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Austria's National Inventory Report 2008

Submission under the United Nations Framework Convention on Climate Change

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AUSTRIA'S NATIONAL INVENTORY REPORT 2008

Submission under the United Nations Framework Convention on Climate Change

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EXECUTIVE SUMMARY

ES.1 Background Information

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), Austria is required to produce and regularly update National Greenhouse Gas Inventories. To date, National Greenhouse Gas Inventories have been produced for the years 1990 to 2006.

With decision 18/CP.8 (see document FCCC/CP/2002/8/Add.2) the Conference of the Parties (COP) adopted the UNFCCC guidelines on reporting and reviewing (FCCC/CP/2002/8). According to this decision Parties shall submit a National Inventory Report (NIR) containing detailed and complete information on their inventories, in order to ensure the transparency of the inventory (see paragraph 38 of FCCC/CP/2002/8). This is the eigth version of the National Inventory Report (NIR) submitted by Austria, it is an update of the NIR submitted in 2007[1]. This report is based on data submitted to the UNFCCC in the common reporting format (CRF submission 2008). They differ from last year's reported data as some activity data have been updated or changes in methodology have been made retrospectively to enhance the accuracy of the greenhouse gas inventory (for further information see Chapter 9 Recalculations and Improvements). Thus the inventory as presented in the NIR 2008 and as submitted to the UNFCCC in the data submission 2008 replaces all previous versions of data submissions.

The structure of the NIR follows the proposal as included in Appendix A of document FCCC/SBSTA/2002/8. First, there is an Executive Summary that gives an overview of Austria's greenhouse gas inventory. Chapters 1 and 2 provide general information on the inventory preparation process and summarize the overall trends in emissions. Comprehensive information on the methodologies used for estimating emissions of Austria's greenhouse gas inventory is presented in the Sector Analysis Chapters 3–8. Chapter 9 gives an overview of actions planned to further improve the inventory and of changes previously made (recalculations), it also describes improvements made in response to the UNFCCC reviews.

The underlying emission data for the year 2006 as reported in the tables of the common reporting format of the data submission 2008 to the convention are also included as well as abbreviations and references used. Furthermore detailed results from the key category analysis, detailed information on the methodology of emission estimates for the fuel combustion sector, the CO_2 reference approach and the National Energy Balance, as well as information on gas specific recalculations and the uncertainty assessment are presented in the Annexes. In this submission, information under Article 7 of the Kyoto Protocol regarding changes to the national system and registry and voluntary supplementary information for estimates of greenhouse gas emissions by sources and removals by sinks resulting from activities under Article 3.3 of the Kyoto Prococol is included for the first time.

The aim of this report is to document the methodology in order to facilitate understanding of the calculation of the Austrian GHG emission data. The more interested reader is kindly referred to the background literature cited in this document.

[1] Austria's National Inventory Report 2007 – Submission under the United Nations Framework Convention of Climate Change. Reports, Bd. REP-0084; Umweltbundesamt, Vienna.

Manfred Ritter in his function as head of the *Department of Air Emissions* of the *Umweltbundesamt* is responsible for the preparation and review of Austria's National Greenhouse Gas Inventory as well as for the preparation of the NIR.

Klaus Radunsky in his function as head of the *Inspection Body for Emission Inventories* is responsible for the content of this report and for the quality management system of the Austrian Greenhouse Gas Inventory.

Project leader for the preparation of the Austrian air pollutant inventory is Stephan Poupa.

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- Chapters 1.1–1.5................................... Barbara Muik
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- Chapter 2... Barbara Muik
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- Chapter 3.5.. Barbara Muik
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- Chapter 6... Michael Anderl
- Chapter 7... Peter Weiss
- Chapter 8.1–8.3, 8.5.............................. Elisabeth Kampel
- Chapter 8.4.. Stephan Poupa
- Chapter 9... Barbara Muik
- Annex 1–7, 10 .... Barbara Muik, Stephan Poupa
- Annex 8 .... Peter Weiss
- Annex 9 .... Katrin Seuss

ES.2 Summary of National Emission and Removal Related Trends

The most important GHG in Austria is carbon dioxide (CO_2), it contributed with 84.8% to total national GHG emissions expressed in CO_2 equivalents in 2006, followed by CH_4, 7.6% and N_2O, 5.9%. PFCs, HFCs and SF_6 amounted together to 1.6% of the overall GHG emissions in the country. The energy sector accounted for 76.7% of the total GHG emissions followed by Industrial Processes 11.8%, Agriculture 8.7% and Waste 2.4%.

Total GHG emissions (excluding land-use change and forestry (LULUCF)) amounted to 91 090 Gg CO_2 equivalents and increased by 15.1% from 1990 to 2006. The base year for all greenhouse gases is 1990.

Table 1 provides data on emissions by sector and Table 2 by gas from 1990 to 2006.

Table 1: Austria's greenhouse gas emissions by sector.

GHG Source and Sink categories		Total (with emissions from LULUCF)	Total (without emissions from LULUCF)	1. Energy	2. Industrial Processes	3. Solvent and Other Product Use	4. Agriculture	5. Land Use, Land Use Change and Forestry	6. Waste
1990*		64 830.93	**79 171.53**	55 728.43	10 110.82	515.17	9 168.74	–14 340.60	3 648.36
1991		62 986.02	**83 242.82**	59 630.11	10 152.82	469.27	9 351.60	–20 256.80	3 639.02
1992		61 289.54	**76 524.83**	54 702.86	8 999.19	420.24	8 866.42	–15 235.29	3 536.13
1993		57 303.74	**76 425.47**	55 128.13	8 750.64	419.85	8 634.39	–19 121.73	3 492.46
1994		59 591.25	**77 339.51**	55 189.72	9 274.83	404.04	9 134.50	–17 748.26	3 336.42
1995		63 510.16	**80 623.93**	58 049.17	9 729.22	422.38	9 240.12	–17 113.77	3 183.04
1996		71 563.82	**83 694.84**	61 879.09	9 601.24	405.31	8 769.95	–12 131.03	3 039.25
1997		62 384.39	**83 259.18**	60 989.53	10 192.53	422.59	8 743.21	–20 874.78	2 911.33
1998	[Gg CO_2 equivalent]	63 542.32	**82 614.39**	60 964.54	9 674.37	404.74	8 746.55	–19 072.06	2 824.18
1999		57 611.11	**81 017.65**	59 919.80	9 391.10	390.87	8 583.14	–23 406.53	2 732.74
2000		63 110.71	**81 135.90**	59 652.70	10 034.18	413.52	8 384.71	–18 025.19	2 650.78
2001		64 532.92	**85 279.15**	64 016.84	9 907.41	435.81	8 329.98	–20 746.23	2 589.10
2002		70 193.95	**87 165.97**	65 380.59	10 591.23	434.56	8 209.37	–16 972.02	2 550.22
2003		74 970.49	**93 299.76**	71 629.77	10 662.00	414.92	8 021.07	–18 329.27	2 572.01
2004		73 175.46	**91 662.54**	70 953.20	9 986.89	399.10	7 876.41	–18 487.08	2 446.93
2005		75 140.17	**93 259.62**	72 423.61	10 300.26	363.74	7 854.41	–18 119.45	2 317.61
2006		72 935.93	**91 090.25**	69 845.50	10 773.09	385.29	7 889.33	–18 154.32	2 197.05

**1990 = Base Year for CO_2, CH_4 and N_2O, HFCs, PFCs and SF_6*

Over the period 1990–2006 CO_2 emissions increased by 24.5%, mainly due to increased emissions from transport. Methane emissions decreased during the same period by 24.5% mainly due to lower emissions from *Solid Waste Disposal* ; N_2O emissions decreased by 14.3% over the same period due to lower emissions from agricultural soils and from chemical industry. HFC emissions are 40 times higher in 2006 than in the base year, whereas PFC and SF_6 emissions decreased by 87% and 4% from the base year to 2006.

Table 2: Austria's greenhouse gas emissions by gas.

GHG		Total	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
1990*	[Gg CO_2 equivalent]	**79 171.53**	62 084.94	9 184.05	6 297.68	23.03	1 079.24	502.58
1991		**83 242.82**	65 674.44	9 162.64	6 620.09	45.21	1 087.08	653.36
1992		**76 524.83**	60 228.81	8 875.04	6 211.79	48.68	462.67	697.85
1993		**76 425.47**	60 544.14	8 852.11	6 025.27	157.34	52.90	793.71
1994		**77 339.51**	60 930.40	8 659.92	6 498.06	206.83	58.61	985.70
1995		**80 623.93**	63 965.22	8 543.04	6 640.48	267.34	68.69	1 139.16
1996		**83 694.84**	67 406.76	8 353.70	6 303.29	346.84	66.20	1 218.05
1997		**83 259.18**	67 198.47	8 076.73	6 339.64	427.42	96.75	1 120.15
1998		**82 614.39**	66 773.24	7 955.03	6 438.58	494.89	44.65	907.99
1999		**81 017.65**	65 540.51	7 781.04	6 405.50	542.20	64.44	683.96
2000		**81 135.90**	65 928.38	7 621.74	6 284.00	596.26	72.21	633.31
2001		**85 279.15**	70 200.00	7 507.02	6 159.04	694.45	82.02	636.62
2002		**87 165.97**	72 115.08	7 380.94	6 161.31	781.07	86.73	640.83
2003		**93 299.76**	78 271.39	7 382.76	6 086.95	862.75	102.39	593.52
2004		**91 662.54**	77 529.03	7 224.40	5 373.74	896.56	125.68	513.12
2005		**93 259.62**	79 515.42	7 071.42	5 353.37	907.68	125.22	286.50
2006		**91 090.25**	77 282.75	6 936.59	5 397.21	857.80	135.67	480.24

**1990 = Base Year for CO_2, CH_4 and N_2O, HFCs, PFCs and SF_6*

NOTE: Emissions without LULUCF

ES.3 Overview of Source and Sink Category Emission Estimates and Trends

In 2006, 69 845 Gg CO_2 equivalents, that is 76.7% of total national emissions, arose from the sector *Energy*. In 2006, 98.7% of these emissions arose from fuel combustion activities. The most important *Fuel Combustion* sub-sector in 2006 was *1 A 3 Transport* with a share of 33%. From 1990 to 2006, emissions from the energy sector increased by 25.3%.

Industrial Processes was the second largest sector in Austria with 11.8% of total GHG emissions in 2006 (10 773 Gg CO_2 equivalents). The main source of greenhouse gas emissions in the industrial processes sector was *Metal Production*, which caused 47% of the emissions from this sector in 2006. From the base year to 2006, emissions from industrial processes increased by 6.6%.

In 2006, 0.4% of total GHG emissions in Austria (385 Gg CO_2 equivalent) arose from the sector *Solvent and Other Product Use*. From 1990 to 2006, emissions from this category decreased by 25%.

Emissions from *Agriculture* amounted to 7 889 Gg CO_2 equivalent in 2006, which corresponded to 8.7% of total national emissions. In 2006 the most important sub-sector *Enteric Fermentation* contributed with 41% to total greenhouse gas emissions from the agricultural sector. In 2006 emissions from this category were 14.0% below the level of the base year.

In 2006 the greenhouse gas emissions from the *Waste* sector amounted to 2 197 Gg CO_2 equivalents which corresponded to 2.4% of total national emissions. The main source of greenhouse gas emissions in this sector was *solid waste disposal on land*, which caused 80.1% of emissions. In 2006 emissions from this category were 39.8% below the base year.

ES.4 Overview of Emission Estimates and Trends of Indirect GHGs and SO_2

Emission estimates of indirect GHGs and SO_2 are presented in Table 3.

Table 3: Emissions of indirect GHGs and SO_2 1990–2006.

		NOx	CO	NMVOC	SO_2
1990	[Gg]	192.41	1444.11	283.18	74.33
1991		202.65	1513.92	275.20	71.42
1992		191.89	1481.31	250.43	55.03
1993		186.24	1448.57	249.27	53.38
1994		180.70	1379.37	231.16	47.61
1995		181.40	1267.33	229.35	46.85
1996		203.81	1246.13	221.54	44.61
1997		193.03	1154.95	206.62	40.16
1998		208.09	1109.26	191.80	35.57
1999		198.89	1034.38	178.44	33.79
2000		205.35	959.09	177.11	31.62
2001		215.03	930.36	188.25	32.70
2002		224.58	898.57	188.79	31.64
2003		235.54	900.10	183.01	32.44
2004		233.29	857.50	176.02	26.93
2005		236.97	823.41	163.65	26.65
2006		225.16	785.35	171.63	28.46

Emissions of indirect greenhouse gases except NO_x decreased in the period from 1990 to 2006: for NMVOCs by 39%, for CO by 46% and for SO_2 emissions by 62%; NOx emissions increased by 17% over the considered period.

The most important emission source for NO_x, SO_2 and CO is fuel combustion. The most important emission source for NMVOC is Solvent and other Product Use.

1 INTRODUCTION

1.1 Background Information

Global Warming

By deforestation people have influenced the local and regional climate at all times. But since the beginning of industrialization in the middle of the 18th century mankind has influenced the climate also globally by emitting greenhouse gases like carbon dioxide, methane, nitrous oxide as well as various fluorinated and chlorinated gases.

The average surface temperature of the earth has risen by about 0.6–0.9°C in the past 100 years and, according to the fourth assessment report of the IPCC, will rise by another 1.8–4.0°C in the next 100 years, depending on the emission scenario.

The increase of the average surface temperature of the earth will lead, with the increase of the surface temperature of the oceans and the continents, to changes in the hydrologic cycle as well as to modification of the albedo (total reflectivity of the earth) and to significant changes of the atmospheric circulation which drives rainfall, wind and temperature on the regional scale. This will increase the risk of extreme weather events such as hurricanes, typhoons, tornadoes, severe storms, droughts and floods.

Climate Change in Austria

The effects of global warming in Austria are manifold because the Alps as well as the region along the Danube have a very high vulnerability to climate change, which is reflected in the overall change in temperature of the Alps of +1.8° C in the past 150 years. That is significantly higher than the global average.

Even more important than the average temperature for agriculture, energy production, tourism etc. is precipitation. So far experts think that north of the Alps rainfall will increase, leading to a high risk of extreme floods, whereas south of the Alps there will be a higher risk for droughts. An exact regionalization of these trends is substantial for adjustments in spatial planning, agriculture and forestry, tourism, flood control measures etc. Being aware of the need for further research in this matter, Austria launched StartClim and FloodRisk, two research programmes, in 2003.

The Convention, its Kyoto Protocol and the flexible mechanisms thereunder

In 1992 Austria signed the United Nations Framework Convention on Climate Change (UNFCCC) which sets an ultimate objective of stabilizing atmospheric concentrations of greenhouse gases at levels that would prevent "dangerous" human interference with the climate system. Such levels, which the Convention does not quantify, should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The UNFCCC covers all greenhouse gases not covered by the Montreal protocol[2]: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) as well as hydrogenated fluorocarbons (HFCs), perfluorated halocarbons (PFCs) and sulphur hexafluoride (SF_6).

Five years after adoption of the Climate Change Convention in 1997, governments took a further step forward and adopted the landmark Kyoto Protocol. Building on the Convention, the Kyoto Protocol broke new ground with its legally binding constraints on greenhouse gas emissions and its innovative "mechanisms" aimed at cutting the cost of curbing emissions. Under the terms of the Protocol, the industrialised world – known as Annex 1 countries – pledged to reduce their greenhouse (GHG) emissions by 5% below 1990 levels by the period 2008–2012. The European Union is also a Party to the Convention and the KP and agreed on a reduction target of 8% below 1990 levels during the five-year commitment period from 2008 to 2012. The EU and its Member States decided to achieve this goal jointly, for Austria an emission target of minus 13% was set.

The KP entered into force on 16 February 2005, triggered by Russia's ratification in November 2004 which fulfilled the requirement that at least 55 Parties to the Convention ratified (or approved, accepted, or acceded to) the Protocol, including Annex I Parties accounting for 55% of that group's carbon dioxide emissions in 1990: by the end of March 2005, 146 Parties had ratified the KP, accounting for 61.6% of emissions of Annex 1 Parties.

The Protocol sets out three 'flexible mechanisms' to help countries meet their obligations to cut emissions.

- *Emission Trading*: Article 17 of the Kyoto Protocol allows Annex I Parties (basically, the industrialised nations) to purchase the rights to emit greenhouse gases (GHG) from other Annex I countries which have reduced their GHG emissions below their assigned amounts. Trading can be carried out by intergovernmental emission trading, or entity-source trading where assigned amounts are allocated to sub-national entities.
- *Joint Implementation*: Article 6 allows an Annex I Party to gain a credit (converted to Assigned Amounts) by investing in another Annex I country in a project which reduces GHG emissions.
- *Clean Development Mechanism*: Article 12 allows an Annex I country (or companies in an Annex 1 country) which funds projects in developing countries (non-Annex I Party) to get credits for certified emission reductions providing that "benefits" accrue for the host country.

Tradable emission permits tie the emissions to a fixed ceiling, the costs of emission reduction being as low as possible.

National Greenhouse Gas Inventories

As a Party to the Convention, Austria is required to produce and regularly update National Greenhouse Gas Inventories. To date, National Greenhouse Gas Inventories have been produced for the years 1990 to 2006. Furthermore Parties shall submit a National Inventory Report (NIR) containing detailed and complete information on their inventories, in order to ensure the transparency of the inventory.

The preparation of Austria's National Greenhouse Gas Inventory as well as the preparation of the NIR is the responsibility of the *Department of Air Emissions* of the Umweltbundesamt in Vienna.

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[2] The Montreal Protocol sets the elimination of ozone-depleting substances as its final objective and covers chloro and bromo fluorocarbons.

For the purpose of Quality Assurance, resulting from increased requirements of transparency, consistency, comparability, completeness and accuracy of the national greenhouse gas inventory as set by the new standards defined in the KP, the inventories have been annually reviewed by international experts managed by the Climate Change Secretariat in Bonn (expert review team ERT) since 2003. To date, Austria's Greenhouse Gas Inventory was reviewed by an in-country review and a centralized review in 2001 during the trial period of the review process as well as during the centralized reviews in 2003, 2004 and 2005. The reports on these reviews can be found on the UNFCCC website[3]. The latest in-country review took place in February 2007 (in-country review of the initial report of Austria). This review combined the review of the submission 2006 and the so-called pre-commitment period review. The latter includes the review of the assigned amounts, the national inventory system and the national registry. The report of this review was published in August 2007[4].

1.2 Institutional Arrangement for Inventory Preparation

1.2.1 Austria's Obligations

Austria has to comply with the following obligations:

- Austria's annual obligation under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) and its Protocols (1979) comprising the annual reporting of national emission data on SO_2, NO_X, NMVOCs, NH_3, CO, TSP, PM_{10}, and $PM_{2.5}$ as well as on the heavy metals Pb, Cd and Hg and persistent organic hydrocarbons (PAHs), dioxins and furans and hexachlorobenzene (HCB).
- Austria's annual obligations under the European Council Decision 280/2004/EC ("Monitoring Decision"; replacing Decision 389/1992/EEC amended by Decision 296/1999/EEC) concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol..
- Austria's obligations under the United Nations Framework Convention on Climate Change. Relevant COP Decisions and Guidelines are:
  - Decision 3/CP.5 Guidelines for the Preparation of National Communications by Parties included in Annex I to the Convention, Part I: UNFCCC Reporting Guidelines on Annual Inventories (referring to Document FCCC/CP/1999/7) revised with Decision 18/CP.8 (referring to Document FCCC/CP/2002/8).
  - Decision 4/CP.5 Guidelines for the Preparation of National Communications by Parties included in Annex I to the Convention, Part II: UNFCCC Reporting Guidelines on National Communications (referring to Document FCCC/CP/1999/7) revised with Decision 19/CP.8 (referring to Document FCCC/CP/2002/8).

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[3] http://unfccc.int/resource/webdocs/iri(2)/2001/aut.pdf,
http://unfccc.int/resource/webdocs/iri(3)/2001/aut.pdf,
http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/autrep03.pdf,
http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2004_irr_centralized_review_austria.pdf,
http://unfccc.int/resource/docs/2006/arr/aut.pdf

[4] http://unfccc.int/resource/docs/2007/irr/aut.pdf and http://unfccc.int/resource/docs/2007/arr/aut.pdf

- Document FCCC/CP/1999/7 Review of the Implementation of Commitments and of other Provisions of the Convention – UNFCCC Guidelines on Reporting and Review revised with Document FCCC/CP/2002/8.
- Decision 11/CP.4 National communications from Parties included in Annex I to the Convention.
- Document FCCC/CP/2001/13/Add.3 Report of the Conference of the Parties on its seventh session, held at Marrakech from 29 October to 10 November 2001, Addendum, Part two: Action taken by the Conference of the Parties, Volume III (Decision 20/CP.7: Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol; Decision 21/CP.7: Good practice guidance and adjustments under Article 5, paragraph 2, of the Kyoto Protocol; Decision 22/C.7: Guidance for the preparation of the information required under Article 7 of the Kyoto Protocol; Decision 23/CP.7: Guidelines for review under Article 8 of the Kyoto Protocol).

- Obligation under the Austrian Ambient Air Quality Law[5] concerning the reporting of national emission data on SO_2, NO_x, NMVOC, CO, heavy metals (Pb, Cd, Hg), benzene and particulate matter.
- Austria's obligation according to Article 15 of the European IPPC Directive 1996/61/EC is to implement a European Pollutant Emission Register (EPER). EPER was displaced and upgraded by regulation (EC) No 166/2006 concerning the establishment of a European Pollutant Release and Transfer Register (E-PRTR Regulation). EPER and E-PRTR are associated with Article 6 of the Aarhus Convention (United Nations: Aarhus, 1998) which refers to the right of the public to access environmental information and to participate in the decision-making process of environmental issues.

1.2.2 History of NISA

As there are so many different obligations which are subject to continuous development, Austria's National Inventory System (NISA) has to be adapted to these changes. A brief history of the development and the activities of NISA is shown here:

- Austria established estimates for SO_2 under EMEP in 1978 (Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe).
- As an EFTA country Austria participated in CORINAIR 90, which was an air emission inventory for Europe. It was part of the CORINE (Coordination d'Information Environmentale) work plan set up by the European Council of Ministers in 1985. The aim of CORINAIR 90 was to produce a complete, consistent and transparent emission inventory for the pollutants: SO_x as SO_2, NO_x as NO_2, NMVOC, CH_4, CO, CO_2, N_2O and NH_3.
- Austria signed the UNFCCC on June 8, 1992 and subsequently submitted its instrument of ratification on February 28, 1994.
- In 1994 the first so-called Austrian Air Emission Inventory (Österreichische Luftschadstoff-Inventur, OLI) was prepared.
- In 1997 a consistent time series for the emission data from 1980 to 1995 was reported for the first time.
- In 1998 also emissions of HM, POPs and FCs were included in the inventory.
- Inventory data for particulate matter were included in the inventory in 2001.

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[5] AUSTRIAN AMBIENENT AIR QUALITY LAW (1997): Immissionsschutzgesetz-Luft. Federal Law Gazette I 115/1997.

1.2.3 Responsibilities

Austria's reporting obligations to the UNFCCC, UNECE and EC are administered by the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW). With the Environmental Control Act ("Umweltkontrollgesetz"; Federal Law Gazette 152/ 1998) that entered into force the 1st of January 1999 the Umweltbundesamt is designated as single national entity with overall responsibility for inventory preparation. This law regulates responsibilities of environmental control in Austria and lists the tasks of the Umweltbundesamt. One task is the preparation of technical expertise and the data basis for fulfilment of the obligations under the UNFCCC and the UNECE LRTAP Convention. Thus the Umweltbundesamt prepares and annually updates the Austrian air emissions inventory ("Österreichische Luftschadstoff-Inventur OLI"), which covers greenhouse gases and emissions of other air pollutants as stipulated in the reporting obligations further explained in Chapter 1.2.5.

Within the Umweltbundesamt the department of air emissions is responsible for the preparation of the Austrian Air Emission Inventory ("Österreichische Luftschadstoff-Inventur OLI") and all work related to inventory preparation. Responsibilities are divided by sectors between sector experts from Departments within the Umweltbundesamt (see Figure 1). The "Inspection body for GHG inventory" within the Umweltbundesamt is responsible for the compilation of the greenhouse gas inventory. The quality system is maintained up to date under the responsibility of the Quality Manager. The Quality Manager has direct access to top management.

For the Umweltbundesamt a national air emission inventory that identifies and quantifies the sources of pollutants in a consistent manner is of a high priority. Such an inventory provides a common means for comparing the relative contribution of different emission sources and hence can serve as an important basis for policies to reduce emissions.

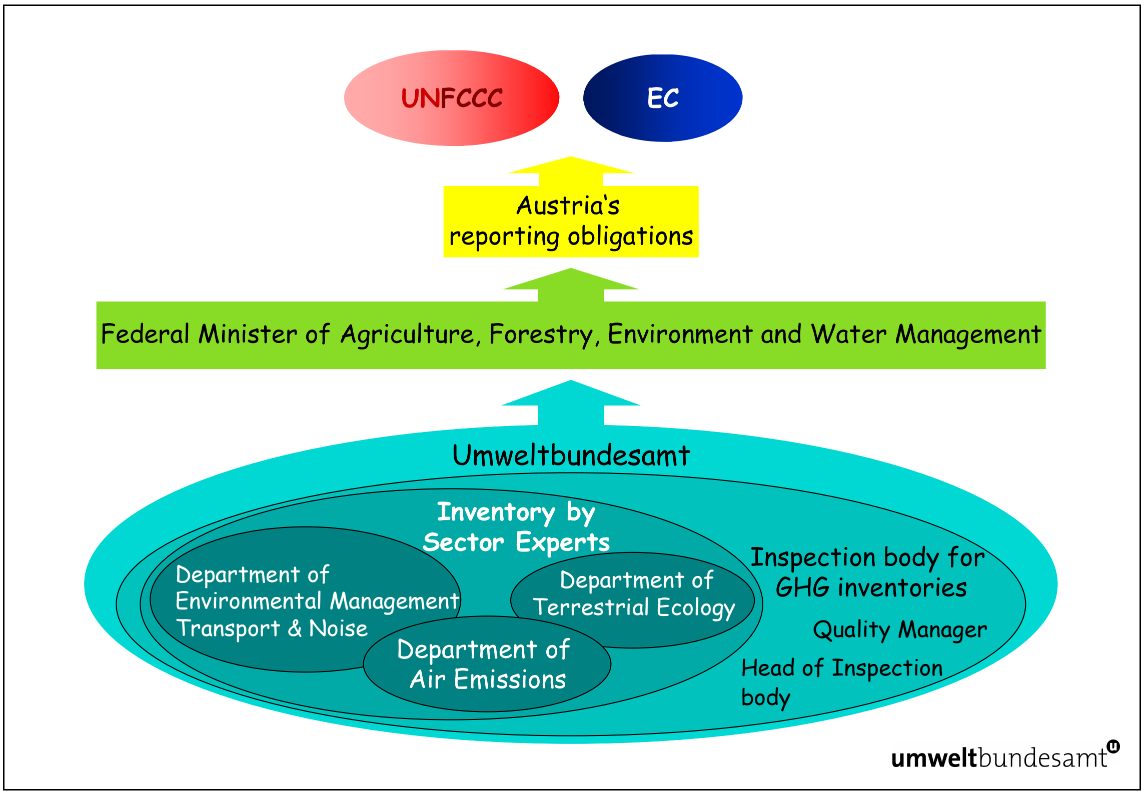

Figure 1: Responsibilities in the Austrian National System for Greenhouse Gas Inventories.

1.2.4 Institutional Arrangements in Place

Besides the Environmental Control Act there are some other legal and institutional arrangements in place as the main basis for the national system:

- Ordinance regarding Monitoring and Reporting of Greenhouse Gas Emissions[6]

  This ordinance pertains to the Austrian Emissions Certificate Trading Act[7] that regulates monitoring and reporting in the context of the EU Emissions Trading scheme (ETS) in Austria.

  Paragraph 15 of this ordinance is designed to ensure consistency of emission trading data with the national inventory. It states that the Umweltbundesamt has to incorporate, as far as necessary, the emission reports of the emissions trading scheme into the national greenhouse gas inventory in order to comply with requirements of the EU Monitoring Mechanism Decision (280/2004/EC) and the UNFCCC. This is not only important for emissions from combustion of fuels, where more detailed information than provided in the national energy balance is available, but also for emissions from industrial processes, where the ordinance ensures data availability for most key sources (see Chapter 4 for details). First data from the EU ETS were available for the year 2005; since then ETS data were considered in the submissions.
- The Austrian statistical office (Statistik Austria) is required by contract with the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) and with the Federal Ministry of Economics and Labour (BMWA) to annually prepare the national energy balance (the contracts also cover some quality aspects). The energy balance is prepared in line with the methodology of the Organisation for Economic Co-operation and Development (OECD) and is submitted annually to the International Energy Agency (IEA) (IEA/EUROSTAT Joint Questionnaire (JQ) Submission). The national energy balance is the most important data basis for the Austrian Air Emissions Inventory.
- According to national legislation (Bundesstatistikgesetz[8]), the Austrian statistical office has to prepare annual import/export statistics, production statistics and statistics on agricultural issues (livestock counts etc.), providing an important data basis for calculating emissions from the sectors *Industrial Processes*, *Solvents and Other Product Use* and *Agriculture*.
- In order to comply with the reporting obligations, the Umweltbundesamt has the possibility to obtain confidential data from the national statistical institute (of course these data have to be treated confidentially). The legal basis for this data exchange is the "Bundesstatistikgesetz"[8] (federal statistics law), which allows the national statistical office to provide confidential data to authorities that have a legal obligation for the processing of these data.
- According to para 17 (1) of the (EG-K)[9] each licencee of an operating boiler with a thermal capacity of 2 megawatts (MW) or more is obligated to report the emissions to the competent authority. The Umweltbundesamt can request copies of these emission declarations. These data are used to verify the data from the national energy balance for the Energy sector.

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[6] „*Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Überwachung und Berichterstattung betreffend Emissionen von Treibhausgasen*", Federal Law Gazette II No. 458/2004

[7] "*Emissionszertifikate-Gesetz*", Federal Law Gazette I No. 46/2004

[8] *"Bundesstatistikgesetz"*, Federal Law Gazette I No. 163/1999

[9] „Emissionsschutzgesetz für Kesselanlagen", Federal Law Gazette I No. 150/2004

- According to the Landfill Ordinance (Deponieverordnung)[10], which came into force in 1997, the operators of landfill sites have to report their activity data annually to the Umweltbundesamt, where they are stored in a landfill database for solid waste disposals (*Deponiedatenbank*). This data provide the main data basis for calculating emissions from the sector *Waste*.
- Since 2004 there is a reporting obligation to the BMLFUW under the Austrian Fluorinated Compounds (FC) Ordinance[11] for users of FCs for the following applications: refrigeration and air-conditioning, foam blowing, semiconductor manufacture, electrical equipment, fire extinguishers and aerosols. These data are used for estimating emissions from the consumption of fluorinated compounds (*IPCC sector 2 F*).

1.2.5 Adaptation of NISA according to the Kyoto Protocol

Regulations under the UNFCCC and the Kyoto Protocol define new standards for national emission inventories. These standards include more stringent requirements related to transparency, consistency, comparability, completeness and accuracy of inventories. Each Party shall have in place a national system, no later than one year prior to the start of the first commitment period; this means by the end of 2006. Also the European Community had to implement such a national system, and as this system is also based on the national systems of the member states, member states had to implement their national system earlier than required by the UNFCCC and the KP, namely by 31 December 2005 (Article 4 of the Monitoring Mechanism Decision 280/2004/EC).

This national system shall include all institutional, legal and procedural arrangements made within a Party for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and for reporting and archiving inventory information.

Austria's aim was to set up a national system that fulfils all the requirements of the Kyoto Protocol and also works as an efficient system to fulfil all the other obligations regarding air emission inventories Austria has to comply with.

The emission inventory system has a structure as illustrated in Figure 2.

[10] *„Deponieverordnung",* Federal Law Gazette 164/1996

[11] *„Industriegas-Verordnung (HFKW-FKW-SF6-VO)";* Federal Law Gazette II No. 447/2002

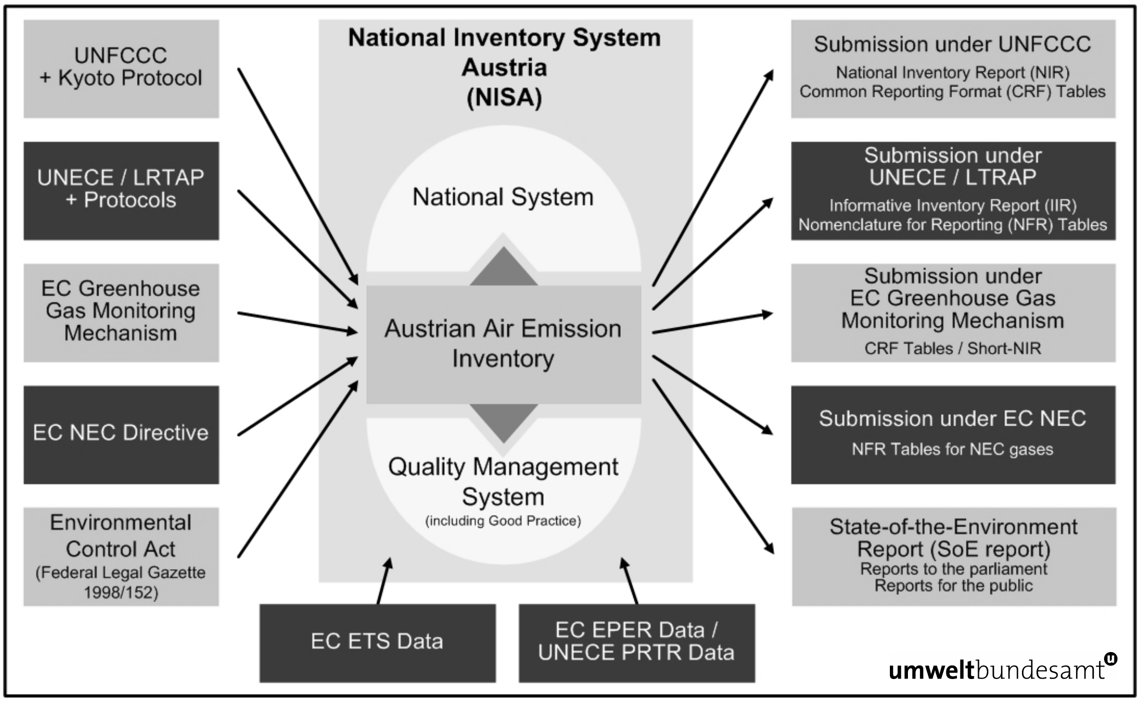

Figure 2: Structure of the emission inventory system in Austria (NISA).

The Austrian Air Emission Inventory, comprising all air pollutants stipulated in the various national and international obligations, is at the centre of NISA. The national system and the quality management system have been incorporated into NISA as complementary sections.

The Guidelines for National Systems for the Estimation of Anthropogenic Greenhouse Gas Emissions by Sources and Removals by Sinks under Article 5.1 of the Kyoto Protocol (Decision 20/CP.7) describe the elements to be included in a national system.

The overall goal of National Systems is to ensure the quality of the inventory through planning, preparation and management of inventory activities. National Systems should enable Parties to estimate emissions in accordance with the relevant inventory guidelines [IPCC Guidelines and Good Practice Guidance (GPG)] to comply with the requirements of the Kyoto Protocol.

The general principles for National Inventories are transparency, consistency, comparability, completeness and accuracy of inventories and the quality of inventory activities (e.g. collecting activity data, selecting methods and emission factors).

The general functions are

- to establish and maintain the institutional, legal, and procedural arrangements defined in the guidelines for national systems between the government agencies and other entities,
- to ensure sufficient capacity for timely performance,
- to designate a single national entity with overall responsibility for the national inventory,
- to prepare national annual inventories and supplementary information in a timely manner and
- to provide information necessary to meet the reporting requirements.

Specific functions stipulated in these guidelines are inventory planning, preparation and management.

Austria has taken significant steps to establish a high-quality emission inventory in which uncertainties are reduced as far as feasible and in which data are developed in a transparent, consistent, complete, comparable and accurate manner.

The following steps have been taken to prepare NISA to meet the requirements of the Kyoto Protocol:

- the Umweltbundesamt has been designated as single national entity with the overall responsibility for the national inventory by law: the Environmental Control Act ("Umweltkontrollgesetz"; Federal Law Gazette I No. 152/1998) regulates responsibilities of environmental control in Austria and lists the tasks of the Umweltbundesamt. One task is the preparation of technical expertise and basic data for the fulfilment of the obligations under the UNFCCC and the UNECE LRTAP Convention. For further institutional arrangements, please refer to sub-chapter 1.2.4)
- The responsibilities for inventory planning, preparation and management are specified and allocated within the Umweltbundesamt. Following internal Umweltbundesamt quality management regulation, a yearly plan is implemented to ensure capacity for timely performance of the functions defined in the guidelines for national systems. The technical competence of the staff involved in the inventory preparation process is ensured by arrangements according to the internal Umweltbundesamt training plan.
- The inventory preparation, including identification of key categories, uncertainty estimates and QC procedures, is performed according to the 2000 Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance (GPG) and Uncertainty Management of Greenhouse Gas Inventories and to the 2003 IPCC GPG for Land Use, Land-Use Change and Forestry.
- A Quality Management System (QMS) has been developed and implemented.
- The national greenhouse gas inventory is prepared by the inspection body for GHG inventories within the Umweltbundesamt which is accredited as inspection body according to the International Standard ISO 17020 *General Criteria for the operation of various types of bodies performing inspections*. The accreditation audit of the Umweltbundesamt as inspection body took place in September 2005. The accreditation was completed officially in December 2005.
- The QMS also includes the necessary procedures to ensure quality improvement of the emission inventory. They comprise documentation of allocated responsibilities, of any discrepancies and of the findings by UNFCCC review experts in particular.
- The inventory management as part of the QMS includes a control system for data and calculations, for records and their archiving as well as documentation of QA/QC activities. This ensures the necessary documentation and archiving for future reconstruction of the inventory and for the timely response to requests during the review process.
- Part of the legal and institutional arrangements in place to provide a basis for the national system pertains to data availability for the annual compilation of the GHG inventory. The main data source for the Austrian inventory preparation is the Austrian statistical office (*Statistik Austria*). The compilation of several statistics is regulated by law; the compilation of the national energy balance is regulated by contracts. Other data sources include reporting obligations under national and European regulations and reports of companies and associations.
- A process for official consideration and approval of the inventory prior to its submission is established. The inventory information is provided by the Umweltbundesamt to the Federal Ministry of Agriculture, Forestry, Environment and Water Management, where the National Focal Point for the UNFCCC is established. The inventory is then submitted by the Ministry to the UNFCCC secretariat.

The Austrian national system was reviewed during the in-country review of the initial report of Austria (February 2007). Para 10 of the review report (FCCC/IRR/2007/AUT) states that the national system has been developed in line with the relevant guidelines and can fulfil the requirements of the Kyoto Protocol as well as other obligations regarding its air emissions inventory that Austria has to comply with.

1.3 Inventory Preparation Process

The present Austrian greenhouse gas inventory for the period 1990 to 2005 was compiled according to the recommendations for inventories set out in the UNFCCC reporting guidelines according to Decision 18/CP.8, the Common Reporting Format (CRF)[12] (version 1.01), Decision 13/CP.9, the new CRF for the Land Use Change and Forestry Sector, the IPCC 1996 Guidelines for National Greenhouse Gas Inventories, which specify the reporting obligations according to Articles 4 and 12 of the UNFCCC (IPCC Guidelines, 1997) as well as the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC GPG, 2000) and the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC GPG-LULUCF, 2003).

The preparation of the inventory includes the following three stages:

(i) inventory planning,

(ii) inventory preparation and

(iii) inventory management.

During the first stage specific responsibilities are defined and allocated: as mentioned before, the Umweltbundesamt has the overall responsibility for the national inventory, which comprises greenhouse gases as well as other air pollutants. Within the inventory system specific responsibilities for the different emission source categories are defined ("sector experts") as well as for all activities related to the preparation of the inventory, including QA/QC, data management and reporting.

In Austria, emissions of greenhouse gases are estimated together with emissions of air pollutants in a single database based on the CORINAIR (CORe INventory AIR)/SNAP (Selected Nomenclature for sources of Air Pollution) nomenclature. This nomenclature was designed by the ETC/AE (European Topic Centre on Air Emissions) to estimate not only emissions of greenhouse gases but all kind of air pollutants.

During the second stage, the inventory preparation process, sector experts collect activity data, emission factors and all relevant information needed for finally estimating emissions. The sector experts also have specific responsibilities regarding the choice of methods, data processing and archiving and for contracting studies, if needed. As part of the quality management system the head of the "Inspection body for GHG inventory" approves the methodological choices. Sector experts are also responsible for performing Quality Control (QC) activities that are incorporated in the Quality Management System (QMS). All data collected together with emission estimates are fed into a database (see below), where data sources are well documented for future reconstruction of the inventory.

As mentioned above, the Austrian Inventory is based on the SNAP nomenclature, and has to be transformed according to the IPCC Guidelines into the UNFCCC Common Reporting Format to comply with the reporting obligations under the UNFCCC. In addition to the actual emission data, the background tables of the CRF are filled in by the sector experts, and finally QA/QC procedures as defined in the inventory planning process are carried out before the data are submitted to the UNFCCC.

[12] http://www.unfccc.de/resource/CRFV1_01o01.zip

For the inventory management a reliable data management to fulfil the data collecting and reporting requirements is needed. As mentioned above, data are collected by the different sector experts and the reporting requirements grow rapidly and may change over time. Data management is carried out by using MS Excel™ spreadsheets in combination with Visual Basic™ macros, which is a very flexible system that can easily be adjusted to new requirements. The data are stored in a central network server which is backed up daily for the needs of data security. Furthermore, as part of the QMS, backups of the entire inventory information are made twice a year on write-protected DVDs. The inventory management as part of the QMS includes a control system for all documents and data, for records and their archives as well as documentation on QA/QC activities (see Chapter 1.6).

This ensures the necessary documentation and archiving for future reconstruction of the inventory and for the timely response to requests during the review process.

1.4 Methodologies and Data Sources Used

The following table presents the main data sources used for activity data as well as information on who did the actual calculations:

Table 4: Main data sources for activity data and emission values.

Sector	Data Sources for Activity Data	Emission Calculation
Energy	Energy Balance from Statistik Austria; EU-ETS; Steam boiler database;	*Umweltbundesamt*, plant operators
Industry	National production statistics; import/export statistics; EU-ETS; direct information from industry or associations of industry;	*Umweltbundesamt*, plant operators F-gases based on a study by: EcoEfficient Technologies, Vienna
Solvent	Import/ export statistics, production statistics, consumption statistics;	*Umweltbundesamt* based on a study by: Forschungsinstitut für Energie und Umweltplanung, Wirtschaft und Marktanalysen GmbH and Institut für industrielle Ökologie*
Agriculture	National Studies, national agricultural statistics obtained from Statistik Austria;	*Umweltbundesamt* based on a study by: University of Natural Resources and Applied Life Sciences, Research Center Seibersdorf
LULUCF	National forest inventory obtained from the Austrian Federal Office and Research Centre for Forest (BFW)	*Umweltbundesamt*
Waste	Database on landfills	*Umweltbundesamt*

* *Research Institute for Energy and Environmental Planning, Economy and Market Analysis Ltd./Institute for Industrial Ecology*

Detailed information on data sources for activity and emission data or emission factors used by sector can be found in the Chapters 3–8.

For large point sources the Umweltbundesamt preferably uses – after careful assessment of plausibility of this data – emission data that are reported by the "operator" of the source because these data usually reflect the actual emissions better than data calculated using general emission factors, as the operator has the best information about the actual circumstances.

If such data is not available, and for area sources, national emission factors are used or, if there are no national emission factors, international emission factors are used to estimate emissions. Where no applicable data is found, standard emission factors e.g. from the CORINAIR Guidebook are applied.

The main sources for emission factors are:

- National studies for country specific emission factors
- IPCC GPG
- Revised IPCC 1996 Guidelines
- EMEP/CORINAIR Guidebook

Table *Summary 3* of the CRF (Summary Report for Methods and Emission Factors Used) in Annex 7 presents the methods applied and the origin of emission factors used for the greenhouse gas source and sink categories in the IPCC format for the present Austrian inventory.

For key source categories (see Chapter 1.5) the most accurate methods for the preparation of the greenhouse gas inventory should be used. Required methodological changes and planned improvements are described in the corresponding sector analysis chapters (Chapters 3–8).

Main Data Suppliers

The main data supplier for the Austrian Air Emission Inventory is Statistik Austria, providing the underlying energy source data. The Austrian energy balances are based on several databases mainly prepared by the Ministry of Economic Affairs and Labour, "Bundeslastverteiler" and Statistik Austria. Their methodology follows the IEA and Eurostat conventions. The aggregated balances, for example transformation input and output or final energy use, are harmonised with the IEA tables as well as their sectoral breakdown which follows the NACE classification.

The main data suppliers are also presented in Table 4.

Information about activity data and emissions of the industry sector is obtained from *Association of the Austrian Industries* or directly from individual plants. Activity data for some sources are obtained from Statistik Austria which provides statistics on production data[13]. The methodology of the statistics changed in 1996, no data are available for that year and there are some product groups no longer reported in the new statistics.

Operators of steam boilers with more than 50 MW report their emissions and their activity data directly to the Umweltbundesamt. National and sometimes international studies are also used as data suppliers. Operators of landfill sites also report their activity data directly to Umweltbundesamt. Emissions for the years 1998–2006 are calculated on the basis of these data. Activity data needed for the calculation of non-energetic emissions are based on several statistics collected by Statistik Austria and national and international studies.

[13] "Industrie und Gewerbestatistik" published by STATISTIK AUSTRIA for the years until 1995; "Konjunkturstatistik im produzierenden Bereich" published by STATISTIK AUSTRIA for the years 1997 to 2006.

Data from the EU Emission trading Scheme

The European emission trading scheme (EU-ETS) was established by Directive 2003/87/EC of the European Parliament and of the Council[14]. Emission trading concerns CO_2 emissions from energy activities and manufacturing industries. These include combustion installations, mineral oil refineries and coke ovens as well as production and processing of ferrous metals, mineral industries and some other production activities. For more detailed information on the included activities please refer to Annex I of the above mentioned directive.

The contribution of emissions from installations under the EU-ETS to the total Austrian GHG emissions is about 30% (~30 Tg CO_2).

Plant operators have to report their CO_2 emissions annually; for the first time they reported their emissions of 2005 in March 2006.

General rules for reporting and verification of these emissions are defined in EU directive 2003/87/EG and specific rules can be found in Commission decision 2004/156/EC[15]. In Austria member state specific regulations are defined in the Austrian Emissions Certificate Trading Act[7] and in its respective ordinance[6]. As mentioned already in chapter 1.2.4 this ordinance also states that the Umweltbundesamt has to incorporate, as far as necessary, the emission reports of the emissions trading scheme into the national greenhouse gas inventory. For a detailed description of the sectors covered and the incorporation of these emissions in the national inventory please refer to the chapters 3 Energy (CRF Sector 1) and 4 Industrial Processes (CRF Sector 2).

An important feature of the CO_2 emissions reported under the EU-ETS is that these emissions have to pass independent verification. The Austrian Ministry of Environment is in charge of the licence for verifiers. The Austrian Ministry of Environment additionally bears a quality control function that is implemented by the Umweltbundesamt on behalf of the Ministry.

Data from EPER/E-PRTR

The European Pollutant Emission Register (EPER) is the first Europe-wide register for emissions from industrial facilities both into air and to water. The legal basis of EPER is Article 15 of the IPPC Directive (EPER Decision 2000/479/EG), which stipulates that information has to be provided to the public[16]. EPER was displaced and upgraded by regulation (EC) No 166/2006 concerning the establishment of a European Pollutant Release and Transfer Register (E-PRTR Regulation). In 2008 emissions will be reported for the first time under the E-PRTR reporting obligation.

EPER covers 50 pollutants including CO_2, CH_4, N_2O, SF_6 and PFCs. However, emissions only have to be reported if they exceed certain thresholds.

The Umweltbundesamt implemented EPER in Austria using an electronic system enabling the facilities and the authorities to fulfil the requirements of the EPER decision electronically via the internet.

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[14] *"Directive 2003/87/Ec of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC"*, OJ L 275/32

[15] *"Commission Decision of 29 January 2004 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council"*, OJ L 59/1

[16] Data can be obtained from: http://www.umweltbundesamt.at/umweltdaten/datenbanken10/eper/.

The Austrian industrial facilities had to report their annual emissions of 2001 or 2002 and 2004. There were about 400 facilities in Austria that had to report to EPER. As the thresholds for reporting emissions are relatively high, only about 130 facilities reported emissions according to the EPER Regulation. The plausibility of the reports was checked by the competent authorities. The Umweltbundesamt finally checked the data for completeness and consistency with the national inventory.

However, data from EPER could not be used as a data source for the national inventory. On the one hand this is due to the high threshold for emission reporting, e.g. only four facilities reported N_2O emissions and none reported fluorinated compounds. On the other hand this is due to the fact that the EPER report only contains very little information other than emission data. Concerning methodology the only information included is whether emissions are estimated, measured or calculated. For activity data facilities report one value that is often not useful in the context of emissions and may be different between producers of the same product.

Additionally, EPER emission information is not complete for IPCC sectors, and it is difficult to include this point source information as no background information (such as fuel consumption data) is available.

Thus the top-down approach of the national inventory was considered more reliable and data of EPER were not used as point source data for the national inventory, but for verification purposes only, where plausible.

1.5 Key Category Analysis

The identification of key categories is described in the IPCC Good Practice Guidance (IPCC-GPG, 2000), Chapter 7 and in the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC-GPG-LULUCF, 2003), chapter 5.4. It stipulates that a key category is one that is prioritised within the National System because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level of emissions or removals, the trend in emissions or removals, or both.

All notations, descriptions of identification and results for key categories included in this chapter are based on the IPCC Good Practice Guidance.

The identification includes all reported greenhouse gases CO_2, CH_4, N_2O, HFC, PFC and SF_6, and all IPCC categories.

The presented key category analysis was performed by the Umweltbundesamt with data for greenhouse gas emissions of the submission 2008 to the UNFCCC and comprises a level assessment for all years between 1990 and 2006 and a trend assessment for the trend of the year 2006 with respect to base year emissions. As stipulated in the IPCC-GPG-LULUCF key categories were first identified for the inventory excluding LULUCF and then the key category analysis was repeated for the full inventory including LULUCF categories.

1.5.1 Austria's Key Categories

This chapter presents the results of Austria's key category analysis. The methodology is described in Chapter 1.5.2.

The identified key categories are listed in Table 5 and Table 6. The key categories without LULUCF comprise 88 432.9 Gg CO_2e in the year 2006, which is a share of 97.1% of Austria's total greenhouse gas emissions (without LULUCF).

Table 5: Austrian key categories based on emission data submitted to the UNFCCC in 2008.

IPCC Category Description		**Gas**	**Emissions 2006 [Gg CO_2e]**	**Share in Total Emissions 2006**
1.A gaseous	Fuel combustion activities	CO_2	16 792.1	18.4%
1.A.3.b diesel oil	Road Transportation	CO_2	15 788.4	17.3%
1.A.4 stat-liquid	Other Sectors	CO_2	7 188.6	7.9%
1.A.3.b gasoline	Road Transportation	CO_2	6 144.1	6.7%
1.A.2 solid	Manufacturing Industries and Construction	CO_2	5 666.2	6.2%
1.A.1.a solid	Public Electricity and Heat Production	CO_2	5 642.5	6.2%
2.C.1	Iron and Steel Production	CO_2	5 089.5	5.6%
4.A.1	Cattle	CH_4	3 009.5	3.3%
1.A.1.b liquid	Petroleum refining	CO_2	2 153.4	2.4%
2.A.1	Cement Production	CO_2	1 954.1	2.1%
1.A.2 stat-liquid	Manufacturing Industries and Construction	CO_2	1 880.7	2.1%
6.A	Solid Waste Disposal on Land	CH_4	1 759.6	1.9%
4.D.1	Direct Soil Emissions	N_2O	1 610.3	1.8%
1.A.4 mobile-diesel	Other Sectors	CO_2	1 348.7	1.5%
1.A.1.a liquid	Public Electricity and Heat Production	CO_2	1 170.6	1.3%
1.A.2 mobile-liquid	Manufacturing Industries and Construction	CO_2	1 119.0	1.2%
4.D.3	Indirect Emissions	N_2O	1 091.9	1.2%
1.A.2 other	Manufacturing Industries and Construction	CO_2	861.7	0.9%
2.F.1/2/3/4/5	ODS Substitutes	HFCs	852.9	0.9%
4.B.1	Cattle	N_2O	787.8	0.9%
1.A.1.a other	Public Electricity and Heat Production	CO_2	695.5	0.8%
2.A.2	Lime Production	CO_2	585.7	0.6%
1.B.2.b	Natural gas	CH_4	577.6	0.6%
1.A.4 solid	Other Sectors	CO_2	560.7	0.6%
2.B.1	Ammonia Production	CO_2	541.8	0.6%
4.B.1	Cattle	CH_4	454.9	0.5%
4.B.8	Swine	CH_4	395.0	0.4%
2.A.7.b	Sinter Production	CO_2	312.4	0.3%
2.F.7	Semiconductor Manufacture	FCs	308.7	0.3%
2.A.3	Limestone and Dolomite Use	CO_2	296.2	0.3%
2.B.2	Nitric Acid Production	N_2O	280.1	0.3%
6.B	Wastewater Handling	N_2O	278.3	0.3%
2.F.9	Other Sources of SF_6	SF_6	274.0	0.3%

IPCC Category Description		Gas	Emissions 2006 [Gg CO_2e]	Share in Total Emissions 2006
1.A.4 biomass	Other Sectors	CH_4	228.2	0.3%
3	Solvent and other Product Use	CO_2	221.0	0.2%
1.A.3.a jet.kerosene	Civil Aviation	CO_2	218.2	0.2%
4.D.2	Animal Production	N_2O	217.3	0.2%
1.A.4 other	Other Sectors	CO_2	75.9	0.1%
2.C.3	Aluminium production	PFCs	0.0	0.0%
2.C.3	Aluminium production	CO_2	0.0	0.0%
2.C.4	SF6 Used in Al and Mg Foundries	SF_6	0.0	0.0%

Table 6: Austrian key categories based on emission and removal data submitted to the UNFCCC in 2008.

IPCC Category Description		Gas	Emissions/Removals 2006 [Gg CO_2e]
5.A.1	Forest land remaining forest land	CO_2	–16 959.3
5.A.2	Land converted to forest land	CO_2	–2 770.0
5.B.1	Cropland remaining cropland	CO_2	70.8
5.B.2	Land converted to cropland	CO_2	1 715.9
5.C.2	Land converted to grassland	CO_2	–1 197.0
5.D.2	Land converted to Wetlands	CO_2	328.8
5.E.2	Land converted to Settlements	CO_2	–233.8
5.F.2	Land converted to Other land	CO_2	484.1

The key category with the highest contribution to national total emissions is *1.A Fuel Combustion – gaseous fuels*, this source has not been further disaggregated for the key category analysis because the same emission factor is used for all sub categories. The contribution to national total emissions in the base year was 14.3% compared to 18.4% in 2006. It ranked number one in all level assessments, and number two in the trend assessment.

The second most important source for greenhouse gas emissions in Austria is *1.A.3.b Road Transportation – diesel oil (CO_2)* for the years since 1996 and *1.A.3.b Road Transportation – gasoline (CO_2)* for the years before 1996. The contribution to national total emissions in the base year was 5.1% for diesel and 10.0% for gasoline, whereas in the last year of the inventory, namely 2006, it was 17.3% (6.7%). Furthermore, *1.A.3.b Road Transportation – diesel oil (CO_2)* was the most important source of GHG emissions in terms of emission trends: emissions have nearly quadrupled since the base year.

The third most important source in terms of its contribution to national total emissions is *1.A.4 stationary-liquid* (commercial and residential plants and plants in agriculture and forestry as well as off-road traffic associated with these sources); it is the third important source for all years. It was also rated a key category in the trend assessment (rank: 8). In the year 2006 it contributed 7.9% of national total greenhouse gas emissions, emissions from this source decreased by 2% from 1990 to 2006.

The key category with the highest contribution to national removals is *5.A.1 Forest land remaining forest land (CO_2)*. In the key category analysis including LULUCF it is among the second most important categories in the level assessment and ranks number three in the trend assessment. Removals from this category increased from 1990 to 2006 by 47%.

Comparison to last years' submission

There is a difference in the identified key categories compared to the results of last year's analysis, as the methodology of this year follows more closely the guidance of the GPG (also, recalculations and the introduction of new source categories might change the result of the KS analysis; for further information see Chapter 9 Recalculations and Improvements).

Compared to last year's key category analysis, six categories have been identified additionally as key:

- 4.D.2 Animal Production (N_2O) in the level assessment (without LULUCF)
- 6.B Wastewater Handling (N_2O) in the trend assessment
- 5.A.2 Land converted to forest land (CO_2) in level and trend assessment
- 5.B.2 Land converted to cropland (CO_2) in the level assessment
- 5.D.2 Land converted to Wetlands (CO_2) in the level assessment
- 5.F.2 Land converted to Other land (CO_2) in level and trend assessment

The following key category has been identified in last years' submission, but not in this:

- 1.A.3.b – gasoline Road transportation (N_2O)

The results are influenced by recalculations.

1.5.2 Description of Methodology

The method used to identify key source categories follows the Tier 1 method – quantitative approach described in the Good Practice Guidance (IPCC-GPG, 2000), Chapter 7 *Methodological Choice and Recalculation* and in the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC-GPG-LULUCF, 2003), Chapter 5.4 *Methodological Choice – Identification of key categories*.

The analysis includes all greenhouse gases reported under UNFCCC: CO_2, CH_4, N_2O, HFC, PFC and SF_6. All IPCC categories are included.

Key categories were first identified for the inventory excluding LULUCF and then the key category analysis was repeated for the full inventory including LULUCF categories.

The identification of key categories consists of six steps:

- Identifying categories
- Level Assessment excluding LULUCF
- Trend Assessment excluding LULUCF
- Level Assessment including LULUCF
- Trend Assessment including LULUCF
- Qualitative considerations

Level of disaggregation and identification of key categories

To identify key categories total emissions were split into those source categories that have been estimated using the same methodology and the same emission factor. LULUCF categories were split as recommended in the GPG-LULUCF, with the additional categories: total CH_4 from LULUCF, total N_2O from LULUCF and 5 B net CO_2 from lime application.

Table A1.5 of Annex 1 presents the 151 defined source categories and their greenhouse gas emissions expressed in CO_2 equivalent emissions and the 12 LULUCF categories in CO_2 equivalent emissions/removals for the years 1990 to 2005.

Further details and a list of the source/sink categories and key categories for each sector are given in the corresponding subchapters *3 Energy – 8 Waste*.

Level Assessment excluding LULUCF

For the Level Assessment the contribution of GHG emissions (expressed in CO_2 equivalent emissions) of each category to national total emissions was calculated. The calculation was performed for the years 1990 to 2006 according to Equation 7.1 of the GPG. Then the sources were ranked in descending order of magnitude according to the results of the level assessment and finally a cumulative total was calculated.

For the year 2006 30 source categories comprised > 95% of the cumulative total and were thus rated as key categories. For the year 1990 31 source categories were identified as key sources in the level assessment and for all other years 29–32 categories were identified as key categories. The result of each level assessment is presented in Annex 1.

Trend Assessment excluding LULUCF

The Trend Assessment identifies source categories that have a different trend from the trend of the overall inventory. As differences in trends are more significant at the overall inventory level for larger source categories, the result of the trend difference (i.e. the source category trend minus total trend) is weighted according to the sources' level assessment.

For the Trend Assessment, emissions of the year 2006 were compared with base year emissions (1990 for all gases).

The calculation was performed according to Equation 7.2 of the GPG. For sources with zero current year emissions Equation 5.4.3 of the GPG-LULUCF was used to calculate the trend. The results were ranked in descending order of magnitude and a cumulative total was calculated. Those sources that make up > 95% of the total trend were rated key categories. 32 sources were identified as key categories in the trend assessment. Results are presented in Annex 1.

Level Assessment including LULUCF

The level assessment was repeated for the full inventory including the LULUCF categories for the years 1990 to 2006 according to Equation 5.4.1 of the GPG-LULUCF. Eight LULUCF key categories were identified by this analysis additionally. The result of each level assessment is presented in Annex 1.

Trend Assessment including LULUCF

Also the trend assessment was repeated for the full inventory including the LULUCF categories for the years 1990 to 2006 according to Equation 5.4.2 of the GPG-LULUCF (Equation 5.4.3 for zero current year emissions). The result of the trend assessment is presented in Annex 1.

Qualitative criteria

The qualitative criteria considered were: mitigation techniques, high expected growth of emissions/removals and unexpected low or high emissions/removals. No additional key source categories were identified with qualitative criteria.

According to the GPG-LULUCF countries should identify and sum up the emission estimates associated with forest conversion to any other land category. This was done and the sum was found to be larger than the smallest category considered key in the quantitative analysis, thus it should be identified as key. The GPG-LULUCF also recommends further examining which land conversions are significant. In this examination it was found that the categories 5.C.2 Forest Land converted to Grassland, 5.E.2. Forest land converted to Settlements and 5.F.2. Forest land converted to Other land contribute together with 89% to deforestation. Nevertheless CO_2 emissions from these three categories are already identified as key categories in the quantitative analysis. There is no further guidance in the GPG how to handle this double accounting of emissions in two different categories. Thus, CO_2 emissions from deforestation are not considered additionally as key category, because 89% of these emissions are already covered by other key categories.

Identification of key categories

Any category meeting the 95% threshold in any year of the Level Assessment or in the Trend Assessment is considered a key category. The key categories are presented in Table 5 in descending order of magnitude of contribution to total national GHG emissions in the year 2006 and the LULUCF key categories are presented in Table 6. In Annex 1 they are presented together with their ranking of all assessments where they are within the 95% threshold.

Consequences of key category selection

Whenever a method used for the estimation of emissions/removals of a key category is not consistent with the requirements of the IPCC Good Practice Guidance, the method will have to be improved in order to reduce uncertainty, which is considered in the emission inventory improvement programme (see Chapter 9.4).

1.6 Quality Assurance and Quality Control (QA/QC)

The Umweltbundesamt is accredited as inspection body (Id.No. 241) in accordance with the Austrian Accreditation Law (AkkG), Federal Law Gazette No. 468/1992 last amended by federal law gazette I No. 85/2002, by decree of the Minister of Economics and Labour, No. BMWA-92.715/0036-I/12/2005, issued on 19 January 2006, valid from 23 December 2005.

The requirements of EN ISO/IEC (Type A) are fulfilled.

Figure 3: Official emblem of an Austrian accredited inspection body.

History of the Austrian QMS

A quality management system (QMS) has been designed to achieve the objectives of *good practice guidance*, namely to improve transparency, consistency, comparability, completeness and confidence in national inventories of emissions estimates. After having been effectively implemented during the development of the UNFCCC submission 2004, the accreditation audit of the Umweltbundesamt as *Inspection body for Greenhouse Gas Inventories* took place in autumn 2005, accreditation was then awarded in December 2005.

Table 7 presents the timetable for the implementation of the quality management system.

Table 7: Timetable for the implementation of the Austrian QMS.

	Date
Development of a quality management system including quality manual	1999–2002
Development of the quality management system Implementation of the quality management system	2003–2005
Accreditation Audit Accreditation as Inspection Body for Greenhouse Gas Inventories	September 2005 December 2005

With the start of the EU Emissions Trading system on January 1st 2005 and the entry into force of the Kyoto Protocol on February 16th 2005, greenhouse gas emissions now equal money. Pressure upon national GHG emission inventories is expected to increase, therefore a QMS is considered crucial in order to ensure the quality of emission estimates established according to the requirements of the IPCC-GPG as a basis for any kind of international emission trading.

1.6.1 The International Standard ISO 17020

The QMS was drawn up to meet requirements of the International Standard ISO 17020[17]. It covers the functions of bodies whose work includes assessments of conformity, and the subsequent reporting of results of conformity assessment to clients and, when required, to supervisory authorities. Inspection parameters may include, among others, matters of quantity and/or quality.

The general criteria, with which these bodies are required to comply in order that their services be accepted by clients and by supervisory authorities, are harmonized in the International Standard ISO/IEC 17020:1998 *General Criteria for the operation of various types of bodies performing inspections.* This standard 17020 has been drawn up with the objective of promoting confidence in those bodies performing inspections which conform to it.

The ISO 17020 also takes into account requirements and recommendations of European and international documents such as the ISO 9000 (EN/ISO 9000) series of standards, and goes beyond: additionally to the requirements of the ISO 9000 series, the ISO 17020 also provides a clear statement of requirements regarding

- competence,
- independence, impartiality and integrity, as well as confidentiality.

[17] The International Standard ISO 17020 superseded the European Standard EN 45004.

Accreditation Act

According to the ISO 17000 series, *accreditation* is the procedure by which an authorized body (accreditation body) formally recognizes that an organisation has the competence to perform a stipulated conformity assessment activity.

The Austrian Accreditation Act ("Akkreditierungsgesetz", Federal Law Gazette 468/1992 as amended by 430/1996) regulates the accreditation of testing, inspection and certification bodies. It designates the Federal Ministry for Economic Affairs and Labour as accreditation body and defines the conditions for granting, maintaining and extending accreditation and the conditions under which accreditation may be suspended or withdrawn.

Accreditation is granted after an successful accreditation audit, where an expert nominated by the accreditation body assesses the conformity of the organization of the inspection body and its QMS with the standard, and additionally a technical expert assesses the competence of the inspection body and the conformity of the methodologies applied with specific requirements. This audit takes three days of in house inspection.

The accreditation requires re-assessment in defined intervals (in the case of an inspection body every twelve to fifteen months an one day audit takes place, and a full three day audit after five years).

Accreditation and Certification

A certification is the procedure by which an official – or officially recognised – body (certification body) gives written assurance that a product, process or service conforms to specified requirements. Thus, in contrast to an accreditation, the certification gives warrantee for conformity, whereas the accreditation is a warrantee for competence, as well as independence, impartiality and integrity (additionally, both require an QMS that guarantees transparency).

One example for certification is the certification of a QMS according to the ISO 9000 series. The certification is issued by a certification body. The certification body on the other side needs an accreditation, which is the warrantee that the certification body is competent to carry out ISO 9000 certifications in specific business sectors.

Figure 4 shows the inter-relationship between the Austrian Accreditation Act, the EN 45000/ISO 17000 series and the ISO 9000 series.

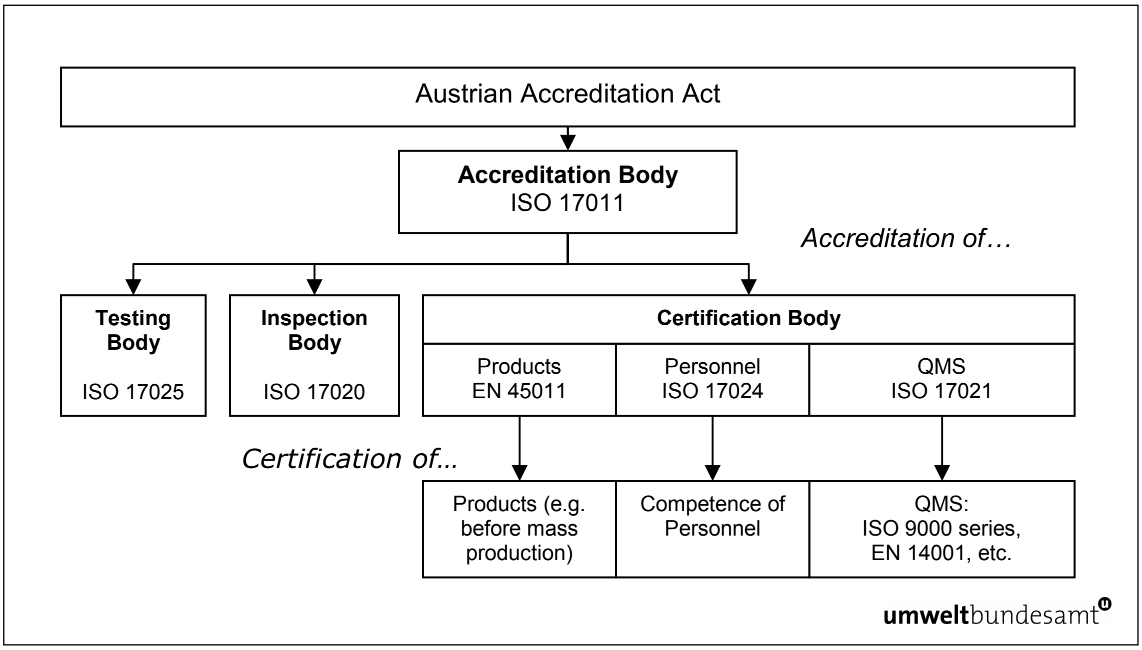

Figure 4: Inter-relationship between the Austrian Accreditation Act, the EN 45000/ISO 17000 and the ISO 9000 series.

Reports issued by an accredited body may carry the federal emblem in addition to the accreditation logo (see Figure 3). These reports are official documents.

Independence

Regarding independence, ISO 17020 distinguishes between different types of inspection bodies:

The Umweltbundesamt is a Type A inspection body, which stands for "third party" services. This means that the inspection body shall be independent of the parties involved (e.g. industry, government). The inspection body and its staff responsible for carrying out the inspection shall not be the authorized representatives of any of these parties. Furthermore, the inspection body and its staff shall not engage in any activities that may be in conflict with their independence of judgement and integrity in relation to their inspection activities. Finally, all interested parties shall have access to the services of the inspection body. The procedures under which the body operates shall be administered in a non-discriminatory manner.

In contrast to this, a Type B inspection body provides "second party" services: inspection services are supplied to the organization of which the inspection body forms a part.

Impartiality and Integrity

The personnel of the inspection body shall be free from any commercial, financial and other pressures which might affect their judgement. It has to be ensured that persons or organisations external to the inspection body cannot influence the results of inspections carried out.

We feel that such a regulation is fundamental in order to guarantee that the emission data reflect real emissions as truly as possible.

Inspection body in the context of National Greenhouse Gas Inventory

In the case of greenhouse gas emissions inventories, inspection covers (i) data collection (emission data and/or of data which are used to estimate emissions e.g. activity data, emission factors, conversion factors), (ii) the application of appropriate methodologies (IPCC, CORINAIR and country specific methodologies) to estimate emissions, (iii) the compilation of the emissions inventory and (iv) the assessment of conformity with national emission reduction targets. The QMS ensures that all requirements of a Type A inspection body as stipulated in ISO 17020 are met, including independence, impartiality and integrity.

When compiling emission inventories according to the standard, the methodologies applied have to be officially approved by the accreditation body. For some sources in the LULUCF Sector (see chapter on LULUCF) and ammonia production new methodologies have been applied which have not yet been approved by the accreditation body – however, the approval is scheduled for spring 2008.

The Austrian Quality Management System (QMS) and requirements of IPCC GPG

The implementation of QA/QC procedures as required by the IPCC-GPG support the development of national greenhouse gas inventories that can be readily assessed in terms of quality and completeness. The QMS as implemented in the Austrian inventory includes all elements of the QA/QC system outlined in IPCC-GPG Chapter 8 „Quality Assurance and Quality Control" (see next subchapter), and goes beyond. It also comprises supporting and management processes in addition to the QA/QC procedures in inventory compilation and thus ensures agreed standards not only within (i) the inventory compilation process and (ii) supporting processes (e.g. archiving), but also for (iii) management processes (e.g. annual management reviews, internal audits, regular training of personnel, definition of procedures for external communication).

1.6.2 Design of the Austrian QMS

The design of the QMS of the *Inspection Body for Greenhouse Gas Inventories* at the Umweltbundesamt follows a *process based approach*. It is illustrated in Figure 5.

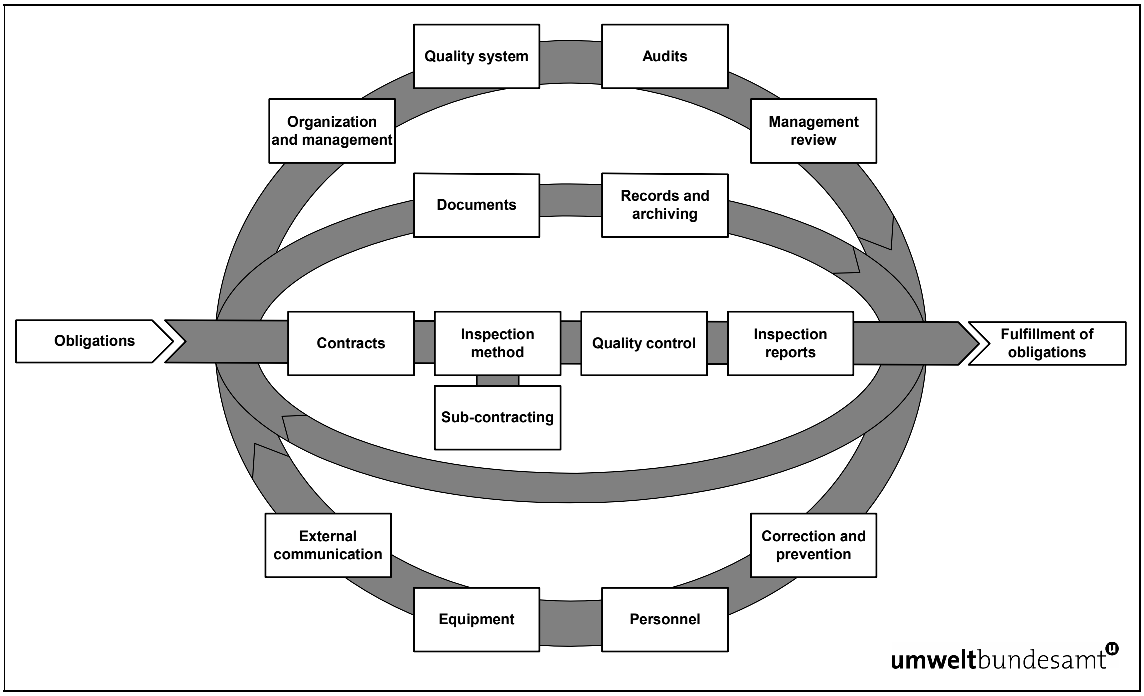

Figure 5: Process-based QMS (the outer circle corresponds to management processes, the straight line to realisation processes and the inner circle to supporting processes).

In the following the processes are explained:

1) Realisation processes (horizontal bar)

Realisation processes are the *Inspection Body for Greenhouse Gas Inventories´* core competencies as they concern the compilation of emission inventories. The first process constitutes a contract control system which ensures that methods to be used are selected in advance, taking into account that for key source categories the most accurate method, i.e. the method with the lowest uncertainty, is the most appropriate. The inspection process consists of two steps, (i) data collection and (ii) the application of methods to estimate emissions. The Umweltbundesamt uses IPCC methods, CORINAIR methods and country specific methods. Country-specific methods are thoroughly documented and validated. Emission estimates are subject to quality control checks before being published in an inspection report.

The inspection body performs the majority of inspection processes. Any subcontractor performing part of the inspection is required to work in compliance with ISO 17020.

2) Management processes (outer circle)

Management Processes comprise all activities necessary for management and control of an organisation: organisation and management, quality system, audits, quality management review, corrective actions and prevention, personnel, equipment, external communication.

The most important aspect with respect to organisation and management is that it has to be ensured that the personnel is free from any commercial, financial or other pressure which might affect their judgement. Such regulations are considered fundamental in order to guarantee that emission data reflect actual emissions as truly as possible.

The personnel responsible for inspection shall have appropriate qualifications, training, experience and a satisfactory knowledge of the requirements of the inspections to be carried out. They have the ability to make professional judgements as to conformity with general requirements using examination results and to report there-on.

Computers are used for the compilation of emission inventories. Procedures for protecting the integrity of data and for maintenance of data security have been established and implemented. Access authorisation is strictly limited for protecting the integrity of data and to ensure data confidentiality where necessary.

3) Supporting processes (inner circle)

Supporting processes support both management and realisation processes. They include a control system for all documents and data as well as for records and their archiving.

As yearly product of the QMS the QMS-Report is presented to the central executive officer. The QMS report includes an evaluation of the QMS, the inventory improvement plan (evaluation of fulfilment of previous plan and decision on new plan) and a plan for the QMS (evaluation of fulfilment of previous plan and decision on new plan).

1.6.3 Elements of QA/QC System, and Austrian approach

According to the GPG (2000) the QA/QC system that should be implemented for GHG inventories consists of:

- an inventory agency responsible for coordinating QA/QC activities
- a QA/QC plan
- general QC procedures (Tier 1)
- source category-specific QC procedures (Tier 2)
- QA review procedures
- reporting, documentation, and archiving procedures

In the following the implementation of these elements in the Austrian QMS is described.

Responsibilities

The Umweltbundesamt is designated as single national entity responsible for Austria's GHG inventory by law, and is thus also responsible for QA/QC activities. For more information regarding responsibilities please refer to Chapter 1.2.3.

Responsibilities of the different functions within the inspection body are defined in the QMS:

- quality coordinator
- sector expert (and deputy sector expert)
- project manager
- head of inspection body
- central executive officer

QA/QC Plan

Activities to be conducted by the personnel of the inspection body are written down in the Quality Manual. Such activities are:

- QC activities
- procedures for country specific methodologies
- internal audits (QM specific)
- procedures for sub-contracting
- inventory improvement plan
- documentation and archiving
- plan of methodologies (needs approval from the formal contracting body)
- treatment of confidential data
- etc.

The Quality Manual is divided in three levels, where the activities as listed above form Level 2:

- Level 1: General (the actual "quality manual": general information, description of QMS, general responsibilities,...)
- Level 2: Detailed description of activities to be conducted and checklists and forms to be filled out.
- Level 3: Documentation of QC activities (filled out checklists,...)

QC Activities

QC Activities are mainly performed by the sector experts themselves (first party) after inventory work has been finished. However, where possible the deputy of the sector experts conducts QC checks (second party).

QC activities are conducted following QC checklists, which cover Tier 1 QC (general QC) such as formal aspects (check of IPCC quality objectives TACCC) as well as Tier 2 QC (source specific QC).

The checklists cover questions like:

- ✓ Are all references clearly made?
- ✓ Are all assumptions documented?
- ✓ Are the correct values used (check for transcription errors, …)?
- ✓ check of calculations, units,...
- ✓ Is the data set complete for the whole time series?
- ✓ check of plausibility of results (time-series, order of magnitude, …)
- ✓ correct transformation/transcription into CRF
- ✓ Are all recalculations clearly explained?
- ✓ Is the data applicable?
- ✓ Where possible data is checked with data from other sources, order of magnitude checks, …
- ✓ etc.

The checklists cover all aspects as required according to Table 8.1 of the IPCC GPG (2000).

Additionally electronic checks (e.g. check for completeness and comparison with last year's inventory) are performed by the project manager, who is also responsible for data management of the inventory.

Source specific QC activities are described in the sector-specific Chapters of this report.

QC activities proved to be helpful to identify errors as well as lack in transparency before inventory data is published.

QA Activities

The following QA activities are performed:

Second party audits for CS methodologies, for key sources more detailed.

Country specific (CS) methodologies are defined in SOPs, before CS methods are applied they need to be

- audited (second party audit):
  - check of formal aspects (are all QMS requirements fulfilled) for all sources
  - additional QA for key sources: is methodology appropriate, in line with requirements
- approved by the head of inspection body
- approved by the accreditation body (after notification to the accreditation body CS methods are part of the accreditation audits, which are third party audits).

Second party audits for work performed by sub-contractors:

A sector expert at the Umweltbundesamt is responsible for incorporation of results in inventory database and additional QA/QC (works as second party audit).

Accreditation audits (third party audits) check conformity of QMS with ISO 17020 and of methodologies with requirements of IPCC GPG.

One finding from the last audit by the accreditation body was for example: Statistik Austria as the main data supplier has no QM certification/ accreditation, thus the Umweltbundesamt has checked in an audit in 2007 if all ISO 17020 requirements are fulfilled (other data suppliers audits will follow).

Error correction and continuous improvement: all issues regarding transparency, accuracy, completeness, consistency or comparability identified by experts from different backgrounds are incorporated in the inventory improvement plan. The source of these findings are:

- UNFCCC Reviews
- external experts (e.g. experts from federal provinces: some of them who prepare a partly independent emission inventory for their federal province compare their results with the disaggregated national inventory),
- stakeholders (e.g. industrial facilities or association of industries: the NIR is communicated to every data supplier and Austrian experts involved in emission inventorying after submission)
- personnel of the inspection body (head of inspection body, sector experts, etc.)

These findings are documented including a plan to improve the inventory, a timeline and responsibilities. The improvement plan and fulfilment of planned improvements is monitored by the head of inspection body. Improvements that are relevant in terms of resources are presented in yearly management review to the central executive officer, and if additional resources are needed are notified to the ministry for environment.

Archiving and documentation

Within the inventory system, a system for transparent documentation of inventory data and information (assumptions etc.) that allows reproduction of inventory is implemented. To allow clear references in documentation of inventory, an archiving system for literature, mails, documents (e.g. review reports), calculations, with an access database containing the archiving information is used. The archived documents are stored on server and/or in inventory archive (paper).

For each sector the documentation includes:

- responsibilities (where relevant)
- "logbook" (who did what and when)
- and for each source category:
  - description (source, emissions, key source)
  - information on completeness
  - methodology
  - references for activity data, emission factor and emissions
  - uncertainty
  - recalculations
  - planned improvements

Focus of QA/QC activities in the year 2007

During the year 2007, QA/QC activities were focused on further improvements of the QMS. Furthermore, as already mentoned above, the Umweltbundesamt audited the main data supplier Statistik Austria.

1.7 Uncertainty Assessment

1.7.1 Introduction

A consistent assessment of uncertainties of the Austrian greenhouse gas inventory requires a detailed understanding of the uncertainties of the respective input parameters. Since the first detailed uncertainty evaluation (WINIWARTER & ORTHOFER 2000, WINIWARTER & RYPDAL 2001), the Austrian inventory compilers have spent considerable effort to also obtain uncertainties from individual contributors to the inventory. This leads to a situation where national information or at least national expert knowledge directly from the stage of inventory development may flow into the assessment of uncertainties.

The respective sectoral uncertainties are documented in detail in the sectoral chapters of this report. Specific uncertainty estimates are e.g. available for agricultural soil, for enteric fermentation from animal husbandry, for F-gases, for transport, and for land-use change and forestry. An assessment of the uncertainties of the energy balance is currently under way.

1.7.2 Theoretical background

The assessment and propagation of uncertainties in emission inventories has been described in detail by IPCC (IPCC 2000), (IPCC 2006). Principally, two different pathways may be taken to arrive at a total uncertainty, and to develop an inventory uncertainty. The "tier 1" approach is based on error propagation: assuming input information is available in form of normal distribution, and input uncertainties are statistically independent, the approach allows for reliable assessment of inventory uncertainty. More flexibility is possible in the "tier 2" method. The Monte-Carlo approach allows any probability distribution of input parameters, and it also enables to define statistical dependencies between parameters. The most obvious dependency is a full dependency. This occurs when two values are based on the identical set of measurements. A variation or error in one value would then be fully reflected also in the other value. While "full dependency" theoretically can also be covered in error propagation, this is normally not done and only in a very limited way possible in the IPCC spreadsheets.

The general properties of error propagation allow to combine (add up) information in a way that the relative uncertainty (as percentage of the mean value) of the combination becomes lower than the relative uncertainty of any of the input parameters. This advantage of going into detail is often implicitly taken advantage of, when a problem is disassembled into sub-problems and the sub-results are being recombined. Nevertheless it is not always the most detailed level that yields results of lowest uncertainty. If measurements or assessments at the most detailed level are difficult, a more comprehensive level of information may provide the lower overall uncertainty.

As a consequence, optimizing the approach requires collecting input information at the most detailed level an inventory is prepared at. Attaching uncertainty data then may be done at a level where greatest confidence can be expected on the data. This may be the most detailed level, but more often uncertainty data will not be available, or a "balance" approach (energy balance, solvent balance) will allow more reliability at an aggregated level.

1.7.3 Procedure

For the update of the uncertainty assessment of the Austrian greenhouse gas inventory, the most detailed level of the inventory system was used as the base level. This "base level" of the inventory facilitates compilation of emission data for different purposes. Reporting on air pollution (according to UN-ECE or European Commission requirements) is performed by agglomerating the details in basically the same way as it is done for the GHG inventory according to UNFCCC procedures.

This approach of starting at the most detailed level the inventory offers facilitated an assessment of emission uncertainty at any level that the most reasonable uncertainty data are available. Very detailed information can be entered directly, for aggregate information the same uncertainty (as a statistically dependent entity) is applied for all input entries concerned.

Uncertainty information was taken from national studies, from international information (as e.g. in the IPCC reports) from variation presented in literature, and by contacting national experts. Structured interviews were not held, but information collected previously in structured interviews still could be used. The same uncertainty information was applied for a tier 1 and a tier 2 uncertainty approach. As will be explained below, considerable difference between those approaches can be explained by covariance of uncertainties between (key) source categories, which occurs when data are statistically dependent. The tier 1 approach allows considering co-variance between years for one source category, but does not cover co-variances between source categories.

In all input and output parameters, uncertainty has been expressed as normal or lognormal probability density function. In line with the IPCC requirements, the uncertainty range is presented as the range with 95% probability of a given value being within its boundaries. Thus the boundaries were given as the 2.5 and 97.5-percentiles of the respective distribution. For a normal distribution, this is +/- 2 standard deviations from the mean.

1.7.4 Random uncertainty vs. systematic uncertainty

In a previous study, random and systematic uncertainty (or: error) were strictly separated. Systematic errors were seen as errors contained and discovered in the national inventory, which had not been corrected (WINIWARTER & RYPDAL 2001). As systematic errors by definition are errors unknown at the time they occur, the systematic uncertainty describes such undiscovered uncertainty. Previously, this undiscovered error was expected to be of the same magnitude as those errors identified. Such an assessment obviously refers to the inventory as a whole, and not to a single sector, as one should not expect an error always occurring in the same sector. Furthermore, it is highly questionable if the assumption, that the error remaining relates to the error discovered, can be sustained.

Consequently here we did not perform a specific assessment of systematic uncertainty.

1.7.5 Data origin

Many of the uncertainties included in the tier 1 and tier 2 calculations have already been covered in the previous submissions. Nevertheless it is worthwhile to consider some of the input uncertainties in detail – especially those that contribute more to the overall uncertainty.

Activities: According to information from the Austrian statistical agency, the Austrian energy balance is strongly affected by inexact reporting, reporting errors or omissions/double counting due to difficult attribution of responsibilities. Detailed statistics are therefore not very reliable, but on the total energy level a number of additional plausibility checks are performed. This procedure allows to expect high quality data of low uncertainty at a rather high level of detail, to be presented separately by the specified fuel types (coal/oil/gas, and also biomass but at a higher uncertainty). Consequently, separate (independent) assessment of energy data has been applied to power plants, other combustion including industry, and transport. Within each of these ranges of sectors the specific uncertainty has been applied, but is considered statistically dependent.

Some very special fuels are also treated separately (landfill gas, black liquor). Additionally, large industrial plants are considered separately, as long as they remain sufficiently separate of the energy input. Iron and steel industry is considered dependent of energy. Non-energy sectors are assessed using the specific Austrian studies already mentioned above. These studies contain specific information on agricultural soil, enteric fermentation from animal husbandry, F-gases, transport, and on land-use change and forestry.

Activity related uncertainties for base year and target year are considered to be the same in all cases, but statistically independent. There are reports, e.g. on the solvent sector, which assume lower uncertainty for more recent data. As the solvent balance is strongly dependent on the trade statistics, which suffered heavily from the relaxation of reporting requirements after Austria's accession to the EU in 1995, such improvement was not considered.

Carbon dioxide (CO_2): The emission factor of CO_2 is in most cases well contained due to the carbon content of fuels or of raw materials. Still it is basically one set of measurements that is applied uniformly. A large number of single data have been applied to arrive at a reliable carbon content and consequently emission factor, but this is already factored-in in the magnitude of the uncertainty. Consequently, all energy related carbon contents by fuel type are here considered identical for all energy related activities. We assume independence of uncertainties between fuel types only. Some more independent uncertainty figures are available for source categories like solvents, chemical industry, land use change.

Methane (CH_4): Methane emissions are derived from a large variety of individual measurements of total hydrocarbon (HC) or total volatile organic compound emissions. But only the smaller part of uncertainties derives from these measurements. The larger part is caused by assumptions on the fraction of CH_4 in the HC mix, which ranges from 10% (coal fired large plants) to 75% (gas combustion). Therefore statistically independent numbers are no more than the CH_4 fractions considered separately. Such separate data is available only in combustion generally, in power plants, and in transport. Consequently we have here a very similar pattern as in activities.

Agricultural methane (enteric fermentation and manure treatment) has been assessed for Austria in specific studies, which also reported the uncertainty involved in emission factors (AMON et al. 2002, GEBETSROITHER et al. 2002). This uncertainty estimate could be applied here.

Nitrous oxide (N_2O): Very limited measurement data are available on nitrous oxide emissions. When trying to trace emission factors back to their origin, the large Austrian data collection on emission factors from combustion (STANZEL et al. 1995) refers virtually all N_2O factors back to GEMIS. In line with an earlier assessment done in an Austrian N_2O balance (ORTHOFER et al. 1994), uncertainties by fuel in general and uncertainties in the domestic heating sector were considered independent. Also transport was considered independently, even separated between Diesel fuel and gasoline (as only the latter is equipped with catalysts, which are responsible for the larger share of emissions).

In addition to the definition of statistically independent parameters, some of the uncertainty attributions had to be adapted. Uncertainty figures in the energy sector refer to measurements done around 1990 (VITOVEC 1991). Changes in fuel quality or in combustion equipment are not at all reflected, leading to enhanced uncertainty which we here take from international data. Furthermore (and most importantly, see below), the uncertainty estimate on N_2O from soils used previously (NIR 2006) could not be sustained. A detailed investigation revealed that the source of the 48% uncertainty presented was a statement in an IPCC report (IPCC 2000) referring to a measurement uncertainty. Here we have to deal with an emission factor uncertainty, which is estimated much higher, at an order of magnitude in the latest IPCC emission inventory guidelines (IPCC 2006). This higher number which we adopt now is still much smaller than the two orders of magnitude recommended by IPCC previously (IPCC 2000), and also smaller than a previous estimate for Austria (WINIWARTER & RYPDAL 2001). The latter was considered in part systematic uncertainty, however (the random uncertainty was considered smaller than the range now used) – this is still in part true, but only reflects our lack of knowledge on soil processes. Choosing to apply a quasi-standardized value conforms to the claim of (WINIWARTER 2007) that application of similar parameters between countries allows for a smaller error in an inter-comparison, even if the difference to a "true value" might be larger.

Fluorinated gases: The uncertainties related to emissions of fluorinated gases (PFC, HFC and SF_6) have been investigated within the emission assessment (NIR 2006). Basically, emissions in areas where substances are specifically brought in, e.g. as solvents, are considered well understood, those that refer to release (refrigeration, electrodes during Al-production) are considered highly uncertain.

1.7.6 Results

Separate uncertainty calculations, albeit with the same (as much as possible) input information was performed using a spreadsheet prepared specifically according to the "Tier 1" approach (IPCC 2000), and with a Monte Carlo approach fully considering statistical dependence of detailed input data as described above ("Tier 2" approach). It should be noted that the "Monte-Carlo" approach, averaging a large number of randomly varied input data, may exhibit slightly different results in total and source category emissions than a direct calculation. This difference is similar to a rounding error and may be ignored.

Data are presented in Table 8 and Table 9 for the key categories of the Austrian GHG inventory, except LULUCF categories. Uncertainty is presented for each category, and for the level of target year 2006 as well as for the trend in percentage points relative to the total base year (1990) emissions. One of the major problems in assigning uncertainty figures appears when introducing asymmetric distribution into Table 8, especially those that have a strong influence. Using the range of 0.3 to 3 times the emission factor for N_2O from soils, we chose to apply an uncertainty of 150%. If we would have taken 200% (consistent with the factor 3 increase), the overall uncertainties would have been slightly higher for both level and trend.

For reasons of better comparing results, Table 9 includes the same source categories and gases as Table 8, even if data are available at any desired level, for all greenhouse gases and also for non-key source categories. Uncertainty introduced by non-key sources has been included in the total uncertainties reported for the Monte-Carlo approach. Non-key sources may also be evaluated individually; here they have been aggregated by gas (Table 10).

Table 8: Tier 1 Uncertainty calculation and reporting according IPCC (2000) Table 6.1.

IPCC Source category	Gas	AD	EF	Combined	Combined as % of total national emissions in 2006	Introduced into the trend in total national emissions
		Uncertainty [%]				
1 A 1 a liquid: Public Electricity and Heat Production	CO_2	0.5	0.5	0.7	0.01	0.01
1 A 1 a other: Public Electricity and Heat Production	CO_2	10.0	20.0	22.4	0.18	0.19
1 A 1 a solid: Public Electricity and Heat Production	CO_2	0.5	0.5	0.7	0.05	0.05
1 A 1 b liquid: Petroleum refining	CO_2	0.5	0.3	0.6	0.01	0.02
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO_2	3.0	0.5	3.0	0.04	0.06
1 A 2 other: Manufacturing Industries and Construction	CO_2	10.0	20.0	22.4	0.22	0.22
1 A 2 solid: Manufacturing Industries and Construction	CO_2	1.0	0.5	1.1	0.07	0.10

IPCC Source category	Gas	AD	EF	Combined	Combined as % of total national emissions in 2006	Introduced into the trend in total national emissions
		Uncertainty [%]				
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO_2	3.0	0.5	3.0	0.06	0.10
1 A 3 a jet kerosene: Civil Aviation	CO_2	3.0	3.0	4.2	0.01	0.01
1 A 3 b diesel oil: Road Transportation	CO_2	3.0	3.0	4.2	0.76	0.98
1 A 3 b gasoline: Road Transportation	CO_2	3.0	3.0	4.2	0.29	0.36
1 A 4 biomass: Other Sectors	CH_4	10.0	50.0	51.0	0.13	0.10
1 A 4 mobile-diesel: Other Sectors	CO_2	3.0	0.5	3.0	0.05	0.07
1 A 4 other: Other Sectors	CO_2	10.0	20.0	22.4	0.02	0.09
1 A 4 solid: Other Sectors	CO_2	1.0	0.5	1.1	0.01	0.02
1 A 4 stat-liquid: Other Sectors	CO_2	3.0	0.5	3.0	0.25	0.40
1 A gaseous: Fuel Combustion (stationary)	CO_2	2.0	0.5	2.1	0.39	0.62
1 B 2 b: Natural gas	CH_4	4.2	14.1	14.7	0.10	0.07
2 A 1: Cement Production	CO_2	5.0	2.0	5.4	0.12	0.18
2 A 2: Lime Production	CO_2	20.0	5.0	20.6	0.14	0.22
2 A 3: Limestone and Dolomite Use	CO_2	19.6	2.0	19.7	0.07	0.11
2 A 7 b: Sinter Production	CO_2	2.0	5.0	5.4	0.02	0.02
2 B 1: Ammonia Production	CO_2	2.0	4.6	5.0	0.03	0.02
2 B 2: Nitric Acid Production	N_2O	0.0	5.0	5.0	0.02	0.05
2 C 1: Iron and Steel Production	CO_2	0.5	0.5	0.7	0.04	0.05
2 C 3: Aluminium production	CO_2	2.0	0.5	2.1	0.00	0.01
2 C 3: Aluminium production	PFC	0.0	50.0	50.0	0.00	0.12
2 C 4: SF6 Used in Al and Mg Foundries	SF_6	0.0	5.0	5.0	0.00	0.02
2 F 1/2/3/4/5: ODS Substitutes	HFC	20.0	50.0	53.9	0.19	0.15
2 F 7: Semiconductor Manufacture	FCs	5.0	10.0	11.2	0.03	0.03
2 F 9: Other Sources of SF6	SF_6	25.0	50.0	55.9	0.54	0.67
3: SOLVENT AND OTHER PRODUCT USE	CO_2	5.0	10.0	11.2	0.03	0.02
4 A 1: Cattle	CH_4	10.0	20.0	22.4	0.76	0.62
4 B 1: Cattle	N_2O	10.0	100.0	100.5	0.90	0.37
4 B 1: Cattle	CH_4	10.0	70.0	70.7	0.36	0.22
4 B 8: Swine	CH_4	10.0	70.0	70.7	0.32	0.13
4 D 1: Direct Soil Emissions	N_2O	5.0	150.0	150.1	2.73	0.93
4 D 2: Pasture, Range and Paddock Manure	N_2O	5.0	150.0	150.1	0.37	0.07
4 D 3: Indirect Emissions	N_2O	5.0	150.0	150.1	1.85	0.83
6 A: Solid Waste Disposal on Land	CH_4	12.0	25.0	27.7	0.55	0.80
6 B: Wastewater Handling	N_2O	20.0	50.0	53.9	0.17	0.14
Total					**3.79**	**2.27**

Table 9: Tier 2 Uncertainty reporting according IPCC (2000) Table 6.2 – key sources.

IPCC Source category	Gas	Uncertainty in 2006 emissions as % of emissions in the category		Uncertainty introduced on national total in 2006	Uncertainty introduced into the trend in total national emissions
		% below (2.5)	% above (97.5)	%	
1 A 1 a liquid: Public Electricity and Heat Production	CO_2	0.7	0.7	0.01	0.01
1 A 1 a other: Public Electricity and Heat Production	CO_2	21.3	22.7	0.2	0.2
1 A 1 a solid: Public Electricity and Heat Production	CO_2	0.7	0.7	0.0	0.1
1 A 1 b liquid: Petroleum refining	CO_2	0.6	0.6	0.01	0.02
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO_2	3.0	3.0	0.04	0.06
1 A 2 other: Manufacturing Industries and Construction	CO_2	21.4	22.9	0.21	0.19
1 A 2 solid: Manufacturing Industries and Construction	CO_2	1.1	1.1	0.07	0.11
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO_2	2.6	2.6	0.06	0.12
1 A 3 a jet kerosene: Civil Aviation	CO_2	4.1	4.1	0.01	0.01
1 A 3 b diesel oil: Road Transportation	CO_2	4.1	4.1	0.73	0.76
1 A 3 b gasoline: Road Transportation	CO_2	4.1	4.1	0.29	0.39
1 A 4 biomass: Other Sectors	CH_4	50.3	50.7	0.13	0.07
1 A 4 mobile-diesel: Other Sectors	CO_2	3.0	3.0	0.05	0.08
1 A 4 other: Other Sectors	CO_2	21.4	22.9	0.02	0.08
1 A 4 solid: Other Sectors	CO_2	1.1	1.1	0.01	0.04
1 A 4 stat-liquid: Other Sectors	CO_2	2.8	2.8	0.23	0.38
1 A gaseous: Fuel Combustion (stationary)	CO_2	3.2	3.2	0.60	0.81
1 B 2 b: Natural gas	CH_4	14.6	14.8	0.10	0.06
2 A 1: Cement Production	CO_2	5.2	5.3	0.11	0.18
2 A 2: Lime Production	CO_2	20.4	20.4	0.13	0.18
2 A 3: Limestone and Dolomite Use	CO_2	19.1	19.3	0.07	0.09
2 A 7 b: Sinter Production	CO_2	5.2	5.3	0.02	0.02
2 B 1: Ammonia Production	CO_2	4.8	4.8	0.03	0.02
2 B 2: Nitric Acid Production	N_2O	19.6	20.1	0.06	0.16
2 C 1: Iron and Steel Production	CO_2	0.7	0.7	0.04	0.04
2 C 3: Aluminium production	CO_2	0.0	0.0	0.00	0.00
2 C 3: Aluminium production	PFC	0.0	0.0	0.00	0.67
2 C 4: SF6 Used in Al and Mg Foundries	SF_6	0.0	0.0	0.00	0.02
2 F 1/2/3/4/5: ODS Substitutes	HFC	53.3	53.1	0.51	0.58

IPCC Source category	Gas	Uncertainty in 2006 emissions as % of emissions in the category		Uncertainty introduced on national total in 2006	Uncertainty introduced into the trend in total national emissions
		% below (2.5)	% above (97.5)	%	
2 F 7: Semiconductor Manufacture	FCs	10.8	11.0	0.04	0.05
2 F 9: Other Sources of SF6	SF_6	54.6	56.0	0.17	0.21
3: SOLVENT AND OTHER PRODUCT USE	CO_2	4.7	4.9	0.01	0.02
4 A 1: Cattle	CH_4	20.9	21.0	0.71	0.44
4 B 1: Cattle	CH_4	68.0	69.2	0.35	0.14
4 B 1: Cattle	N_2O	50.3	99.7	0.69	0.17
4 B 8: Swine	CH_4	67.9	68.7	0.30	0.07
4 D 1: Direct Soil Emissions	N_2O	70.0	209.5	2.70	0.42
4 D 2: Pasture, Range and Paddock Manure	N_2O	70.0	209.5	0.36	0.03
4 D 3: Indirect Emissions	N_2O	70.0	209.5	1.83	0.44
6 A: Solid Waste Disposal on Land	CH_4	26.1	28.6	0.53	0.79
6 B: Wastewater Handling	N_2O	42.4	45.2	0.13	0.09
National Total without LULUCF				**5.32**	**2.27**

Uncertainty expressed as percentiles (2.5%, 97.5%) is able to cover asymmetric distributions. Expressing percentages only (or percentage points, in the case of the trend) comes closer to the Tier 1 result, but fails to reflect the full potential of the approach.

Table 10: Tier 2 Uncertainty reporting according IPCC (2000) Table 6.2 – non-key sources (aggregated by gas).

IPCC Source category	Gas	Uncertainty in 2006 emissions as % of emissions in the category		Uncertainty introduced on national total in 2006	Uncertainty introduced into the trend in total national emissions
		% below (2.5)	% above (97.5)	%	
Non-Key Sources	CO_2	1.5	1.5	0.02	0.02
Non-Key Sources	CH_4	18.3	18.5	0.11	0.05
Non-Key Sources	N_2O	15.1	16.3	0.20	0.10
Non-Key Sources	PFC	53.3	53.1	0.00	0.00
Non-Key Sources	HFC	–	–	0.00	0.00
Non-Key Sources	SF_6	54.6	56.0	0.02	0.03

The complete uncertainty information (IPCC GPG tables 6.1 and 6.2) can be found in Annex 6.

1.7.7 Conclusions

The comparison of Tier 1 and Tier 2 results shows that, basically, both approaches yield very similar results in terms of contribution to level or trend uncertainty for an individual source category. Differences become visible where distributions are not symmetric (in the case of Austria, lognormal distributions have been applied to N_2O emissions only, most visible for N_2O from soils). This is also seen in the difference between the "lower range" vs. "upper range" uncertainties, and those determined by standard deviations (2s).

The most striking difference is that of the total uncertainty, the tier 1 approach is clearly lower. This difference may be explained by the fact that the tier 1 approach necessarily considers input data for two source categories to be independent. As we have described above, we do believe that such dependence is quite typical. Statistically dependent variables, as can easily be defined in a Monte Carlo analysis, will not allow overall relative uncertainty to be reduced as strongly during error propagation. Consequently, uncertainty results will be considerably higher than presented in a tier 1 approach.

We need to mention specifically that this difference in the results is not a necessity of the tier 2 approach, but depends just on the input assumptions taken. Many studies (MONNI & SYRI 2003, RAMIREZ-RAMIREZ et al. 2006, US-EPA 2007) apply different assumptions, or at least do not clearly refer to this problem. We have outlined above, however, why we believe that many of the parameters in the inventory are not independent and thus have to be assumed to contribute to a correlation.

Figure 6 shows the resulting probability density distribution for Austria, 2006. The distribution is most strongly influenced by the lognormal distribution of the uncertainty in soil N_2O emissions. If the previous (WINIWARTER & RYPDAL 2001) assumption on "random" N_2O emission factor uncertainty is taken (triangular distribution between 50% and 200% of the given emission factor), the total level uncertainty of the Austrian inventory decreases considerably. This is again proof of the importance on assumptions taken on N_2O emissions on the overall uncertainty of a national GHG inventory.

Compared to the previous Monte-Carlo uncertainty analysis of the Austrian GHG inventory (WINIWARTER & ORTHOFER 2000, WINIWARTER & RYPDAL 2001), results (without LULUCF, and without considering systematic uncertainties) are somewhat higher. As has been discussed above, virtually all of that increase is due to different and new assumptions on the uncertainty of the emission factor of N_2O.

As is also shown in Figure 7, studying the sensitivity of the output to the input parameters yields a result virtually fully determined by soil N_2O emission factor. While, compared to previously, other components have improved, it is now virtually N_2O alone that determines the uncertainty. It should be noted that even at quite low uncertainty, transport has taken over a considerable role due to its large overall contribution to emissions, albeit not at all challenging the leading role of N_2O.

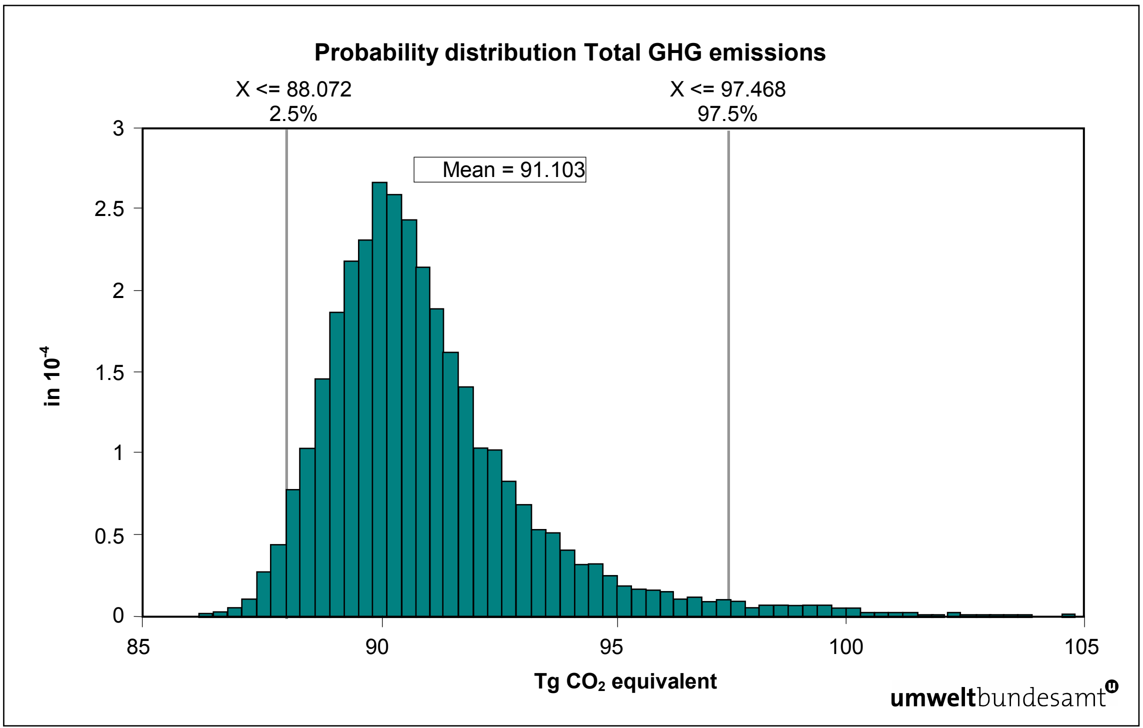

Figure 6: Austria's greenhouse gas emissions in 2006 without LULUCF – probability bins according to uncertainty analysis.

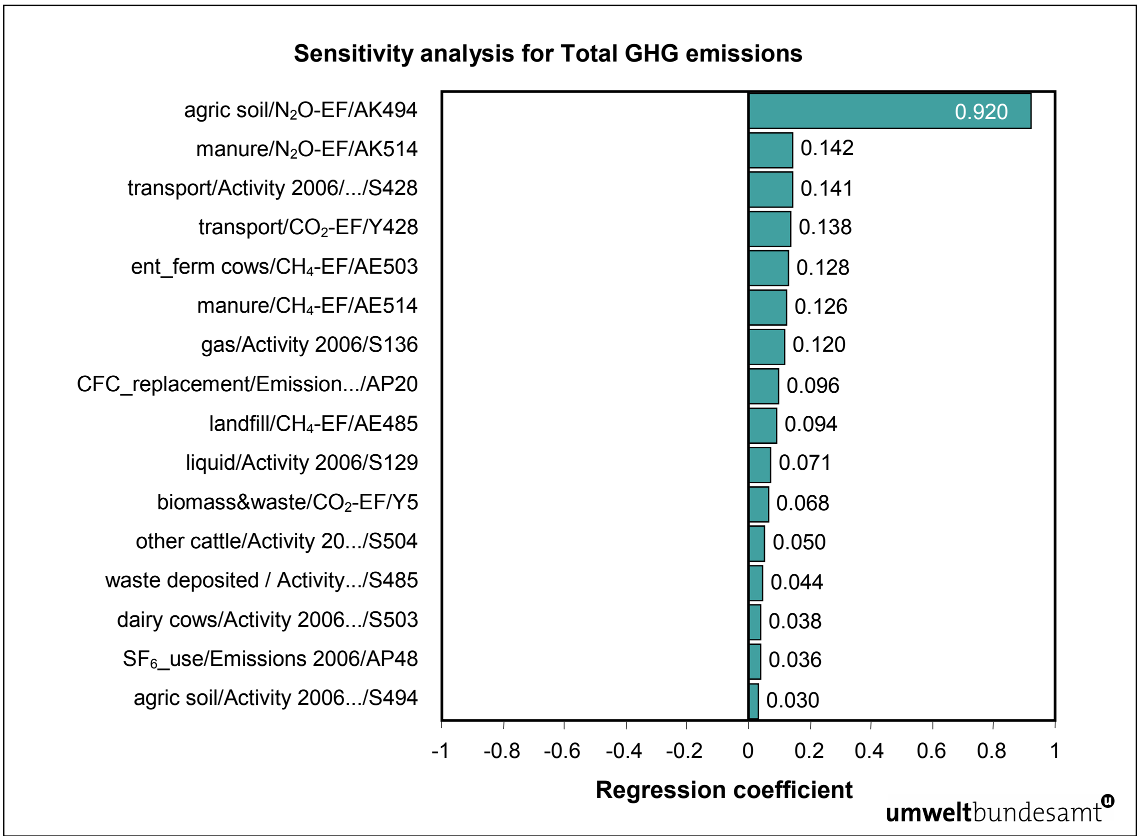

Figure 7: Sensitivity analysis: regression coefficients between total GHG emissions 2006 (without LULUCF) and input parameters.

Table 11 and Table 12 present a comparison to the previous study on uncertainties of the Austrian GHG inventory (WINIWARTER & RYPDAL 2001). As is evident from the 1990 emission figures (mean value), methodical problems of the underlying inventory as of the late 1990s only allow for a limited evaluation (differences to the state-of-the-art compilation methods, then not implemented in the national inventory, were regarded as systematic error and are not included in this analysis). The low uncertainty for CO_2, the dominating greenhouse gas, could be sustained. Improved analysis lead to better understanding of CH_4 emissions, thus reducing uncertainty. For N_2O, as discussed above, some of the uncertainty considered systematic and method-relevant had to be included into the random uncertainty after adaptation of the method. This is also the main reason for the change in total uncertainty, which is mostly determined by the N_2O uncertainty and hardly influenced by uncertainties from the additionally evaluated F-gases.

Differences also become obvious when comparing between years (1990 vs. 2006). This is not due to the method, but only due to shifts in activities. Abolishing Al-production in Austria stops the highly uncertain emissions and decreases PFC uncertainty. The increase in uncertainty on CO_2 is due to a shift of the activity into transport, which is considered more uncertain than most other parts of fossil fuel consumption. The increase in uncertainty for individual gas emissions still allows for a decrease of the overall inventory, as the weight of CO_2 emissions becomes larger, and N_2O emissions actually have been reduced in that period.

Table 11: Key results of the first comprehensive study on the Austrian GHG inventory uncertainty (WINIWARTER & RYPDAL 2001).

Random uncertainty		CO_2	CH_4	N_2O	PFC	HFC	SF_6	Total GHG emissions
1990	Mean value	63.54	11.41	1.99	–	–	–	76.94
	Standard deviation	0.30	1.64	0.26	–	–	–	1.73
	2σ	**1.0%**	**28.7%**	**25.6%**	**–**	**–**	**–**	**4.5%**
1997	Mean value	68.05	10.02	2.27	–	–	–	80.34
	Standard deviation	0.34	1.43	0.27	–	–	–	1.53
	2σ	**1.0%**	**28.5%**	**23.9%**	**–**	**–**	**–**	**3.8%**

Table 12: Key results of the Austrian GHG inventory uncertainty analysis 2008.

	Random uncertainty	CO_2	CH_4	N_2O	PFC*	HFC	SF_6*	Total GHG emissions
1990	Mean value [Tg]	62.08	9.18	6.31	1.05	0.02	0.53	79.18
	Standard deviation	0.40	0.72	2.57	0.27	0.01	0.04	2.71
	2σ	**1.3%**	**15.8%**	**81.5%**	**50.6%**	**54.3%**	**15.9%**	**6.9%**
2006	Mean value [Tg]	77.29	6.93	5.41	0.00	0.85	0.62	91.10
	Standard deviation	0.62	0.52	2.26	0.00	0.23	0.09	2.42
	2σ	**1.6%**	**15.0%**	**83.4%**	**54.4%**	**54.4%**	**28.7%**	**5.3%**

**Due to the definition of key category FC emissions from 2.F.7, PFC emissions are partly considered in SF_6 emissions.*

The results presented here are comparable to internationally discussed national inventory uncertainties, as they also do not include systematic uncertainties. If such systematic uncertainties should also be included, this can not be done for individual source categories, but only for the total inventory. We may expect (according to WINIWARTER & RYPDAL 2001) that systematic uncertainty will add about 5% to the level uncertainty, and 2% to the trend uncertainty.

1.8 Completeness

CRF-Table 9 (Completeness) has been used to give information on the aspect of completeness. This chapter includes additional information. An assessment of completeness for each sector is given in the Sector Overview part of the corresponding subchapters.

Sources and sinks

All sources and sinks included in the IPCC Guidelines are covered. No additional sources and sinks specific to Austria have been identified.

Gases

Both direct GHGs as well as precursor gases are covered by the Austrian inventory.

Geographic coverage

The geographic coverage is complete. There is no part of the Austrian territory not covered by the inventory.

Notation keys

The sources and sinks not considered in the inventory but included in the IPCC Guidelines are clearly indicated, the reasons for such exclusion are explained. In addition, the notation keys presented below are used to fill in the blanks in all the tables in the CRF. Notation keys used in the NIR are consistent with those reported in the CRF. Notation keys are used according to the UNFCCC guidelines on reporting and review (FCCC/CP/2002/8).

Allocations to categories may differ from Party to Party. The main reasons for different category allocations are different allocations in national statistics, insufficient information on the national statistics, national methods, and the impossibility to disaggregate emission declarations.

IE (included elsewhere):

"IE" is used for emissions by sources and removals by sinks of greenhouse gases that have been estimated but included elsewhere in the inventory instead of the expected source/sink category. Where "IE" is used in the inventory, the CRF completeness table (Table 9) indicates where (in the inventory) these emissions or removals have been included. Such deviation from the expected category is explained.

NE (not estimated):

"NE" is used for existing emissions by sources and removals by sinks of greenhouse gases which have not been estimated. Where "NE" is used in an inventory for emissions or removals, both the NIR and the CRF completeness table indicate why emissions or removals have not been estimated. For emissions by sources and removals by sinks of greenhouse gases marked by "NE" check-ups are in progress to establish if they actually are "NO" (not occurring). As part of the improvement programme of the inventory, it is planned that these source or sink categories are either estimated or allocated to "NO".

NA (not applicable):

"NA" is used for activities in a given source/sink category that do not produce emissions or lead to removals of a specific gas.

C (confidential):

"C" is used for emissions which could lead to the disclosure of confidential information if reported at the most disaggregated level. In this case a minimum of aggregation is required to protect business information. Activity data for SF_6 from Aluminium Foundries (cast aluminium – sector *2 C 3*) and semiconductor manufacture are reported as "confidential".

In the Austrian QMS a transparency and a completeness index is used trying to quantify the quality of the inventory. They are calculated as follows:

*Transparency [%] = [1 – (number of IE/number of estimates)]*100*

*Completeness [%] = [1 – (number of NE/number of estimates)]*100*

In the following table transparency and completeness of submissions 2007 is compared to the values of 2008. As can be seen in the table, the transparency for the Sector *Industrial Processes* has decreased due to confidentiality reasons, whereas the transparency for the Sectors *Energy* and *LULUCF* increased slightly due to more detailed data.

Table 13: Transparency and completeness in UNFCCC submissions 2007 and 2008.

Sector	**Submission 2007**				**Submission 2008**			
	IE	**NE**	**Transparency**	**Completeness**	**IE**	**NE**	**Transparency**	**Completeness**
1 Energy	31	0	*91%*	*100%*	28	0	*91%*	*100%*
2 Industrial Processes	41	24	*93%*	*96%*	49	24	*91%*	*95%*
3 Solvents	0	0	*100%*	*100%*	0	0	*100%*	*100%*
4 Agriculture	2	0	*96%*	*100%*	2	0	*96%*	*100%*
5 LULUCF	20	8	*92%*	*97%*	18	8	*92%*	*97%*
6 Waste	4	0	*89%*	*100%*	4	0	*89%*	*100%*
Total	**98**	**32**	***92%***	***97%***	**101**	**32**	***92%***	***97%***
Total number of estimates*	**1 236**				**1 236**			

* (including IE and NE, also including NO and NA)

Remark: The value for "IE"s in the IP sector reported in NIR 2007 (39) was not correct due to a counting error.

2 TREND IN TOTAL EMISSIONS

According to the Kyoto Protocol, Austria's greenhouse gas emissions will have to be 13% below base year emissions during the five-year commitment period from 2008 to 2012. The European Community and its Member States also have a common reduction target of 8%, which they decided to achieve jointly. In April 2002 the Council of the EC has adopted a decision, the so-called "burden sharing agreement"[18] which includes reduction targets for each EC Member State. Austria agreed to reduce its greenhouse gas emissions for 2008–2012 by 13% compared to base year emissions.

2.1 Emission Trends for Aggregated GHG Emissions

Under the burden sharing agreement of the European Union, Austria is committed to a reduction of its greenhouse gases by 13% below 1990 levels by 2008–2012. Table 14 gives a summary of Austria's anthropogenic greenhouse gas emissions 1990–2006.

Table 14: Summary of Austria's anthropogenic greenhouse gas emissions from 1990–2006.

GHG		Total	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
BY*	[Gg CO_2 equivalent]	**79 171.53**	62 084.94	9 184.05	6 297.68	23.03	1 079.24	502.58
1991		**83 242.82**	65 674.44	9 162.64	6 620.09	45.21	1 087.08	653.36
1992		**76 524.83**	60 228.81	8 875.04	6 211.79	48.68	462.67	697.85
1993		**76 425.47**	60 544.14	8 852.11	6 025.27	157.34	52.90	793.71
1994		**77 339.51**	60 930.40	8 659.92	6 498.06	206.83	58.61	985.70
1995		**80 623.93**	63 965.22	8 543.04	6 640.48	267.34	68.69	1 139.16
1996		**83 694.84**	67 406.76	8 353.70	6 303.29	346.84	66.20	1 218.05
1997		**83 259.18**	67 198.47	8 076.73	6 339.64	427.42	96.75	1 120.15
1998		**82 614.39**	66 773.24	7 955.03	6 438.58	494.89	44.65	907.99
1999		**81 017.65**	65 540.51	7 781.04	6 405.50	542.20	64.44	683.96
2000		**81 135.90**	65 928.38	7 621.74	6 284.00	596.26	72.21	633.31
2001		**85 279.15**	70 200.00	7 507.02	6 159.04	694.45	82.02	636.62
2002		**87 165.97**	72 115.08	7 380.94	6 161.31	781.07	86.73	640.83
2003		**93 299.76**	78 271.39	7 382.76	6 086.95	862.75	102.39	593.52
2004		**91 662.54**	77 529.03	7 224.40	5 373.74	896.56	125.68	513.12
2005		**93 259.62**	79 515.42	7 071.42	5 353.37	907.68	125.22	286.50
2006		**91 090.25**	77 282.75	6 936.59	5 397.21	857.80	135.67	480.24
Trend BY*–2006		**15.1%**	24.5%	–24.5%	–14.3%	3 624.5%	–87.4%	–4.4%

Emissions without LULUCF

* *BY= Base Year: 1990 for all gases*

Note: Global warming potentials (GWPs) used (100 years time horizon): carbon dioxide (CO_2) = 1; methane (CH_4) = 21; nitrous oxide (N_2O) = 310; sulphur hexafluoride (SF_6) = 23 900; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances

[18] Council Decision of 25 April 2002 (2002/358/CE) concerning the approval, on behalf of the EC, of the KP to the UNFCCC and the joint fulfilment of commitments thereunder

Austria's total greenhouse gases showed an increase of 15.1% from the base year to 2006 (CO_2: +24.5%).

In the period from 2005 to 2006 Austria's total greenhouse gases decreased by 2.3%, CO_2 emissions decreased by 2.8%. The following figure presents the trend in total GHG emissions 1990–2006 in comparison to Austria's Kyoto reduction target of 13% from the base year 1990 (BY). This figure excludes emissions and removals from land use, land-use change and forestry (LULUCF).

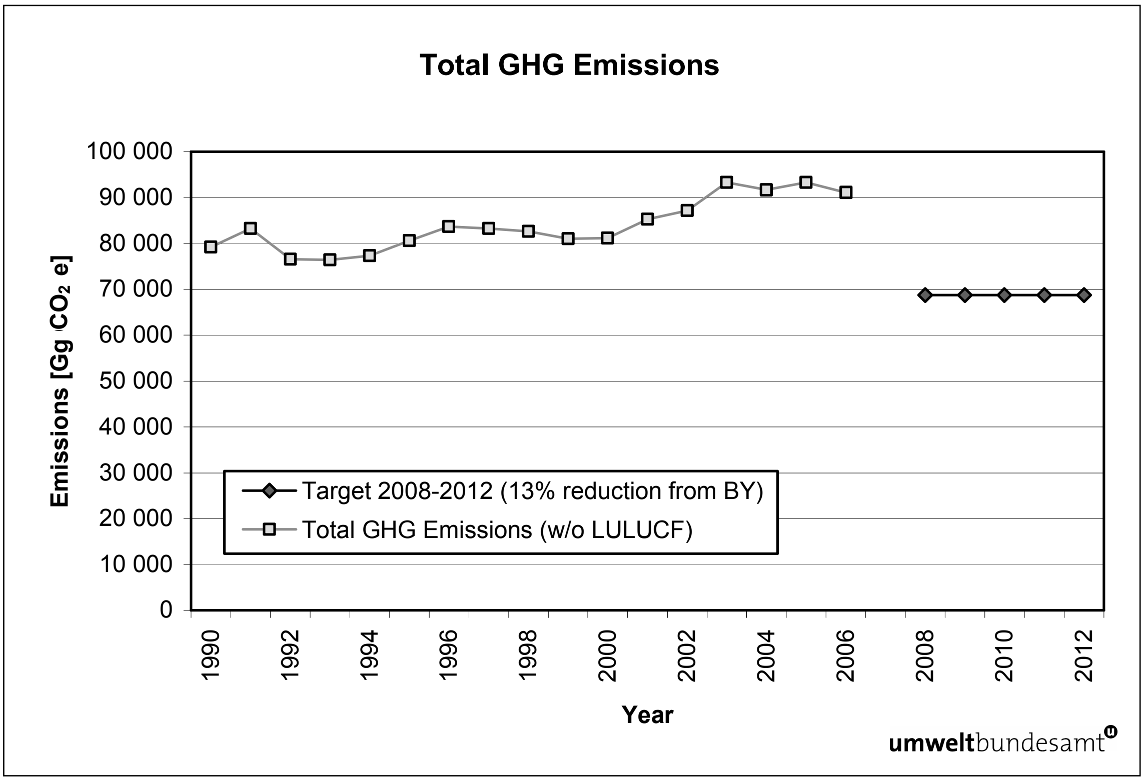

Figure 8: Trend in total GHG emissions 1990–2006.

2.2 Emission Trends by Gas

Table 15 presents greenhouse gas emissions of the base year and 2006 as well as their share in total greenhouse gas emissions.

Table 15: Austria's greenhouse gas emissions by gas in the base year and in 2006.

GHG	BY 1990	2006	BY 1990	2006
	CO_2 equivalent [Gg]		[%]	
Total	79 172	91 090	100.0%	100.0%
CO_2	62 085	77 283	78.4%	84.8%
CH_4	9 184	6 937	11.6%	7.6%
N_2O	6 298	5 397	8.0%	5.9%
F-Gases	1 605	1 474	2.0%	1.6%

Emissions without LULUCF

The greenhouse gas most emitted in Austria is CO_2, which represented 84.8% of total greenhouse gas emissions in 2006 compared to 78.4% in the base year, followed by CH_4 (7.6% in 2006 and 11.6% in the base year), N_2O (5.9% in 2006 and 8.0% in the base year) and finally fluorinated hydrocarbons with a share of 1.6% compared to 2.0% in the base year.

The trend in Austrian greenhouse gas emissions, compared to emissions in the base year (1990), is presented in Figure 9.

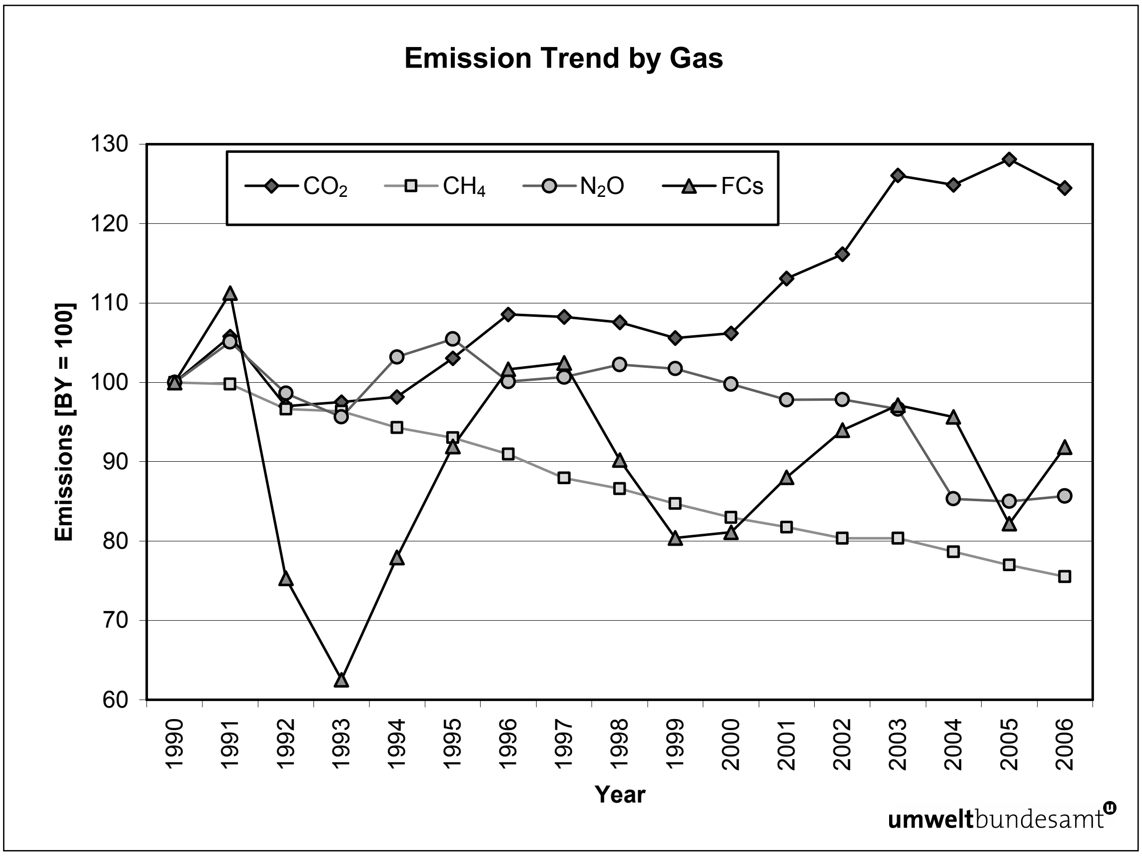

Figure 9: Trend in greenhouse gas emissions 1990–2006 by gas in index form (base year = 100).

CO_2

CO_2 emissions fluctuated at the beginning of the 1990s, with an increasing trend until 1996; this was followed by a slight decrease until 1999. Since 2000 emissions have strongly increased, from 2000 to 2006 by 17.2%. From 2005 to 2006 emissions decreased by 2.8%.

This results in a total increase of 24.5% from 1990 to 2006. In absolute figures, CO_2 emissions increased from 62 085 to 77 283 Gg (see Table 14) during the period from 1990 to 2006 mainly due to higher emissions from transport, which increased by 84%.

The main source of CO_2 emissions in Austria is fossil fuel combustion; within the fuel combustion sector transport is the most important sub-source.

According to the Climate Convention, Austria's CO_2 emissions should have been reduced to the levels of 1990 by 2000, but the CO_2 stabilisation target for 2000 could not be met. However, the Member States agreed to jointly achieve this goal and the EC was successful in doing so.

CH_4

CH_4 emissions decreased steadily during the period from 1990 to 2006 from 9 184 to 6 937 Gg CO_2 equivalents (see Table 14). In 2006 CH_4 emissions were 24.5% below the level of the base year, mainly due to lower emissions from solid waste disposal sites.

The main sources of CH_4 emissions in Austria are solid waste disposal on land (landfills) and agriculture (enteric fermentation).

N_2O

N_2O emissions in Austria fluctuated between 1990 and 1998, increasing by 2% over this period. Since then emissions have shown a decreasing trend, resulting in 5 397 Gg CO_2 equivalents in 2006 compared to 6 298 in the base year (minus 14.3%). The general decrease is mainly due to lower N_2O emissions from agricultural soils; the strong decrease 2003–2004 was due to emission reduction measures in the chemical industry.

The main source of N_2O emissions are agricultural soils with a share of 54% in national total N_2O emissions. Manure management has a share of 16% and Fossil fuel combustion, which is another important source with regard to national total N_2O emissions, has a share of 15%.

HFCs

HFC emissions increased remarkably during the period from 1990 to 2006 from 23 to 858 Gg CO_2 equivalents. HFCs are used as substitutes for HCFCs (Hydro Chloro Fluoro Carbons; these are ozone depleting substances), the use of which has been banned for most applications.

PFCs

PFC emissions show an inverse trend of HFC emissions. PFC emissions decreased remarkably during the period from 1990 to 2006, from 1 079 to 136 Gg CO_2 equivalents. PFCs were in the base year mainly emitted as side-products of primary aluminium production, which closed down in Austria in 1992; in 2006 the main source of PFC emissions was semiconductor manufacture.

SF_6

SF_6 emissions in 1990 amounted to 503 Gg CO_2 equivalents. They increased steadily until 1996 reaching a maximum of 1 218 Gg CO_2 equivalents. Since then they have been decreasing, in 2006 SF_6 emissions amounted to 480 Gg CO_2 equivalents, which was 4% below the level of the base year (1990).

The main sources of SF_6 emissions in 2006 were semiconductor manufacture and disposal of noise insulating windows.

2.3 Emission Trends by Source

Table 16 presents a summary of Austria's anthropogenic greenhouse gas emissions by sector for the period from 1990 to 2006:

- Sector 1: Energy
- Sector 2: Industrial Processes
- Sector 3: Solvent and Other Product Use (Solvents)
- Sector 4: Agriculture
- Sector 5: Land Use, Land-Use Change and Forestry (LULUCF)
- Sector 6: Waste

Table 16: Summary of Austria's anthropogenic greenhouse gas emissions from 1990–2006.

		Total	Energy	Industrial Processes	Solvents	Agriculture	LULUCF	Waste
1990	[Gg CO_2 equivalent]	**79 171.53**	55 728.43	10 110.82	515.17	9 168.74	-14 340.60	3 648.36
1991		**83 242.82**	59 630.11	10 152.82	469.27	9 351.60	-20 256.80	3 639.02
1992		**76 524.83**	54 702.86	8 999.19	420.24	8 866.42	-15 235.29	3 536.13
1993		**76 425.47**	55 128.13	8 750.64	419.85	8 634.39	-19 121.73	3 492.46
1994		**77 339.51**	55 189.72	9 274.83	404.04	9 134.50	-17 748.26	3 336.42
1995		**80 623.93**	58 049.17	9 729.22	422.38	9 240.12	-17 113.77	3 183.04
1996		**83 694.84**	61 879.09	9 601.24	405.31	8 769.95	-12 131.03	3 039.25
1997		**83 259.18**	60 989.53	10 192.53	422.59	8 743.21	-20 874.78	2 911.33
1998		**82 614.39**	60 964.54	9 674.37	404.74	8 746.55	-19 072.06	2 824.18
1999		**81 017.65**	59 919.80	9 391.10	390.87	8 583.14	-23 406.53	2 732.74
2000		**81 135.90**	59 652.70	10 034.18	413.52	8 384.71	-18 025.19	2 650.78
2001		**85 279.15**	64 016.84	9 907.41	435.81	8 329.98	-20 746.23	2 589.10
2002		**87 165.97**	65 380.59	10 591.23	434.56	8 209.37	-16 972.02	2 550.22
2003		**93 299.76**	71 629.77	10 662.00	414.92	8 021.07	-18 329.27	2 572.01
2004		**91 662.54**	70 953.20	9 986.89	399.10	7 876.41	-18 487.08	2 446.93
2005		**93 259.62**	72 423.61	10 300.26	363.74	7 854.41	-18 119.45	2 317.61
2006		**91 090.25**	69 845.50	10 773.09	385.29	7 889.33	-18 154.32	2 197.05

Total emissions without LULUCF

Base Year: 1990 for CO_2, CH_4 and N_2O, HFCs, PFCs and SF_6

Austria's greenhouse gas emissions by sector in the base year and in 2006 as well as their share and trends are presented in the following table.

Table 17: Austria's greenhouse gas emissions by sector in the base year and in 2006 as well as their share and trends.

GHG	Base year*	2006	Trend BY*–2006	Base year*	2006
	Emissions [Gg CO_2e]			Share [%]	
Total	**79 172**	**91 090**	**15.1%**	**100.0%**	**100.0%**
1 Energy	55 728	69 845	25.3%	70.4%	76.7%
2 Industry	10 111	10 773	6.6%	12.8%	11.8%
3 Solvent	515	385	-25.2%	0.7%	0.4%
4 Agriculture	9 169	7 889	-14.0%	11.6%	8.7%
5 LULUCF	-14 341	-18 154	26.6%	-18.1%	-19.9%
6 Waste	3 648	2 197	-39.8%	4.6%	2.4%

Total emissions without LULUCF

* *1990 for CO_2, CH_4 and N_2O, HFC, PFC, and SF_6*

The dominant sector is the energy sector, which caused 77% of total greenhouse gas emissions in Austria in 2006 (70% in 1990), followed by the Sector Industrial Processes, which caused 12% of greenhouse gas emissions in 2006 (13% in 1990).

The trend of Austria's greenhouse gas emissions by sector, relative to emissions in the base year 1990, is presented in Figure 10.

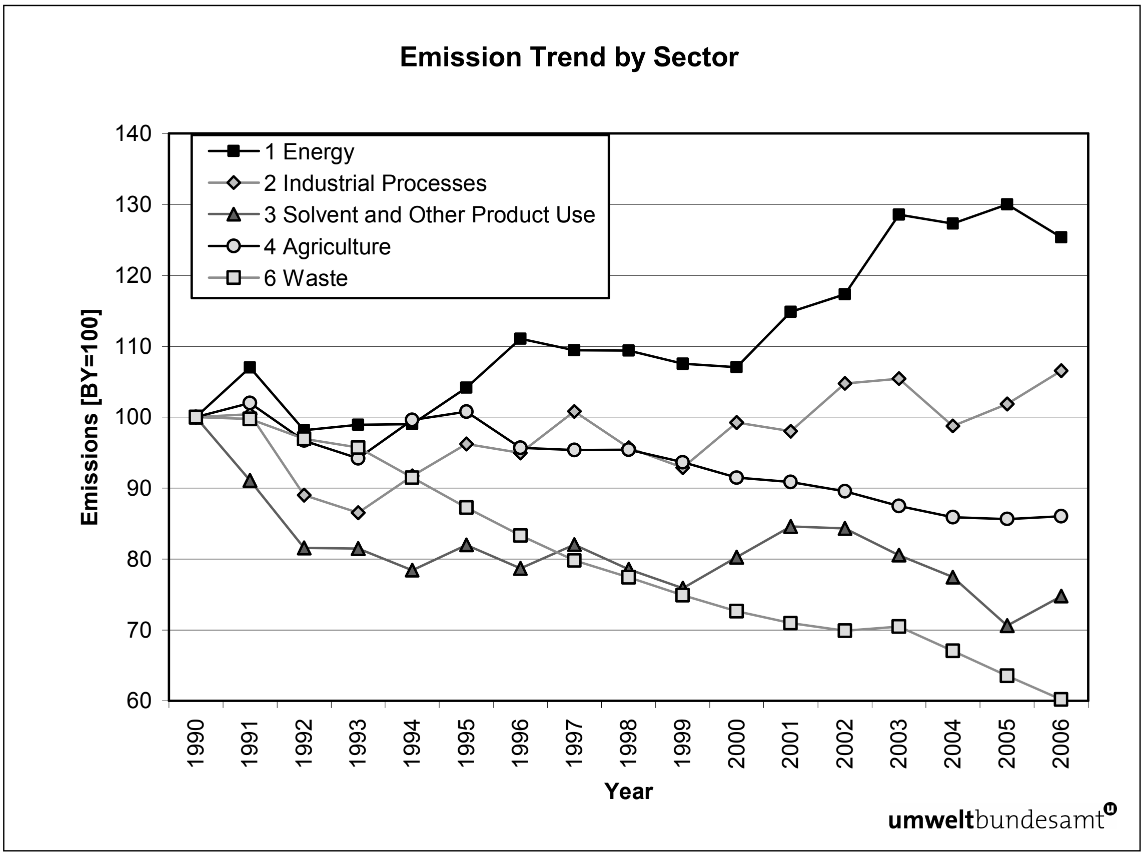

Figure 10: Trend in emissions 1990–2006 by sector in index form (base year = 100).

2.3.1 Energy (IPCC Category 1)

The trend for greenhouse gas emissions from IPCC Category 1 (Energy) shows that emissions increased between 1990 and 1995 and then slightly decreased between 1996 and 2000. Between 2000 and 2003 emissions increased by 20%. Since 2003 emissions were fluctuating with a general decrease until 2006 by 2.5%. In 2006 greenhouse gas emissions from Category *1 Energy* amounted to 69 845 Gg CO_2 equivalents, which corresponds to 76.7% of total national emissions.

In 2006, 98.7% of the emissions from this sector originated from fossil fuel combustion (Sector *1 A*), fugitive emissions from fuels (Sector *1 B*) were of minor importance.

CO_2 contributed 97.4% to total GHG emissions from *Energy*, CH_4 1.4% and N_2O 1.2%.

The most important energy sub-sectors in 2006 were *1.A.3 Transport* with a share of 33.1%, followed by *1.A.2 Manufacturing Industries and Construction* (22.9%), *1.A.1 Energy Industries* (22.2%), and *1.A.4 Other Sectors* (20.3%).

The increasing trend from IPCC Category 1 (Energy) is mainly due to a strong increase of emissions from sub-sector *1.A.3 Transport*, which almost doubled from 1990 to 2006 with +82%. Apart from an increase of road performance (kilometres driven) in Austria, another main reason for this strong increase is the so-called 'fuel tourism'. In the early 1990s fuel prices in Austria were higher compared to neighbouring countries, whereas since the middle of the 1990s it has been the other way round.

Emissions from *1.A.2 Manufacturing Industries and Construction* increased by 17% from 1990 to 2006, due to the increase in fuel consumption (increase of natural gas and fuel waste consumption, whereas consumption of liquid fossil fuels decreased). Between 2005 and 2006 emissions decreased slightly by 0.6%.

Emissions from sub-sector *1.A.1 Energy Industries* show an increase of 12% from the base year to 2006. The main drivers for emissions from this sector are total electricity production (which increased about 23% from 1990 to 2006) and an increase in heat production, which tripled over this period due to an increase in the demand for district heating in the residential and commercial sector. Furthermore, the share of biomass used as a fuel in this sector and the contribution of hydro plants to total electricity production, which is generally about 72% and varied from 65% to 78% in the period under observation (depending on the annual water situation), are important drivers. Also the climatic circumstances influence emissions from this sector: a cold winter leads to an increase of heat production.

The increase of heating, demand for hot water generation, climatic circumstances and the change of fuel mix are the most important drivers for emissions from *1.A.4 Other Sectors*. Emissions in 2006 were 6% lower than in the base year and 4% lower than in 2005.

2.3.2 Industrial Processes (IPCC Category 2)

Greenhouse gas emissions from the industrial processes sector fluctuated during the period 1990–2006 and were at a minimum level in 1993. In 2006 they were 6.6% above the level of the base year. In 2006 greenhouse gas emissions from Category *2 Industrial Processes* amounted to 10 773 Gg CO_2 equivalents, which corresponds to 11.8% of total national emissions.

The main sources of greenhouse gas emissions in the industrial processes sector are *Metal Production* and *Mineral Products*, which caused 47% and 31% of the emissions from this sector in 2006. The emission trend in this sector follows more or less production figures.

The most important GHG of the industry sector is carbon dioxide with 83.5% of emissions from this category, followed by HFCs with 8.0%, SF_6 with 4.5%, N_2O with 2.6%, PFCs with 1.3% and finally CH_4 with 0.2%.

2.3.3 Solvent and Other Product Use (IPCC Category 3)

In the year 2006, 0.4% of total GHG emissions in Austria (385 Gg CO_2 equivalents) originated from *Solvent and Other Product Use*. Greenhouse gas emissions in this sector decreased by 25% between 1990 and 2006, due to decreasing solvent and N_2O use.

57% of these emissions were indirect CO_2 emissions, 43% were accounted for by N_2O emissions.

2.3.4 Agriculture (IPCC Category 4)

Greenhouse gas emissions from the agricultural sector fluctuated in the early 1990s, since 1995 they have shown a steady downward trend. In 2006 emissions from this category were 14.0% below the base year. The decrease is mainly due to decreasing livestock numbers. The fluctuations result from changes in mineral fertilizer sales data which were used as activity data for calculating N_2O emissions from agricultural soils, which is an important sub-source.

Emissions from Agriculture amounted to 7 889 Gg CO_2 equivalents in 2006, which corresponds to 8.7% of total national emissions. In 2006 the most important sub-sector *Enteric Fermentation* contributed 41% to total greenhouse gas emissions from the agricultural sector; the second largest sub-source *Agricultural Soils* had a share of 37%.

In the Austrian GHG inventory Agriculture is the largest source for both N_2O and CH_4 emissions: in 2006 70% of total N_2O emissions and 59% (195 Gg) of total CH_4 emissions in Austria originated from this sector. N_2O emissions from *Agriculture* amounted to 12.2 Gg in 2006 (3 794 Gg CO_2 equivalents), which corresponds to 48% of the GHG emissions from this sector, methane contributed 52%.

2.3.5 LULUCF (IPCC Category 5)

The category Land Use, Land-Use Change and Forestry is a net sink in Austria. Net removals from this category amounted to 14 341 Gg CO_2 equivalents in the base year, which corresponds to 18% of national total GHG emissions (without LULUCF) compared to 20% in the year 2006. The trend in net removals from LULUCF is plus 26.6% over the observed period.

The main sink is subcategory *5.A Forest Land* with net removals of 19 729 Gg CO_2 in 2006. Small CO_2 and N_2O emissions arise from the other subcategories, where total net emissions amounted to 1 575 Gg CO_2 equivalents in 2006.

2.3.6 Waste (IPCC Category 6)

Greenhouse gas emissions from Category *6 Waste* decreased steadily during the period 1990–2002, mainly as a result of waste management policies: the amount of landfilled waste has decreased and methane recovery improved. The slight increase from 2002 to 2003 was followed by a decrease until 2006. The trend between 2002 and 2006 is influenced by the amount of deposited waste. In 2006 emissions from this category were 39.8% below the base year level.

In 2006 the greenhouse gas emissions from the waste sector amounted to 2 197 Gg CO_2 equivalents, which corresponds to 2.4% of total national emissions

The main source of greenhouse gas emissions in the waste sector is *solid waste disposal on land*, which caused 80.1% of the emissions from this sector in 2006; the second largest source is *waste water handling* with 14.6%.

In 2006 the most important GHG of the Sector Waste was CH_4 with 83.5% of emissions from this category, followed by N_2O with 15.9%, and CO_2 with 0.6%.

2.4 Emission Trends for Indirect Greenhouse Gases and SO_2

Emission estimates for NO_x, CO, NMVOC and SO_2 are also reported in the CRF. This chapter summarizes the trends for these gases.

A detailed description of the methodology used to estimate these emissions will be provided in *Austria's Informative Inventory Report (IIR) 2008, Submission under the UNECE/CLRTAP Convention*, which will be published by the end of 2008.

Table 18 presents a summary of emission estimates for indirect greenhouse gases and SO_2 for the period from 1990 to 2006. The "National Emission Ceilings" (NEC) as set out in the 1999 *Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone* are also presented in Table 18. These reduction targets should be met by 2010 by parties to the UNECE/CLRTAP convention who signed this protocol.

Table 18: Emissions of indirect GHGs and SO_2 1990–2006.

GHG		NO_x	CO	NMVOC	SO_2
1990	[Gg]	192.4	1 444.1	283.2	74.3
1991		202.7	1 513.9	275.2	71.4
1992		191.9	1 481.3	250.4	55.0
1993		186.2	1 448.6	249.3	53.4
1994		180.7	1 379.4	231.2	47.6
1995		181.4	1 267.3	229.3	46.9
1996		203.8	1 246.1	221.5	44.6
1997		193.0	1 154.9	206.6	40.2
1998		208.1	1 109.3	191.8	35.6
1999		198.9	1 034.4	178.4	33.8
2000		205.4	959.1	177.1	31.6
2001		215.0	930.4	188.2	32.7
2002		224.6	898.6	188.8	31.6
2003		235.5	900.1	183.0	32.4
2004		233.3	857.5	176.0	26.9
2005		237.0	823.4	163.6	26.6
2006		225.2	785.4	171.6	28.5
NEC		107.0	–	159.0	39.0

NEC: National Emission Ceiling, goal to be met by 2010

Emissions of indirect greenhouse gases except NO_x decreased in the period from 1990 to 2006: NMVOCs by 39%, CO by 46% and SO_2 emissions by 62%. NO_x emissions increased by 17% over the considered period.

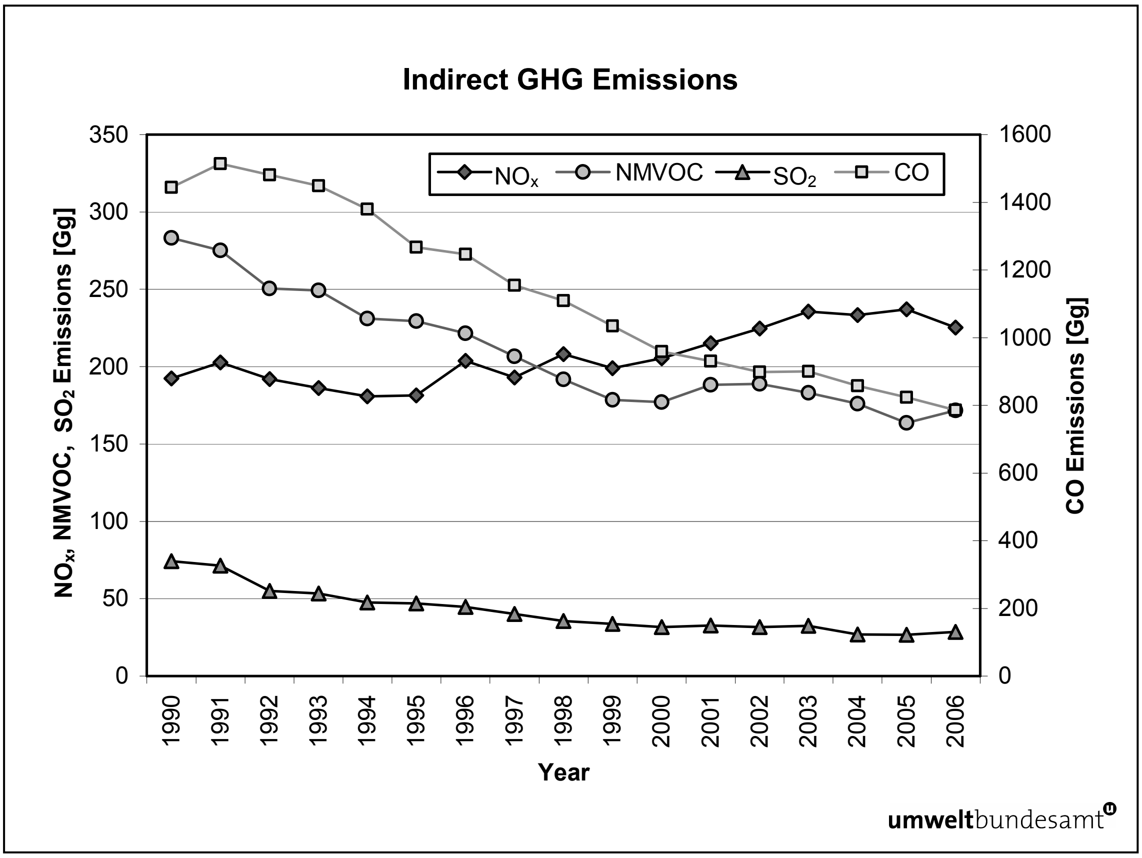

Figure 11: Emissions of indirect GHGs and SO_2 1990–2006.

The most important emission source for NO_x, SO_2 and CO is fuel combustion. The most important emission source for NMVOC is Solvent and other Product Use.

NO_x

NO_x emissions increased from 192 to 225 Gg during the period from 1990 to 2006. In 2006 the NO_x emissions were 17% above the level of 1990.

Nearly 97% of NO_x emissions in Austria originate from fossil fuel combustion, with the major part originating from mobile combustion – road transport.

CO

CO emissions decreased from 1 444 to 785 Gg during the period from 1990 to 2006. In 2006 CO emissions were 46% below the level of 1990.

In the year 2006, 96% of total CO emissions in Austria originated from fuel combustion activities. The most important sub-source regarding CO emissions is the residential sector followed by mobile combustion – road transport.

NMVOC

NMVOC emissions decreased from 283 to 172 Gg during the period from 1990 to 2006. In 2006 NMVOC emissions were 39% below the level of 1990.

The most important emission sources for NMVOC emissions are *Solvent Use* and fossil fuel combustion, contributing 55% and 39% respectively of national total emissions in 2006.

SO_2

SO_2 emissions decreased from 74 to 28 Gg during the period from 1990 to 2006. In 2006 SO_2 emissions were 62% below the level of 1990.

The decrease is mainly due to lower emissions from residential heating, combustion in industries and energy industries, mainly caused by a switch from high sulfur fuels (like coal and heavy oil) to fuels with lower sulfur content, and the implementation of desulphurization units.

3 ENERGY (CRF SECTOR 1)

3.1 Sector Overview

In sector *1 Energy* emissions originating from fuel combustion activities (Category *1 A*) as well as fugitive emissions from fuels (Category *1 B*) are considered.

CO_2 emissions from fossil fuel combustion are the main source of GHGs in Austria. In the year 2006 about 73.8% of national total GHGs emissions and 88.1% of national total anthropogenic CO_2 emissions from Austria were caused by fossil fuel combustion in road traffic, in the energy and manufacturing industry and in the commercial, agricultural and residential sector.

3.1.1 Emission Trends

Figure 12 presents the trend for emission from IPCC Sector *1 Energy* in Gg CO_2 equivalent. The trend shows an increase by 25.3% from 55.73 Tg CO_2 equivalents in 1990 to 69.85 Tg CO_2 equivalents in 2006, which is mainly caused by increasing emissions from the transport sector.

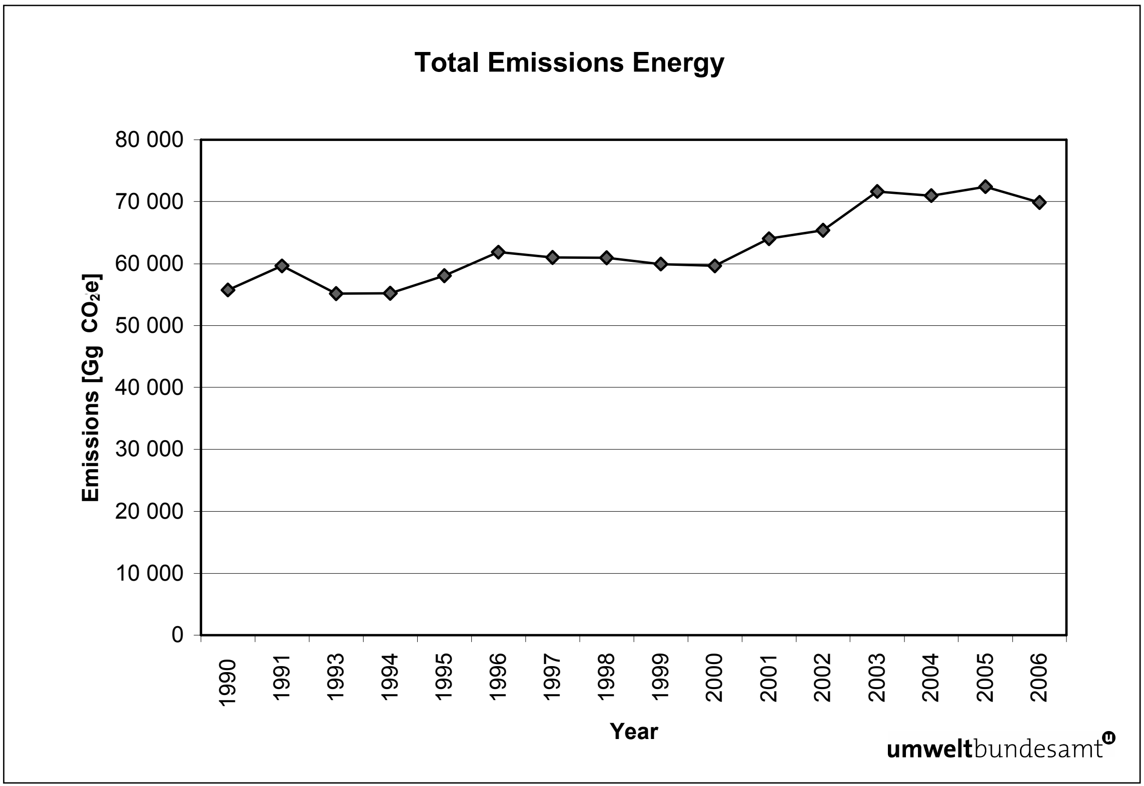

Figure 12: Trend of GHG emissions from 1990–2006 for Sector 1 Energy.

Table 19 presents the emission trend by GHG. The increase of CO_2 and N_2O emissions is mainly caused by the increasing activity of the transport sector. The strong increase of CO_2 emissions from 2002 to 2003 was additionally caused by public electricity plants. The increase of CH_4 emissions from 1999 onwards has been due to increasing fugitive emissions from natural gas distribution networks.

Table 19: Emissions of greenhouse gases and their trend from 1990–2006 from category 1 Energy.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1990	54 196	40.45	2.20
1991	57 989	42.96	2.38
1992	53 092	42.00	2.35
1993	53 493	42.56	2.39
1994	53 565	41.41	2.44
1995	56 382	42.94	2.47
1996	60 141	44.97	2.56
1997	59 326	41.34	2.57
1998	59 274	41.24	2.66
1999	58 207	42.29	2.66
2000	57 969	42.06	2.58
2001	62 279	43.07	2.69
2002	63 617	43.34	2.75
2003	69 836	44.03	2.80
2004	69 147	45.36	2.75
2005	70 622	46.37	2.67
2006	68 050	47.01	2.61
Trend 1990–2006	*25.6%*	*16.2%*	*18.5%*

Emission trends by sectors

Table 20 presents the emission trend by sub category. Emissions from category *1 A 3 Transport* has increased very strongly since 1990 whereas emissions from stationary combustion do not show such a significant increase. The increase of emissions from category *1 B* is mainly caused by the increase of CH_4 emissions from natural gas distribution.

Table 20: Total GHG emissions in [Gg CO_2 equivalent] from 1990–2006 by sub categories of sector 1 Energy.

	1	1.A	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	1.B.1	1.B.2
1990	55 728	55 242	13 844	13 615	12 669	15 078	36	487	11	476
1991	59 630	59 120	14 681	14 020	14 309	16 073	38	510	9	500
1992	54 703	54 166	11 528	12 719	14 259	15 625	35	537	8	529
1993	55 128	54 581	11 515	13 135	14 443	15 447	40	547	8	540
1994	55 190	54 613	11 811	14 144	14 411	14 205	43	577	6	571
1995	58 049	57 450	12 973	14 348	14 796	15 299	33	599	6	593
1996	61 879	61 309	13 858	14 443	16 372	16 596	40	570	5	565
1997	60 990	60 352	13 937	16 023	15 288	15 066	38	638	5	633
1998	60 965	60 294	13 051	14 724	17 514	14 962	43	670	5	665
1999	59 920	59 200	12 898	14 075	16 927	15 257	43	720	5	715
2000	59 653	58 923	12 409	14 678	18 067	13 723	46	730	6	724
2001	64 017	63 260	14 193	14 597	19 232	15 195	44	756	5	751
2002	65 381	64 617	13 737	14 958	21 114	14 765	43	764	6	757

	1	1.A	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	1.B.1	1.B.2
2003	71 630	70 788	16 192	15 362	23 045	16 097	91	842	5	836
2004	70 953	70 090	16 436	15 441	23 640	14 464	109	863	1	862
2005	72 424	71 547	16 168	16 074	24 350	14 833	123	876	0	876
2006	69 845	68 915	15 508	15 984	23 119	14 176	128	931	0	931
Trend 1990–2006	*25.3%*	*24.8%*	*12.0%*	*17.4%*	*82.5%*	*-6.0%*	*256.0%*	*91.2%*	*-99.7%*	*95.7%*

3.2 Fuel Combustion Activities (CRF Source Category 1.A)

This chapter gives an overview of emissions and key sources of category *1.A Fuel Combustion*, includes information on completeness, QA/QC, planned improvements as well as on emissions, emission trends and methodologies applied (including emission factors).

Additionally to information provided in this chapter, Annex 2 includes further information on the underlying activity data used for emissions estimation. The Annex describes the national energy balance (fuels and fuel categories, net calorific values) and the methodology of how activity data are extracted from the energy balance (correspondence of energy balance to SNAP and IPCC categories). Activity data and emission factors used for emissions calculation and information on the last revision of the national energy balance are also presented in Annex 2.

For results, methodology and detailed data used for the CO_2 reference approach see Annex 3.

National energy balance data are presented in Annex 4.

3.2.1 Source Category Description

In 2006 the most important source of GHGs was the transport sector (sub-category *1.A.3 Transport*), with a share of 24.8% in national total GHG emissions. 14.1% of national GHG emissions were released by passenger cars, 1.9% by light duty vehicles, 8.3% by heavy-duty vehicles and 0.1% by mopeds and motorcycles. Austria's railway system is mainly driven by electricity, only 0.2% of overall GHGs originate from this sector. Fuels used by ships on inland waterways have a share of 0.1% in total GHG emissions. Because Austria is a landlocked country, there is no occurrence of maritime activities. About 0.3% of national GHG arise from domestic air transport.

Combustion in Industry (sub-category *1.A.2 Manufacturing Industries and Construction*) was the second largest sub-category with a share of 17.1% in 2006 total GHG emissions. This sector also includes mobile machinery mainly used in the construction sector. Emissions from non energy fuel use are reported under category *2 Industrial Pocesses*.

The third largest GHG source of the energy sector in 2006 with a share of 16.6% total GHG emissions of was category *1.A.1 Energy Industries*, were fossil fuels are used for electrical power and district heating production. In the year 2006 overall gross public electricity production was 55 006 GWh[19] of which 36 465 GWh (66.3%) were generated by hydro plants, 16 779 GWh (30.5%) by thermal power plants and 1 769 GWh (3.2%) by solar, geothermal and wind power plants. Industrial auto producers generated 8 529 GWh of electricity in the year 2006. There are no operating nuclear plants in Austria. Due to the importance of hydropower the seasonal water

[19] Source: IEA Questionnaire Nov/2006 by STATISTICS AUSTRIA.

situation in Austria has a high influence on the need for electric power generation by fossil fuels. In category *1 A 1* biomass is mainly used by smaller district heating plants. The refinery industry which consists of only one plant in Austria is also included in this category (sub-category *1.A.1.b Petroleum refining*).

Fossil fuels, mainly used for space and water heating in the commercial, agricultural and household sector (sub-category *1.A.4 Other Sectors* or "small combustion" sector) formed the fourth largest sub-category with a share of 15.2% in 2006 total GHG emissions. Emissions of this category are very dependent on the climatic circumstances and on the economic trend. E.g. a "cold winter" in combination with an economic uptrend may increase emissions from space heatings significantly. In Austria the main share of solid biomass consumption is used for space and water heating. Category *1.A.4* also includes emissions from mobile machinery mainly used in agriculture and forestry.

Category *1.A.5 Other* includes emissions from military air and road transport as well as from other mobile machinery. It contributes 0.1% to total GHG emissions in 2006.

3.2.1.1 Key Sources

The methodology and results of the key category analysis is presented in Chapter 1.5. Table 21 presents the key source categories of category *1 A Fuel Combustion Activities*.

Table 21: Key sources of Category 1 Energy.

IPCC Category	Category Name	GHG	Keysource Assessment
1.A gaseous	Fuel Combustion (stationary)	CO_2	LA; TA
1.A.1.a liquid	Public Electricity and Heat Production	CO_2	LA; TA
1.A.1.a other	Public Electricity and Heat Production	CO_2	LA 2001–2006; TA
1.A.1.a solid	Public Electricity and Heat Production	CO_2	LA; TA
1.A.1.b liquid	Petroleum refining	CO_2	LA
1.A.2 mob-liquid	Manufacturing Industries and Constr.	CO_2	LA
1.A.2 other	Manufacturing Industries and Constr.	CO_2	LA; TA
1.A.2 solid	Manufacturing Industries and Constr.	CO_2	LA
1.A.2 stat-liquid	Manufacturing Industries and Constr.	CO_2	LA; TA
1.A.3.b diesel.oil	Road Transportation	CO_2	LA; TA
1.A.3.b gasoline	Road Transportation	CO_2	LA; TA
1.A.4 biomass	Other Sectors	CH_4	LA 1990–1996, 1999; TA
1.A.4 mob-diesel	Other Sectors	CO_2	LA; TA
1.A.4 solid	Other Sectors	CO_2	LA; TA
1.A.4 stat-liquid	Other Sectors	CO_2	LA; TA
1.A.4 other	Other Sectors	CO_2	LA 1990–1992, 1996–1997; TA

LA = Level Assessment

TA = Trend Assessment 2006

3.2.1.2 Completeness

Table 22 gives an overview of the IPCC categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this sub-category have been estimated. "NO" indicates that the Austrian energy balance does not quote an energy consumption for the relevant sector and fuel category.

Emissions of all sources of category *1.A Fuel Combustion* have been estimated; the status of emission estimates of this category is complete.

Table 22: Overview of subcategories of Category 1.A Fuel Combustion: transformation into SNAP Codes and status of estimation.

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
1.A.1.a Public Electricity and Heat Production	**0101 Public power 0102 District heating plants**			
1.A.1.a Liquid Fuels		✓	✓	✓
1.A.1.a Solid Fuels		✓	✓	✓
1.A.1.a Gaseous Fuels		✓	✓	✓
1.A.1.a Biomass		✓	✓	✓
1.A.1.a Other Fuels		✓	✓	✓
1.A.1.b Petroleum refining	**0103 Petroleum refining plants**			
1.A.1.b Liquid Fuels		✓	IE(1)	✓
1.A.1.b Solid Fuels		NO	NO	NO
1.A.1.b Gaseous Fuels		✓	IE(1)	✓
1.A.1.b Biomass		NO	NO	NO
1.A.1.b Other Fuels		NO	NO	NO
1.A.1.c Manufacture of Solid fuels and Other Energy Industries	**010503 Oil/Gas Extraction plants**			
1.A.1.c Liquid Fuels		✓	✓	✓
1.A.1.c Solid Fuels		NO	NO	NO
1.A.1.c Gaseous Fuels		✓	✓	✓
1.A.1.c Biomass		NO	NO	NO
1.A.1.c Other Fuels		NO	NO	NO
1.A.2.a Iron and Steel	**0301 Comb. In boilers, gas turbines and stationary engines (Iron and Steel Industry) 030326 Processes with Contact-Other(Iron and Steel Industry)**			
1.A.2.a Liquid Fuels		✓	✓	✓
1.A.2.a Solid Fuels		✓	✓	✓
1.A.2.a Gaseous Fuels		✓	✓	✓
1.A.2.a Biomass		✓	✓	✓
1.A.2.a Other Fuels		NO	NO	NO

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
1.A.2.b Non-ferrous Metals	**0301 Comb. In boilers, gas turbines and stationary engines(Non-ferrous Metals Industry)**			
1.A.2.b Liquid Fuels		✓	✓	✓
1.A.2.b Solid Fuels		✓	✓	✓
1.A.2.b Gaseous Fuels		✓	✓	✓
1.A.2.b Biomass		NO	NO	NO
1.A.2.b Other Fuels		NO	NO	NO
1.A.2.c Chemicals	**0301 Comb. in boilers, gas turbines and stationary engines (Chemical Industry)**			
1.A.2.c Liquid Fuels		✓	✓	✓
1.A.2.c Solid Fuels		✓	✓	✓
1.A.2.c Gaseous Fuels		✓	✓	✓
1.A.2.c Biomass		✓	✓	✓
1.A.2.c Other Fuels		✓	✓	✓
1.A.2.d Pulp, Paper and Print	**0301 Comb. in boilers, gas turbines and stationary engines (Pulp, Paper and Print Industry)**			
1.A.2.d Liquid Fuels		✓	✓	✓
1.A.2.d Solid Fuels		✓	✓	✓
1.A.2.d Gaseous Fuels		✓	✓	✓
1.A.2.d Biomass		✓	✓	✓
1.A.2.d Other Fuels		✓	✓	✓
1.A.2.e Food Processing, Beverages and Tobacco	**0301 Comb. in boilers, gas turbines and stationary engines (Food Processing, Beverages and Tobacco Industry)**			
1.A.2.e Liquid Fuels		✓	✓	✓
1.A.2.e Solid Fuels		✓	✓	✓
1.A.2.e Gaseous Fuels		✓	✓	✓
1.A.2.e Biomass		✓	✓	✓
1.A.2.e Other Fuels		✓	✓	✓
1.A.2.f Other	**0301 Comb. in boilers, gas turbines and stationary engines (Other Industry+ Electricity and Heat Production in Industry)** **030311 Cement** **030317 Glass** **030312 Lime** **030319 Bricks and Tiles** **030323 Magnesia production (dolomite treatment)** **0808 Other Mobile Sources and Machinery-Industry**			
1.A.2.f Liquid Fuels		✓	✓	✓
1.A.2.f Solid Fuels		✓	✓	✓
1.A.2.f Gaseous Fuels		✓	✓	✓
1.A.2.f Biomass		✓	✓	✓
1.A.2.f Other Fuels		✓	✓	✓

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
1.A.3.a Civil Aviation	**080501 Domestic airport traffic (LTO cycles – < 1 000 m)** **080503 Domestic cruise traffic (> 1 000 m)**			
1.A.3.a Aviation Gasoline		✓	✓	✓
1.A.3.a Jet Kerosene		✓	✓	✓
1.A.3.b Road Transportation	**0701 Passenger cars** **0702 Light duty vehicles < 3.5 t** **0703 Heavy duty vehicles > 3.5 t and buses** **0704 Mopeds and Motorcycles < 50 cm³** **0705 Motorcycles > 50 cm³** **0706 Gasoline evaporation from vehicles**			
1.A.3.b Gasoline		✓	✓	✓
1.A.3.b Diesel Oil		✓	✓	✓
1.A.3.b Natural Gas		NO	NO	NO
1.A.3.b Biomass		NO	NO	NO
1.A.3.b Other Fuels		NO	NO	NO
1.A.3.c Railways	**0802 Other Mobile Sources and Machinery-Railways**			
1.A.3.c Solid Fuels		✓	✓	✓
1.A.3.c Liquid Fuels		✓	✓	✓
1.A.3.c Other Fuels		NO	NO	NO
1.A.3.d Navigation	**0803 Other Mobile Sources and Machinery-Inland waterways**			
1.A.3.d Coal		NO	NO	NO
1.A.3.d Residual Oil		NO	NO	NO
1.A.3.d Gas/Diesel oil		✓	✓	✓
1.A.3.d Other Fuels: Gasoline		✓	✓	✓
1.A.3.e Other	**010506 Pipeline Compressors**			
1.A.3.e Liquid Fuels		NO	NO	NO
1.A.3.e Solid Fuels		NO	NO	NO
1.A.3.e Gaseous Fuels		✓	✓	✓
1.A.4.a Commercial/Institutional	**0201 Commercial and institutional plants**			
1.A.4.a Liquid Fuels		✓	✓	✓
1.A.4.a Solid Fuels		✓	✓	✓
1.A.4.a Gaseous Fuels		✓	✓	✓
1.A.4.a Biomass		✓	✓	✓
1.A.4.a Other Fuels		✓	✓	✓
1.A.4.b Residential	**0202 Residential plants** **0809 Other Mobile Sources and Machinery-Household and gardening**			
1.A.4.b Liquid Fuels		✓	✓	✓
1.A.4.b Solid Fuels		✓	✓	✓
1.A.4.b Gaseous Fuels		✓	✓	✓
1.A.4.b Biomass		✓	✓	✓
1.A.4.b Other Fuels		NO	NO	NO

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
1.A.4.c Agriculture/Forestry/Fisheries	**0203 Plants in agriculture, forestry and aquaculture 0806 Other Mobile Sources and Machinery-Agriculture 0807 Other Mobile Sources and Machinery-Forestry**			
1.A.4.c Liquid Fuels		✓	✓	✓
1.A.4.c Solid Fuels		✓	✓	✓
1.A.4.c Gaseous Fuels		✓	✓	✓
1.A.4.c Biomass		✓	✓	✓
1.A.4.c Other Fuels		NO	NO	NO
1.A.5 Other	**0801 Other Mobile Sources and Machinery-Military**			
1.A.5 Liquid Fuels		✓	✓	✓
1.A.5 Solid Fuels		NO	NO	NO
1.A.5 Gaseous Fuels		NO	NO	NO
1.A.5 Biomass		NO	NO	NO
1.A.5 Other Fuels		NO	NO	NO
Marine Bunkers				
Gasoline		NO	NO	NO
Gas/Diesel oil		NO	NO	NO
Residual Fuel Oil		NO	NO	NO
Lubricants		NO	NO	NO
Coal		NO	NO	NO
Other Fuels		NO	NO	NO
Aviation Bunkers	**080502 International airport traffic (LTO cycles – < 1 000 m) 080504 International cruise traffic (> 1 000 m)**			
Jet Kerosene		✓	✓	✓
Gasoline		NO	NO	NO
Multilateral Operations		NO	NO	NO

(1) *CH_4 emissions from petroleum refining are included in* 1 B 2 Fugitive Emissions from Fuels.

3.2.2 Methodological Issues

Choice of Methodology

In general the CORINAIR methodologies are applied. In the inventory area sources as well as point sources are considered.

However, the applied methodologies are equivalent to the IPCC Tier 2 and Tier 3 methodologies, respectively.

Tier 2 methodology

For the following categories and pollutants the IPCC Tier 2 methodology is used:

- *1 A 1 a Public Electricity and Heat Production, plants >= 50 MW_{th}*: CO_2, CH_4, N_2O, NMVOC
- *1 A 1 a Public Electricity and Heat Production, plants < 50 MW_{th}*: All Pollutants

- *1 A 1 b Petroleum Refining:* CO_2, CH_4, N_2O
- *1 A 1 c Manufacture of Solid Fuels and Other Energy Industries:* All Pollutants
- *1 A 2 Manufacturing Industries and Construction – Stationary sources:* All Pollutants
- *1 A 3 c Railways:* All Pollutants
- *1 A 3 d Navigation:* All Pollutants
- *1 A 3 e Other Transportation – Pipeline compressors:* All Pollutants
- *1 A 4 Other Sectors – Stationary sources:* All Pollutants

Methodology of emission calculation: Each activity (fuel input) of each sub-category is multiplied by an emission factor.

Activity data are taken from official energy statistics.

Calorific values used for conversion of fuel activity data from [tonnes] and [cubicmetres] into [Terajoule] are country specific.

Emissions factors are country specific, fuel and technology dependent.

Regarding the above listed criteria this methodology is equivalent to the IPCC bottom up Tier 2 methodology. See (IPCC 1996 rev. Guidelines) chapter *2.1.1.1 Choice of Method.*

Tier 3 methodology

For the following categories the IPCC Tier 3 methodology is used.

- *1 A 3 a Civil Aviation*
- *1 A 3 b Road Transport*
- *1 A 2 f Industry – Mobile machinery*
- *1 A 4 b Residential – Mobile machinery*
- *1 A 4 c Agriculture and Forestry – mobile machinery*
- *1 A 5 Other Mobile – Military*
- *International Bunkers – Aviation*

Methodology of emission calculation: Each activity (fuel input) of each sub-category is multiplied by an emission factor.

Emissions factors are fuel and technology dependent.

Calorific values used for conversion of fuel activity data from [tonnes] into [Terajoule] are country specific.

Technology dependent activity data are calculated by means of a bottom up model and adjusted to top down activity data. Bottom up activity data are calculated by means of vehicle-kilometres, vehicle stock statistics and operating condition dependant fuel consumption per vehicle kilometer. Top down activity data are based on fuel sales taken from the national energy balance.

Consideration of point source emissions

Within the following categories and pollutants plant specific emission declarations are considered.

- *1 A 1 a Public Electricity and Heat Production (42 plants):* CO, SO_2, NO_x
- *1 A 1 b Petroleum Refining (1 plant):* SO_2, NO_x, CO, VOC ("IE": reported under 1 B)
- *1 A 2 a Iron and Steel (2 integrated iron & steel plants):* CO_2, CO, VOC, SO_2, NO_x
- *1 A 2 f Other – Cement production (10 plants):* CO_2, SO_2, NO_x, CO, VOC

To avoid double counting of point source emissions with area sources (data from the national energy balance) consistency of reported activity by plant operators with activity data from energy statistics is checked: reported data must not be greater than data from energy statistics for the respective category (the correspondence of a plant to the specific energy balance sector is determined by identical NACE or ISIC-Codes). Only consistent and complete point source data are used for inventory preparation, if data are not consistent then data from the national energy balance are used. Activity data and emissions of point source emissions declarations are checked by comparing implied emission factors against IPCC default values or by comparing emissions to those of a simple Tier1 approach.

Consideration of CO_2 emission trading system (ETS) "bottom up" data

At current the following industrial branches are fully covered by the national ETS:

- Refineries
- Iron and steel manufacturing industries
- Non metallic mineral industries (cement, glass, lime, bricks and tiles, other ceramic materials)
- Pulp an paper manufacturing industries

Other industrial branches (including power plants) are considered by thermal plant capacity:

- Combustion plants > 20 MW_{th} (excluding hazardous and muncipal waste incineration plants)

Description of received ETS data

ETS data is submitted by means of a standard calculation sheet which may include numerical data about multiple fuels, processes and material flows. Additionally a written QA/QC report has to be submitted.

For fuel combustion and industrial processes the following numerical data is reported:

- Activity data: mass or volume of fuel consumption/process input material.
- Net calorific value of fuel
- Oxidation factor of fuel/conversion factor of process material
- CO_2 emission factor of fuel or process material
- Share of non fossil CO_2 in case of "non-traded fuels"

For sites with complex material flows (e.g. refineries, iron and steel plants) carbon mass balance data is reported alternatively:

- Activity data: mass or volume of material flow
- Net calorific value of material
- Carbon content of material

Direct CO_2 measurements have not been submitted.

The ETS reports include data about "traded-fuels" (e.g. different types of coal and fuel oils, natural gas) as well as "non-traded fuels" (e.g. industrial wastes, biomass). For each of the "traded fuels" a national default NCV and a national default CO_2 emisson factor may be selected for emission calculation. For "non-traded fuels" plant operators have to make their own estimate of carbon content and NCV.

Methodology of ETS data consideration

ETS "bottom up" data 2005–2006 are used for calculation of emission data in categories *1 A 1*, *1 A 2* and *1 A 4 a*. About 200 plants reported 800 fuel and material flows which have been considered in the inventory.

1. In accordance with STATISTIK AUSTRIA each plant is allocated to a NACE category of the energy balance.
2. In accordance with STATISTIK AUSTRIA each reported fuel is allocated to a fuel type according to the energy statistics system. For "non-traded fuels" systematic errors of allocation have to be avoided as far as possible.
3. ETS fuel masses/volumes and NCVs are used for activity data calculation. The remaining activity data is calculated by means of remaining fuel masses/volumes and averaged NCVs from the energy balance:
   $Activity_{category,\ fuel} = (Energy\_Balance\_Activity_{category,\ fuel} - \Sigma i(ETS\_Activity_{plant\ i,\ fuel})) \times Energy\_Balance\_NCV_{fuel} + \Sigma i(ETS\_Activity_{plant\ i,\ fuel} \times ETS\_NCV_{plant\ i,\ fuel})$
4. ETS CO_2 emissions are considered by fuel. The remaining CO_2 emissions are calculated by remaining activity data and "national default" emission factors:
   $CO2_{category,\ fuel} = (Energy\_Balance\_Activity_{category,\ fuel} - \Sigma i(ETS\_Activity_{plant\ i,\ fuel})) \times Energy\_Balance\_NCV_{fuel} \times Default\_EF_{fuel} + \Sigma i(ETS\_CO2_{plant\ i,\ fuel})$

Choice of emission factors for stationary sources

Emission factors for combustion plants are expressed as kg/GJ for CO_2 and as g/GJ for CH_4 and N_2O. Please note that emission factors sometimes are different for different sectors because of the different share of fuel types combusted (e.g. the CO_2 emission factor for "hard coal" used in the energy industries is different from the factor used for manufacturing industry because different hard coal types with different origin are used; "hard coal" is actually a group of different hard coal types).

Emission factors may vary over time for the following reasons:

- The chemical characteristics of a fuel category varies, e.g. sulphur content in residual oil, carbon content of coal, CH_4 content of natural gas.
- The mix of fuels in the fuel category changes over time. If the different fuels of a fuel category have different calorific values and their share in the fuel category changes, the calorific value of the fuel category might change over time.
- The technical equipment of a combustion plant, which burns a specific fuel, changes over time.

References for CO_2 and CH_4 emission factors are national studies (BMWA-EB 1990, 1996, 2003, GEMIS 2002). N_2O emission factors are also taken from national studies (STANZEL et al. 1995) and (BMUJF 1994). Detailed figures are included in the relevant chapters.

CO_2 emission factors for stationary sources per fuel type

Natural Gas (fossil)

For all stationary sources of natural gas combustion a CO_2 emission factor of 55.4 t CO_2/TJ (GEMIS 2002) has been applied.

Liquid fuels (fossil)

Fuel oil: Depending on the sulphur content three fuel oil categories are considered in the inventory. CO_2 emisson factors are taken from (BMWA-EB 1996).

Gasoil, Diesel Oil : CO_2 emisson factors are taken from (BMWA-EB 1996).

Liquid Petroleum Gas, LPG: CO_2 emisson factors are taken from (BMWA-EB 1996).

Refinery Gas: The CO_2 emission factor is based on plant specific measurements. See chapter 3.2.2.2 1.A.1.b Petroleum Refining.

Solid fuels (fossil)

Coal: (BMWA-EB 1996): CO_2 emission factors are based on elemental analysis with the assumption that 100% of carbon is released as CO_2 (values originate from the study (HACKL & MAUSCHITZ 1994), where the EF are based on the elemental analysis for different coal types).

Peat: A default carbon content of 29.9 t C/TJ for peat is taken from (IPCC Guidelines 1997).

Municipal Solid Waste, MSW (partly fossil)

The fossil carbon content for MSW is taken from (ABFALLWIRTSCHAFT 2003). A fraction analysis of the typical wet MSW for Vienna[20] was performed by the local waste authority of Vienna (MA 48) in 1997/1998.

The fossil and non fossil carbon content of each fraction is taken from (ÖKOINSTITUT 2002). This leads to a fossil share of 45% of the overall carbon content of 261 t C/t $MSW_{wet\ matter}$. The CO_2 emission factor is converted into t CO_2/TJ by means of a heating value of 9.8 GJ/t. The heating value is a personal information of STATISTIK AUSTRIA to the Umweltbundesamt and consistent with the energy balance (IEA JQ 2007). STATISTIK AUSTRIA quotes that the heating value was obtained from the plant operator.

Industrial Waste (partly fossil)

The main share of industrial waste is used in cement and chemical industry for the purpose of energy recovery. For cement industry emission factors are based on the studies (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003, 2007) and (MAUSCHITZ 2004) which include information about fractions and carbon contents. Details about emissions from cement industry are given in chapter 3.2.2.9 (1.A.2.f Manufacturing Industries and Construction – Other).

The fractions and the specific carbon contents of waste incinerated in chemical industry, pulp and paper industry and wood products manufacturing industry are not reported by the ETS and are unknown. It is assumed that the heating value is mainly determined by combustion of carbon which is mainly of fossil origin. Therefore the default emission factor from GPG, Table 5.6 for hazardous waste is used:

[20] Until 1998 incineration of MSW in Vienna took place only at the one plant where the analysis was performed; in 2003 73% of total MSW in Austria was combusted in this plant, the value was applied to total MSW combustion in Austria.

A carbon content of 500 kg C/ t waste is selected with a fossil share of 90% and 99.5% combustion efficiency. This leads to an emissions factor of 1 641.8 t CO_2/t Waste. By selecting a net calorific value of 15.76 GJ/t (which is the value used by STATISTIK AUSTRIA for preparing the energy balance) this leads to an emission factor of 104.17 t CO_2/TJ Waste.

Sewage Sludge (non fossil)

Sewage sludge is incinerated in one waste incineration plant and a couple of public power plants. A default carbon content of 29.9 t C/TJ for solid biomass is taken from (IPCC Guidelines, 1997).

Black Liquor (non fossil)

Black liquor is incinerated in pulp and paper industry and in wood products manufacturing industry. A default carbon content of 29.9 t C/TJ for solid biomass is taken from (IPCC Guidelines, 1997).

Biogas, Sewage Sludge Gas, Landfill Gas (non fossil)

Biogas reported by (IEA JQ 2004) is used for energy recovery in all subcategories of Category *1 A.* A default carbon content of 30.6 t C/TJ for biogas is taken from (IPCC Guidelines 1997).

CO_2 emissions reported by the ETS

The following Table 23 shows certificated CO_2 emissions from the ETS (UMWELTBUNDESAMT, ECRA 2006/2007) and their allocation to IPCC categories. The allocation does not always follow the category reported by plant operators but is harmonized by means of reported NACE-codes and therefore harmonized with energy statistics. To improve time series consistency industrial so called "co-generation" plants are allocated to the industrial sectors where the energy is used. Minor emissions could not be allocated to a specific category but are assumed to be included elsewhere in the inventory (e.g. carburisation material) or negligible (e.g. pyrolisis material).

Table 23: 2005–2006 CO_2 emissions [Gg] as reported by the ETS.

	Category	2005	2006
Total ETS[1)]		33 373	32 381
1.A	FUEL COMBUSTION ACTIVITIES	25 299	24 101
1.A.1.a	Public Electricity and Heat Production	11 482	10 374
1.A.1.b	Petroleum refining	2 827	2 830
1.A.1.c	Manufacture of Solid fuels and Other Energy Industries	43	50
1.A.2.a	Iron and Steel	5 688	5 631
1.A.2.b	Non-ferrous Metals	0	0
1.A.2.c	Chemicals	665	623
1.A.2.d	Pulp, Paper and Print	2 245	2 153
1.A.2.e	Food Processing, Beverages and Tobacco	316	278
1.A.2.f	Other	2 010	2 139
1.A.4.a	Commercial/Institutional	22	23
2.	INDUSTRIAL PROCESSES	8 091	8 343
2.A.1	Cement Production	1 797	1 954
2.A.2	Lime Production	579	570
2.A.3	Limestone and Dolomite Use	267	272
2.A.4	Soda Ash Production and use	15	16
2.A.7.a	Bricks and Tiles (decarbonizing)	128	130
2.A.7.b	Sinter Production	310	312
2.C.1.a	Steel	763	778
2.C.1.b	Pig Iron	4 186	4 263
2.C.1.e.1	Electric furnace steel plant	45	49
	Included elsewhere[2)]	*17*	*63*

1) *Source: UMWELTBUNDESAMT, ECRA (2006/2007).*

2) *Emissions which could not be allocated to a specific IPCC category.*

CO_2 emission factors reported within the ETS

Table 24 and Table 25 show the implied CO_2 emisson factors reported within the ETS by fuel and SNAP category for the recent reported year. In some cases rather small fuel consumption was reported for specific categories. This may lead to significant errors in implied emission factor calculation (e.g. diesel, gasoil) because within the ETS CO_2 emissions are rounded to the nearest ton wheras reported fuel consumption is not rounded.

Table 24: 2006 CO_2 implied emission factors calculated from ETS data. Coal, Petrol Coke, Waste and Natural Gas.

SNAP	102A Hard Coal	105A Brown Coal	107A Coke Oven Coke	110A Petrol Coke	115A Ind. Waste	301A Natural Gas
Weighted average	**93.30**	**101.32**	**106.29**	**279.92**	**58.14**	**54.80**
010101 Public Power plants >= 300 MW_{th}	92.76	102.00	–	–	–	55.00
010102 Public Power plants >= 50 MW_{th} < 300 MW_{th}	93.07	0.00	–	–	107.51	55.00
010103 Public Power plants <= 50 MW_{th}	–	–	–	–	–	–
010201 Public District Heating plants >= 300 MW_{th}	–	–	–	–	–	55.00
010202 Public District Heating plants >= 50 MW_{th} < 300 MW_{th}	–	–	–	–	–	55.00
010203 Public District Heating plants < 50 MW_{th}	–	–	–	–	–	55.00
010301 Refinery	–	–	–	–	–	53.65
010504 Other Energy Industries – Gas Turbines	–	–	–	–	–	55.00
020103 Commercial plants < 50 MW_{th}	–	–	–	–	–	55.00
0301 Industry – Steel	NA	–	111.23	–	–	55.00
0301 Industry – Non ferrous metals	–	–	–	–	–	–
0301 Industry – Chemicals	93.62	–	104.01	–	74.59	55.00
0301 Industry – Pulp and Paper	89.69	97.01	–	–	43.85	55.00
0301 Industry – Food and Beverages	98.32	–	104.00	–	–	55.00
03010 Industry – Other	–	–	–	–	22.75	55.00
030311 Cement kilns	94.42	97.67	–	94.32	63.02	55.00
030312 Lime kilns	–	–	–	–	–	55.00
030317 Glass	–	–	–	–	–	55.00
030319 Bricks and Tiles	94.07	NA	103.99	100.02	6.09	55.00
030323 Dolomite Treatment	–	–	–	95.72	–	55.00
030326 Integrated Iron & Steel works	–	–	NA	–	76.81	55.03

Table 25: 2006 CO_2 implied emission factors calculated from ETS data. Oil products.

SNAP	203B light fel oil	203C Medium fuel oil	203D Heavy fuel oil	204A Gasoil	2050 Diesel	224A other liquid	303A LPG
Weighted average	**77.57**	**78.00**	**79.34**	**74.99**	**73.12**	**78.83**	**63.99**
010101 Public Power plants >= 300 MW_{th}	77.06	–	79.57	74.96	74.33	–	–
010102 Public Power plants >= 50 MW_{th} < 300 MW_{th}	77.02	–	75.12	77.01	–	–	–
010103 Public Power plants <= 50 MW_{th}	–	–	–	–	–	–	–
010201 Public District Heating plants >= 300 MW_{th}	77.00	–	80.00	74.94	71.07	–	–
010202 Public District Heating plants >= 50 MW_{th} < 300 MW_{th}	77.00	78.00	80.00	75.02	59.91	–	–
010203 Public District Heating plants < 50 MW_{th}	76.80	–	79.73	74.93	74.71	–	63.97
010301 Refinery	–	–	–	–	–	78.83	–
010504 Other Energy Industries – Gas Turbines	–	–	–	–	–	–	–
020103 Commercial plants < 50 MW_{th}	–	–	–	75.38	–	–	–
0301 Industry – Steel	–	–	–	–	–	–	–
0301 Industry – Non ferrous metals	–	–	–	–	–	–	–
0301 Industry – Chemicals	–	–	80.81	74.93	–	–	–
0301 Industry – Pulp and Paper	78.14	–	78.30	75.01	71.77	–	–
0301 Industry – Food and Beverages	–	–	78.00	77.67	71.11	–	–
03010 Industry – Other	78.08	–	78.03	75.08	74.39	–	–
030311 Cement kilns	78.01	–	77.98	75.04	–	–	–
030312 Lime kilns	–	–	77.72	75.25	–	–	–
030317 Glass	78.00	–	–	71.29	63.24	–	–
030319 Bricks and Tiles	78.03	–	78.01	74.99	132.75	–	63.99
030323 Dolomite Treatment	74.17	–	–	–	83.94	–	66.38
030326 Integrated Iron & Steel works	–	–	79.56	–	–	–	–

Choice of activity data for stationary sources

For information on the underlying activity data used for estimating emissions see Annex 2. It describes the national energy balance (including fuel and fuel categories, net calorific values) and the methodology applied to extract activity data from the energy balance for the calculation of emissions for *Sector 1 A Fuel Combustion* (such as correspondence of categories of the energy balance to IPCC categories). Activity data used for estimating emissions in the sectoral approach is taken from the energy balance as well as information on the last revision of the national energy balance (see Annex 2).

The national energy balance is provided by Statistik Austria (IEA JQ 2007) and presented in Annex 4. The net calorific values (NCV) used for converting mass or volume units of the fuel quantities into energy units [TJ] are provided by Statistik Austria and presented in Annex 4.

In the sectoral approach of Category *1 A* only the fuel quantities that are combusted are relevant and thus considered for emission calculation. Quantities not considered are: non energy and feedstock use, international bunker fuels, transformation and distribution losses, transformations of fuels to other fuels like hard coal to coke oven coke and internal refinery processes which have been added to the transformation sector of the energy balance.

Potential emissions from non energy and feedstock fuel use are considered in the correspondent IPCC categories as described in Chapter 3.4 Feedstocks.

3.2.2.1 1.A.1.a Public Electricity and Heat Production

Key Sources: CO_2 from gaseous, liquid, solid and other fuels

Category *1 A 1 a Public Electricity and Heat Production* covers emissions from fuel combustion in public power and heat plants. The share in total GHG emissions from sector *1 A* is 19.8% for the year 1990 and 17.6% for the year 2006. The increased CH_4 emissions are due to increased natural gas combustion in plants smaller 50 MW_{th} (see tables in Annex 2). In 2006 CO_2 emissions decreased by 5%, mainly due to less use of natural gas for electricity production.

Methodology

For the years 1990 to 2004 IPCC Tier 2 methodology is applied by using activity data from energy balance and national default emission factors.

For the years 2005–2006 CO_2 emissions from plants >= 20 MW_{th} are taken from ETS reports and CO_2 emissions from plants < 20 MW_{th} are calculated by means of national default emission factors and remaining fuel consumption of the energy balance. Coal consumption is fully covered by the ETS. The general methodology is described in chapter 3.2.2.

Emission factors

National emission factors for CO_2 and CH_4 are taken from (BMWA-EB, 1990, 1996, (UMWELTBUNDESAMT 2001) and (GEMIS, 2002). N_2O-emission factors are taken from a national study (STANZEL et al. 1995). The selected emissions factors for 2005 are listed in the following table. The CO_2 emission factor for municipal solid waste is taken from (ABFALLWIRTSCHAFT 2003). The following table shows the national default emission factors.

Table 26: Emission factors of Category 1.A.1 a for the year 2006.

Fuel	Default CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Light Fuel Oil in plants >= 50 MW_{th}	77.00	1.00	1.00
Light Fuel Oil in plants <= 50 MW_{th}	78.00	0.80	0.60
Medium Fuel Oil	78.00	1.00	1.00
Heavy Fuel Oil in plants >= 50 MW_{th}	80.00	0.60–1.00	1.80
Heavy Fuel Oil in plants <= 50 MW_{th}	78.00	2.00	1.00
Gasoil	75.00	1.20	1.00
Diesel oil	75.00	0.20	0.60
Liquified Petroleum Gas	64.00	1.50	1.00
Hard coal in power and CHP plants	95.00	0.10	0.50
Hard coal in district heating plants.	93.00	0.30	5.00
Lignite and brown coal in power and CHP plants >= 50 MW_{th}	110.00	0.10	0.50
Lignite and brown coal in district heating plants >= 50 MW_{th}	108.00	0.20	2.00
Lignite, brown coal and brown coal briquettes in plants < 50 MW_{th}	97.00	7.00	1.40
Natural Gas in power and CHP plants >= 50 MW_{th}	55.40	0.18	0.50
Natural Gas in district heating plants >= 50 MW_{th}	55.40	1.50	1.00
Natural Gas in plants <= 50 MW_{th}	55.40	1.50	0.10
Fuel Wood	100.00[1)]	21.00	3.00

Fuel	Default CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Wood Waste	110.00[1)]	2.00	4.00
Sewage Sludge	110.00[1)]	12.00	1.40
Biogas, Sewage Sludge Gas, Landfill Gas	112.00[1)]	1.50	1.00
Municipal Solid Waste$_{wet}$	48.88[2)]	12.00	1.40
Industrial Waste	104.17[2)]	12.00	1.40

1) *Reported as CO_2 emissions from biomass.*

2) *According to IPCC guidelines non fossil CO_2 emissions of "other fuels" are not reported.*

Activity data

1.A.1 a total fuel consumption is taken from (IEA JQ 2007) prepared by Statistik Austria (see Annex 4).

Fuel consumption in the public electricity sector varies strongly over time. The most important reason for this variation is the fact that in Austria up to 78% of yearly electricity production comes from hydropower. If production of electricity from hydropower is low, production from thermal power plants is high and vice versa.

The following Table 27 shows the gross electricity and heat production of public power and district heating plants. Increasing district heat production is mainly generated by new biomass (local) heat plants and by waste incineration. The share of combined heat and power plants (CHP generation) is increasing and leads to higher efficiency of energy generation.

Table 27: Public gross electricity and heat production.

	Public gross electricity production [GWh]						Public Heat Production [TJ] by Combustible Fuels
	Total	Hydro[1)]	Combustible Fuels	Geothermal	Solar	Wind	
1990	**43 403**	30 111	13 292	0	0	0	24 426
1991	**43 498**	30 268	13 229	0	0	0	29 038
1992	**42 838**	33 530	9 307	0	0	0	27 599
1993	**45 063**	35 334	9 729	0	1	0	30 427
1994	**44 982**	34 243	10 738	0	1	0	30 727
1995	**47 943**	35 794	12 147	0	1	1	34 425
1996	**46 011**	32 950	13 055	0	1	5	44 482
1997	**47 696**	34 701	12 972	0	2	20	40 630
1998	**48 251**	36 058	12 146	0	2	45	43 454
1999	**52 191**	39 593	12 546	0	2	51	43 083
2000	**53 089**	41 410	11 609	0	3	67	42 654
2001	**54 082**	39 681	14 224	0	4	172	46 505
2002	**54 465**	40 581	13 672	3	7	203	45 981
2003	**52 501**	34 230	17 890	3	11	366	49 516
2004	**56 028**	37 700	17 388	2	14	924	53 001
2005	**57 468**	37 379	18 745	2	14	1 328	55 931
2006	**55 006**	36 458	16 779	2	15	1 752	60 691

1) *including use for pumped storage; Source: STATISTIK AUSTRIA*

Although electricity consumption increases continously the domestic production is decreasing since 2004 but net imports have more than doubled since 2004 as shown in the following Table 28.

Table 28: Electricity supply, gross production imports, exports and net imports [GWh].

	Electricity [GWh]				
	Supply[1)]	Gross production[2)]	Imports	Exports	Net Imports
1990	46 123	50 294	6 839	7 298	-459
1991	48 344	51 484	8 503	7 738	765
1992	47 618	51 180	9 175	8 621	554
1993	48 505	52 675	8 072	8 804	-733
1994	49 040	53 310	8 219	9 043	-824
1995	50 383	56 589	7 287	9 757	-2 470
1996	51 890	54 938	9 428	8 476	952
1997	52 417	56 873	9 008	9 775	-767
1998	53 360	57 462	10 304	10 467	-163
1999	55 299	60 943	11 608	13 507	-1 899
2000	55 716	61 517	13 824	15 192	-1 368
2001	57 837	62 376	14 467	14 252	214
2002	57 077	62 419	15 375	14 676	699
2003	58 637	60 099	19 003	13 389	5 614
2004	59 820	64 126	16 629	13 548	3 080
2005	60 916	65 697	20 397	17 732	2 665
2006	62 266	63 534	21 257	14 407	6 850

Source: Statistik Austria

1) *Excluding own use and heat pumps, boilers and pumped storage use. Including losses*

2) *Public and autoproducer gross production*

Recalculations

Changes of activity data are based on energy balance recalculation as described in Annex 2.

Sector specific QA/QC procedures

Large point source data are used for validation of energy consumption. The Umweltbundesamt operates a database to store boiler specific data, which is called "*Dampfkesseldatenbank*" (DKDB) which includes fuel consumption, CO, NO_x, SO_x and dust emissions from boilers with a thermal capacity greater than 3 MW for the years 1990 onwards. These data are used to generate a sectoral split of the categories *Public Power* and *District Heating* each into the two categories ≥ *300 MW* and ≥ *50 MW to 300 MW* of thermal capacity. Currently 56 boilers between 35 and 1 760 MW_{th} are considered in this approach.

The remaining fuel consumption (= total consumption minus consumption of large point sources) is the activity data for boilers smaller than 50 MW.

3.2.2.2 1.A.1.b Petroleum Refining

Key Sources: CO_2 from gaseous and liquid fuels

Category *1 A 1 b Petroleum Refining* enfolds CO_2 and N_2O emissions from fuel combustion, flaring and thermal cracking of the only petroleum refining plant in Austria. CH_4 emissions are included in category *1 B 2 a Fugitive Emissions from Fuels – Oil*. Since 2003 the plant has been upgraded which increases CO_2 emissions from bitumen blowing and hydrogen production.

The share in total GHG emissions from sector *1 A* is 4.3% for the year 1990 and 4.1% for the year 2006. Crude oil input which was 8 Mio t in 1990 and 8.4 Mio t in 2006.

Methodology

The IPCC Tier 2 bottom up methodology is used. Activity data is multiplied by emission factors. For calculation of CO_2 emissions plant specific emission factors are used. For calculation of N_2O emissions country specific default emission factors are used.

The carbon contents for the fuel groups *gaseous*, *liquid* and *solid* are reported by plant operator. The fuel groups do not correspond with IPCC definitions, e.g. gaseous fuels include refinery gas which is, according to IPCC definition, a liquid fuel.

Table 29: Carbon content per fuel group for petroleum refining.

Fuel-Group	PS Carbon Content [t CO_2/t fuel]	Associated IEA-Fuels
Gaseous	2.683	Natural Gas, Refinery Gas
Liquid	3.047	Residual Fuel Oil, Gas Oil, Diesel, Petroleum, Jet Gasoline, Other Oil Products, LPG
Solid	3.430	Petrol Coke

1990 to 2001 CO_2 emissions are calculated by multiplying activity data from the energy balance by the emission factors in Table 29. CO_2 emissions 2002 to 2005 are reported by the Austrian Association of Mineral Oil Industries and consistent with ETS 2005 data. For the year 2006 reported ETS data is used.

To be consistent with IPCC fuel group definition, total CO_2 emissions are disaggregated to the IEA fuel types (see column "Associated IEA-fuels") by using default emission factors for industrial boilers (they are presented in Table 31, for references see Chapter 3.2.2 Methodological Issues), subtracting the calculated CO_2 emissions from total CO_2 emissions, and associating remaining CO_2 emissions to refinery gas. The resulting IEF for refinery gas is presented in Table 30.

Table 30: Implied emission factors for refinery gas.

	t CO_2/TJ
1990	51.6
1991	50.7
1992	50.9
1993	48.9
1994	50.2
1995	52.1
1996	51.6

	t CO_2/TJ
1997	50.8
1998	51.0
1999	55.1
2000	50.7
2001	51.2
2002	50.7
2003	68.6
2004	66.8
2005	58.4
2006	48.1

N_2O emissions are calculated by multiplying fuel consumption by the emission factors presented in Table 31 (they are selected according to chapter 3.2.2 Methodological Issues).

No combustion specific CH_4 emissions are reported for this category, process-specific CH_4 emissions are reported in Category *1.B.2.a Fugitive Emissions from Fuels – Oil*.

For corresponding crude oil input data which may be used as an indicator over time series refer to description of category *1.B.2.a Oil*.

Table 31: Emission factors of Category 1.A.1.b.

Fuel	CO_2 [t/TJ]	N_2O [kg/TJ]
Residual Fuel Oil	80.00	0.60
Gas oil	75.00	0.60
Diesel	78.00	0.60
Petroleum	78.00	0.60
Jet Gasoline	78.00	0.60
Other Oil Products	78.00	0.60
LPG	64.00	1.00
Petrol Coke	100.88	–
Natural Gas	55.40	0.10

Activity data

Fuel consumption is taken from (IEA JQ 2007) as presented in Annex 4 except for the years 1999 to 2005, where *petrol coke* is additionally counted in *other oil products* (1999: +63 kt, 2004: +59 kt) to reach consistency with plant specific activity data reported in (DKDB 2007).

Recalculations

Recalculations follow the changes of the energy balance. CO_2 emissions from natural gas between 1990 and 1992 and 2002 to 2004 are up to 95 Gg lower (in 2003).

Sector specific QA/QC procedures

A simple mass balanced input/output validation of energy balance data has been performed which shows a plausible and time series consistent correlation of the input and output material flows as shown in the following Table 32. The last line shows the difference between input and output. Natural gas consumption is not considered in this approach.

Table 32: Refinery input/output mass balance.

Material flow [kt]	1990	1995	2000	2005	2006
Total Input	9 062	9 244	8 887	9 190	9 154
Crude oil	7 952	8 619	8 240	8 709	8 433
NGL	41	43	107	76	86
Feedstocks	1 069	582	541	370	523
Biofuel (blending)				34	112
Total Output	8 824	8 959	8 610	9 059	8 889
Fuel oil	1 913	1 502	979	992	915
Gas oil	1 239	1 454	1 062	997	1 004
Diesel	1 531	1 920	2 662	2 931	2 780
Other Kerosene	31	8	1	1	1
Aviation kerosene	291	420	544	592	526
Aviation gasoline	0	0	0	0	0
Motör gasoline	2 631	2 271	1 815	1 798	1 615
White spirit	0	5	0	12	0
Bitumen	269	254	343	466	392
Other petroluem products	499	761	859	854	1 215
LPG	47	60	34	107	50
Refinery gas	373	305	312	309	390
Input-Output	237	285	277	130	265

Planned improvements

A large fluctuation of Refinery gas CO_2-IEF (see Table 30) has been identified. Activity data should be reconsidered. From 2005 to 2006 refinery gas activity data (IEA JQ 2007) increased by 31% while CO_2 emissions increased by only 0.1%.

3.2.2.3 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries

Key Source: CO_2 from gaseous fuels

Category *1.A.1.c Manufacture of Solid Fuels and Other Energy Industries* enfolds emissions from fuel combustion in the oil and gas extraction sector (reported by companies as 'own use'), compressors used for natural gas storage tanks and fuel use of gas processing facilities ("gas refineries"). For 1990 to 1995 transformation losses/own use in gas works are included too. The share in sector *1 A* overall GHG emissions is 0.9% for the year 1990 and 0.8% for the year 2006.

Methodology

The CORINAIR simple methodology is applied.

For 2005 to 2006 CO_2 emissions and activity data of natural gas storage compressors are taken from ETS data.

Emission factors

CO_2 and CH_4 emission factors are taken from studies (BMWA-EB 1990, 1996).

The N_2O emission factor is taken from a national study (BMUJF, 1994).

The emission factors are presented in Table 33.

Table 33: Emission factors of Category 1.A.1.c.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Natural Gas	55.40	1.50	0.10
Heavy Fuel Oil	78.00	2.00	1.00

Activity data

Fuel consumption is taken from (IEA JQ 2007) as presented in Annex 4.

Transformation losses in gas works are calculated by subtracting final energy use from transformation input. Since the energy balance (IEA JQ 2007) does not report gas works gas the activity data is taken from the "Austrian Energy Balance" provided by STATISTIK AUSTRIA which is in a different structure but consistent with (IEA JQ 2007).

Recalculations

New information from E-Control clarified that 'natural gas distribution losses' in the Energy Balance also includes the natural gas suppliers' 'own usage' of natural gas. Previously it was assumed that 'distribution losses' included statistical differences and therefore no emissions had been calculated from this quantity. The energy balance has been revised from 1990 on and 'own usage' has been shifted to the oil/gas extraction sector. The remaining quantity of distribution losses is now much lower and represents a more reliable quantity of real fugitive losses.

The sectoral approach considers now combustion related GHG emissions from the gas suppliers 'own usage'. This leads to higher consumption (1990: 2 382 TJ) and GHG emissions (1990: +132 Gg CO_2) of category 1.A.1.c for natural gas.

Planned improvements

Investigate 'own usage' of natural gas suppliers. Check if a share of pipeline compressor gas turbine fuel consumption which should be reported under Category 1.A.3.e is included here.

Avoid possible double counting with category 1.B.2.b. Clarify where gas hydraulic starting system of turbines and gas hydraulic actuators for pipeline valves are included. Check what natural gas "losses" reported by the energy statistics includes.

3.2.2.4 1.A.2.a Iron and Steel

Key Source: CO_2 from 1.A.2 gaseous, solid and liquid-stationary fuels

Category *1.A.2.a Iron and Steel* enfolds emissions from fuel combustion in iron and steel industry. CO_2 emissions from ore reduction in blast furnaces are included in category *2.C.1*. The share in total GHG emissions from sector 1 A is 9% for the year 1990 and 9.4% for the year 2006.

Methodology

Two iron and steel production sites (the only operating blast furnaces in Austria) are considered as point sources. For 1990 to 2002 CO_2 emissions and fuel consumption from these two plants were reported by the plant operator. The reported fuel consumption of the two plants is subtracted from total fuel consumption for iron and steel production in Austria, the resulting fuel consumption is considered as area source. For the area sources CORINAIR simple methodology was applied for all GHGs.

CO_2, NMVOC, CO, NO_X and SO_2 emissions are reported by the two Austrian iron and steel plants together with their coal, fuel oil and natural gas fuel consumption. For liquid fuels, natural gas and coke oven coke CO_2 emission factors taken from (BMWA-EB 1996) are applied. The remaining CO_2 emissions are allocated to the reported coke oven gas consumption. The methodology to divide the reported fuel consumption into energy related and process related consumption is performed with the information provided in (IEA JQ 2007). The complex carbon fluxes in iron and steel plants can not be well modelled within the energy balance which leads to a fluctuation of implied CO_2 emission factors for *1 A 2 a* solid fuels over time. CO_2 emissions 2005 to 2006 are reported from plant operators. The emissions declaration includes emissions from natural gas consumption not inluded in the ETS.

N_2O emissions of the two iron and steel plants are calculated with the CORINAIR simple methodology.

CH_4 emissions are calculated under the assumption that the ratio of CH_4 emissions to the reported NMVOC emissions is equal to the ratio of CH_4 and NMVOC emissions if calculated with the CORINAIR simple method. For the year 2006 this ratio is 382/315; the plant reported 315 t NMVOC and by applying the ratio obtained from the CORINAIR simple methodology, total CH_4 emissions were estimated to be 94 t. In a last step CH_4 emissions were allocated to the different fuel types.

<u>Point source CO_2 emissions 2003 and 2004</u>

Since for the years 2003 and 2004 no point source CO_2 emissions have been reported by plant operators, the *Umweltbundesamt* performed calculations on the basis of 2000 to 2002 data by means of a simple approach: Activity data reported by plant operators are multiplied by national default emission factors. The resulting emissions are those from blast furnaces and autoproducer power plants. CO_2 emissions from coke ovens (2004: 285 Gg) are estimated by means of coke oven output and an emission factor of 0.2 t CO_2/t coke which is equal to 5% transformation losses.

Emissions

The following table lists the results of the two approaches. Please note that process related CO_2 emissions from blast furnaces are reported under category 2.C.1.

Table 34: Greenhouse gas emissions from Category 1.A.2.a by sub sources.

	area sources			point sources		
	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1990	191	0.005	0.001	4 753	0.020	0.042
1991	250	0.007	0.001	4 365	0.016	0.042
1992	202	0.005	0.001	3 730	0.014	0.036
1993	222	0.006	0.002	3 969	0.016	0.037
1994	234	0.006	0.002	4 207	0.020	0.040
1995	291	0.007	0.002	4 483	0.018	0.045
1996	445	0.012	0.003	4 221	0.019	0.041
1997	465	0.012	0.002	4 822	0.022	0.046
1998	424	0.011	0.002	4 291	0.022	0.047
1999	316	0.008	0.001	4 521	0.022	0.048
2000	413	0.011	0.002	4 804	0.027	0.054
2001	302	0.008	0.001	4 889	0.027	0.052
2002	381	0.010	0.001	5 118	0.027	0.052
2003	361	0.010	0.001	5 263	0.068	0.053
2004	161	0.004	0.001	5 557	0.081	0.054
2005	444	0.011	0.002	6 003	0.089	0.057
2006	495	0.013	0.002	5 954	0.094	0.063

Emission factors

CO_2 and CH_4 emission factors are taken from studies (BMWA-EB 1990, 1996) and (GEMIS 2002).

N_2O emission factors are taken from the national study (BMUJF 1994).

The selected and calculated emission factors for 2006 are presented in Table 35 and Table 36.

Table 35: Emission factors of Category 1.A.2.a for 2006, area sources.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Light Fuel Oil	78.00	0.20	0.60
Heavy Fuel Oil	78.00	2.00	1.00
Gas oil	75.00	1.20	1.00
Petroleum	78.00	0.20	0.60
LPG	64.00	1.50	1.00
Hard Coal	94.00	5.00	1.40
Lignite and brown coal	97.00	7.00	1.40
Coke	104.00	2.00	1.40
Natural Gas	55.40	1.50	0.10
Wood Waste	110.00[1)]	2.00	4.00

[1)] *Reported as CO_2 emissions from biomass.*

Table 36: Emission factors of Category 1.A.2.a for 2006, point sources.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Heavy Fuel Oil	78.00	1.65	1.00
Coke	104.00	1.65	1.40
Coke Oven Gas	94.60	–	–
Natural Gas	55.40	1.24	0.10

Activity data

Total fuel consumption is taken from (IEA JQ 2007) as presented in Annex 4.

Point source activity data are reported by plant operators which are widely consistent with (IEA JQ 2007).

Recalculations

Update of activity data according to the revised energy balance as described in Annex 2 implies updated GHG emissions for the years 1998 (-190 Gg CO_2 from coal) to 2005 (+54 Gg CO_2 from natural gas). and minor changes for 1990 (+2 Gg CO_2 from coal).

Updated natural gas activity data from 2004 to 2005 has been submitted by the integrated steel plants operator. The plant operator affirms that updated activity data is more consistent with reported CO_2 emissions. This leads up to -105 Gg less CO_2 emissions for the respective years due to the avoidance of fuel consumption 'double counting'.

CO_2 emission factor error correction for the year 1998.

3.2.2.5 1.A.2.b Non-Ferrous Metals

Key Source: CO_2 from 1.A.2 gaseous, solid and liquid-stationary fuels

Category *1.A.2.b Non-Ferrous Metals* enfolds emissions from fuel combustion in non ferrous metal industry. The share in total GHG emissions from sector *1.A* is 0.2% for the year 1990 and 0.3% for the year 2006.

Methodology

CORINAIR simple methodology is applied. Fuel consumption is taken from (IEA JQ 2007) as described in Annex 4.

CO_2 and CH_4 emission factors are taken from studies (BMWA-EB 1990, 1996) and (GEMIS 2002).

N_2O emission factors are taken from a national study (BMUJF 1994).

The emission factors for 2006 are presented in Table 37.

Table 37: Emission factors of Category 1.A.2.b for 2006.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Light Fuel Oil	78.00	0.20	0.60
Medium Fuel Oil	78.00	2.00	1.00
Heavy Fuel Oil	78.00	2.00	1.00
Gas oil	75.00	1.20	1.00
Petroleum	78.00	0.20	0.60
LPG	64.00	1.50	1.00
Hard Coal	94.00	5.00	1.40
Coke	104.00	2.00	1.40
Natural Gas	55.40	1.50	0.10

Activity data

Fuel consumption is taken from [IEA JQ 2007] as presented in Annex 4.

Recalculations

Changes of activity data are based on a recalculation of the energy balance as described in Annex 2.

Recalculations mainly affect CO_2 emissions from natural gas consumption in 1995 (+85 Gg CO_2) and 2005 (-135 Gg CO_2).

Emissions from sinter magnesit plants have been shifted from category *1.A.2.b Non Ferrous Metals* to category *1.A.2.f. Other Industry*. This affects the years 2002 to 2005 only.

3.2.2.6 1.A.2.c Chemicals

Key Source: CO_2 from 1.A.2 gaseous, solid and liquid-stationary fuels

Category *1.A.2.c Chemicals* enfolds emissions from fuel combustion in chemical industry. The share in total GHG emissions from sector *1 A* is 1.6% for the year 1990 and 2.1% for the year 2006. Larger fluctuations in emission trends occur because economic main activity of combined pulp and viscose manufacturing plants is changing over time and therefore allocated either to sector *1 A 2 c* or *1 A 2 d* by energy statistics.

Methodology

CORINAIR simple methodology is applied. For the years 2005 to 2006 CO_2 ETS data are considered.

Emission factors

CO_2 and CH_4 emission factors are taken from studies (BMWA-EB 1990, 1996) and (GEMIS 2002).

N_2O emission factors are taken from a national study (BMUJF 1994).

Emission factors for 2006 are presented in Table 38.

Table 38: Emission factors of Category 1 A 2 c for 2006.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Light Fuel Oil	78.00	0.20	0.60
Medium Fuel Oil	78.00	2.00	1.00
Heavy Fuel Oil	78.00	2.00	1.00
Gas oil	75.00	1.20	1.00
LPG	64.00	1.50	1.00
Hard Coal	94.00	5.00	1.40
Lignite and brown coal	97.00	7.00	1.40
Brown Coal Briquettes	97.00	7.00	1.40
Coke	104.00	2.00	1.40
Natural Gas	55.40	1.50	0.10
Fuel Wood	100.00[1)]	2.00	4.00
Wood Waste	110.00[1)]	2.00	4.00
Black Liquor	110.00[1)]	2.00	1.40
Biogas	112.00[1)]	1.50	1.00
Industrial Waste	104.17[2)]	12.00	1.40

1) *Reported as CO_2 emissions from biomass*

2) *According to IPCC guidelines non fossil CO_2 emissions of "other fuels" are not reported.*

Activity data

Fuel consumption is taken from (IEA JQ 2007) as presented in Annex 4.

Recalculations

Changes of activity data are based on a recalculation of the energy balance as described in Annex 2.

Recalculations mainly affect CO_2 emissions from industrial waste 1990 (-62 Gg CO_2) to 2002 (-135 Gg CO_2) and from natural gas in 2005 (+219 Gg CO_2).

3.2.2.7 1.A.2.d Pulp, Paper and Print

Key Source: CO_2 from 1.A.2 gaseous, solid and liquid-stationary fuels

Category *1.A.2.d Pulp, Paper and Print* enfolds emissions from fuel combustion in pulp, paper and print industry. The share in total GHG emissions from sector *1.A* is 4% for the year 1990 and 3.2% for the year 2006.

Methodology

The CORINAIR simple methodology is applied. For the years 2005 to 2006 CO_2 ETS data are considered.

Emission factors

CO_2 and CH_4 emission factors are taken from studies (BMWA-EB 1990, 1996) and (GEMIS 2002). N_2O emission factors are taken from a national study (BMUJF 1994).

Emission factors for 2006 are presented in Table 39.

Table 39: Emission factors of Category 1.A.2.d for 2006.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Hard Coal	94.00	5.00	1.40
Lignite and brown coal	97.00	7.00	1.40
Brown Coal Briquettes	97.00	7.00	1.40
Coke	104.00	2.00	1.40
Light Fuel Oil	78.00	0.20	0.60
Heavy Fuel Oil	78.00	2.00	1.00
Gas oil	75.00	1.20	1.00
Petroleum	78.00	0.20	0.60
Diesel	75.00	0.20	0.60
LPG	64.00	1.50	1.00
Natural Gas	55.40	1.50	0.10
Fuel Wood	100.00[1)]	2.00	4.00
Wood Waste[2)]	110.00[1)]	2.00	4.00
Black Liquor	110.00[1)]	2.00	1.40
Biogas	112.00[1)]	1.50	1.00
Landfill Gas	112.00[1)]	1.50	1.00
Industrial Waste	104.17[3)]	12.00	1.40

[1)] *Reported as CO_2 emissions from biomass*

[2)] *Including sewage sludge from paper mills*

[3)] *According to IPCC guidelines non fossil CO_2 emissions of "other fuels" are not reported.*

Activity data

Fuel consumption is taken from (IEA JQ 2007) as presented in Annex 4.

Recalculations

Changes of activity data are based on a recalculation of the energy balance as described in Annex 2.

Recalculations mainly affect CO_2 emissions from natural gas 1990 (-11 Gg CO_2) to 2004 (+244 Gg CO_2) and from industrial waste 1990 (-48 Gg CO_2) to 2000 (+244 Gg CO_2).

3.2.2.8 1.A.2.e Food Processing, Beverages and Tobacco

Key Source: CO_2 from 1.A.2 gaseous, solid and liquid-stationary fuels

Category *1.A.2.e Food Processing, Beverages and Tobacco* enfolds emissions from fuel combustion in food processing, beverages and tobacco industry. The share in total GHG emissions from sector *1.A* is 1.6% for the year 1990 and 1.2% for the year 2006.

Methodology

CORINAIR simple methodology is applied. For the years 2005 to 2006 CO_2 ETS data are considered.

Emission factors

CO_2 and CH_4 emission factors are taken from studies (BMWA-EB 1990, 1996) and (GEMIS 2002).

N_2O emission factors are taken from a national study (BMUJF 1994).

Emission factors for 2006 are presented in Table 40.

Table 40: Emission factors of Category 1.A.2.e for 2006.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Light Fuel Oil	78.00	0.20	0.60
Medium Fuel Oil	78.00	2.00	1.00
Heavy Fuel Oil	78.00	2.00	1.00
Gas oil	75.00	1.20	1.00
Petroleum	78.00	0.20	0.60
Diesel	75.00	0.20	0.60
LPG	64.00	1.50	1.00
Hard Coal	94.00	5.00	1.40
Lignite and brown coal	97.00	7.00	1.40
Brown Coal Briquettes	97.00	7.00	1.40
Coke	104.00	2.00	1.40
Natural Gas	55.40	1.50	0.10
Fuel Wood	100.00[1)]	2.00	4.00

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Wood Waste	110.00[1)]	2.00	4.00
Biogas	112.00[1)]	1.50	1.00
Industrial Waste	104.17[2)]	12.00	1.40

[1)] *Reported as CO_2 emissions from biomass*

[2)] *According to IPCC guidelines non fossil CO_2 emissions of "other fuels" are not reported.*

Activity data

Fuel consumption is taken from (IEA JQ 2007) as presented in Annex 4.

Recalculations

Changes of activity data are based on a recalculation of the energy balance as described in Annex 2.

Recalculations mainly affect CO_2 emissions from natural gas 1995 (-20 Gg CO_2) and 1999 (+66 Gg CO_2) to 2005 (+54 Gg CO_2).

3.2.2.9 1.A.2.f Manufacturing Industries and Construction – Other

Key Source: CO_2 from 1.A.2 gaseous, solid and liquid-stationary fuels

Category *1.A.2.f Other* enfolds emissions from fuel combustion in industry which are not reported under categories *1.A.2.a, 1.A.2.b, 1.A.2.c, 1.A.2.d* and *1.A.2.e*. It also includes emissions from mobile sources (off road machinery) of total industry. For the stationary sources cement industry is considered separately.

The share in total GHG emissions from sector *1.A* is 8.2% for the year 1990 and 7% for the year 2006. N_2O emissions mainly arise from mobile machinery (1990: 90%; 2006: 75%).

<u>1.A.2.f Manufacturing Industries and Construction – Other – stationary sources</u>

In the following the methodology of estimating emissions from stationary sources of category *1.A.2.f Other* is described. The share in total GHG emissions from sector *1.A* is 6.2% for the year 1990 and 5.2% for the year 2006.

1.A.2.f Manufacturing Industries and Construction – Cement Clinker Production (NACE 26.51)

This category enfolds emissions from fuel combustion in cement clinker kilns. The yearly production capacity of the 9 Austrian plants is about 4.3 mio t cement clinker. Yearly clinker production is about 80% of total capacity. Further information about yearly clinker production is provided in the methodology chapter of category *2.A.1 cement production*.

Methodology

Information about CO_2 emissions due to fuel combustion for cement production is taken from four studies of the Austrian cement industry (HACKL & MAUSCHITZ, 1995, 1997, 2001, 2003, 2007) and (MAUSCHITZ 2004). The data presented in these studies include fuel consumption and emission data for emissions from combustion processes and from calcination processes (process specific emissions, see category *2 A 1*) separately. The studies cover the years 1988 to 2005.

For the studies mentioned above CO_2 emissions from all cement production plants in Austria were investigated. The determination of the emission data took place by inspection of every single plant, recording and evaluation of plant specific records and also plant specific measurements and analysis carried out by independent scientific institutes. Using this data (single measurement data or half-hourly mean values from continuous measurements) yearly mean values for concentration of CO_2 in the waste gas flow were calculated. With the average flow of dry waste gas the plant specific CO_2 emission mass stream and consequently the plant specific emission factors (normalized to ton clinker and/ or ton cement) were calculated.

CO_2 emissions 1990 to 2003

Emissions for the years 1990 to 2003 are taken from industry (HACKL & MAUSCHITZ, 1995, 1997, 2001, 2003, 2007) and (MAUSCHITZ 2004).

For solid, liquid and gaseous fuels CO_2 emissions are calculated by multiplying activity data by national default emission factors (for sources of emission factors see relating chapter). The remaining CO_2 emissions are allocated to industrial waste.

CO_2 emissions 2004 to 2006 are taken from the ETS allocation plan survey and ETS data.

CH_4 and N_2O emissions

Are calculated with the simple CORINAIR methodology.

Activity data

Calculated thermal energy intake of cement kilns is between 3.46 GJ/t clinker in 1990 and 3.68 GJ/t clinker in 2006.

Hard Coal, Brown Coal, Petrol Coke and Industrial Waste

In (IEA JQ 2007) the category *Non-metallic Mineral Products* enfolds fuel consumption of NACE Division 26. As within this NACE division industrial branches other than cement industry do not use coal and industrial waste for fuel combustion, 100% of those fuels are allocated to the cement industry. The same is for for petrol coke until 2001 but from 2002 on a share is allocated to magnesia production from dolomite by using ETS data. It has to be noted that for industrial waste (IEA JQ 2007) calorific values between 22,06 GJ/t in 1990 and 20,74 GJ/t in 2006 are used which is different to (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003, 2007) and (MAUSCHITZ 2004). By keeping activity data consistent with (IEA JQ 2007) this leads to slightly different implied emission factors than calculated from the above mentioned studies for *other fuels* – CO_2 between 1990 and 2004.

Natural Gas and Fuel Oil

For the period 1990 to 2004 natural gas and fuel oil consumption is taken from (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003, 2007) and (MAUSCHITZ 2004) and converted into the unit TJ by applying the calorific values reported in (IEA JQ 2007).

Activity data 2005–2006

For the years 2005–2006 ETS data are taken.

Emission factors

CO_2 and CH_4 emission factors are taken from studies (BMWA-EB 1990, 1996).

N_2O emission factors are taken from a national study (BMUJF 1994).

Recalculations

Minor corrections of activity data 2003 following (HACKL & MAUSCHITZ, 2007).

1 A 2 f Manufacturing Industries and Construction – Other (NACE 17, 18, 19, 20, 25, 26.1, 26.2, 26.3 , 26.4, 26.6, 26.7, 26.8, 33, 34, 35, 36, 37, 45)

This category enfolds emissions due to fuel combustion of the industrial branches as specified in NACE 17, 18, 19, 20, 25, 26.1, 26.2, 26.3 , 26.4, 26.6, 26.7, 26.8, 33, 34, 35, 36, 37, 45.

Methodology

The CORINAIR simple methodology is applied. For 2005 to 2006 ETS data is considered for glass, bricks & tiles and lime manufacturing plants.

Activity data

Fuel consumption is taken from (IEA JQ 2007) as presented in Annex 4. Fuel consumption of cement industry is subtracted as it is considered separately (see above).

Since the energy balance (IEA JQ 2007) does not report gas works gas the activity data is taken from the "Austrian Energy Balance" provided by STATISTIK AUSTRIA which is in a different structure but consistent with (IEA JQ 2007).

Emission factors

CO_2 and CH_4 emission factors are taken from studies (BMWA-EB 1990, 1996) and (GEMIS 2002).

N_2O emission factors are taken from a national study (BMUJF 1994).

The emission factors for 2006 are presented in Table 41.

Table 41: Emission factors of Category 1.A.2.f stationary sources for 2006.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Hard Coal	94.00	5.00	1.40
Lignite and brown coal	97.00	7.00	1.40
Brown Coal Briquettes	97.00	7.00	1.40
Coke	104.00	2.00	1.40
Light Fuel Oil	78.00	0.20	0.60
Medium Fuel Oil	78.00	2.00	1.00
Heavy Fuel Oil	78.00	2.00	1.00
Gas oil	75.00	1.20	1.00
Diesel	75.00	0.20	0.60
Petroleum	78.00	0.20	0.60
LPG	64.00	1.50	1.00
Gas Works Gas	64.00	0.20	1.00
Petrol Coke	100.88	0.00	0.00
Natural Gas	55.40	1.50	0.10
Fuel Wood	100.00[1)]	2.00	4.00
Wood Waste	110.00[1)]	2.00	4.00
Black Liquor	110.00[1)]	2.00	1.40
Biogas	112.00[1)]	1.50	1.00
Sewage Sludge Gas	112.00[1)]	1.50	1.00
Landfill Gas	112.00[1)]	1.50	1.00
Industrial Waste –unspecified	104.17[2)]	12.00	1.40
Industrial Waste – Cement industry	63.02[3)]	12.00	1.40

[1)] *Reported as CO_2 emissions from biomass*

[2)] *According to IPCC guidelines non fossil CO_2 emissions of "other fuels" are not reported.*

[3)] *Implied emission factor as cited in chapter methodology, see Page 103*

Recalculations

Changes of activity data are based on energy balance recalculation as described in Annex 2.

Recalculations mainly affect CO_2 emissions from natural gas 1995 (-77 Gg CO_2), 1996 (-169 Gg CO_2) and 1999 (+66 Gg CO_2) and 1999 to 2005 (+151 Gg CO_2). Minor changes of industrial waste activity data for single years between 1996 and 2004 were made.

1.A.2.f Manufacturing Industries and Construction – Other – mobile sources

In the following the methodology of estimating emissions from mobile sources of category *1 A 2 f Other* is described. The share in total GHG emissions from sector *1 A* is 2.0% for the year 1990 and 1.7% for the year 2006. All GHGs emissions originate from liquid fossil fuel combustion.

Table 42: Greenhouse gas emissions from Category 1 A 2 f mobile sources.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	Gg CO_2 equivalent
1990	1 015.97	0.07	0.35	1 127.41
1991	1 056.86	0.08	0.37	1 172.76
1992	1 068.11	0.08	0.37	1 185.22
1993	1 034.06	0.08	0.36	1 147.42
1994	1 061.29	0.08	0.38	1 181.26
1995	1 036.25	0.07	0.37	1 153.45
1996	1 007.97	0.07	0.37	1 123.00
1997	1 024.94	0.07	0.38	1 144.65
1998	1 040.14	0.07	0.39	1 163.42
1999	1 046.85	0.06	0.37	1 163.10
2000	1 060.60	0.06	0.36	1 173.94
2001	1 075.62	0.06	0.35	1 186.62
2002	1 080.98	0.06	0.35	1 189.46
2003	1 086.04	0.05	0.31	1 184.00
2004	1 143.51	0.05	0.29	1 233.83
2005	1 145.70	0.05	0.28	1 232.22
2006	1 119.02	0.05	0.26	1 200.81
Trend 1990–2006	*10%*	*-37%*	*-26%*	*7%*

Combustion of liquid fossil fuels is the only mobile source of CO_2 emissions from category *1 A 2 f*.

Methodology

The energy consumption and the emissions of the off-road in Austria are calculated with the model GEORG (Grazer Emissionsmodell für Off Road Geräte). This model has been developed within a study about off road emissions in Austria (PISCHINGER 2000). The study was prepared to improve the poor data quality in this sector. The following categories were taken into account:

- 1 A 2 f Industry
- 1 A 3 c Railways
- 1 A 3 d Navigation
- 1 A 4 b Household and Gardening
- 1 A 4 c Agriculture and Forestry
- 1 A 5 Military Activities

Depending on the fuel consumption of the engine the ratio power of the engine was calculated, emissions were calculated by multiplying ratio power by emission factors. To improve data quality the influence of the vehicle age on the operating time was taken into account.

With this method all relevant effects on engine emissions could be covered:

- Emissions according to the engine type
- Emissions according to the effective engine performance
- Emissions according to the engine age
- Emissions depending on the engine operating time
- Engine operating time according to the engine age

The used methodology conforms to the requirements of the IPCC tier 3 methodology.

Emission factors

Emission factors were defined for four categories of engine type depending on the year of construction. Emission factors are listed in Table 43 to Table 46. The emission factors present fuel consumption and emissions according to the engine power output. Total emissions are calculated by multiplying emission factors by average motor capacity and activity data. With this method national total fuel consumption and total emissions are calculated with a bottom-up method. Calculated total fuel consumption of off-road traffic is summed up with total fuel consumption of road transport and is compared with national total sold fuel: due to uncertainties of the bottom-up method the values differ by about 5%. To be consistent with the national energy balance, activity data in the bottom-up approaches for both road transport and off-road transport is adjusted so that finally the calculated total fuel consumption equals the figure of fuel sold in the national energy balance.

Table 43: Emission Factors for diesel engines > 80 kW.

Year	CO_2	CH_4	N_2O
	[t/TJ]	[kg/TJ]	
1993	247.2	13.89	88.89
1997	239.2	11.11	97.22
2000	231.7	8.33	61.11

Table 44: Emission Factors for diesel engines < 80 kW.

Year	CO_2	CH_4	N_2O
	[t/TJ]	[kg/TJ]	
1993	259.7	27.78	88.89
1997	251.1	19.44	97.22
2000	243.3	16.67	61.11

Table 45: Emission Factors for 4-stroke-petrol engines.

Year	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
1993	481.7	600.00	11.11
1997	455.6	533.33	11.11
2000	438.1	494.44	11.11

Table 46: Emission Factors for 2-stroke-petrol engines.

Year	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
1993	613.1	833.33	2.78
1997	591.1	750.00	2.78
2000	573.6	666.67	2.78

Activity data

Activity data, vehicle stock and specific fuel consumption for vehicles and machinery (e.g. leader, digger, …) were taken from:

- Statistik Austria
- Questionnaire to vehicle and machinery user
- Information from vehicle and machinery manufacturer
- Interviews with experts
- Expert judgment

Activities used for estimating emissions of *1 A 2 f* as well as the implied emission factors (national total emissions divided by total fuel consumption in TJ) are presented in the following table.

Table 47: Implied emission factors and activities for industrial off-road traffic 1990–2006.

	Activity	Implied Emission Factors		
	TJ	CO_2 T/TJ	CH_4 kg/TJ	N_2O kg/TJ
1990	13 724	74.03	5.44	25.82
1991	14 277	74.03	5.46	25.82
1992	14 429	74.03	5.48	25.81
1993	13 971	74.02	5.50	25.80
1994	14 339	74.02	5.30	26.63
1995	14 033	73.84	5.27	26.58
1996	13 650	73.84	5.21	26.83
1997	13 880	73.84	5.05	27.48
1998	14 086	73.84	4.94	27.90
1999	14 210	73.67	4.44	26.09
2000	14 396	73.67	4.18	25.11
2001	14 600	73.67	3.95	24.26
2002	14 673	73.67	3.77	23.59

	Activity	Implied Emission Factors		
	TJ	CO_2 T/TJ	CH_4 kg/TJ	N_2O kg/TJ
2003	14 742	73.67	3.53	21.20
2004	15 522	73.67	3.23	18.55
2005	15 793	72.55	3.08	17.46
2006	16 041	69.76	2.93	16.25

3.2.2.10 1.A.3.a Civil Aviation

Key Source: CO_2

Greenhouse gas emissions from aviation are low in comparison to emissions from the transport sector but show a strong increase from 1990 to 2006. However, the trend for the different GHGs varies due to different methodologies of emission estimation.

The category *1 A 3 a Civil Aviation* contains flights according to Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) for national LTO (landing/take off) and national cruise. International LTO and international cruise is considered in *I B Av International Bunkers Aviation*. Military Aviation is allocated in *1 A 5 Other.* For VFR only CO_2 emissions were considered.

Table 48: CO_2 and N_2O emissions from 1 A 3 a Civil Aviation by subcategories 1990–2006.

Year	CO_2			N_2O		Activity		
	dom. LTO	dom. LTO	dom. cruise	dom. LTO	dom. cruise	dom. LTO	dom. LTO	dom. cruise
	Kerosene [Gg]	Gasoline [Gg]	Kerosene [Gg]	Kerosene [Gg]	Kerosene [Gg]	Kerosene [TJ]	Gasoline [TJ]	Kerosene [TJ]
1990	10.0	7.8	14.2	0.0006	0.0005	138	103	197
1991	10.8	8.1	18.7	0.0007	0.0006	149	107	259
1992	11.6	8.3	23.2	0.0007	0.0007	160	110	321
1993	12.4	8.6	27.6	0.0008	0.0009	171	116	382
1994	13.2	8.8	32.1	0.0008	0.0010	182	119	444
1995	14.0	7.1	36.6	0.0009	0.0012	192	95	503
1996	16.2	6.8	40.6	0.0010	0.0013	222	92	559
1997	18.4	7.6	44.5	0.0011	0.0014	253	103	614
1998	20.6	8.2	48.5	0.0012	0.0015	283	111	668
1999	21.1	8.7	51.3	0.0012	0.0016	290	118	705
2000	21.6	6.4	54.1	0.0014	0.0017	297	87	743
2001	20.7	5.9	51.7	0.0013	0.0016	284	79	711
2002	20.1	7.5	50.3	0.0013	0.0016	277	102	691
2003	44.0	8.2	110.0	0.0031	0.0035	605	110	1 513
2004	52.8	7.6	131.9	0.0035	0.0042	725	102	1 812
2005	59.6	8.8	149.0	0.0036	0.0047	820	118	2 048
2006	62.4	9.0	155.8	0.0036	0.0049	857	124	2 142

Methodological Issues

IFR

A country-specific methodology was applied.

The calculations are based on a study commissioned by the Umweltbundesamt finished in 2002 (KALIVODA et al. 2002).

For the air transport class IFR (Instrument Flight Rules) the very detailed methodology from the CORINAIR guidebook in an advanced version (based on the (MEET 1999) model) has been used. It is based on air traffic movement data[21] (flight distance and destination per aircraft type), aircraft/ engine performance data and emission factors.

VFR

CORINAIR, simple methodology was applied

Activity Data

Fuel consumptions for the different transport modes IFR national LTO, IFR international LTO, IFR national cruise and IFR international cruise as obtained from the MEET model were summed up to a total fuel consumption figure. This value was compared by the Umweltbundesamt with the total amount of kerosene sold in Austria of the national energy balance: a difference was observed (lower fuel consumption in the energy balance).

Therefore the fuel consumption of IFR international cruise was adjusted so that the total fuel consumption of the calculations according to the MEET model is consistent with national fuel sales figures from the energy balance. The reason for choosing IFR international cruise for this adjustment is that this mode is assumed to have the highest uncertainty.

Fuel consumption for VFR flights were directly obtained from the energy balance, as total fuel consumption for this flight mode is represented by the total amount of aviation gasoline sold in Austria.

The number of LTO cycles performed was obtained by disaggregating total LTOs obtained from STATISTIK AUSTRIA according to the ratio of fuel used for IFR domestic LTO and IFR international LTO respectively as obtained from the study

The study only delivers values until 2000. The splitting of the energy data of 2001 to 2006 into national and international aviation has been done according to the energy balance (Statistic AUSTRIA), the share into LTO and cruise as well as the share into VFR and IFR of the years 2001 to 2006 was done according to the shares for 2000 of the study.

Table 49 shows the remarkable increase by up to 100% of national jet kerosene between 2002 and 2003. This increase is due to reported fuel sold data from the Austrian statistics.

[21] This data is also used for the split national/ international aviation.

Table 49: Number of national LTO cycles and fuel consumptions as obtained from the MEET model 1990–2006.

	Activity			national
	nat. LTO Kerosene [Mg]	**VFR Gasoline [Mg]**	**nat. cruise Kerosene [Mg]**	**LTO [no.]**
1990	3 164	2 487	4 508	6 220
1991	3 417	2 563	5 929	6 644
1992	3 670	2 641	7 351	7 450
1993	3 924	2 722	8 773	7 947
1994	4 177	2 805	10 195	8 219
1995	4 430	2 241	11 616	8 923
1996	5 128	2 153	12 877	10 233
1997	5 827	2 417	14 137	11 013
1998	6 525	2 602	15 398	12 025
1999	6 697	2 771	16 279	12 210
2000	6 868	2 039	17 161	13 551
2001	6 568	1 868	16 412	12 853
2002	6 386	2 389	15 956	13 325
2003	13 982	2 596	34 936	30 786
2004	16 753	2 405	41 861	34 712
2005	18 929	2 787	47 297	35 619
2006	19 796	2 868	49 464	35 680
Trend 1990–2006	*526%*	*15%*	*997%*	*474%*

CO_2

IFR/VFR

CO_2 emissions covered in this sub-category were calculated separately for VFR-flights and IFR-flights, for national LTO and national cruise.

For calculation of CO_2 emissions an emission factor of 3 150 kg CO_2/ Mg fuel has been used for all subcategories (IFR and VFR), that was taken from the study (KALIVODA et al. 2002).

N_2O

CORINAIR simple methodology was used.

IFR

The applied emission factors for national/international cruise and national/international LTO were taken from the CORINAIR Guidebook, they are based on LTO cycles and fuel used for cruise (0.1 kg N_2O/LTO for LTO and 0.1 kg N_2O/Mg fuel for cruise).

VFR

For N_2O emissions VFR flights are not considered as the applied emission factors only refers to an "average international fleet with large aircraft" which is not true for this sub-category.

CH_4

National/international cruise

Following the simple methodology of the CORINAIR Guidebook, CH_4 emissions for national and international cruise are assumed to be Zero. Furthermore, for calculating CH_4 emissions VFR aviation was not considered.

National/international LTO

For calculation of CH_4 emissions an emission factor of 0.53 g/GJ kerosene (IFR national/international LTO) taken from the study (KALIVODA et al. 2002) has been applied.

Recalculations

No recalculation have been required for this version of the inventory.

Planned improvements

The national amount of Jet Kerosene which is reported by the Austrian Statistics has to be examined more closely with a new aviation study (in consideration of all aircraft/engine combinations based on real flight movements).

3.2.2.11 1.A.3.b Road Transport

Key Source: Yes (CO_2: diesel/gasoline)

Emissions from road transportation are covered in this category.

Table 50: Greenhouse gas emissions from Category 1 A3 b Road Transport.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	Gg CO_2 equivalent
1990	11 943	3.04	0.54	12 175
1991	13 528	3.34	0.67	13 807
1992	13 473	3.34	0.70	13 759
1993	13 653	3.34	0.72	13 948
1994	13 603	3.17	0.75	13 903
1995	13 974	2.96	0.77	14 274
1996	15 550	2.68	0.79	15 852
1997	14 473	2.40	0.78	14 764
1998	16 540	2.32	0.88	16 862
1999	15 847	2.03	0.85	16 154
2000	16 876	1.85	0.87	17 185
2001	18 119	1.72	0.90	18 435

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	Gg CO_2 equivalent
2002	20 156	1.65	0.98	20 496
2003	21 919	1.53	1.02	22 268
2004	22 429	1.37	1.00	22 767
2005	23 051	1.23	0.96	23 375
2006	21 932	1.06	0.89	22 232
Trend 1990–2006	*84%*	*-65%*	*65%*	*83%*

Table 51: GHG emissions from Road Transport, differentiated by means of transportation.

	Passenger cars		light duty vehicles	heavy duty vehicles	moped	motorcycle
	petrol	diesel				
	[Gg CO_2e]	[Gg CO_2e]	[Gg CO_2e]	[Gg CO_2e]	[Gg CO_2e]	[Gg CO_2e]
1990	7 435.7	1 456.00	1 309.28	1 909.10	30.79	34.30
1991	8 269.9	1 676.90	1 352.63	2 442.03	28.71	36.55
1992	7 924.5	1 793.36	1 394.88	2 578.22	27.25	40.70
1993	7 621.4	1 939.19	1 417.22	2 899.03	25.81	45.02
1994	7 360.3	2 198.24	1 472.07	2 797.45	24.71	50.30
1995	7 126.9	2 427.91	1 493.09	3 145.50	23.74	57.12
1996	6 583.8	2 699.50	1 510.60	4 971.98	22.94	63.41
1997	6 237.7	2 971.38	1 545.51	3 917.36	22.20	69.62
1998	6 579.4	3 438.91	1 589.39	5 154.47	21.69	77.81
1999	6 103.8	3 655.75	1 640.35	4 647.11	21.06	86.20
2000	5 905.6	4 015.94	1 688.43	5 463.45	20.28	91.04
2001	5 973.2	4 515.55	1 700.71	6 129.98	19.61	95.57
2002	6 481.3	5 343.94	1 697.01	6 854.50	18.90	100.35
2003	6 650.3	6 039.82	1 715.57	7 740.13	18.41	104.11
2004	6 469.1	6 525.89	1 740.96	7 906.14	17.83	106.99
2005	6 254.7	6 792.12	1 786.22	8 414.87	17.67	109.94
2006	6 020.7	6 823.76	1 711.73	7 547.87	16.82	111.16
Trend 1990–2006	*-19%*	*369%*	*31%*	*295%*	*-45%*	*224%*

In 2006 even more than a third of the greenhouse gas emissions of the road sector are caused by heavy duty vehicles. In comparison with the emissions of 1990 the emissions of diesel cars and heavy duty vehicles nearly quadrupled.

Methodology

Mobile combustion is differentiated into the categories *Passenger Cars*, *Light Duty Vehicles*, *Heavy Duty Vehicles* and *Buses, Mopeds and Motorcycles*.

In order to apply the CORINAIR methodology a split of the fuel consumption of different vehicle categories is needed. Calculations of emissions from *Mobile Combustion* are based on the GLOBEMI study (HAUSBERGER 1998).

The program calculates vehicle mileages, passenger-km, ton-km, fuel consumption, exhaust gas emissions, evaporative emissions and suspended PM 10 of the road traffic. The balances use the vehicle stock and functions of the km driven per vehicle and year to assess the total traffic volume of each vehicle category.

Model input is:

1. the vehicle stock of each category split into layers according to the propulsion system (SI,CI,..), cylinder capacity classes or vehicle mass
2. the emission factors of the vehicles according to the year of first registration and the layers from 1)
3. The passengers per vehicle and tons payload per vehicle
4. Optional either
   a) the total gasoline and diesel consumption of the area under consideration
   b) the average km per vehicle and year

Following data is calculated:

a. km driven per vehicle and year or total fuel consumption
b. total vehicle mileages
c. total passenger-km and ton-km
d. specific emission values for the vehicle fleets [g/km], [g/t-km], [g/pass-km]
e. total emissions and energy consumption of the traffic (fc, CO, HC, NO_x, particulate matter, CO_2, SO_2 and several unregulated pollutants among them CH_4 and N_2O)

Figure 13 shows a schematic picture of GLOBEMI.

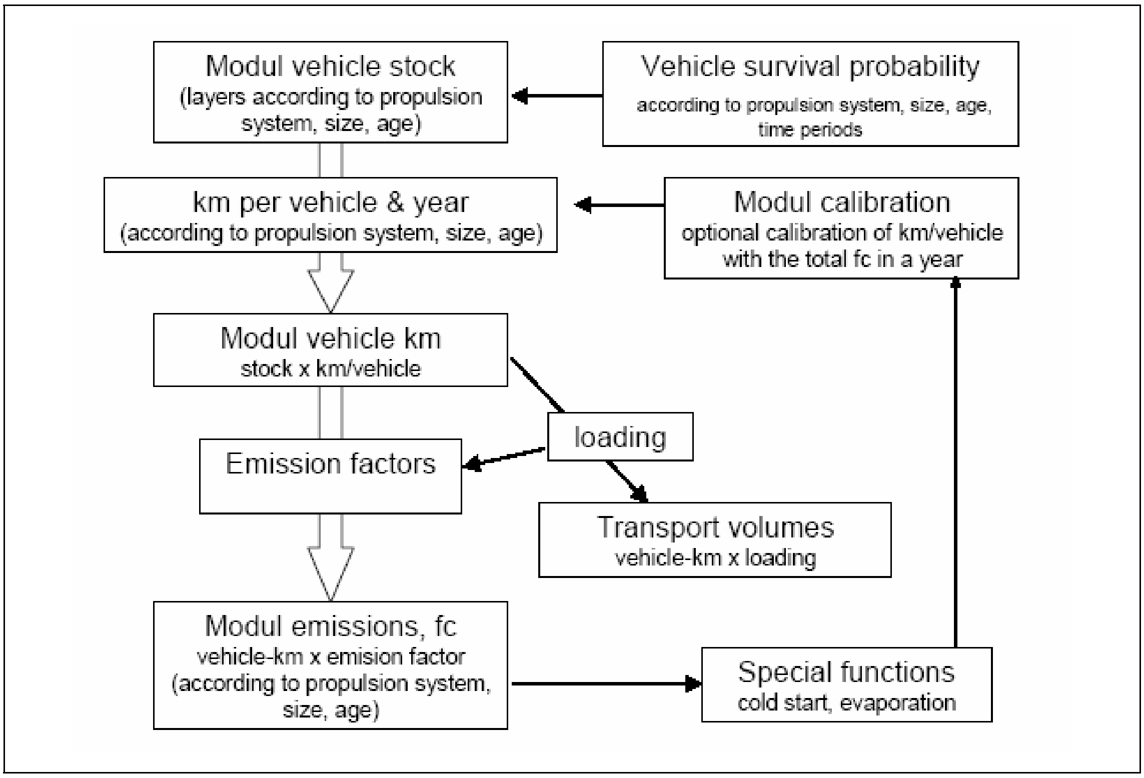

Figure 13: Schematic picture of the model GLOBEMI.

The calculation is done according to the following method for each year:

1. assessment of the vehicle stock split into layers according to the propulsion system (SI, CI, …), cylinder capacity classes (or vehicle mass for HDV) and year of first registration using the vehicle survival probabilities and the vehicle stock of the year before
2. assessment of the km per vehicle for each vehicle layer using age and size dependent functions of the average mileage driven. If option switched on, iterative adaptation of the km per vehicle to meet the total fuel consumption targets.
3. calculation of the total mileage of each emission category (e.g. passenger car diesel, < 1 500 ccm, EURO 3)
4. calculation of the total fuel consumption and emissions of each emission category
5. calculation of the total fuel consumption and emissions of each vehicle category
6. calculation of the total passenger-km and ton-km
7. summation over all vehicle categories
8. calibration with total amount of fuel sold (Austrian Statistics)
9. adaption of vehicle km/year

Emission factors used for GLOBEMI are based on a representative number of vehicles and engines measured in real world driving situations defined and are compatible to the HBEFA 2.1

Emissions are calculated by multiplying fuel consumption in tons and emission factors.

Emission factors

Implied emission factors for the different means of road transportation are listed in the following tables. The IEFs change over time due to new technologies and changes in the fleet composition (e.g. the shift from petrol to diesel vehicles).

Table 52: Implied emission factors of passenger cars 1990–2006.

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	114 995	75.64	19.37	4.10
1991	128 405	75.63	19.92	4.58
1992	125 336	75.60	20.75	4.85
1993	125 348	74.28	21.04	5.01
1994	125 250	74.26	20.08	5.27
1995	125 279	74.22	18.67	5.35
1996	121 775	74.20	16.95	5.43
1997	120 927	74.13	15.30	5.49
1998	131 536	74.12	13.55	5.68
1999	128 336	74.03	11.99	5.68
2000	130 591	74.01	10.53	5.61
2001	138 251	73.98	9.13	5.47
2002	155 993	73.99	7.77	5.32
2003	167 627	73.98	6.65	5.12
2004	171 949	73.95	5.66	4.86
2005	174 337	73.32	4.80	4.55
2006	176 934	71.21	4.01	4.19

The catalytic converter of former generation (EURO 1) had a higher N_2O-niveau than the catalysts of the newer generation (as of EURO 2). Therefore, since 1996 (implementation of EURO 2) the implied emission factor of N_2O is decreasing steadily.

The decrease of the IEF for CH_4 is also due to the increasing share of vehicles with catalytic converters and improved combustion technologies.

Table 53: Implied emission factors of light duty vehicles 1990–2006.

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	17 306	74.80	14.04	1.80
1991	17 897	74.73	13.01	1.84
1992	18 473	74.67	12.04	1.90
1993	18 908	74.12	11.19	1.94
1994	19 651	74.11	9.93	1.93
1995	19 975	73.97	8.75	1.91
1996	20 221	73.96	7.74	1.88
1997	20 705	73.93	6.72	1.84
1998	21 305	73.92	5.80	1.80
1999	22 042	73.77	4.95	1.76
2000	22 700	73.76	4.24	1.71
2001	22 877	73.75	3.66	1.68
2002	22 835	73.74	3.17	1.64
2003	23 093	73.73	2.69	1.61
2004	23 444	73.72	2.25	1.57
2005	24 397	72.69	2.01	1.55
2006	24 288	69.98	1.56	1.49

Table 54: Implied emission factors of heavy duty vehicles 1990–2006.

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	25 581	74.10	2.64	1.52
1991	32 732	74.09	2.37	1.52
1992	34 563	74.08	2.25	1.51
1993	38 896	74.02	2.11	1.50
1994	37 541	74.02	2.07	1.45
1995	42 317	73.85	1.96	1.42
1996	66 901	73.85	1.67	1.40
1997	52 718	73.85	1.64	1.37
1998	69 375	73.85	1.45	1.36
1999	62 697	73.67	1.38	1.34

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
2000	73 717	73.67	1.28	1.34
2001	82 728	73.67	1.20	1.29
2002	92 527	73.67	1.14	1.25
2003	104 502	73.67	1.09	1.20
2004	106 762	73.67	1.08	1.16
2005	115 407	72.54	1.04	1.14
2006	107 668	69.75	1.02	1.08

Table 55: Implied emission factors of Mopeds 1990–2006.

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	271	75.98	1 791	0.37
1991	253	75.97	1 774	0.39
1992	243	75.97	1 717	0.41
1993	237	74.35	1 635	0.42
1994	230	74.34	1 571	0.43
1995	224	74.35	1 510	0.45
1996	219	74.35	1 444	0.46
1997	215	74.27	1 381	0.47
1998	213	74.27	1 308	0.47
1999	210	74.26	1 249	–
2000	204	74.26	1 207	–
2001	199	74.22	1 159	–
2002	193	74.27	1 120	–
2003	190	74.27	1 069	–
2004	186	74.24	1 024	–
2005	187	74.21	957	–
2006	182	72.98	917	–

Table 56: Implied emission factors of Motorcycles 1990–2006.

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	445	75.98	41.2	0.899
1991	474	75.97	40.5	0.843
1992	528	75.97	39.2	0.757
1993	597	74.35	37.3	0.837
1994	668	74.34	36.2	0.749
1995	758	74.35	35.1	0.791
1996	842	74.35	34.2	0.831
1997	925	74.27	33.4	0.865
1998	1 034	74.27	32.7	0.870
1999	1 146	74.26	31.9	0.872
2000	1 211	74.26	31.1	0.826
2001	1 272	74.22	30.5	0.865
2002	1 335	74.27	29.8	0.899
2003	1 385	74.27	29.0	0.866
2004	1 425	74.24	28.3	0.842
2005	1 464	74.21	27.7	0.888
2006	1 506	72.98	26.7	0.863

Activity data

Calculation of the activity data is based on the GLOBEMI study (HAUSBERGER 1998). Information on the number of new vehicles is published yearly by STATISTIK AUSTRIA. Information on the yearly road performance of the vehicles is supplied by the Austrian automobile clubs throughout the annual vehicle inspection system.

The yearly road performance of the vehicle categories for different street categories is calculated as a function of vehicle size and vehicle age. The extrapolation of the yearly vehicle stock- and performance share (by vehicle age, motor type and vehicle size) is based on a dynamic, vehicle specific drop out- and road performance function.

Based on the GLOBEMI model total fuel consumption and total emissions for road transport are calculated with a bottom-up approach. Calculated total fuel consumption of road transport is summed up with total fuel consumption of off road traffic and is compared with national total sold fuel: to be consistent with the national energy balance, activity data in the bottom-up approach is adjusted so that finally the calculated total fuel consumption equals the figure of fuel sold in the national energy balance.

Based on the results of investigations on biodiesel in the transport sector in Austria (UMWELTBUNDESAMT 2006a), for the year 2006 a consumption of 321 000 t biodiesel is used as input data for the calculation model.

Uncertainties

Uncertainty estimates are based on (WINIWARTER & RYPDAL 2001):

- The uncertainty of activity data (total fuel sold) for road transport is considered to be low (3%), and also the uncertainty of CO_2 emission factors is estimated to be 3%.
- N_2O emission factors are determined in vehicle emission tests, mostly carried out on test benches. Therefore emission factors are prone to uncertainties for the following reasons:
  - test driving cycles cannot fully reflect real driving behaviour
  - uncertainties of test equipment and emission measurement equipment
  - emission factor varies over time because of chemical characteristics of the fuels
  - the influence of aging and maintenance of the vehicle stock

  Due to these reasons the uncertainty for the N_2O emission factor is relatively high; it is estimated to be -70 and +170% (lognorm) for gasoline and ±30% (norm) for diesel.

Recalculation

- update of statistical energy data, particularly the biodiesel consumption;
- update of all EF for PC, LDV, MC (ARTEMIS measurements).

3.2.2.12 1.A.3.c Railways

Key Source: No

In this category emissions from diesel railcars and steam engines are considered.

Table 57: Greenhouse gas emissions from Category 1 A 3 c Railways.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg}
1990	174	0.01	0.02
1991	180	0.01	0.02
1992	180	0.01	0.02
1993	175	0.01	0.02
1994	177	0.01	0.02
1995	165	0.01	0.02
1996	149	0.01	0.02
1997	148	0.01	0.02
1998	146	0.01	0.02
1999	180	0.01	0.02
2000	179	0.01	0.02
2001	177	0.01	0.02
2002	173	0.01	0.02
2003	169	0.01	0.02
2004	175	0.01	0.02
2005	149	0.00	0.02
2006	144	0.00	0.02
Trend 1990–2006	*-17%*	*-42%*	*-30%*

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 3.2.2.9 1.A.2.f Manufacturing Industries and Construction – Other). Activities used for estimating the emissions and the implied emission factors are presented in the following table.

Table 58: Emission factors and activity data for railway 1990–2006.

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	2 330	74.64	3.14	9.30
1991	2 417	74.56	3.10	9.35
1992	2 411	74.59	3.03	9.20
1993	2 351	74.55	2.95	9.07
1994	2 372	74.53	2.88	8.94
1995	2 217	74.42	2.82	8.78
1996	2 004	74.48	2.77	8.64
1997	1 998	74.21	2.65	8.53
1998	1 968	74.17	2.58	8.40
1999	2 433	73.94	2.50	8.26

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
2000	2 428	73.90	2.44	8.14
2001	2 391	73.89	2.38	8.01
2002	2 343	73.91	2.32	7.89
2003	2 288	73.90	2.26	7.77
2004	2 365	73.87	2.21	7.66
2005	2 041	72.78	2.10	7.47
2006	2 059	70.00	2.05	7.36

3.2.2.13 1.A.3.d Navigation

Key Source: No

In this category, emissions from diesel and gas fuelled ships are considered.

Table 59: Greenhouse gas emissions from Category 1 A 3 d Navigation.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1990	52	0.01	0.01
1991	47	0.01	0.01
1992	46	0.01	0.01
1993	47	0.01	0.01
1994	56	0.01	0.01
1995	61	0.01	0.01
1996	62	0.01	0.01
1997	62	0.01	0.01
1998	66	0.01	0.01
1999	65	0.01	0.01
2000	70	0.01	0.02
2001	73	0.01	0.02
2002	80	0.01	0.02
2003	66	0.01	0.01
2004	53	0.01	0.01
2005	52	0.01	0.01
2006	52	0.01	0.01
Trend 1990–2006	*1%*	*-12%*	*-15%*

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 3.2.2.9 1.A.2.f Manufacturing Industries and Construction – Other). Activities used for estimating the emissions and the implied emission factors are presented in the following table.

Table 60: Emission factors and activity data for the sector Navigation 1990–2006.

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	701	74.36	18.44	17.76
1991	636	74.39	20.10	17.52
1992	622	74.40	20.45	17.19
1993	630	74.08	20.18	16.89
1994	750	74.07	17.17	17.19
1995	826	73.92	15.64	17.17
1996	843	73.92	15.24	16.97
1997	836	73.91	15.21	16.71
1998	899	73.90	14.12	16.62
1999	883	73.75	14.16	16.29
2000	951	73.74	13.08	16.20
2001	986	73.74	12.50	16.02
2002	1 079	73.74	11.42	15.93
2003	889	73.75	13.39	15.35
2004	714	73.76	16.17	14.65
2005	715	72.81	16.00	14.41
2006	745	70.26	15.24	14.18

An update for energy consumption and the emissions of off-road is planned for the next submission. In the course of this update it is planned to bring the fuel allocation methods for the IEA and CRF data into agreement as it was recommended by the ERT during the inventory review 2005.

3.2.2.14 1.A.3.e Other Transportation – Pipeline Compressors

Key Source: Yes (CO_2: gaseous)

Category *1.A.3.e Other Transportation* enfolds emissions from pipeline transport by gas turbine driven compressors. The share in total GHG emissions from sector *1 A* is 0.4% for the year 1990 and 0.7% for the year 2006. The increase of emissions is mainly caused by the increase of natural gas transfer through Austria.

Methodology

The CORINAIR simple methodology is applied.

Activity data

Activity data (fuel consumption) is taken from (IEA JQ 2007) as presented in Annex 4.

Emission factors

CO_2 and CH_4 emission factors are taken from studies (BMWA-EB 1996) and (GEMIS 2002).

N_2O emission factors are taken from a national study (BMUJF 1994).

Emission factors are presented in Table 61.

Table 61: Emission factors of Category 1 A 2 e for all years.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
Natural Gas	55.40	1.50	0.10

Recalculations

Changes of activity data are based on energy balance recalculation as described in Annex 2.

Minor changes of CO_2 from natural gas for single years between 1999 (+2 Gg CO_2) to 2005 (+1 Gg CO_2).

3.2.2.15 1.A.4 Other sectors

Category *1 A 4 Other sectors* enfolds emissions from stationary fuel combustion in the small combustion sector. It also includes emissions from mobile sources in households and gardening including snow cats and skidoos as well as from agriculture and forestry.

The share in total GHG emissions from sector *1 A* is 27.3% for the year 1990 and 20.6% for the year 2006.

<u>1.A.4 Other sectors – stationary sources</u>

Key Source: CO_2 from gaseous, liquid and solid solid; CH_4 from biomass.

Category *1.A.4 Other Sectors* includes emissions from stationary fuel combustion in the small combustion sector. Emissions from generation of public district heating plants are included in category *1.A.1.a Public Electricity and Heat* or the respective sub categories of *1.A.2 Manufacturing Industries and Construction* if district heat is sold by industry. Information about type of heatings is collected by micro census surveys and according to the energy statistics supplier. A clear distinction between "real" public district heating or micro heating networks which serve several buildings under the same ownership can not always be made by the interviewed person or interviewers.

The share in total GHG emissions from sector *1.A* is 24.3% for the year 1990 and 18.2% for the year 2006.

Methodology

The CORINAIR simple methodology is applied.

There are three technology dependent subcategories (heating types) for this category:

1. Central Heatings (CH)
2. Apartment Heatings (AH)
3. Stoves (ST)

1 A 4 a Commercial/Institutional; 1 A 4 b Agriculture/Forestry/Fishing

There is no information about the structure of devices within this categories. Therefore it is assumed that the whole fuel consumption reported in (IEA JQ 2007) is combusted in devices similar to central heatings.

1 A 4 b Residential

Energy consumption by type of fuel and by type of heating is taken from a statistical evaluation of micro census data 1990, 1992, 1999 and 2004 by STATISTIK AUSTRIA. The calculated shares are used to subdivide total final energy consumption to the several technologies. For the years in between the shares are interpolated and the shares of 2004 are taken for the years from 2005 on.

Emission factors

CO_2, CH_4 and VOC emission factors are taken from studies (BMWA-EB 1990, 1996) and (GEMIS 2002). N_2O emission factors are taken from a national study (BMUJF 1994). CO_2 emission factors are identical for the three different heating types. The studies provide VOC and C_{org} emission factors for different fuels and heating types.

The C_{org} (Organic Carbon) emission factors provided in (BMWA-EB 1996) are converted into VOC emission factors with the formula $VOC = 1.3 * C_{org}$. The factor of 1.3 is an expert judgement by Umweltbundesamt as no factor was available from literature. It is based on analytical data of the composition of VOC emissions from the combustion of fuel wood for residential heating.

CH_4 emission factors are determined assuming that a certain percentage of VOC emissions is methane as listed in Table 62. The split follows closely (STANZEL et al. 1995).

From 2001 on new biomass boiler types are considered which have lower VOC emissions and thus lower CH_4 emissions than conventional boiler types.

Table 62: Share of CH_4 and NMVOC on VOC for small combustion devices.

	CH_4	NMVOC	VOC
Coal	25%	75%	100%
Gas oil; Petroleum	20%	80%	100%
Residual Fuel Oil	25%	75%	100%
Natural Gas; LPG	80%	20%	100%
Biomass	25%	75%	100%

The selected emission factors for 2006 are presented in Table 63.

Table 63: Emission factors of Category 1.A.4 conventional boilers for the year 2006.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]		N_2O [kg/TJ]	
		CH and AH	Stove	CH and AH	Stove
Hard Coal	93.00	90.00	110.00	2.00	1.00
Hard Coal Briquettes	93.00	90.00	110.00	2.00	1.00
Lignite and brown coal	108.00	90.00	110.00	4.00	1.00
Brown Coal Briquettes	97.00	90.00	110.00	4.00	4.00
Coke	92.00	90.00	110.00	2.00	2.00
Peat	106.00	–	90.00	–	1.00
Light Fuel Oil	77.00	0.25	–	0.60	–
Medium Fuel Oil	78.00	2.00	–	1.00	–
Heavy Fuel Oil	78.00	2.00	–	1.00	–
Gas oil	75.00	0.20	0.50	1.00	1.00
Petroleum	78.00	0.20	–	0.60	–
LPG	64.00	1.50	–	1.00	–
Gas Works Gas	64.00	0.20	–	1.00	–
Natural Gas	55.40	0.80	0.80	1.00	1.00
Fuel Wood	100.00[1)]	144.34	203.81	3–5	7.00
Wood Waste	110.00[1)]	76.24	203.81	3–7	7.00
Landfill Gas	112.00[1)]	1.50	–	1.00	–
Industrial Waste	104.17[2)]	12.00	–	1.40	–

1) *reported as CO_2 emissions from biomass*

2) *According to IPCC guidelines non fossil CO_2 emissions of "other fuels" are not reported.*

Because no measurements are available CH_4 emission factors for new biomass heatings (Table 64) are derived from conventional boiler emission factors with the ratio of conventional boiler and new biomass heatings NMVOC emission factors:

$$EF(CH_4)_{new\ biomass} = EF(CH_4)_{conventional} * EF(NMVOC)_{new\ biomass}/EF(NMVOC)_{conventional}$$

Table 64: Emission factors of Category 1 A 4 new biomass boilers for the year 2006.

Fuel	CO_2 [t/TJ]	CH_4 [kg/TJ]		N_2O [kg/TJ]	
		CH/AH	Stove	CH and AH	Stove
Fuel Wood	100.00[1)]	80.1/108.2	164.3	3.00	7.00
Wood Chips	110.00[1)]	27.06	–	2.00	–
Pellets	110.00[1)]	12.14	–	2.00	–

1) *Reported as CO_2 emissions from biomass.*

Activity data

Total fuel consumption for each of the sub categories of 1.A.4 is taken from (IEA JQ 2007) as presented in Annex 4.

Since (IEA JQ 2007) does not report gas works gas the activity data is taken from the "Austrian Energy Balance" provided by STATISTIK AUSTRIA which is in a different structure but consistent with (IEA JQ 2007).

From the view of energy statistics compilers this sector is sometimes the residual of gross inland fuel consumption because fuel consumption data of energy industries and manufacturing industry is in general of higher quality. However, in case of the Austrian energy balance fuel consumption of the small combustion sector is modelled over time series in consideration of heating degree days and micro census data.

Table 65 shows the selected share of each heating type for category *1.A.4.b.*

Table 65: Share of 1.A.4.b heating type on fuel category for the year 2006.

	Central Heating	Appartement Heating	Stove
Hard Coal	65.0%	11.0%	25.0%
Brown Coal	65.0%	11.0%	25.0%
Brown Coal Briquettes	65.0%	11.0%	25.0%
Coke	65.0%	11.0%	25.0%
Gas oil	83.7%	8.1%	8.2%
Residual Fuel Oil, Gas Works Gas, LPG, Petroleum	100%	–	–
Natural Gas	56.7%	40.6%	2.7%
Fuel Wood	63.4%	6.3%	30.3%
Wood Chips, Pellets, other solid biomass	81.3%	3.3%	15.4%

Recalculations

Changes of activity data are based on energy balance recalculation as described in Annex 2.

Recalculations mainly affect CO_2 emissions from natural gas 1990 (+23 Gg CO_2) to 1995 and 1999 (-580 Gg CO_2) and 1999 to 2005 (+723 Gg CO_2). Changes in CO_2 emissions from liquid fuels 1990(-3 Gg CO_2) to 1995 and 1999 (+272 Gg CO_2) to 2005 (-53 Gg CO_2). Minor changes of solid fuels activity data 1999 to 2001 and 2005.

Update of heating type split from 2001 onwards by means of 2004 household census data. This affects calculation of CH_4, CO, NMVOC, NO_X and other non-GHG emissions from residential heatings.

Fuel consumption of new biomass heatings have been revised from the year 2000 onwards by means of new boiler sales statistics. This affects calculation of CH_4, CO, NMVOC, NO_x and other non-GHG emissions from residential biomass heatings.

1.A.4 Other sectors – mobile sources

1.A.4.b Household and Gardening

Key Source: No

The applied methodology is described in the subchapter on mobile sources of 1 A 2 f (see Chapter 3.2.2.9 1.A.2.f Manufacturing Industries and Construction – Other). Activities used for estimating the emissions and the implied emission factors are presented in Table 67.

Table 66: Greenhouse gas emissions from mobile sources of household and gardening 1990–2006.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1990	142.00	0.11	0.02
1991	142.41	0.11	0.02
1992	143.82	0.11	0.02
1993	144.68	0.11	0.02
1994	143.63	0.11	0.03
1995	144.43	0.10	0.03
1996	143.47	0.10	0.03
1997	142.39	0.10	0.03
1998	141.48	0.10	0.03
1999	140.70	0.10	0.02
2000	140.52	0.09	0.02
2001	140.48	0.08	0.02
2002	140.55	0.07	0.02
2003	140.28	0.06	0.02
2004	140.12	0.05	0.02
2005	139.11	0.05	0.02
2006	136.98	0.04	0.02
Trend 1990–2006	*-4%*	*-64%*	*-31%*

Table 67: Emission factors and activity data for mobile sources of household and gardening 1990–2006.

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	1 891.2	75.08	55.53	12.56
1991	1 896.8	75.08	55.57	12.55
1992	1 915.6	75.08	55.33	12.61
1993	1 950.0	74.20	54.52	12.51
1994	1 935.9	74.19	54.67	12.95
1995	1 948.7	74.12	53.69	13.31
1996	1 935.8	74.12	53.43	13.23
1997	1 922.1	74.08	53.12	13.29
1998	1 910.0	74.07	52.77	13.37
1999	1 901.5	73.99	51.09	11.90
2000	1 899.1	73.99	46.27	11.71
2001	1 899.1	73.98	41.66	11.56
2002	1 899.3	74.00	37.32	11.41
2003	1 895.6	74.00	32.98	9.92
2004	1 893.8	73.99	28.15	9.53
2005	1 893.6	73.47	23.77	9.12
2006	1 914.5	71.55	19.80	8.62

1.A.4.c Agriculture and Forestry

Key Source: Yes (CO_2: mobile-diesel)

In this category emissions from off-road machinery in agriculture and forestry (mainly tractors) are considered.

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 3.2.2.9 1.A.2.f Manufacturing Industries and Construction – Other). Activities used for estimating the emissions and the implied emission factors are presented in the following tables.

Table 68: Greenhouse gas emissions for mobile sources of Agriculture and Forestry.

	Agriculture			Forestry		
	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1990	821	0.12	0.27	536	0.08	0.18
1991	823	0.12	0.27	394	0.06	0.13
1992	833	0.12	0.27	427	0.06	0.14
1993	839	0.12	0.28	431	0.06	0.14
1994	844	0.12	0.28	510	0.07	0.17
1995	768	0.11	0.26	493	0.07	0.17
1996	837	0.11	0.28	544	0.07	0.19
1997	933	0.12	0.32	542	0.07	0.19
1998	898	0.12	0.31	523	0.07	0.18
1999	916	0.11	0.31	529	0.06	0.18
2000	858	0.10	0.28	500	0.06	0.17
2001	917	0.10	0.29	509	0.06	0.17
2002	902	0.10	0.28	563	0.06	0.18
2003	813	0.09	0.24	648	0.06	0.21
2004	868	0.09	0.25	637	0.06	0.19
2005	859	0.08	0.24	576	0.05	0.17
2006	834	0.08	0.23	558	0.05	0.17
Trend 1990–2006	*1%*	*-30%*	*-15%*	*4%*	*-39%*	*-5%*

Table 69: Emission factors and activity data for mobile sources of Agriculture and Forestry 1990–2006.

	Agriculture				Forestry			
	Activity [TJ]	Implied Emission Factors			Activity [TJ]	Implied Emission Factors		
		CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]		CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
1990	11 088	74.1	10.5	24.3	7 234	74.1	10.4	24.3
1991	11 108	74.1	10.5	24.3	5 318	74.1	10.4	24.3
1992	11 243	74.1	10.5	24.3	5 758	74.1	10.3	24.3
1993	11 338	74.0	10.5	24.3	5 826	74.0	10.3	24.3
1994	11 401	74.0	10.4	24.4	6 883	74.0	10.2	24.6
1995	10 398	73.9	10.5	24.5	6 678	73.9	10.0	24.8
1996	11 327	73.9	10.1	24.9	7 371	73.9	9.7	25.1

	Agriculture				Forestry			
	Activity [TJ]	Implied Emission Factors			Activity [TJ]	Implied Emission Factors		
		CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]		CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O [kg/TJ]
1997	12 631	73.9	9.6	25.3	7 340	73.9	9.5	25.4
1998	12 162	73.9	9.5	25.2	7 076	73.9	9.4	25.7
1999	12 424	73.7	9.0	24.7	7 174	73.7	8.9	25.3
2000	11 639	73.7	8.8	24.2	6 784	73.7	8.5	24.8
2001	12 445	73.7	8.2	23.5	6 905	73.7	8.0	24.4
2002	12 244	73.7	7.9	22.6	7 642	73.7	7.6	24.0
2003	11 037	73.7	7.9	21.7	8 800	73.7	7.2	23.3
2004	11 779	73.7	7.4	20.8	8 651	73.7	6.7	22.5
2005	11 834	72.6	7.1	20.0	7 930	72.6	6.2	21.7
2006	11 934	69.8	6.8	19.2	7 999	69.8	5.8	20.9

3.2.2.16 1.A.5 Other

In this category emissions of military transport (road and aviation) are reported.

Military Aviation

The following table presents GHG emissions from military aviation.

Table 70: Greenhouse gas emissions from military aviation.

	CO_2 [t]	CH_4 [t]	N_2O [t]
	military Kerosene	military Kerosene	military Kerosene
1990	32 883	1.08	2.05
1991	34 971	1.15	2.16
1992	31 560	1.04	2.03
1993	37 294	1.22	2.40
1994	39 461	1.30	2.47
1995	30 467	1.00	1.95
1996	36 822	1.21	2.33
1997	35 024	1.15	2.10
1998	40 348	1.32	2.36
1999	39 534	1.30	2.29
2000	42 880	1.41	2.69
2001	41 010	1.35	2.55
2002	39 871	1.31	2.64
2003	87 296	2.86	6.10
2004	104 600	3.43	6.88
2005	118 183	3.88	7.06
2006	123 597	4.06	7.07

Methodological Issues

Fuel consumption for military flights was reported by the Ministry of Defence. Calculation of emissions from military aviation did not distinguish between LTO and cruise.

For calculation of CO_2 emissions an emission factor of 3 150 kg CO_2/Mg fuel has been used, it was taken from (KALIVODA et al. 2002).

CH_4 emissions have been calculated with an emission factor of 0.53 g/GJ. The emission factor is assumed to be the same as the emission factor of national LTO.

As recommended in the IPCC GPG, for calculation of N_2O emissions of military flights the IEF of civil aviation domestic LTO was applied as no military specific emission factor was available.

Military Off-Road (without aviation)

The applied methodology is described in the subchapter on mobile sources of 1 A 2 f (see Chapter 3.2.2.9 1.A.2.f Manufacturing Industries and Construction – Other).

Emission estimates for military activities were taken from (PISCHINGER 2000). Information on the fleet composition was taken from official data presented in the internet as no other data were available. Also no information on the road performance of military vehicles was available, that's why emission estimates only present rough estimations, which were obtained making the following assumptions: for passenger cars and motorcycles the yearly road performance as calculated for civil cars was used. For tanks and other special military vehicles the emission factors for diesel engines > 80 kW was used (see Table 43; for these vehicles a power of 300 kW was assumed). The yearly road performance for such vehicles was estimated to be 30 h/year (as a lot of vehicles are old and many are assumed not to be in actual use anymore).

Activities used for estimating the emissions and the emissions are presented in the following table.

Table 71: Greenhouse gas emissions from Military (Off-Road without Aviation).

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	Activity [TJ]
1990	2.14	0.0001	0.0008	28.9
1991	2.14	0.0001	0.0008	28.9
1992	2.14	0.0001	0.0008	28.9
1993	2.14	0.0001	0.0008	28.9
1994	2.14	0.0001	0.0008	28.8
1995	2.13	0.0001	0.0008	28.8
1996	2.12	0.0001	0.0008	28.7
1997	2.11	0.0001	0.0008	28.6
1998	2.10	0.0001	0.0008	28.4
1999	2.08	0.0001	0.0008	28.3
2000	2.07	0.0001	0.0007	28.1
2001	2.06	0.0001	0.0007	27.9
2002	2.03	0.0001	0.0006	27.6
2003	2.01	0.0001	0.0006	27.3
2004	1.99	0.0001	0.0005	27.0
2005	1.94	0.0001	0.0005	26.8
2006	1.86	0.0001	0.0004	26.7
Trend 1990–2006	*-13%*	*-42%*	*-42%*	*-8%*

3.2.2.17 International Bunkers – Aviation

Emissions from aviation assigned to international bunkers include the transport modes international LTO and international cruise for IFR-flights (International Flight Rules).

Table 72: Emissions and Activity from International Aviation 1990–2006.

	CO_2 [Gg]		N_2O [Gg]		CH_4 [Gg]	Activity [TJ]
	int. LTO	int. cruise	int. LTO	int. cruise	int. LTO	int. cruise
	Kerosene	Kerosene	Kerosene	Kerosene	Kerosene	Kerosene
1990	90.3	795.7	0.006	0.025	0.015	11 014
1991	103.0	890.8	0.006	0.028	0.016	12 330
1992	115.8	961.6	0.007	0.031	0.017	13 310
1993	128.6	1 011.4	0.008	0.032	0.018	13 998
1994	141.4	1 044.2	0.009	0.033	0.019	14 453
1995	154.2	1 173.2	0.010	0.037	0.020	16 127
1996	164.8	1 301.6	0.010	0.041	0.023	17 927
1997	175.4	1 350.2	0.011	0.043	0.027	18 605
1998	186.0	1 392.3	0.011	0.044	0.030	19 187
1999	190.1	1 351.6	0.011	0.043	0.029	18 583
2000	194.2	1 480.8	0.012	0.047	0.029	20 356
2001	188.8	1 439.8	0.012	0.046	0.028	19 791
2002	176.9	1 349.2	0.012	0.043	0.026	18 547
2003	151.3	1 153.7	0.011	0.037	0.022	15 858
2004	177.6	1 354.2	0.012	0.043	0.026	18 614
2005	200.6	1 530.1	0.012	0.049	0.030	21 031
2006	209.8	1 600.2	0.012	0.051	0.031	21 994

Methodological Issues

Emissions have been calculated using the methodology and emission factors as described in Chapter *1 A 3 a Civil Aviation*.

3.2.3 Quality Assurance/Quality Control and Verification

For general QA/QC see Chapter 1.6.

At present STATISTIK AUSTRIA works on a written documentation for the national energy balance. Additionally a document which covers a more actual quantification of uncertainty is expected. Both documents will be presented to the *Umweltbundesamt* in 2008.

Concerning activity data for sectors *1.A.1* and *1.A.2* there are specific regulations in the Austrian legislation:

- BGBl II No. 1997/331 Feuerungsanlagen-Verordnung
- BGBl 1989/19 Luftreinhalteverordnung für Kesselanlagen
- BGBl 1988/380 Luftreinhaltegesetz für Kesselanlagen

Extracts of the relevant paragraphs are provided in Annex 10.

Additionally the following sector specific QA/QC procedures have been carried out:

- activity data check
  - National ET Allocation Plan 1 survey (1990) 1998 to 2002
  - 1.A.1.a: public report: fuel consumption and energy production by plant (1990)
  - discussion of activity data with Refinery (incl. methodology of CO_2 emission calculation) and Iron and Steel Industry
  - check of gas consumption with data from E-Control
  - check of oil consumption with data from Mineral Oil Association
- indicators and analysis (activity data and CO_2 emissions)
  - Public Kyoto Progress Report
  - energy intensity indicators: Iron and Steel, Cement industry. Refinery. Households
- external review
  - Federal provinces air emission inventory
  - Check of methodology and CO_2 emissions by WIFO
- emission factors check
  - check of IEF (time series)
  - NAP1 survey: Country specific CO_2 emission factors used in the inventory were widely accepted
  - comparison with IPCC
- time series consistency
  - plausibility checks of dips and jumps
  - yearly public trend report
- recalculations check of activity data (energy balance) and emissions
- Method Documentation with Standard Operation Procedure (SOP)
- „Quick-calculation" of 1.A activity
- improvement list (external and internal findings)
- link to STATISTIK AUSTRIA, Industrial associations
- calculation by spreadsheets
  - consistent use of energy balance data (central file)
  - documented sources
  - use of Units
  - strictly defined interfaces between spreadsheets/calculation modules
  - unique structure of sheets which do the same
  - use of coding systems (SNAP, SPLIT, NAPFUE)
  - record keeping. Use of write protection
  - unique use of formulas. Special cases are documented /highlighted
  - quick-control checks for data consistency through all steps of calculation

3.2.4 Uncertainty

As the overall fuel balance for Austria is expected to be considerably more accurate than source specific information (Statistik Austria, pers. communication), also assessment of uncertainties was performed on the level of the overall energy balance. It was not possible, however, to strictly use this straightforward approach because dealing with all fuel related activities at the same time would make it difficult to provide separation of major source categories; as domestic combustion, industry and power plant would fall in the same category with traffic.

For these reasons, an arbitrary split was drawn between energy use in large sources (covering IPCC sectors 1.A.1, refineries as they are included in 1.B.2, and energy in iron and steel production covered in 2.C.1), transport sources (IPCC sector 1.A.3, but including transport related machinery in 1.A.2, manufacturing industry, and 1.A.4, other sectors like agriculture, forestry and households) and small sources (covering all other combustion sources, specifically the rest of manufacturing industry, 1.A.2, as well as other sectors, 1.A.4. Also 1.A.5, "other" is included which basically covers military energy consumption including transport). Activity uncertainty was assessed separately by fuel for fossil solids (fuel code 102–110), biomass and waste fuels (fuel code 111–118), liquid fuels (fuel codes 203–224 except for black liquor, code 215 which is treated separately) and gaseous fuels (fuel codes above 300). Uncertainty factors have been maintained from previous studies (WINIWARTER & ORTHOFER 2000; CHARLES et al. 1998) and are listed in Table 73. For transport, the respective factors are new and have been taken from an assessment of the overall transport GHG emissions (HAUSBERGER 2005).

Table 73: Uncertainty parameters for fuel combustion activities.

	Fossil solid	Biomass & waste	liquid	Black liquor	Gas
large sources	0.5	10	0.5	–	2.0
small sources	1.0	10	1.0	10.0	5.0
transport			3.0		

Uncertainty factors presented account for the generally high quality level of Austrian fuel statistics, which is based on physical measurements (weighing, flow-metering), but data reported in statistics are derived from the respective heat content of fuels. Transformation requires analysis or measurement of the heat content in the fuel. Biomass, waste and black liquor, which are not contained in detail by trade statistics, exhibit a much larger uncertainty.

Emission factors in fuel combustion are also considered to be well-known. CO_2 emissions can be derived from stoichiometry. Carbon content of fuels (within gaseous/liquid/solid fuels, respectively) is largely proportional to its heat content. Thus we estimate uncertainty of the emission factor – separately for solid, liquid and gaseous fuels – at 0.5%. Within these respective fuel classes we consider uncertainty correlated.

Even more interesting is the case of methane. A considerable number of seemingly independent emission factors for different emission situation are available. At closer inspection, however, it appears that data presented by STANZEL et al. (1995) and used in OLI actually derive from HC measurements. The fraction of CH_4 in total HC combustion exhaust has been estimated by ORTHOFER (1991) at 75% in gaseous fuels, 20% in solid fuels and 25% in liquid fuels. As this percentage is what drives overall uncertainty for methane emission factors, we again have to treat gaseous, liquid and solid fuels as dependent (correlated) parameters. As an indicator of overall uncertainty we may refer to CHARLES et al. (1998) who reported 50% for methane from combustion sources.

For nitrous oxide, emission measurements have been performed by VITOVEC (1991) and resulting uncertainty has been estimated at 20%. This figure has previously been used for Austria, but is not sustainable any more considering the fact that emission factors originally used for an Austrian inventory by ORTHOFER et al. (1995) are now more than 15 years old and refer to a considerably different combustion regime. We now apply 50% (taken from MONNI & SYRI 2003; see also RAMIREZ et al. 2006), a figure which we understand to also include uncertainty due to limited knowledge on the fraction of fluidized bed combustion in the installation park. Emission factors reported for nitrous oxide by STANZEL et al. (1991) and used in OLI originally derive from the GEMIS modelling system, again just one source. Thus they again need to be considered correlated within each fuel class (solid, liquid and gaseous).

3.2.5 Recalculations of Category 1.A

The revision of the national energy statistics for the time series 1990–2005 by STATISTIK AUSTRIA results in changes for category *1 A* for all GHGs from 1990 onwards. For details see Annex 2 and the respective chapters of the subsectors of *1 A*.

Description of reasons for recalculation for each GHG is given in the relevant subchapters. The tables below show the recalculation difference of emissions from Sector *1 A Fuel Combustion* and its sub categories with respect to the previous submission.

CO_2 emissions

Table 74 shows the recalculations of CO_2 emissions for the subcategories of sector *1.A Fuel Combustion.*

Table 74: Recalculation difference of CO_2 emissions in [Gg] for Category 1 A Fuel Combustion with respect to previous submission.

	1 A	1 A 1	1 A 2	1 A 3	1 A 4	1 A 5
1990	154.60	133.20	-133.44	25.22	129.63	-0.01
1991	191.14	170.11	-4.50	25.51	0.03	0.00
1992	187.17	166.83	-150.63	25.10	145.87	0.00
1993	132.80	113.70	-81.85	22.17	78.79	0.00
1994	167.13	149.51	-60.98	20.57	58.03	0.00
1995	304.28	281.45	-35.88	21.49	37.23	0.00
1996	79.52	68.83	-2.73	19.79	-6.37	0.00
1997	50.50	52.63	-4.66	10.43	-7.89	0.00
1998	-38.68	141.89	-200.28	9.75	9.97	0.00
1999	203.89	391.63	196.27	11.04	-395.05	0.00
2000	-31.75	62.38	179.20	10.63	-283.96	0.00
2001	133.95	479.23	70.92	6.52	-422.72	0.00
2002	369.67	239.83	279.02	6.83	-156.01	0.00
2003	266.83	137.53	322.78	7.30	-200.79	0.00
2004	354.87	310.80	158.82	6.88	-121.62	0.00
2005	-150.03	261.73	369.98	-14.99	-766.73	-0.03

CH_4 emissions

Table 75 shows the recalculations of CH_4 emissions for the subcategories of sector *1.A Fuel Combustion.*

Table 75: Recalculation difference of CH_4 emissions in [Gg] for Category 1 A Fuel Combustion with respect to previous submission.

	1 A	1 A 1	1 A 2	1 A 3	1 A 4	1 A 5
1990	0.16	0.01	-0.01	0.16	0.01	0.00
1991	0.49	0.01	-0.01	0.49	0.01	0.00
1992	0.76	0.01	-0.01	0.75	0.02	0.00
1993	0.97	0.00	-0.01	0.97	0.01	0.00
1994	1.02	0.00	-0.01	1.01	0.01	0.00
1995	1.00	0.01	0.00	0.99	0.00	0.00
1996	0.90	0.00	0.00	0.89	0.00	0.00
1997	0.81	0.00	0.00	0.81	0.00	0.00
1998	0.80	0.00	0.00	0.80	0.00	0.00
1999	0.79	0.01	0.00	0.68	0.10	0.00
2000	0.81	0.00	0.02	0.61	0.18	0.00
2001	0.46	0.02	0.00	0.57	-0.13	0.00
2002	0.55	0.01	0.00	0.55	0.00	0.00
2003	0.67	0.01	0.00	0.50	0.17	0.00
2004	0.38	0.01	0.01	0.42	-0.06	0.00
2005	0.24	0.01	0.02	0.35	-0.14	0.00

N_2O emissions

Table 76 shows the recalculations of N_2O emissions for the subcategories of sector *1.A Fuel Combustion.*

Table 76: Recalculation difference of N_2O emissions in [Gg] for Category 1 A Fuel Combustion with respect to previous submission.

	1 A	1 A 1	1 A 2	1 A 3	1 A 4	1 A 5
1990	-0.27	0.00	0.00	-0.27	0.00	0.00
1991	-0.36	0.00	0.00	-0.36	0.00	0.00
1992	-0.39	0.00	0.00	-0.39	0.00	0.00
1993	-0.41	0.00	0.00	-0.41	0.00	0.00
1994	-0.38	0.00	0.00	-0.38	0.00	0.00
1995	-0.32	0.00	0.00	-0.32	0.00	0.00
1996	-0.24	0.00	0.00	-0.24	0.00	0.00
1997	-0.19	0.00	-0.01	-0.18	0.00	0.00
1998	-0.15	0.00	0.00	-0.15	0.00	0.00
1999	-0.09	-0.01	0.00	-0.07	-0.01	0.00
2000	-0.04	-0.01	0.00	-0.03	0.00	0.00
2001	-0.03	-0.01	-0.02	0.00	-0.01	0.00

	1 A	1 A 1	1 A 2	1 A 3	1 A 4	1 A 5
2002	0.02	0.00	-0.02	0.03	0.00	0.00
2003	0.05	0.00	-0.02	0.06	0.01	0.00
2004	0.09	0.00	-0.01	0.09	0.01	0.00
2005	0.12	0.01	-0.02	0.12	0.00	0.00

Emissions in Gg CO_2 equivalent

Table 77 shows the recalculations in [Gg CO_2 equivalent] for the subcategories of sector *1.A Fuel Combustion.*

Table 77: Recalculation difference of GHG emissions in [Gg CO_2 equivalent] for Category 1 A Fuel Combustion with respect to previous submission.

	1 A	1 A 1	1 A 2	1 A 3	1 A 4	1 A 5
1990	74.02	133.38	-134.10	-55.76	130.50	-0.01
1991	88.60	170.34	-4.83	-76.95	0.05	0.00
1992	82.80	167.06	-151.37	-79.72	146.84	0.00
1993	26.74	113.83	-82.22	-84.19	79.33	0.00
1994	71.55	149.68	-61.34	-75.22	58.43	0.00
1995	225.84	281.77	-35.97	-57.43	37.47	0.00
1996	22.82	68.94	-2.80	-36.93	-6.38	0.00
1997	7.23	52.90	-8.12	-29.61	-7.94	0.00
1998	-67.07	142.16	-200.54	-18.73	10.04	0.00
1999	192.92	389.37	195.67	3.05	-395.16	0.00
2000	-26.45	60.41	179.60	14.09	-280.55	0.00
2001	134.20	477.16	66.07	18.57	-427.60	0.00
2002	387.51	240.11	274.19	28.02	-154.81	0.00
2003	295.48	136.21	317.33	36.23	-194.29	0.00
2004	390.98	311.80	155.05	44.33	-120.20	0.00
2005	-108.16	265.98	365.39	29.16	-768.66	-0.03

3.2.6 Planned Improvements

At current no relevant improvements are planned.

3.3 Comparison of the Sectoral Approach with the Reference Approach

3.3.1 Comparison of CO_2 emissions

At the following CO_2 emissions from the sectoral and reference approach are compared and explanations for the differences are provided.

The following improvements have been applied since the last inventory: Naphta, anthracite and sub-bituminous coal are now considered as separate fuels/flows.

Table 78 presents CO_2 emissions of sectoral and reference approach.

Table 78: CO_2 emissions of sectoral and reference approach.

Year	Reference Approach				Sectoral Approach				
	Liquid [Gg CO_2]	Solid [Gg CO_2]	Gaseous [Gg CO_2]	Total [Gg CO_2]	Liquid [Gg CO_2]	Solid [Gg CO_2]	Gaseous [Gg CO_2]	Other [Gg CO_2]	Total [Gg CO_2]
1990	28 302	15 917	12 238	56 457	28 138	13 924	11 301	732	54 094
1991	30 837	16 771	12 939	60 547	30 615	14 518	11 940	805	57 878
1992	29 870	12 957	12 705	55 532	29 349	10 666	12 000	956	52 972
1993	30 933	11 650	13 399	55 982	30 758	9 495	12 453	675	53 381
1994	30 181	11 810	13 782	55 774	30 127	9 379	13 111	820	53 437
1995	30 771	13 499	15 048	59 318	30 336	10 741	14 339	839	56 255
1996	33 210	13 511	16 017	62 738	32 950	10 760	15 287	1 073	60 070
1997	32 653	14 318	15 437	62 408	32 150	11 318	14 720	1 017	59 205
1998	34 935	12 550	15 848	63 333	34 274	8 905	15 136	818	59 133
1999	32 921	12 478	16 125	61 524	32 617	9 195	15 406	820	58 037
2000	32 035	14 151	15 388	61 574	31 812	10 443	14 684	866	57 804
2001	34 435	14 581	16 309	65 325	34 209	11 249	15 629	1 009	62 096
2002	35 402	14 880	16 494	66 776	35 318	11 133	15 792	1 205	63 450
2003	38 276	15 970	17 833	72 079	38 554	12 607	17 070	1 372	69 603
2004	38 069	15 725	17 622	71 416	38 221	12 225	16 915	1 576	68 937
2005	38 912	15 705	19 307	73 924	38 602	11 897	18 508	1 410	70 417
2006	38 698	15 803	17 605	72 106	37 521	11 872	16 792	1 633	67 818

Table 79 presents the difference of CO_2 emissions in percent between reference and sectoral approach.

Table 79: Difference of CO_2 emissions by type of fuel in percent.

Year	Liquid	Solid	Gaseous	Total
1990	0.58%	14.31%	8.29%	4.37%
1991	0.73%	15.52%	8.36%	4.61%
1992	1.78%	21.47%	5.87%	4.83%
1993	0.57%	22.70%	7.60%	4.87%
1994	0.18%	25.92%	5.12%	4.37%
1995	1.44%	25.67%	4.94%	5.45%
1996	0.79%	25.57%	4.77%	4.44%
1997	1.56%	26.50%	4.87%	5.41%
1998	1.93%	40.94%	4.71%	7.10%
1999	0.93%	35.71%	4.67%	6.01%
2000	0.70%	35.50%	4.80%	6.52%
2001	0.66%	29.62%	4.35%	5.20%
2002	0.24%	33.65%	4.44%	5.24%
2003	-0.72%	26.67%	4.47%	3.56%
2004	-0.40%	28.63%	4.18%	3.60%
2005	0.80%	32.01%	4.31%	4.98%
2006	3.14%	33.12%	4.84%	6.32%

Positive numbers indicate that CO_2 emissions from the reference approach are higher than emissions from the sectoral approach.

Explanation of differences

- In the reference approach the IPCC default net calorific values are used. In the sectoral approach country-specific net calorific values are taken to calculate the energy consumption.
- The selected emission factors (carbon content) of the two approaches are different, especially for coal.
- *Liquid Fuels:* Energy balance is mass-balanced but not carbon balanced. Fuel category *Other Oil* is an aggregation of several fuel types and therefore it is difficult to quantify a reliable carbon emission factor for the reference approach. The reference approach takes a share of feedstocks used for plastics and solvent production as non-carbon stored. In the sectoral approach a share of emissions from the waste incineration of plastics is included in category *1 A 1 a Public Electricity and Heat Production*. Emissions from solvent use are included in category *3 Solvent and Other Products Use*. In the sectoral approach a share of municipal solid waste without energy recovery is considered in category 6C for 1990 and 1991.
- *Diesel:* In the Reference Approach CO_2 emissions from diesel are fully accounted as fossil emissions while in the sectoral the share of mixed biofuels is accounted as biogenic.
- *Solid fuels:* The Reference Approach includes process emissions from blast furnaces and steel production which are included in category *2.C Metal Production* as well as process emissions from carbide production which are included in category *2.B.4 Carbide Production*. In the sectoral approach plant specific CO_2 emission factors are used for large coal boilers since 2005.
- *Gaseous fuels:* The national approach uses country specific carbon contents and heating values different to IPCC default factors. Process emissions from ammonia-production are included in category *2 B 1 Ammonia Production*.
- *Other fuels:* The sectoral approach considers waste as an additional fuel type (e.g. municipal solid waste, hazardous waste and industrial fuel waste)
- *Carbon Stored:* The reference approach uses IPCC default values for "fraction of carbon stored".

Quantification of differences

- By quantifying the difference between the two approaches the remaining difference is between -1.0 to +1.6%. Note that this may be interpreted as emissions according to the sectoral approach (plus process emissions) being even higher than emissions according to the reference approach.
- At current it is not possible to quantify the amount of solvents and plastic products which are imported or exported by products, bulk or waste.

Table 80 represents the differences which can be easily quantified. Positive numbers indicate CO_2 emissions not included in the sectoral approach. Negative numbers indicate CO_2 emissions which are not considered by the reference approach. The remaining differences are mainly due to the use of country specific emission factors and NCVs within the sectoral approach and the use of "default fractions of carbon stored" within the reference approach.

Table 80: Quantification of differences.

Year	Natural Gas(1) [Gg CO_2]	2.B.1 (3) [Gg CO_2]	Coke Oven Coke(4) [Gg CO_2]	Other Fuels [Gg CO_2]	Biofuels(5) [Gg CO_2]	Total [Gg CO_2]	Remaining total deviation(2)
1990	162	826	2 704	-732	0	2 960	-1.0%
1991	168	884	2 722	-805	0	2 969	-0.5%
1992	167	595	2 458	-956	0	2 263	0.5%
1993	171	831	2 526	-675	0	2 854	-0.5%
1994	177	556	2 767	-820	0	2 680	-0.6%
1995	194	583	3 136	-839	0	3 075	0.0%
1996	205	597	2 918	-1 073	0	2 648	0.0%
1997	196	591	3 316	-1 017	0	3 086	0.2%
1998	200	585	3 214	-818	0	3 181	1.6%
1999	203	590	3 102	-820	0	3 075	0.7%
2000	193	582	3 489	-866	0	3 398	0.6%
2001	204	551	3 449	-1 009	0	3 194	0.1%
2002	205	573	3 879	-1 205	0	3 451	-0.2%
2003	220	625	3 721	-1 372	0	3 194	-1.0%
2004	218	570	3 650	-1 576	0	2 862	-0.5%
2005	239	598	4 128	-1 410	250	3 804	-0.4%
2006	217	638	4 206	-1 633	877	4 305	0.0%

1) *Deviation due to the use of different carbon emissions factors, losses and statistical differences.*

2) *Negative numbers indicate that CO_2 emissions from the reference approach are lower than emissions from the sectoral approach.*

3) *Process emissions of natural gas used for ammonia production.*

4) *Process emissions of coke oven coke used in blast furnaces. Emissions are allocated to 2 C 1 Iron and Steel Production.*

5) *Share of biofuels in diesel.*

3.3.2 Comparison of energy consumption

Table 81 compares the energy consumption of the two approaches.

Table 81: Energy consumption of sectoral and reference approach.

Year	Reference Approach				Sectoral Approach				
	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Total [TJ]	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Other [TJ]	Total [TJ]
1990	432 378	168 749	219 239	820 366	377 044	139 852	203 981	8 990	729 866
1991	466 621	177 293	231 794	875 708	409 401	146 121	215 528	10 079	781 129
1992	456 953	137 588	227 610	822 151	393 086	108 289	216 608	12 009	729 992
1993	465 288	123 589	240 044	828 921	413 983	96 253	224 788	9 775	744 799
1994	456 885	125 316	246 908	829 109	406 119	95 033	236 666	10 527	748 345
1995	462 024	142 854	269 583	874 462	408 678	108 466	258 830	10 916	786 890
1996	500 793	143 595	286 941	931 330	444 820	109 187	275 944	14 015	843 966
1997	500 167	152 325	276 551	929 043	433 476	114 939	265 706	13 122	827 244
1998	529 402	133 791	283 920	947 113	461 985	90 303	273 204	12 285	837 777

Year	Reference Approach				Sectoral Approach				
	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Total [TJ]	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Other [TJ]	Total [TJ]
1999	501 264	132 620	288 876	922 759	438 954	92 194	278 086	11 500	820 733
2000	489 393	150 040	275 681	915 115	430 383	105 420	265 047	12 180	813 029
2001	525 323	154 736	292 169	972 228	462 409	113 754	282 109	14 383	872 656
2002	537 783	157 556	295 485	990 825	477 589	112 553	285 061	16 278	891 481
2003	577 962	169 385	319 481	1 066 828	517 504	127 859	308 120	18 244	971 727
2004	579 014	167 045	315 695	1 061 755	513 377	124 638	305 324	22 016	965 355
2005	585 184	166 350	345 876	1 097 410	526 006	122 402	334 173	20 290	1 002 871
2006	589 188	167 618	315 391	1 072 196	526 288	122 518	303 198	25 481	977 485

Energy consumption is lower in the sectoral approach because

(i) non–energy use of fuels is not considered in the sectoral approach except the share that is considered in fuel waste and reported as "Other Fuels",

(ii) transformation and distribution losses are not considered in the sectoral approach and

(iii) net calorific values for the different fuel types in the two approaches are different.

For solid fuels the difference is additionally caused by transformation losses from coking coal to coke oven coke and from coke oven coke and fuel oil to blast furnace gas which are not considered in the sectoral approach.

3.4 Feedstocks

Non-energy use of fuels is considered in the national energy balance. Below explanations for the reported non-energy use is provided together with information on where CO_2 emissions due to the manufacture, use and disposal of carbon containing products are considered.

For fraction of carbon stored the IPCC default values are applied for all fuels except for coke oven coke, of which the amount carbon stored in steel was calculated.

Lubricants

manufacture: emissions are assumed to be included in total emissions from category *1 A 1 b* petroleum refinery.

use: emissions from the use of motor oil are included in CO_2 emissions from transport. VOC emissions from lubricants used in rolling mills are considered in category *2 C 1*. It is assumed that other uses of lubricants do not result in VOC or CO_2 emissions due to the low vapour pressure of lubricants.

disposal: emissions from incineration of lubricants (waste oil) are either included in categories *1 A 1 a* and *1 A 2* if waste oil is used as fuels or in category *6 C* respectively if energy is not recovered.

Bitumen

manufacture: emissions from the production of bitumen are assumed to be included in total emissions of category *1 A 1 b* petroleum refinery.

use: indirect CO_2 emissions from the use of bitumen for road paving and roofing that should be reported in categories *2 A 5* and *2 A 6* are included in sector *3 solvent and other product use*.

disposal: CO_2 emissions from the disposal from bitumen are assumed to be negligible. Recycling is not considered.

Natural Gas

manufacture: emissions from the use of natural gas as a feedstock in ammonia production are accounted for in the industrial processes sector (category *2 B 1*).

use/disposal: not applicable, no CO_2 emissions result from the use or disposal of ammonia.

Coke oven coke

manufacture: emissions from the production of coke are considered in category *1 A 2 a*.

use: CO_2 emissions from coke used in iron and steel industry are reported under *2 C*.

disposal: not applicable.

Other bituminous coal

In [IEA JQ 2007] non energy use is reported for the manufacture of electrodes.

manufacture: No information about emissions from manufacture of electrodes is currently available. Therefore it is not clear if emissions are not estimated or not applicable.

use: Emissions from the use of electrodes are considered in category *2 B 4* carbide production and *2 C* metal production.

disposal: not applicable.

Other oil products

manufacture: emissions from the production of ethylene and propylene are included in total emissions of category *1 A 1 b petroleum refinery*. CO_2 emissions from solvent use are considered in sector *3 solvent and other product use*.

use: CO_2 emissions from solvent use are considered in sector *3*.

disposal: emissions from the disposal of plastics in landfills are considered in *6 A* and from the use of plastic waste as a fuel in *1 A 2*; emissions from the incineration of plastic in waste without energy recovery is included in *6 C*; emissions from incineration of plastics in waste with energy recovery are considered in *1 A 1 a*.

3.5 Fugitive Emissions (CRF Source Category 1.B)

3.5.1 Source Category Description

In the year 2006 1.0% of national total emissions arise from IPCC Category *1 B Fugitive Emissions*. The only key source identified within this category is 1 B 2 b Natural Gas – CH_4.

3.5.1.1 Emission Trends

Table 82 presents GHG emissions arising from this category, their share and trend from 1990 to 2006.

Table 82: Greenhouse gas emissions from Category 1 B Fugitive Emissions.

	GHG emissions [Gg CO_2 equivalent]		
	Total	**CO_2**	**CH_4**
1990	486.75	102.03	384.72
1991	509.76	111.03	398.73
1992	536.56	120.03	416.54
1993	547.40	112.03	435.38
1994	576.71	127.53	449.19
1995	599.16	127.03	472.14
1996	569.60	71.03	498.57
1997	637.63	120.51	517.12
1998	670.08	141.83	528.25
1999	720.15	170.53	549.62
2000	730.01	164.53	565.48
2001	756.49	182.73	573.76
2002	763.78	167.03	596.75
2003	841.67	233.04	608.63
2004	863.08	210.04	653.05
2005	876.14	205.04	671.11
2006	930.89	232.04	698.85
Share 2006	*100%*	*25%*	*75%*
Trend 1990–2006	*91%*	*127%*	*82%*

3.5.1.2 Completeness

Table 83 gives an overview of the IPCC categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this sub-category have been estimated.

As can be seen in the table, emissions from solid fuel transformation (production of coke oven coke) are included in the energy sector (sub category *Iron and Steel*), because the only solid fuel transformation occurring in Austria is one coking plant as part of an integrated iron and steel site.

Furthermore, emissions from oil and from gas exploration and production are reported together under oil production (as oil and gas are extracted together at most sites) except CO_2 emissions from sour gas processing, which is reported separately under gas extraction.

Regarding petroleum refining, all CO_2 emissions, thus including flaring, are reported in the Energy Sector, as these are emissions due to combustion. Fugitive CO_2 losses are considered negligible. In category *1 B* only CH_4 and NMVOC emissions, included venting, are considered.

Table 83: Overview of subcategories of Category 1 B Fugitive Emissions: transformation into SNAP Codes and status of estimation.

IPCC Category	SNAP	Status	
		CO_2	**CH_4**
1 B 1 a Coal Mining and Handling			
i Underground Mines	050102 Underground mining	NO	NO
ii Surface Mines	050101 Open cast mining	NA	✓
1 B 1 b Solid Fuel Transformation		IE[1)]	IE[1)]
1 B 2 a Oil			
i Exploration	0502 Extraction, 1st treatment and loading of liquid fossil fuels	IE[2)]	IE[2)]
ii Production		✓	✓
iii Transport	050502 Transports and Depots	IE[2)]	IE[2)]
iv Refining/Storage	0401 Processes in Petroleum Industries	NA[3)]	✓
v Distribution of oil products	0504 Liquid fuel distribution 0505 Petrol distribution	NA	NA[4)]
1 B 2 b Natural Gas			
i Exploration	0503 Extraction, 1st treatment and loading of gaseous fossil fuels	NA	IE[2)]
ii Production/Processing		✓[2)]	
iii Transmission	050601 Pipelines/Storage	✓	✓
iv Distribution	050603 Distribution Networks	NA	✓
v Other Leakage		NO	NO
1 B 2 c Venting/Flaring		IE[5)]	IE[6)]

1) *included in 1 A 2 a Iron and Steel*

2) *1 B 2 a i Oil Exploration, 1 B 2 a iii Transport, 1 B 2 b Natural Gas Exploration and 1 B 2 b I Natural Gas Production/Processing, except CO_2 emissions from processing of sour gas, are included in 1 B 2 a ii.*

3) *CO_2 emissions due to combustion are included in 1 A 1 b Petroleum Refining, fugitive CO_2 emissions are assumed to be negligible.*

4) *also includes storage in storage tanks and refinery dispatch station – only NMVOC emissions are estimated as CH_4 emissions are assumed to be negligible.*

5) *included in 1 A 1 b Petroleum Refining*

6) *included in 1 B 2 a iv Petroleum Refining*

3.5.2 Methodological issues

3.5.2.1 1.B.1.a Fugitive Emissions from Fuels – Coal Mining

Emissions: CH_4

Key Source: No

This category covers methane emissions from one brown coal surface mine. CH_4 emissions from this category decrease by more than 50% from 1990 to 1999 due to lower mining activities. In the last years CH_4 emissions remain quite stable, but decrease strongly from 2003 to 2004 by minus 80%, following the trend of coal mined (see Table 84). Activity was reported to be 6.7 kt for 2006, thus the overall trend from the base year to 2006 is minus 99.7%.

Emissions are calculated by multiplying the amount of brown coal produced (= activity data) by the CORINAIR default emission factor of 214 g CH_4/ Mg coal (Emission Factor Data Base #11378[22]). Activity data are taken from the national energy balance, except for 2005 and 2006, because no activity is reported there, but in the yearbook of the *Association of Mining and Steel*.

Table 84: Activity data (brown coal produced) and CH_4 emissions for Fugitive Emissions from Fuels – Coal Mining 1990–2006.

Year	Coal Mined [Mg]	CH_4 emissions [Gg]
1990	2 447 710	0.524
1991	2 080 726	0.445
1992	1 746 756	0.374
1993	1 691 675	0.362
1994	1 369 217	0.293
1995	1 297 919	0.278
1996	1 108 558	0.237
1997	1 130 839	0.242
1998	1 140 651	0.244
1999	1 137 888	0.244
2000	1 254 605	0.268
2001	1 193 970	0.256
2002	1 411 819	0.302
2003	1 152 383	0.247
2004	235 397	0.050
2005	6 168	0.001
2006	6 677	0.001

3.5.2.2 1.B.2.a Fugitive Emissions from Fuels – Oil

Emissions: CH_4, CO_2

Key Source: No

In this category fugitive emissions from oil refining (CH_4) and CO_2 and CH_4 emissions from combined oil and gas production are considered. CO_2 emissions from the refinery resulting from combustion processes (including flaring) are included in *1 A 1 b Petroleum Refining*.

For transport, distribution and storage only NMVOC emissions are estimated, the CH_4 content of the NMVOC emissions is assumed to be negligible.

Refining

Methane emissions from refining are calculated using IPCC Tier 1 methodology (reference manual chapter 1.8).

[22] http://www.ipcc-nggip.iges.or.jp/EFDB/main.php

Emissions are calculated by multiplying the amount of crude oil input (= activity data) by an emission factor. Activity data are taken from the national energy balance (see Table 85).

The implied emission factor of 31.66 CH_4 g/t crude oil resulted from multiplying an average value of 745 kg CH_4/PJ crude oil input for methane emissions from this category (selected from table 1-58 of the IPCC Reference Manual) by the net calorific value of 42.5 GJ/t oil (taken from the national energy balance).

Production

The amount of gas produced was reported by the *Association of the Austrian Petroleum Industry* (see Table 85).

Methane emissions for the years 1992 to 2006 from combined oil and gas production was also reported by the *Association of the Austrian Petroleum Industry*, they were calculated according to „SHELL Paper Environment/Storage – References 1) USA EPA1986, AP-42 and 2) E&P Forum 1994, Report 2.59/197".

CO_2 emissions from production were also reported by the *Association of the Austrian Petroleum Industry*, they have been calculated according to the composition of the raw gas (the reported CO_2 emissions refer to CO_2 that has been separated from the raw gas).

Table 85: Activity data (Crude Oil Refined and Gas Produced, respectively) and emissions for Fugitive Emissions from Fuels – Oil Refining and Production 1990–2006.

	Refining		Production				
Year	**Crude Oil Refined [Gg]**	**CH_4 [Gg]**	**Gas Produced [Mio m³]**	**CH_4 [Gg]**	**IEF CH_4 [kg/ 1 000 m³]**	**CO_2 [Gg]**	**IEF CO_2 [kg/ 1 000 m³]**
1990	7 952	0.25	1 288	4.56	3.54	43	33
1991	8 273	0.26	1 326	4.56	3.44	43	32
1992	8 732	0.28	1 437	4.56	3.17	40	28
1993	8 522	0.27	1 488	4.54	3.05	37	25
1994	8 898	0.28	1 355	4.50	3.32	48	35
1995	8 619	0.27	1 482	4.41	2.97	38	26
1996	8 754	0.28	1 492	4.47	3.00	41	27
1997	9 374	0.30	1 428	4.55	3.18	31	22
1998	9 190	0.29	1 568	4.39	2.80	61	39
1999	8 635	0.27	1 741	4.15	2.38	90	52
2000	8 240	0.26	1 805	4.03	2.23	72	40
2001	8 799	0.28	1 954	4.10	2.10	88	45
2002	8 947	0.28	2 014	4.18	2.08	84	42
2003	8 819	0.28	2 030	3.92	1.93	133	66
2004	8 442	0.27	1 963	5.11	2.60	122	62
2005	8 709	0.28	1 637	5.21	3.18	122	75
2006	8 433	0.27	1 819	5.51	3.03	140	77

3.5.2.3 1.B.2.b Fugitive Emissions from Fuels – Natural Gas

Emissions: CH_4, CO_2

Key Source: *Yes (CH_4)*

CH_4 emissions from 1 B 2 b Natural gas is a key source because of the contribution both to the level of all years of the greenhouse gas inventory and to the trend. In 2006 fugitive CH_4 emissions from natural gas contributed 0.6% to total greenhouse gas emissions in Austria.

In this category CO_2 emissions from sour gas processing, CH_4 emissions from gas distribution and CO_2 and CH_4 emissions from gas transmission and storage are reported.

CO_2 emissions from this category mainly arise from sour gas processing; the trend is increasing emissions due to increasing gas production. Gas transmission is only a minor source of CO_2 emissions.

Sour Gas Processing

CO_2 emissions from natural gas production (sour gas processing) are reported by the *Association of the Austrian Petroleum Industry* (see Table 86) and were calculated from sour gas composition. Activity data for natural gas production are reported by the *Association of the Austrian Petroleum Industry* (see Table 86).

Distribution

Emissions from natural gas distribution are calculated using the mean IPCC default emission factor of 0.615 Mg CH_4 per km of distribution mains (IPCC GPG Table 2.16).

Activity data for natural gas distribution were taken from publications from the *Austrian Natural Gas and District Heat Association* and from direct information from E-Control (Austrian Energy Regulator).

Transmission, Storage

Pipeline lengths and natural gas stored were taken from annual reports of the *Association of the Austrian Petroleum Industry* (if no value was available for a certain year, the value of the year before or after was used).

Emission factors were taken from the IPCC GPG Table 2.16 (for transmission sum of lower values for venting and fugitives; for storage the lower value).

Table 86: Activity data and emissions for Fugitive Emissions from Fuels – Natural Gas Distribution and Sour Gas Processing 1990–2006.

Year	Natural Gas Distribution		Sour Gas Processing	
	Gas network [km]	CH_4 Emissions [Gg]	Sour Gas Prod. [1 000 m³]	CO_2 Emissions [Gg]
1990	15 200	9.35	248 090	59
1991	16 396	10.08	285 901	68
1992	17 779	10.93	357 135	80
1993	19 051	11.72	321 653	75
1994	20 743	12.76	363 582	80

Year	Natural Gas Distribution		Sour Gas Processing	
	Gas network [km]	CH_4 Emissions [Gg]	Sour Gas Prod. [1 000 m³]	CO_2 Emissions [Gg]
1995	22 358	13.75	405 638	89
1996	23 391	14.39	136 737	30
1997	24 661	15.17	406 177	89
1998	25 792	15.86	367 195	81
1999	27 300	16.79	352 318	81
2000	28 800	17.71	358 357	93
2001	29 700	18.27	393 492	95
2002	31 500	19.37	347 513	83
2003	32 000	19.68	408 198	100
2004	33 800	20.79	373 099	88
2005	34 750	21.37	338 349	83
2006	35 350	21.74	402 990	92

Table 87: Activity data and emissions for Fugitive Emissions from Fuels – Natural Gas Transmission and Storage 1990–2006.

Year	Natural Gas Transmission (Pipelines Fugitive & Venting)			Natural Gas Storage	
	Pipelines [km]	CH_4 Emissions [Gg]	CO_2 Emissions [Gg]	Natural Gas Stored [Mm³]	CH_4 Emissions [Gg]
1990	1 032	2.99	0.03	1 500	0.65
1991	1 032	2.99	0.03	1 500	0.65
1992	1 032	2.99	0.03	1 625	0.70
1993	1 032	2.99	0.03	1 980	0.85
1994	1 032	2.99	0.03	1 329	0.57
1995	1 032	2.99	0.03	1 820	0.78
1996	1 238	3.59	0.03	1 820	0.78
1997	1 238	3.59	0.03	1 820	0.78
1998	1 238	3.59	0.03	1 820	0.78
1999	1 358	3.94	0.03	1 820	0.78
2000	1 358	3.94	0.03	1 665	0.72
2001	1 358	3.94	0.03	1 132	0.49
2002	1 358	3.94	0.03	789	0.34
2003	1 430	4.15	0.04	1 651	0.71
2004	1 430	4.15	0.04	1 716	0.74
2005	1 430	4.15	0.04	2 207	0.95
2006	1 548	4.49	0.04	2 962	1.27

3.5.3 QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in chapter 1.6. Additional checks performed are cross-checks between activities reported by the operators and activities from national statistics, wherever possible.

3.5.4 Uncertainty

For the key source 1 B 2 b Natural Gas – CH_4 an uncertainty estimate was made that was calculated from the combination of estimated uncertainties of the sub-sources.

Transmission: The total pipeline length crossing Austria is assumed to be well known (5% uncertainty). The uncertainty of the EF is estimated according to the range given in the GPG (40%).

Storage: The uncertainty of the AD (20%) results from the fact that the value reported for natural gas stored corresponds to the meter reading at the end of the respective year and not to a mean value of daily meter readings. The uncertainty of the EF is assumed to be high (100%), because of the wide range that is given in the GPG.

Distribution: The total length of distribution mains is assumed to be well known (5% uncertainty) The uncertainty of the EF is estimated according to the range given in the GPG (15%).

This leads to the combined uncertainty (using the Tier 1 approach, with weights for the contribution to total source emissions) of 4% for AD, 14% for EF, resulting in a total uncertainty of emissions of 15%.

3.5.5 Recalculations

Update of activity data:

1.B.1.a Coal Mining: Activity data for 2005 was updated according to information from the Association of Mining and Steel.

1.B.2.a Refining/Storage: Activity data for 2005 was updated according to data from the national energy balance.

1.B.2.b Distribution: Length of Distribution Network for 2005 was updated according to updated data from E-Control.

3.5.6 Planned improvements

It is planned to investigate the data availability for implementing a higher Tier method for the key source 1.B.2.b Fugitive Emissions from Fuels – Natural Gas.

4 INDUSTRIAL PROCESSES (CRF SECTOR 2)

4.1 Sector Overview

This chapter includes information on and descriptions of methodologies used for estimating greenhouse gas emissions as well as references for activity data and emission factors reported under IPCC Category *2 Industrial Processes* for the period from 1990 to 2006.

Emissions from this category comprise emissions from the following sub categories: *Mineral Products*, *Chemical Industry*, *Metal Production* and *Consumption of Halocarbons and* SF_6.

Only process related emissions are considered in this Sector; emissions due to fuel combustion in manufacturing industries are allocated in IPCC Category *1 A 2 Fuel Combustion – Manufacturing Industries and Construction* (see Chapter 3).

Categories where emissions are not occurring because there is no such production in Austria, and categories that are not estimated or included elsewhere are summarized in Table 95.

4.1.1 Emission Trends

In the year 2006, 11.8% of national total greenhouse gas emissions (without LULUCF) originated from industrial processes, compared to 12.8% in the base year 1990.

Greenhouse gas emissions from the industrial processes sector fluctuate during the period; they reach a minimum in 1993, which is mainly due to termination of primary aluminium production in Austria in 1992 which is an important source for PFC emissions. Since then emissions are slightly increasing, mainly due to increasing emissions from consumption of fluorinated compounds and iron and steel industry. From 2003 to 2004 emissions decrease again due to a strong decrease of N_2O emissions from Chemical Industry. Since then emissions are increasing again due to strongly increasing activities in the iron and steel industry.

In 2006, greenhouse gas emissions from Category *2 Industrial Processes* amount to 10 773 Gg CO_2 equivalent compared to 10 111 Gg in the base year. Figure 14 shows the trend of GHG emissions from this category for 1990–2006.

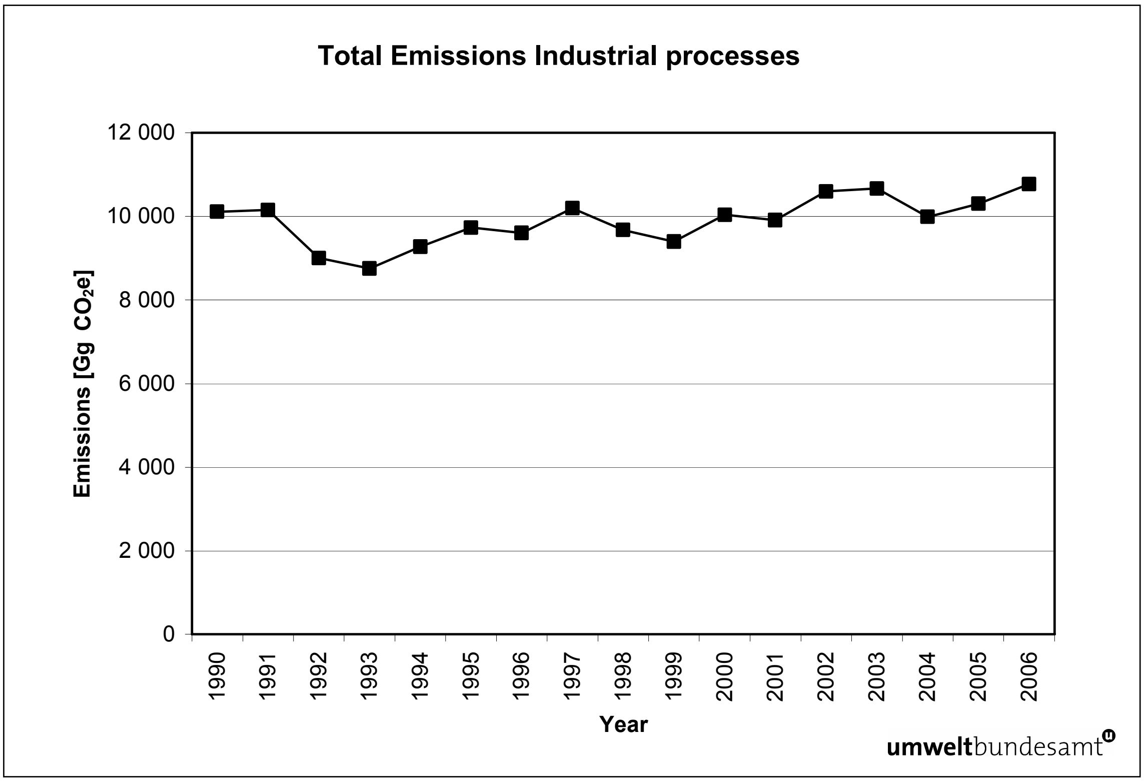

Figure 14: GHG emissions from IPCC Sector 2 Industrial Processes 1990–2006.

Emission trends by gas

Table 88 presents greenhouse gas emissions of the industrial processes sector as well as their share in total greenhouse gas emissions from that sector in the base year and in 2006.

Table 88: Greenhouse gas emissions from 2 Industrial Processes by gas in the base year and in 2006.

GHG	Base year*	2006	Base year*	2006
	CO_2 equivalent [Gg CO_2e]		[%]	
Total	10 110.82	10 773.09	*100.0%*	*100.0%*
CO_2	7 579.11	8 999.94	*75.0%*	*83.5%*
CH_4	14.83	19.33	*0.1%*	*0.2%*
N_2O	912.02	280.12	*9.0%*	*2.6%*
HFCs	23.03	857.80	*0.2%*	*8.0%*
PFCs	1 079.24	135.67	*10.7%*	*1.3%*
SF_6	502.58	480.24	*5.0%*	*4.5%*

* *1990 for all gases*

The most important GHG of the industrial processes sector is carbon dioxide with 83.5% of emissions from this category in 2006, followed by HFCs with 8.0%, SF_6 with 4.5%, N_2O with 2.6%, PFCs with 1.3% and finally CH_4 with 0.2%. Emissions by gas and their trends are presented in Table 89.

Table 89: Emissions from IPCC Category 2 Industrial Processes by gas from 1990–2006 and their trend.

GHG emissions [Gg CO_2e]							
	Total	**CO_2**	**CH_4**	**N_2O**	**HFCs**	**PFCs**	**SF_6**
1990	10 111	7 579	15	912	23	1 079	503
1991	10 153	7 425	15	927	45	1 087	653
1992	8 999	6 939	14	837	49	463	698
1993	8 751	6 853	15	879	157	53	794
1994	9 275	7 183	15	825	207	59	986
1995	9 729	7 382	14	857	267	69	1 139
1996	9 601	7 081	15	874	347	66	1 218
1997	10 193	7 671	15	863	427	97	1 120
1998	9 674	7 315	15	897	495	45	908
1999	9 391	7 162	15	923	542	64	684
2000	10 034	7 766	15	952	596	72	633
2001	9 907	7 694	14	786	694	82	637
2002	10 591	8 261	15	807	781	87	641
2003	10 662	8 205	15	883	863	102	594
2004	9 987	8 156	15	281	897	126	513
2005	10 300	8 691	16	274	908	125	286
2006	10 773	9 000	19	280	858	136	480
Trend 1990–2006	*7%*	*19%*	*30%*	*-69%*	*3 625%*	*-87%*	*-4%*

CO_2 emissions

As can be seen in Figure 15, CO_2 emissions from the industrial processes sector fluctuate during the period from 1990 to 2000; since 2001 the emissions tend upwards mainly due to increasing emissions from metal production. In 2006 CO_2 emissions from Industrial Processes amount to 9 000 Gg CO_2 equivalent, which corresponds to an increase of 19% compared to base year emissions (7 579 Gg).

About 57% of CO_2 emissions originate from *Metal Production (mainly Iron and Steel Production)* and about 37% from *Mineral Products*. The rest originates from *Chemical Industry (mainly Ammonia Production)*.

CH_4 emissions

As can be seen in Figure 15, CH_4 emissions from Industrial Processes fluctuate over the period from 1990 to 2004, since then they show an increasing trend, mainly due to augmented capacity in ethylene production. In 2006 emissions are 30% above base year level.

CH_4 emissions from this sector mainly arise from *Chemical Industry (Production of Urea and Fertilizers, Ethylene and Ammonia);* a minor source for CH_4 emissions is *Metal Production (Electric Furnace Steel Plants, Rolling Mills)*.

N_2O emissions

N_2O emissions from this sector arise from *Nitric Acid Production (Chemical Industry)*. As can be seen in Figure 15, N_2O emissions from the industrial processes sector fluctuate until 2000. From 2000 to 2001 emissions drop by 17%; this is due to the introduction of a new catalyst in the nitric acid plant. After an increase until 2003, emissions decrease strongly from 2003 to 2004 by 68%. This decrease is due to the installation of a N_2O decomposition facility in the nitric acid plant.

In 2006, N_2O emissions from *Industrial Processes* are 69% below the level of the base year.

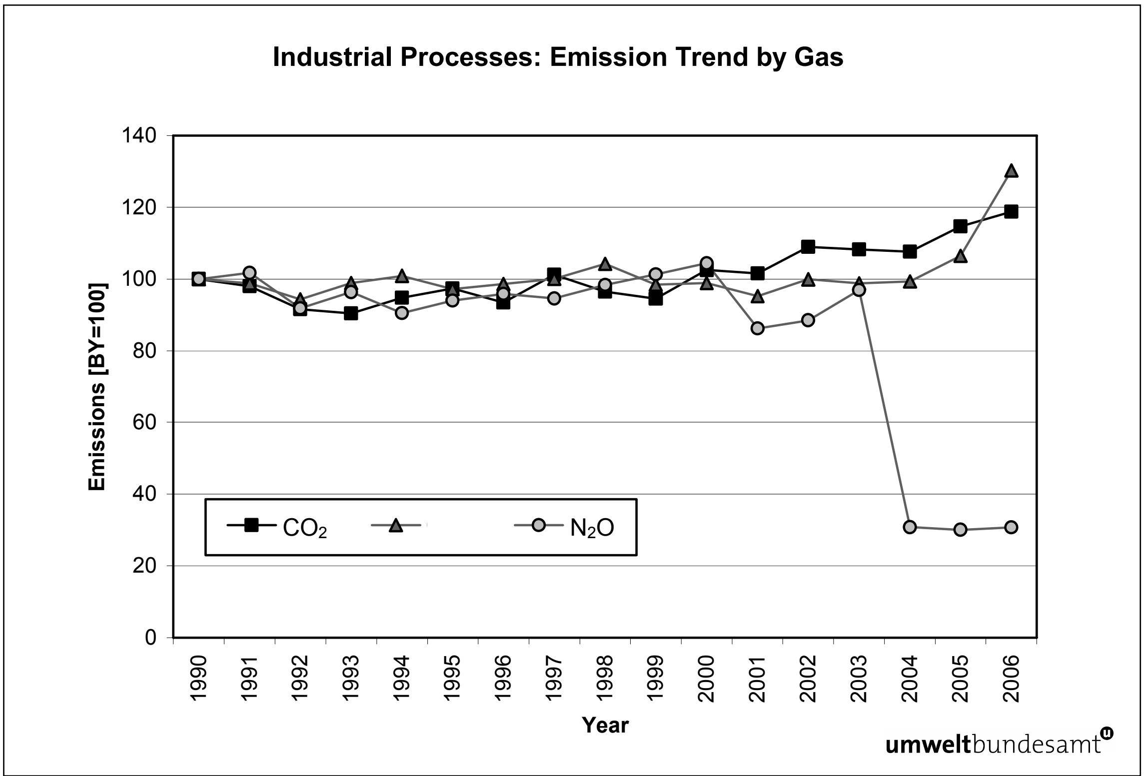

Figure 15: CO_2, CH_4 and N_2O emissions from Industrial Processes 1990–2006 in index form (base year = 100).

HFC emissions

As can be seen in Figure 16, HFC emissions increase remarkably during the period from 1990 to 2005. From 2005 to 2006 emissions decreased by 5.5% to 858 Gg CO_2 equivalents, which is about 40 times the level of the base year (1990).

HFC emissions mainly arise from *Refrigeration and Air Conditioning Equipment* and *Foam Blowing*.

PFC emissions

As can be seen in Figure 16, PFC emissions decrease remarkably during the period from 1990 to 2006. In 1990 PFC emissions amount to 1 079 Gg CO_2 equivalent, they decrease until 1993 to around 53 Gg CO_2 equivalent due to the termination of primary aluminium production in 1992 which was the major source for PFC emissions. Since then PFC emissions increased, and in the year 2006 they amounted to 136 Gg CO_2 equivalent, which is 87% below the level of the base year (1990).

In 2006 PFC emissions only arise from semiconductor manufacture.

SF_6 emissions

As can be seen in Figure 16, SF_6 emissions increase at the beginning of the period and reach a maximum in 1996, since then SF_6 emissions are decreasing again. The strong decrease between 2004 and 2005 is explained by a lower SF_6 use in Semiconductor Manufacture. The subsequent increase in 2006 is due to emissions from disposal of noise insulating windows. In 2006 SF_6 emissions amount to 480 Gg CO_2 equivalent, 4% below the level of the base year (1990).

In 2006 SF_6 emissions arise mainly from semiconductor manufacture, electric equipment and noise insulating windows.

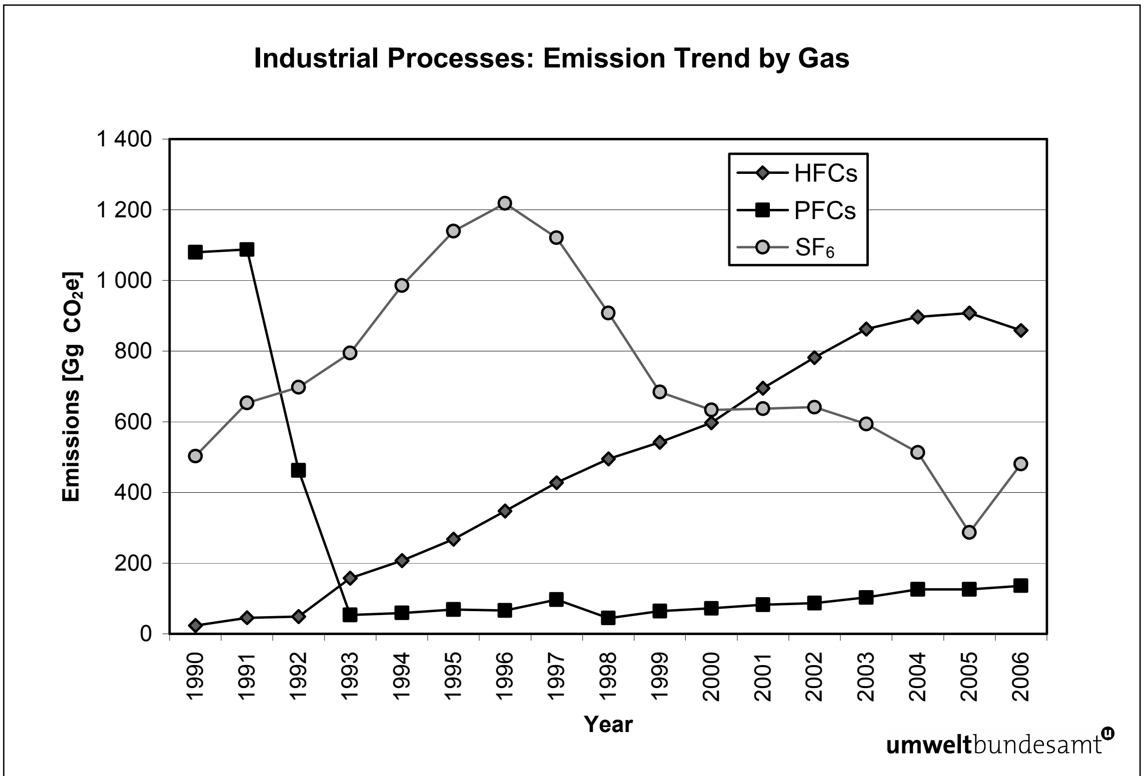

Figure 16: HFC, PFC and SF_6 emissions from Industrial Processes 1990–2006.

Emission trends by sources

The main sources of greenhouse gas emissions in the industrial processes sector are *Metal Production* and *Mineral Products*, which cause 47% and 31%, respectively, of the emissions from this sector in 2006 (see Table 90).

Emissions from processes in *Iron and Steel Production* are the most important single source of the industry sector. It is also one of the ten most important sources of Austria's greenhouse gas inventory (see below and Chapter 1.5).

Table 90: Greenhouse gas emissions from IPCC Category 2 Industrial Processes by sector, their share and trend for the base year and 2006.

	Emissions [Gg CO_2e]		Share [%]		Trend BY–2006
	BY*	2006	BY*	2006	
2 Industrial Processes	10 110.82	10 773.09	100.0%	100.0%	6.6%
A Mineral Products	3 269.05	3 294.35	32.3%	30.6%	0.8%
B Chemical Industry	1 511.91	898.61	15.0%	8.3%	-40.6%
C Metal Production	5 028.54	5 106.43	49.7%	47.4%	1.5%
F Consumption of Halocarbons and SF_6	301.33	1 473.71	3.0%	13.7%	389.1%

* *1990 for all gases*

Figure 17 and Table 91 present greenhouse gas emissions from IPCC Category *2 Industrial Processes* by sub category for the years 1990 to 2006.

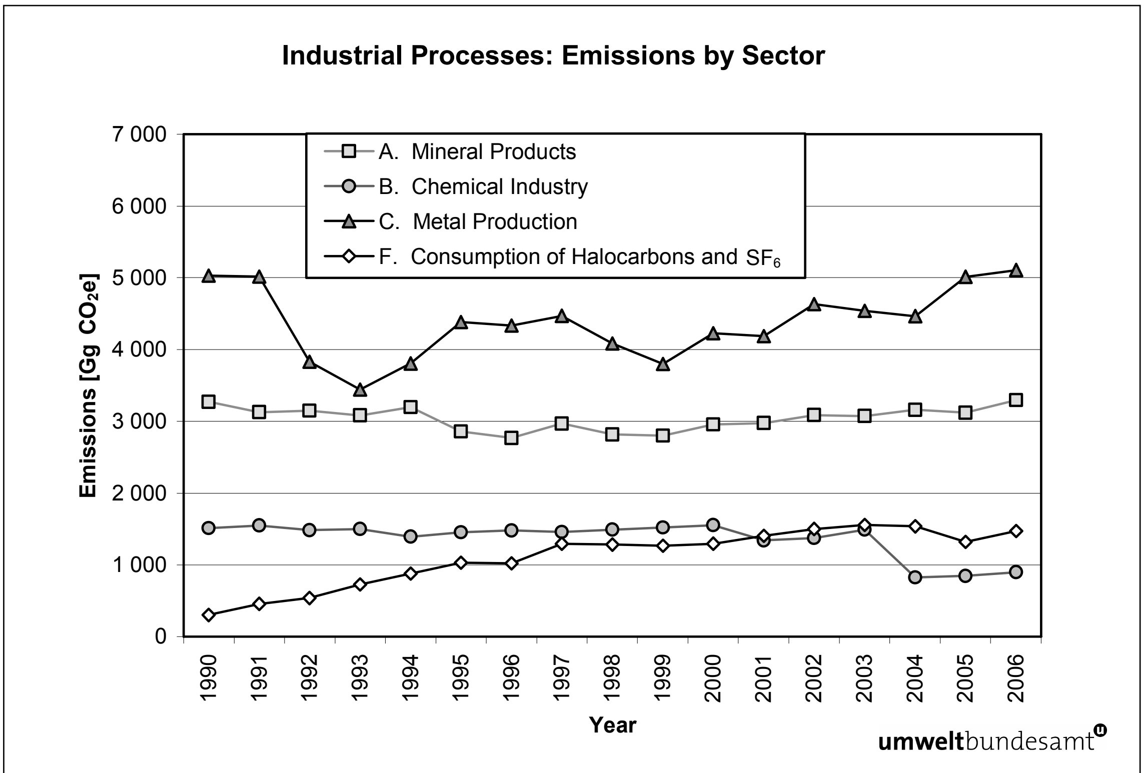

Figure 17: Emissions from IPCC Category 2 Industrial Processes per sub sector 1990–2006.

Table 91: Total greenhouse gas emissions from 1990–2006 by subcategories of Category 2 Industrial Processes.

GHG emissions [Gg CO_2 equivalent]					
	2 Total	**2.A**	**2.B**	**2.C**	**2.F**
1990	10 111	3 269	1 512	5 029	301
1991	10 153	3 127	1 551	5 016	458
1992	8 999	3 147	1 484	3 830	538
1993	8 751	3 082	1 499	3 443	727
1994	9 275	3 196	1 395	3 805	878
1995	9 729	2 857	1 455	4 385	1 032
1996	9 601	2 769	1 479	4 332	1 020
1997	10 193	2 969	1 460	4 468	1 295
1998	9 674	2 815	1 492	4 084	1 283
1999	9 391	2 801	1 521	3 801	1 268
2000	10 034	2 958	1 553	4 228	1 294
2001	9 907	2 977	1 340	4 185	1 405
2002	10 591	3 085	1 373	4 632	1 501
2003	10 662	3 073	1 490	4 540	1 559
2004	9 987	3 163	826	4 463	1 535
2005	10 300	3 120	847	5 014	1 319
2006	10 773	3 294	899	5 106	1 474

2.A Mineral Products

Greenhouse gas emissions decreased by 0.8% from 1990 to 2006 in this sub-category. In this sub-category emissions from *Magnesia Sinter Production* decreased between 1990 and 2006. Emissions from *Lime Production* and *Limestone and Dolomite Use* increased and emissions from *Cement Production* are back at base year level in 2006, after a minimum in 1995–1996.

Only CO_2 emissions arise from this source category.

2.B Chemical Industry

For the source *Chemical Industry* greenhouse gas emissions remain quite stable over the period from 1990 to 2003. From 2003 to 2004 emissions decrease by 45%, because of implemented mitigation techniques in the nitric acid production. In 2006 emissions are 41% below the level of the base year.

The main sources of this sub-category are CO_2 emissions from ammonia production and N_2O emissions from nitric acid production.

2.C Metal Production

Greenhouse gas emissions from *Metal Production* fluctuated over the period, which is mainly a result of a drop in PFC emissions from primary aluminium production which was terminated in 1992, and a strong increase in CO_2 emissions from *Iron and Steel Production* (+44%). The overall trend is a increase by 1.5% related to emissions of the base year (1990).

The main source of this sector is CO_2 emissions from pig iron production.

2.F Consumption of Halocarbons and SF_6

In 2006 greenhouse gas emissions are 5 times higher than base year emissions for the subcategory *Consumption of Halocarbons and SF_6.* This increase is mainly due to the higher consumption of HFCs as substitutes for ozone depleting substances (*ODS Substitutes*).

4.1.2 Key Categories

The methodology and results of the key category analysis is presented in Chapter 1.5. Table 92 summarizes the key sources in the IPCC Sector *2 Industrial Processes*.

Table 92: Key categories of Sector 2 Industrial Processes.

IPCC Category	Source Categories	Key Sources	
		GHG	KS-Assessment
2.A.1	Cement Production	CO_2	All
2.A.2	Lime Production	CO_2	All
2.A.3	Limestone and Dolomite Use	CO_2	LA95, 98–00, 06
2.A.7.b	Magnesia Sinter Plants	CO_2	All
2.B.1	Ammonia Production	CO_2	All LA
2.B.2	Nitric Acid Production	N_2O	LA90–03, TA
2.C.1	Iron and Steel Production	CO_2	All
2.C.3	Aluminium production	PFCs	LA90–92, TA
2.C.3	Aluminium production	CO_2	TA
2.C.4	SF_6 used in Al and Mg Foundries	SF_6	LA91–97, TA
2.F.1/2/3/4/5	ODS Substitutes	HFCs	LA95–06, TA
2.F.7	Semiconductor Manufacture	FCs	LA92–06, TA
2.F.9	Other Sources of SF6	SF_6	LA97, 98, 00

LA90 = Level Assessment 1990

LA06 = Level Assessment 2006

TA = Trend Assessment BY–2006

In the base year (1990), 12.4% of total greenhouse gas emissions in Austria originate from the 13 key sources of the industrial processes sector compared to 11.5% in 2006. These key sources cover 97% of total emissions from IPCC Sector *2 Industrial Processes.* The most important key source is *Iron and Steel Production* which has a share of 5.6% in total emissions in 2006. Emissions from *Cement Production* contribute with 2.1% to total emissions 2006 and 0.9% of total emissions originate from *ODS Substitutes*. All other key sources of the industrial processes sector had a share of less than 1% in national total greenhouse gas emissions in 2006 (see Table 93).

Table 93: Level Assessment for the base year and 2006 for the key sources of Category 2 Industrial Processes.

IPCC Category	Source Categories	GHG	Level Assessment	
			BY	2006
2.A.1	Cement Production	CO_2	2.6%	2.1%
2.A.2	Lime Production	CO_2	0.5%	0.6%
2.A.3	Limestone and Dolomite Use	CO_2	0.3%*	0.3%
2.A.7.b	Magnesia Sinter Plants	CO_2	0.6%	0.3%
2.B.1	Ammonia Production	CO_2	0.7%	0.6%
2.B.2	Nitric Acid Production	N_2O	1.2%	0.3%*
2.C.1	Iron and Steel Production	CO_2	4.5%	5.6%
2.C.3	Aluminium production	PFCs	1.3%	0.0%*
2.C.3	Aluminium production	CO_2	0.2%*	0.0%*
2.C.4	SF_6 used in Al and Mg Foundries	SF_6	0.3%*	0.0%*
2.F.1/2/3/4/5	ODS Substitutes	HFCs	0.0%*	0.9%
2.F.7	Semiconductor Manufacture	FCs	0.2%*	0.3%
2.F.9	Other Sources of SF_6	SF_6	0.2%*	0.3%*

* *lLevel Assessment does not meet the 95% threshold of that year*

4.1.3 Methodology

The general method for estimating emissions for the industrial processes sector, as recommended by the IPCC, involves multiplying production data for each process by an emission factor per unit of production.

In some categories emission and production data were reported directly by industry or associations of industries and thus represent plant specific data. Methodologies are described for all IPCC source categories.

For the sub category *2.B.1 Ammonia Production* the methodology has been changed to a method similar to IPCC Tier 2 including accounting for C bound using CS parameters. Furthermore a double counting with emissions from urea was corrected following recommendations of the ERT. As this methodology also uses country-specific parameters it is – in terms of the QMS – a CS method and has to be officially approved by the accreditation body, which is scheduled for spring 2008.

Detailed information on the methodology can be found in the corresponding subchapters, where it was applied.

4.1.3.1 Emission data reported under the European Emission Trading Scheme (ETS)

Verified CO_2 emissions reported under the EU ETS were available for the years 2005 and 2006. These emissions have been incorporated in the inventory as far as possible (see respective sub-chapters for more information). The relevant sources are 2.A.1 Cement Production, 2.A.2 Lime Production, 2.A.3 Limestone and Dolomite Use, 2.A.4 Soda Ash Use, 2.A.7a Bricks production, 2.A.7b Magnesia Sinter Plants and 2.C.1 Iron and Steel. Special attention was turned to time-series consistency. Furthermore the background data for the emission calculations under the ETS were used for further QA/QC checks.

4.1.4 Uncertainty Assessment

In this year's submissions uncertainty estimates for all key sources based on the IPCC GPG, on the uncertainty study cited in Chapter 1.7 and on expert judgement by Umweltbundesamt are provided (see Table 94, explanations see respective subchapters).

Table 94: Uncertainty assessment for key sources of Sector 2 Industrial Processes.

IPCC Category	Source Categories	Uncertainty [%]		
		Activity data	Emission factor	Emission estimate
2.A.1	Cement Production – CO_2	5.0	2.0	5.4
2.A.2	Lime Production – CO_2	20.0	5.0	20.6
2.A.3	Limestone and Dolomite Use – CO_2	19.6	2.0	19.7
2.A.7.b	Magnesia Sinter Plants – CO_2	2.0	5.0	5.4
2.B.1	Ammonia Production – CO_2	2.0	4.6	5.0
2.B.2	Nitric Acid Production – N_2O	0.0	5.0	5.0
2.C.1	Iron and Steel Production – CO_2	0.5	0.5	0.7
2.C.3	Aluminium production – PFC	0.0	50.0	50.0
2.C.3	Aluminium production – CO_2	2.0	0.5	2.1
2.C.4	SF_6 used in Al and Mg Foundries – SF_6	0.0	5.0	5.0
2.F.1/2/3/4/5	ODS Substitutes – HFC	20	50	53.9
2.F.7	Semiconductor Manufacture – FC	5	10	11.2
2.F.9	Other Sources of SF_6	25	50	55.9

4.1.5 Quality Assurance and Quality Control (QA/ QC)

For the Austrian Inventory an internal quality management system has been established. The QC procedures defined in the QMS correspond to general QC Tier 1 procedures defined in the IPCC GPG. For further information see Chapter 1.6.

Concerning measurement and documentation of emission data the Commission Decision 2004/156/EC establishes guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council that establishes a scheme for greenhouse gas emission allowance trading within the Community (EU ETS).

This decision provides general guidelines on emission reporting and verification as well as sector specific guidelines on the methodologies to account for process specific CO_2 emissions. These include guidance on calculations and measurements at different level of detail, similar to the different Tier methods in the IPCC guidelines.

The implementation of the European directive in Austria is furthermore supplemented by specific national regulations: the Austrian Emissions Certificate Trading Act[23] and the Ordinance regarding Monitoring and Reporting of Greenhouse Gas Emissions[24].

[23] "*Emissionszertifikate-Gesetz*", Federal Law Gazette I No. 46/2004

[24] „*Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Überwachung und Berichterstattung betreffend Emissionen von Treibhausgasen*", Federal Law Gazette II No. 458/2004

Furthermore, most of the plants that are reporting emission data – this includes plants that are not obliged to participate in the EU ETS – have quality management systems according to the ISO 9000-series or similar systems.

4.1.6 Recalculations

Compared to last year's inventory only few recalculations were made. A summary of these changes is presented below:

Update of activity data:

2.A.7.a Bricks: Activity data for 2005 was updated.

2.B.1 Ammonia: Natural gas consumption was updated according to data from the national energy balance.

2.C.2 Ferroalloys: Activity data for 2005 was updated.

2.F.3 Fire Extinguishers: the stocks of C_4F_{10} and HFC 23 were updated.

2.F.4 Aerosols and 2.F.5 Solvents:
Potential emissions were updated for the years 2003–2005 according to recalculations of the Austrian GDP in these years.

2.F.7 Semiconductor Manufacture: Potential emissions were updated for 2003 to 2005.

2.F.8 Electrical equipment: Potential emissions were updated for 2005.

Improvements of methodologies and emission factors:

2.F.2 Foam Blowing: HFC 245fa and HFC 365mfc emissions, previously reported as unspecified mix of HFC, were excluded from the GHG Inventory totals, because they are not fluorinated gases as defined in the CRF. They are now reported in CRF Table 9(b) as additional GHG.

For further information see the recalculation sections of the respective subchapters of this chapter and the tables presented in Chapter 9.

4.1.7 Completeness

Table 95 gives an overview of the IPCC categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this sub-category have been estimated, the grey shaded cells are those also shaded in the CRF.

Table 95: Overview of subcategories of Category 2 Industrial Processes: transformation into SNAP Codes and status of estimation.

	IPCC Category	SNAP		Status		
				CO_2	CH_4	N_2O
2.A	**MINERAL PRODUCTS**					
2.A.1	Cement Production	040612	Cement (decarbonising)	✓	NA	NA
2.A.2	Lime Production	040614	Lime (decarbonising)	✓	NA	NA
2.A.3	Limestone and Dolomite Use	040618	Limestone and Dolomite Use	✓	NA	NA
2.A.4	Soda Ash Production and Use	040619	Soda Ash Production and Use	✓	NA	NA
2.A.5	Asphalt Roofing	040610	Roof covering with asphalt materials	IE[1)]	NA	NA
2.A.6	Road Paving with Asphalt	040611	Road paving with asphalt	IE[1)]	NA	NA
2.A.7	*Other*					
	2.A.7.a Bricks	040617	Bricks (decarbonising)	✓	NA	NA
	2.A.7.b Magnesit Sinter	040617	Other – Magnesia Sinter Plants	✓	NA	NA
2.B	**CHEMICAL INDUSTRY**					
2.B.1	Ammonia Production	040403	Ammonia	✓	✓	NA
2.B.2	Nitric Acid Production	040402	Nitric acid	✓	NA	✓
2.B.3	Adipic Acid Production	040521	Adipic acid	NA	NA	NO[2)]
2.B.4	Carbide Production	040412	Calcium carbide production	✓	NA[3)]	NA
2.B.5	Other	040407 040408	NPK fertilisers Urea	✓	✓	NA
2.B.5	Other	040501	Ethylene production	NA	✓	NA
2.C	**METAL PRODUCTION**					
2.C.1	Iron and Steel Production	040202 040206 040207 040208	Blast furnace charging Basic oxygen furnace steel plant Electric furnace steel plant Rolling mills	✓	✓	NA
2.C.2	Ferroalloys Production	040302	Ferro alloys	✓	NA	NA
2.C.3	Aluminium Production	040301	Aluminium production (electrolysis) – except SF_6	✓/NO[4)]	✓/NO[4)]	NA
2.C.4	SF_6 Used in Aluminium and Magnesium Foundries	040301 040304	Aluminium Production – SF_6 only Magnesium Production – SF_6 only		SF_6 ✓	
2.C.5	*Other*					
2.D	**OTHER PRODUCTION**					
2.D.1	*Pulp and Paper*					
2.D.1	*Food and Drink*			NA[5)]	NA	NA

	IPCC Category		SNAP	HFCs, PFCs, SF_6
2.E	**PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE**	0408	Production of halocarbons and sulphur hexaflouride	NO[(6)]
2.F	**CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE** [7)]	0605	Use of HFC, PFC and SF_6	
2.F.1	Refrigeration and Air Conditioning Equipment			✓
2.F.2	Foam Blowing			✓
2.F.3	Fire Extinguishers			✓
2.F.4	Aerosols			✓
2.F.5	Solvents			✓
2.F.6	Other applications using ODS substitutes			NO
2.F.7	Semiconductor Manufacture			✓
2.F.8	Electrical Equipment			✓
2.F.9	*Other*			✓

1) *Emissions are included in Sector 3 Solvent and Other Product Use.*

2) *There is no adipic acid production in Austria.*

3) *Silicon carbide is not produced in Austria.*

4) *Primary aluminium production was terminated in 1992.*

5) *CO_2 emissions from this source are of biogenic origin.*

6) *There is no production of halocarbons or SF_6 in Austria.*

7) *No corresponding SNAP category is presented here as the actual estimation is based on IPCC Categories.*

4.1.8 Planned Improvements

The data availability problem in this sector that occurred in previous submissions is solved for all key sources. The ordinance that regulates monitoring and reporting in the context of the EU Emissions Trading scheme in Austria also regulates that data reported from the plant operators can be used for the inventory (see Chapter 1.2.

During the in-country review of the initial report of Austria (February 2007) the ERT encouraged to further investigate whether emissions occur from foam manufacturing/installation (or other ODS substitute applications) to determine whether emissions are currently being underestimated. It is planned to make these investigations.

4.2 Mineral Products (CRF Source Category 2.A)

4.2.1 Cement Production (2.A.1)

4.2.1.1 Source Category Description

Emissions: CO_2

Key Source: *Yes* (CO_2)

CO_2 emissions from cement production is a key source because of its contribution to the level of the greenhouse gas inventory of all years and was also identified as key in the trend analysis. In 2006 CO_2 emissions from cement production contributed 2.1% to total greenhouse gas emissions in Austria (see Table 93).

In this category process specific CO_2 emissions are reported, emissions due to combustion are reported in the energy sector (category *1.A.2.f*).

Process specific CO_2 is emitted during the production of clinker (calcination process) when calcium carbonate ($CaCO_3$) is heated in a cement kiln up to temperatures of about 1 300°C. During this process calcium carbonate is converted into lime (CaO – Calcium Oxide) and CO_2.

Table 96 presents the process-related CO_2 emissions from the production of cement for the period from 1990 to 2006.

Table 96: CO_2 emissions from decarbonising from cement production 1990–2006.

Year	Process specific CO_2 emissions [Gg]	Clinker [t/a]	IEF [kg/t_{Cl}]
1990	2 033	3 693 539	551
1991	2 005	3 635 462	552
1992	2 105	3 820 397	551
1993	2 032	3 678 293	552
1994	2 102	3 791 131	555
1995	1 631	2 929 973	557
1996	1 634	2 915 956	560
1997	1 761	3 103 312	567
1998	1 599	2 869 035	557
1999	1 607	2 891 785	556
2000	1 712	3 052 974	561
2001	1 720	3 061 338	562
2002	1 736	3 118 227	557
2003	1 754	3 119 808	562
2004	1 790	3 222 802	555
2005	1 797	3 221 167	558
2006	1 954	3 653 477	535

CO_2 emissions (see Table 96) are quite constant from 1990 to 1994; 1995 they drop by 21.7% compared to the previous year, due to a drop in clinker production of almost 20%. This drop is due to an economic turndown in cement industry and the shutdown of one clinker oven. Since 1995 emissions as well as production of cement are slowly increasing again with only minor fluctuations. The overall trend from 1990 to 2006 is minus 4%.

4.2.1.2 Methodological Issues

Emissions were estimated using a country specific method similar to the IPCC Tier 2 methodology.

Activity data (clinker production) as well as emission data were taken from studies on emissions from the Austrian cement production industry (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003 and MAUSCHITZ 2004). The studies cover the years 1988 to 2003.

In these studies process-specific CO_2 emissions and CO_2 emissions due to combustion are presented separately. In the course of these studies all cement production plants in Austria were investigated. The determination of the emission data took place by inspection of every single plant, recording and evaluation of plant specific records and also plant specific measurements and analysis carried out by independent scientific institutes.

Activity data and emissions for 2004 were reported directly by the Association of the Austrian Cement Industry as well as activity data for 2005 and 2006. For 2005 and 2006 verified CO_2 emissions, reported under the ETS, were used for the inventory. These data cover the whole cement industry in Austria. The methodology for these emission calculations is the same like in the years before.

CO_2 emissions from the raw meal calcination (decarbonising) were calculated from the raw meal composition:

$$M_{(CO2\ calc)} = \sum_k (m_{(raw\ meal)})_k \cdot x_{(CaCO3)k} \cdot (44.0088/100.0892)$$

Whereas:

m *mass stream [kg/a]*

x *mass portion*

k *for the k^{th} cement plant*

The raw meal composition was determined at every Austrian plant, considering also the $MgCO_3$ content of the raw meal. Based on this data and plant specific production data total emissions from this source were calculated.

With the used methodology no cement kiln dust (CKD) correction factor has to be considered. However, in the Austrian plants cement kiln dust is returned back into the process.

4.2.1.3 Source specific QA/QC

The analysis of the raw material was carried out by independent scientific institutes. Cement production was checked with statistical data to ensure completeness. The Association of the Austrian Cement Industry reported total CO_2 emissions, which were compared with the ETS data and found to accord.

4.2.1.4 Uncertainty Assessment

As the applied methodology is based on plant specific data, the uncertainty of activity data is assumed to be low (5%). According to the IPCC GPG (p. 3.14) the uncertainty of the CO_2 emission factor for Tier 2 is low (1–2%). In the Austrian method the uncertainty derives basically from the raw meal composition as the uncertainty for the stochiometric emission factor is negligible; thus, the uncertainty of the emission factor is assumed to be 2%. This results in a combined uncertainty of 5.4% (according to the IPCC GPG Table 3.2, the uncertainty for emissions using Tier 2 methodology (based on clinker production data) is 5–10%).

4.2.1.5 Recalculations

No recalculations have been required for this version of the inventory.

4.2.2 Lime Production (2.A.2)

4.2.2.1 Source Category Description

Emissions: CO_2

Key Source: Yes (CO_2)

CO_2 emissions from lime production is a key source because of its contribution to the total inventory's level in all inventory years and to the trend of emissions of the total greenhouse gas inventory. In the year 2006 emissions from this category contributed 0.6% to the total amount of greenhouse gas emissions in Austria (see Table 93).

CO_2 is emitted during the calcination step of lime production. Calcium carbonate ($CaCO_3$) in limestone and calcium/ magnesium carbonates in dolomite rock ($CaCO_3$•$MgCO_3$) are decomposed to form CO_2 and quicklime (CaO) or dolomite quicklime (CaO•MgO) respectively.

Table 97 presents activity data for this category (lime produced) as well as CO_2 emissions from lime production for the period from 1990 to 2006.

Table 97: Activity data and CO_2 emissions for Lime production 1990–2006.

Year	Lime Produced [t/a]	CO_2 emissions Gg]	CO_2 IEF [kg/Mg]
1990	512 610	396	773
1991	477 135	361	757
1992	462 392	355	768
1993	479 883	365	761
1994	518 544	390	753
1995	522 934	395	755
1996	505 189	383	758
1997	549 952	412	750
1998	594 695	454	763
1999	595 978	453	760
2000	654 437	498	760
2001	666 633	507	760
2002	719 246	547	760

Year	Lime Produced [t/a]	CO_2 emissions Gg]	CO_2 IEF [kg/Mg]
2003	756 140	577	763
2004	788 790	601	762
2005	760 464	579	761
2006	780 873	586	750

The overall trend for CO_2 emissions from this category is increasing emissions, in the year 2006 emissions were 48% higher than 1990 (see Table 97).

4.2.2.2 Methodological Issues

Emissions were estimated using a country specific method based on detailed production data.

Activity data and emission values were reported by the *Association of the Stone & Ceramic Industry.* For 2005 and 2006 verified CO_2 emissions reported under the ETS were used for the inventory. These data cover the whole lime producing industry in Austria. The methodology for this emission calculation is the same like in the years before.

The reported CO_2 emission data is based on data of each lime production plant in Austria, considering the CaO and MgO content either from limestone or lime at the different plants and calculating CO_2 emissions from the stoichiometric ratios (using IPCC default emission factors).

4.2.2.3 Source specific QA/QC

Lime production was checked with statistical data. The IEF are compared with IPCC default values. The Association of the Stone & Ceramic Industry reported total CO_2 emissions, which were compared with the ETS data and found to accord.

4.2.2.4 Uncertainty Assessment

Uncertainties for activity data are considered to be low as it is based on plant specific data of all Austrian plants. However, according to the IPCC GPG (p 3.22) omission of non-marketed lime production may lead to an error of +100% or more. Considering the Austrian circumstances (none of the industries identified in IPCC GPG were identified in the surveys made for the National Allocation Plans) the uncertainty of activity data is assumed to be plus 20% and minus 5%. The uncertainty of the emission factor derives basically from the raw-material composition and is assumed to be 5%. This leads to a combined uncertainty of 20.6% (calculating with the plus 20% of activity data).

4.2.2.5 Recalculations

No recalculations have been required for this version of the inventory.

4.2.3 Limestone and Dolomite Use (2.A.3)

4.2.3.1 Source Category Description

Emissions: CO_2

Key Source: Yes (CO_2)

CO_2 emissions from limestone and dolomite use is a key source because of its contribution to the total inventory's level for the years 1995, 1998–2000 and 2006. In the year 2006 emissions from this category contributed 0.3% to the total amount of greenhouse gas emissions in Austria (see Table 93).

In this category CO_2 emissions from decarbonising of limestone and dolomite in the glass industry, in the iron and steel industry, the limestone use for desulphurization and in chemical industry are considered.

Emissions from this category increased by 33% between 1990 and 2006 mainly due to increased limestone use in iron and steel industries.

Table 98: Activity data and CO_2 emissions for Limestone and Dolomite Use 1990–2006.

Year	Limestone Used [t/a]	Dolomite Used [t/a]	CO_2 emissions [Gg]
1990	479 376	24 020	222
1991	481 769	27 646	225
1992	439 897	24 463	205
1993	439 433	24 485	205
1994	471 505	26 212	220
1995	542 377	26 225	251
1996	487 657	26 225	227
1997	551 173	24 457	254
1998	573 724	24 457	264
1999	533 213	26 826	247
2000	601 844	22 624	276
2001	587 220	26 573	271
2002	634 620	23 477	290
2003	638 899	30 368	296
2004	655 220	19 208	297
2005	644 921	21 241	291
2006	659 546	23 264	296

4.2.3.2 Methodological Issues

Emissions were estimated using the methodology and the default emission factor of the IPCC guidelines for the years 1990–2004.

Activity data for limestone and dolomite used in glass industry were reported by the *Association of Glass Industry* for the years 2002–2004, for the years before activity data was estimated using a constant ratio of limestone and dolomite used per ton of glass produced (glass production was reported by the *Association of Glass Industry* for all years).

Activity data for limestone used in blast furnaces for the years 1998 to 2002 was reported directly by the plant operator of the two integrated iron and steel production sites that operate blast furnaces. For the years before and after activity data was estimated using the average ratio of limestone used per ton of pig iron produced of the years 1998–2002.

For 2005 and 2006 verified CO_2 emissions and activity data, reported under the ETS, were used for the inventory. These data cover limestone and dolomite use in the glass, the iron and steel and chemical industry.

Activity data for limestone used for desulphurization were taken from a national report on desulphurization technologies in Austria (WINDSPERGER & HINTERMEIER 2002). The time series was constructed with the help of plant specific SO_2 emission declarations from the annual steam boiler database. For 2005 additional information due to emissions reported under the ETS was included.

For calculation of CO_2 emissions the IPCC default emission factors of 440 kg CO_2/t limestone and 477 kg CO_2/t dolomite were used. Since 2005 ETS background data provided more detailed information on the actual carbon content of the limestone and dolomite used. Therefore, the IEFs since 2005 are slightly different to the IPCC default values.

4.2.3.3 Source specific QA/QC

Limestone and dolomite use in glass industry is checked with glass production figures.

4.2.3.4 Uncertainty Assessment

According to the IPCC GPG (Table. 3.4) the uncertainty of the CO_2 emission factor is ±2%. This derives from the uncertainty about the composition and fractional purity of limestone in $CaCO_3$ (or of dolomite in $CaCO_3 \cdot MgCO_3$) per tonne of total raw material.

Uncertainty of activity data derives mainly from omission of limestone and dolomite use in unidentified industries. For limestone it is assumed to be plus 20% and minus 10%, because the use in iron and steel industry covers the major part and this is included. Dolomite use covers only glass industry, therefore the uncertainty is assumed to be high (plus 100%). This results in a combined uncertainty of activity data of 19.6%, using the higher limits and taking into account their respective shares in total emissions from this sector; and leads to a combined uncertainty of emissions of 19.7%.

4.2.3.5 Recalculations

No recalculations have been required for this version of the inventory.

4.2.4 Soda Ash Use (2.A.4)

4.2.4.1 Source Category Description

Emissions: CO_2

Key Source: *No*

In this category CO_2 emissions from decarbonising of soda used in glass industry is considered. In 2006 emissions from this category contributed 0.02% to total emissions in Austria. The following table presents CO_2 emissions from this category.

Table 99: Activity data and CO_2 emissions for Soda Use 1990–2006.

Year	Soda Used [t/a]	CO_2 emissions [Gg]
1990	46 690	19
1991	53 737	22
1992	47 551	20
1993	47 593	20
1994	50 950	21
1995	50 975	21
1996	50 975	21
1997	47 539	20
1998	47 539	20
1999	52 144	22
2000	43 976	18
2001	51 652	21
2002	45 633	19
2003	45 263	19
2004	28 559	12
2005	36 876	15
2006	38 644	16

4.2.4.2 Methodological Issues

Emissions were estimated using the methodology and the default emission factor of the IPCC guidelines.

Activity data for soda used in glass industry were reported from the *Association of Glass Industry* for the years 2002–2004, for the years before activity data was estimated using a constant ratio of soda used per ton of glass produced, taken from the data reported for 2002 (glass production was reported by the *Association of Glass Industry* for all years).

For 2005 and 2006 verified CO_2 emissions and activity data, reported under the ETS, were considered for the inventory. These data cover soda ash use in the glass industry.

For calculation of CO_2 emissions from 1990 to 2004 the IPCC default emission factor of 415 kg CO_2/t soda was used. For 2005 and 2006 ETS background data provided more detailed information on the actual carbon content of the limestone and dolomite used. Therefore, the IEF since 2005 slightly differs from the IPCC default value.

4.2.4.3 Recalculations

No recalculations have been required for this version of the inventory.

4.2.5 Asphalt Roofing (2.A.5) and Road Paving with Asphalt (2.A.6)

Emissions previously reported under these categories resulted from asphalt roofing production and bitumen production as well as pre-painting before the asphalt roofing or road paving. However, these emissions are already accounted for in the solvents sector, that's why emissions are reported as included elsewhere "IE".

4.2.6 Mineral Products – Other (2.A.7)

4.2.6.1 Source Category Description

In this category bricks (decarbonising) and magnesia sinter production are addressed.

4.2.6.2 Bricks Production

Emissions: *CO_2*

Key Source: *No*

This category includes CO_2 emissions from the production of bricks where CO_2 is generated through decomposition of the carbonate content of the raw materials.

Table 100 presents CO_2 emissions from bricks production for the period from 1990 to 2006. CO_2 emissions from bricks production had a maximum in 1995/1996, following brick production. In the year 2006 emissions from this category contributed 0.1% to the total amount of greenhouse gas emissions in Austria.

Methodological Issues

No IPCC methodology is available for this source.

Emission values for the years 1998–2001 were reported by the *Association of the Stone & Ceramic Industry*. The reported CO_2 emission data is based on data of the different brick production sites in Austria, considering the carbonate contents of raw materials used for bricks production at the different plants and calculating CO_2 emissions from the stoichiometric ratios (using IPCC default emission factors). For 2005 and 2006 verified CO_2 emissions, reported under the ETS, were taken for the inventory. These data cover the whole brick industry in Austria.

Activity data for the production of bricks was taken from national statistics (STATISTIK AUSTRIA), for 1996 the value of 1995 was used due to lack of data. From the IEF for 1998 emissions of the years before 1998 were calculated; and the IEF from 2001 was used to calculate emissions after 2001.

Table 100 presents activity data for production of bricks and CO_2 emissions for this category for the period from 1990 to 2006.

Table 100:Activity data and CO_2 emissions for Bricks Production 1990–2006.

Year	Bricks [t/a]	CO_2 emissions [Gg]	CO_2 IEF
1990	2 230 000	116	52.23
1991	2 333 852	122	52.23
1992	2 412 902	126	52.23
1993	2 593 236	135	52.23

Year	Bricks [t/a]	CO_2 emissions [Gg]	CO_2 IEF
1994	2 675 473	140	52.23
1995	2 848 716	149	52.23
1996	2 848 716	149	52.23
1997	2 625 046	137	52.23
1998	2 557 448	134	52.23
1999	2 184 773	122	55.62
2000	1 954 855	116	59.30
2001	1 959 395	124	63.15
2002	1 904 142	120	63.15
2003	1 833 557	116	63.15
2004	2 116 786	134	63.15
2005	2 170 069	128	58.99
2006	2 130 866	130	60.98

The increasing IEF between 1998 and 2001 is due to a switch in porous material used in brick production. Previously mainly sawdust was used, whereas nowadays residual fibre material from paper industry is used. Furthermore, $CaCO_3$ is added for moisture compensation.

Generally, fluctuations in the IEF occur because of different brick types produced. The higher the density of the particular brick, the more CO_2 is emitted during production. High and low density bricks have different properties. Consequently, fluctuating quantities of brick types are produced from year to year depending on the demand.

Recalculations

Activity data for 2005 were updated according to national statistics, but this has no effect on CO_2 emissions.

4.2.6.3 Magnesia Sinter Production

Emissions: *CO_2*

Key Source: *Yes (CO_2)*

This category includes CO_2 emissions from the production of magnesia sinter. CO_2 emission from magnesia sinter production is a key source both due to the contribution to total emissions of all inventory years and also with regard to the trend assessment. In 2006 it contributed 0.3% to the total amount of greenhouse gas emissions in Austria (see Table 93).

During production of magnesia sinter CO_2 is generated during the calcination step, when magnesite ($MgCO_3$) is sintered at high temperatures in a kiln to produce MgO. Magnesia sinter is processed in the refractory industry.

Table 101 presents CO_2 emissions from production of magnesia sinter for the period from 1990 to 2006. CO_2 emissions from magnesia sinter plants vary over the period from 1990 to 2006 with an overall decreasing trend. In 2006 emissions are 35% less than in 1990.

Fluctuations in CO_2 emissions from this category are explained by:

- Varying implied emission factors that reflect different qualities of sinter produced and proportions of sinter/caustic sinter production.
- Varying production figures. The decrease in production figures between 1990 and 1992 results from a more efficient sinter production process due to a higher quality of the magnesite raw material.

Methodological Issues

No IPCC methodology is available for this source.

Emission values and activity data were directly reported by the only company in Austria sintering magnesia. For 2005 and 2006 verified CO_2 emissions, reported under the ETS, were taken for the inventory.

Emissions are calculated stoichiometrically according to Calculation method B: Alkali Oxides (2004/156/EC Guidelines for the monitoring and reporting of GHG emissions, Annex X). Oxides are measured by X-ray fluorescence analysis.

Table 101 presents activity data and CO_2 emissions from this category for the period from 1990 to 2006.

Table 101: CO_2 emissions from Magnesia Sinter Production 1990–2006.

Year	Magnesite [t]	CO_2 Emissions [Gg]	CO_2 IEF [kg/Mg]
1990	966 066	481	498
1991	795 932	392	492
1992	675 284	336	498
1993	670 294	325	484
1994	669 260	323	482
1995	753 575	410	544
1996	744 726	355	477
1997	801 273	384	480
1998	716 869	345	482
1999	716 959	350	488
2000	699 707	339	485
2001	691 278	334	483
2002	766 887	374	487
2003	651 332	311	478
2004	655 236	329	501
2005	638 749	310	485
2006	608 737	312	513

Source specific QA/QC

The calculation is based on a European recognized standard method. Order of magnitude and time-series checks are performed. The operator is contacted in case of inconsistencies. The operator reported total CO_2 emissions, which were compared with the ETS data and found to accord.

Uncertainty Assessment

Emissions were calculated based on stoichiometric ratios and this is a fixed number, therefore the uncertainty of the emission factor is the uncertainty of raw material composition which is estimated to be about 5%. The uncertainty of activity data is assumed to be low (2%) as there is only one plant in Austria and data is obtained from this plant.

Recalculations

No recalculations have been required for this version of the inventory.

4.3 Chemical Industry (CRF Source Category 2.B)

4.3.1 Ammonia Production (2.B.1)

4.3.1.1 Source Category Description

Emissions: *CO_2 and CH_4*

Key source: *Yes (CO_2)*

CO_2 emissions from production of ammonia are a key source due to the contribution to the level of total emissions of the Austrian greenhouse gas inventory of all years from 1990 to 2006. In 2006 it contributed 0.6% to the total amount of greenhouse gas emissions in Austria (see Table 93).

Ammonia (NH_3) is produced by catalytic steam reforming of natural gas or other light hydrocarbons (e.g. liquefied petroleum gas, naphtha) – in Austria natural gas is used. By way of these processes the feedstock is reformed with steam in a heated primary reformer and subsequently with air in a second reformer in order to produce the synthesis gas. CO_2 is produced by stoichiometric conversion and is mainly emitted during the primary reforming step.

One half of the methane introduced in the synthesis is CH_4 that is generated in the so called methanator: small amounts of CO and CO_2, remaining in the synthesis gas, are poisonous for the ammonia synthesis catalyst and have to be removed by conversion to CH_4 in the methanator. The other half is recycled methane that has not been converted in the reforming step. Only a small part of the methane is actually emitted, the main part is used as a fuel in the primary reformer.

Table 102 presents CO_2 and CH_4 emissions from ammonia production as well as ammonia production figures and natural gas input for the period from 1990 to 2006.

Emissions vary during the period and follow closely the trend in ammonia production. CO_2 emissions reach a first minimum in 1994 and a second in 2001, both due to low production numbers. In 2006 CO_2 emissions are 5% higher than in the base year.

4.3.1.2 Methodological Issues

Activity data since 1990 and CH_4 emission data from 1994 onwards were reported directly to the Umweltbundesamt by the only ammonia producer in Austria and thus represent plant specific data. The composition of the synthesis gas is measured regularly at the only ammonia producer in Austria. CH_4 emissions are calculated from the measured synthesis gas composition and the number and duration of start-ups. The implied emission factor for CH_4 that was calculated from activity and emission data from 1994 was applied to calculate emissions of the years 1990 to 1993 as no emission data was available for these years.

CH_4 emission factors of ammonia plants depend largely on the number of shutdowns and start ups during the year. Especially a start up after a turn around with exchange of catalyst in some of the reactors of the plant (as in 1998) needs a prolonged start up procedure. This causes an increase of emissions without production of ammonia.

CO_2 emissions are calculated from the natural gas input – Tier 2 method of the IPCC guidelines – (non-energy use from the national energy balance) with a standard emission factor (55.4 t/TJ). For the years 1990, 1991 and 1993 natural gas input was calculated from Ammonia Production with the conversion factor 0.451 t/t NH_3, because natural gas input in the Energy Balance exceeded by far ammonia production capacity in these years.

In this methodology it is assumed that all natural gas is transformed to CO_2 and emitted at once. But, according to information from the producer, there are also CH_4 emissions during start-ups of the ammonia production. Therefore this CH_4 has to be subtracted from total CO_2 to avoid double counting. Furthermore, CO_2 and CH_4 emissions from urea production are reported, that both derive directly from ammonia (see chapter 4.3.4.2 for further information). These emissions are reported under urea production – where they occur – and are also subtracted from total CO_2 emissions from ammonia production to avoid double counting of emissions. CO_2 is directly subtracted and CH_4 is converted to CO_2 by multiplying with the stoichiometric ratio (44/12) and subsequently subtracted.

According to the IPCC guidelines no account should be taken for intermediate binding of CO_2 in downstream manufacturing processing and products. Nevertheless in the Austrian ammonia production facility melamine is produced from urea, a product in which carbon can be considered to be stored for a long time. Melamine is primarily used to produce melamine resin, which when combined with formaldehyde produces a very durable thermoset plastic. Melamine is fire resistant and heat tolerant and has a highly stable structure. Thus, account was taken for the carbon bound in the melamine production. Carbon stored was calculated stoichiometrically from urea input for melamine production, and was subtracted from the total CO_2 emissions.

Table 102 shows all the relevant parameters for the calculation of CO_2 emissions from ammonia production. The resulting CO_2 IEF (with respect to ammonia) is decreasing over time, because of the increasing melamine production.

Table 102:Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from ammonia production 1990–2006.

Year	Ammonia Produced [t]	Natural gas input [TJ]	Carbon stored [Gg C]	CO_2 Emissions [Gg]	IEF CO_2 [kg/ t Ammonia]	CH_4 Emissions [Mg]
1990	461 000	10 239	13.6	517	1 121	62.2
1991	475 000	10 550	10.4	546	1 149	64.1
1992	432 000	10 735	11.2	553	1 280	58.3
1993	469 000	10 417	10.2	539	1 149	63.3
1994	444 000	10 036	13.1	507	1 142	59.9
1995	473 000	10 518	12.2	537	1 136	61.2
1996	484 772	10 781	15.7	539	1 111	59.1
1997	479 698	10 669	15.8	532	1 109	81.1
1998	484 449	10 554	15.9	525	1 084	102.0
1999	490 493	10 644	15.9	530	1 081	54.8
2000	482 333	10 504	17.2	518	1 074	60.0
2001	448 176	9 945	21.2	472	1 054	51.0

Year	Ammonia Produced [t]	Natural gas input [TJ]	Carbon stored [Gg C]	CO_2 Emissions [Gg]	IEF CO_2 [kg/ t Ammonia]	CH_4 Emissions [Mg]
2002	464 028	10 336	23.3	486	1 048	68.8
2003	510 887	11 278	26.6	526	1 030	47.3
2004	510 024	10 292	27.1	470	921	56.4
2005	478 427	10 795	25.7	503	1 051	93.9
2006	502 286	11 512	25.9	542	1 079	105.1

4.3.1.3 Source specific QA/QC

Emission factor is consistent with emission factor used in fuel combustion. Natural gas input from energy balance is checked for plausibility with ammonia production figures.

4.3.1.4 Uncertainty assessment

As activity data are obtained from the only ammonia plant in Austria and from the national energy balance, uncertainty is rated as very low (2%). Also the emission factor and other conversion factors are considered to have low uncertainties. Thus, the quality of emission estimates is rated as "high" (5% uncertainty).

4.3.1.5 Recalculations

Natural gas consumption was updated according to data from the national energy balance.

4.3.2 Nitric Acid Production (2.B.2)

4.3.2.1 Source Category Description

Emission: N_2O, CO_2

Key Source: *Yes* (N_2O)

N_2O emissions from nitric acid production is a key source due to the contribution to the level of total emissions of the Austrian greenhouse gas inventory in the years 1990 to 2003 and to the trend of emissions. In 2006 it contributed 0.3% to the total amount of greenhouse gas emissions in Austria (see Table 93).

Nitric acid (HNO_3) is manufactured from ammonia (NH_3). In a first step NH_3 reacts with air to NO and NO_2 and is then transformed with water to HNO_3.

Ammonia used as feedstock (gaseous or liquid) in the nitric acid plant always contains small amounts of methane, which is dissolved in ammonia. By burning ammonia on an alloy catalyst – which is the basis of the nitric acid process – a small amount of CO_2 is produced and leads to CO_2 emissions in the tail gas.

In Austria there is only one producer of nitric acid.

Table 103 presents N_2O and CO_2 emissions from production of nitric acid for the period from 1990 to 2006.

N_2O emissions fluctuate during the period 1990 to 2000, but follow generally the trend of nitric acid production. The increase of IEF between 1993 and 1994 is due to the closing down of part of a production facility that contributed to total emissions with lower specific N_2O emissions per produced HNO_3. Since 2000 two strong drops in emissions can be observed that are not due to variations in production figures. From 2000 to 2001 emissions decrease by 17% due to the introduction of a new catalyst in the nitric acid plant; the IEF decreased from an average of 5.7 kg N_2O/t nitric acid, to about 5.0 kg N_2O/t nitric acid. From 2003 to 2004 emissions drop by 68% due to the installation of a N_2O decomposition facility in the nitric acid plant; the IEF decreased from an average of 5.0 kg N_2O/t nitric acid, to about 1.6 kg N_2O/t nitric acid. In 2006 emissions are 69% below base year emissions.

CO_2 emissions also varied over the period from 1990–2005 following the trend of nitric acid production closely until 1999. Specific emissions decreased since 2000 due to process optimization (also see implied emission factors in Table 103).

4.3.2.2 Methodological Issues

Following the IPCC Guidelines plant specific measurement data was collected.

Activity and emission data of N_2O emissions was obtained directly from the plant operator. Since 1998, emissions are measured continuously. Based on the analysed emission data of 1998 and due to the fact that the production technology has not changed between 1990 and 1998 emission factors per ton of product were calculated for the used technologies (nitric acid is produced at one site in up to five plants with different technologies; some of the plants were closed since 1990, two are still in operation). With these estimates of plant specific emission factors and the production volume of the individual plants the total emission of N_2O per year was calculated.

Activity and emission data of CO_2 emissions from the years 1994 onwards have been reported directly to the Umweltbundesamt by the plant operator and thus represent plant specific data. The implied emission factor that was calculated from activity and CO_2 emission data from 1994 was applied to calculate CO_2 emissions of the years 1990 to 1993 as no CO_2 emission data was available for these years.

Table 103:Activity data, emissions and implied emission factors for N_2O and CO_2 emissions from Nitric Acid Production 1990–2006.

Year	Nitric Acid Produced [t]	N_2O Emissions [Mg]	CO_2 Emissions [Gg]	IEF N_2O [kg/t]	IEF CO_2 [kg/t]
1990	529 998	2 942	0.41	5.55	0.78
1991	534 910	2 991	0.42	5.59	0.78
1992	484 731	2 702	0.38	5.57	0.78
1993	513 224	2 835	0.40	5.52	0.78
1994	467 391	2 662	0.36	5.70	0.78
1995	484 016	2 765	0.37	5.71	0.76
1996	495 738	2 820	0.38	5.69	0.76
1997	489 376	2 783	0.36	5.69	0.73
1998	504 977	2 893	0.38	5.73	0.75
1999	512 797	2 979	0.40	5.81	0.78
2000	533 715	3 070	0.37	5.75	0.69
2001	510 800	2 537	0.36	4.97	0.71

Year	Nitric Acid Produced [t]	N_2O Emissions [Mg]	CO_2 Emissions [Gg]	IEF N_2O [kg/t]	IEF CO_2 [kg/t]
2002	522 410	2 604	0.37	4.98	0.70
2003	558 226	2 850	0.41	5.10	0.73
2004	572 719	906	0.41	1.58	0.71
2005	557 870	884	0.41	1.59	0.74
2006	579 623	904	0.42	1.56	0.72

4.3.2.3 Source specific QA/QC

Measurements are done by accredited testing body with internationally recognized standard methods. Order of magnitude and time-series checks are performed and operator is contacted in case of inconsistencies.

4.3.2.4 Uncertainty assessment

According to (WINIWARTER 2008) uncertainty is mainly affected by EF uncertainty (20%). The EF uncertainty is based on a national study from the beginning of the 1990ies and is considered to be valid for base year emissions. For recent years an uncertainty of 5% was considered to be more appropriate because the analyses of N_2O concentrations changed from discontinous measurements to online spectroscopic measurements.

4.3.2.5 Recalculations

No recalculations have been required for this version of the inventory.

4.3.3 Calcium Carbide Production (2.B.4)

4.3.3.1 Source Category Description

Emission: CO_2

Key Source: No

Calcium carbide is made by heating calcium carbonate and subsequently reducing CaO with carbon – both steps lead to emissions of CO_2.

This source is only a minor source of CO_2 emissions in Austria: in 2006, emissions from this source contribute 0.03% to national total emissions.

4.3.3.2 Methodological Issues

Emissions were estimated using a country specific methodology.

Activity data were directly reported by the plant operator of the only carbide production plant in Austria.

An emission factor of 1.2957 t/t carbide obtained from industry was applied. It was obtained by summing the emission factors for the carbonate and coke step up:

- Production of lime needed for calcium carbide production: 0.7153 t/t carbide
- Calcium carbide production: 0.5804 t/t carbide

Table 104:Activity data and emissions for CO_2 emissions from Calcium Carbide Production 1990–2006.

Year	Calcium Carbide [t]	CO_2 Emissions [Gg]
1990	28 951	38
1991	27 159	35
1992	31 896	41
1993	25 374	33
1994	19 406	25
1995	20 236	26
1996	25 324	33
1997	25 313	33
1998	27 043	35
1999	25 047	32
2000	37 130	48
2001	36 026	47
2002	31 488	41
2003	32 010	41
2004	27 613	36
2005	27 677	36
2006	23 557	31

4.3.3.3 Recalculations

No recalculations have been required for this version of the inventory.

4.3.4 Chemical Industry – Other: Production of Fertilizers and Urea (2.B.5)

4.3.4.1 Source Category Description

Emission: CH_4, CO_2

Key Source: No

This category includes CH_4 and CO_2 emissions from the production of urea and from the production of fertilizers (NPK as well as calcium ammonium nitrate). There is only one producer of urea in Austria, it is also the main producer of fertilizers in Austria.

This source is only a minor source in Austria: in 2006, total emissions from this source contribute 0.04% to national total emissions.

CO_2 emissions from the production of fertilizers varied over the period following the trend of fertilizer production. They first decreased, reaching a minimum in 1997 and since then increased again. In 2006 emissions from this category are 13% lower than in 1990 (see Table 105).

4.3.4.2 Methodological Issues

No IPCC methodology is available for these sources.

Data for urea production were directly reported by the Austrian producer of urea and thus represent plant-specific data. Urea is a downstream manufacturing process of ammonia production. The input gases for urea production are NH_3 and CO_2; the latter is also formed in the ammonia production. In urea production CO_2 is emitted at start-ups of the process and emissions are calculated by the number and duration of start-ups. Ammonia always contains a small amount of non-reacted CH_4 that is released when NH_3 reacts to urea. CH_4 emissions are calculated from the ammonia input and its methane content.

CH_4 emissions from the production of urea were reported for the years 2002–2006. For the years before no data is available; therefore the implied emission factor for the year 2002 was used for all years. CO_2 emissions are reported by the operator since 1995. The IEF from this year was applied to calculate emissions from the previous years.

Data for fertilizer production for 1990 to 1994 were taken from national statistics (STATISTIK AUSTRIA), for 1995 to 2004 production data were reported directly by the main producer of fertilizers in Austria.

Emission data for CO_2 emissions from the production of fertilizers for 1994 to 2006 were directly reported by industry and thus represent plant–specific data. With the emission and activity data from 1994 an implied emission factor for 1994 was calculated and applied for the years 1993 to 1990. However, there is an inconsistency in the time series (see subchapter on time series consistency below). CO_2 emissions from fertilizer production were calculated by industry using a mass balance approach.

CH_4 emissions from the production of fertilizers were reported for the years 2002–2006; these data became available due to a measurement programme for CH_4 at the plant starting in 2002. For the years before no data is available; therefore the implied emission factor for the year 2002 was used for all years.

Table 105 presents activity data, emissions and implied emission factors for CH_4 and CO_2 emissions from *Fertilizer Production* and *Urea Production* for the period from 1990 to 2006.

Table 105:Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from NPK-fertilizer Production and Urea Production 1990–2006.

Year	Urea Production			Fertilizer Production			
	Urea Production [t]	CO_2 [Gg]	CH_4 [Mg]	Fertilizer Production [t]	CO_2 [Gg]	IEF CO_2 [kg/t]	CH_4 [Mg]
1990	282 000	0.27	108.4	1 388 621	30.26	21.79	183.5
1991	295 000	0.29	113.4	1 273 467	27.75	21.79	168.3
1992	259 000	0.25	99.5	1 182 595	37.75	31.92	156.3
1993	305 000	0.30	117.2	1 250 804	33.53	26.81	165.3
1994	360 000	0.35	138.3	1 222 578	22.27	18.22	161.6
1995	393 000	0.40	151.0	916 265	19.55	21.34	121.1
1996	417 705	0.30	160.5	940 313	18.07	19.22	124.3
1997	392 017	0.35	150.6	924 856	17.22	18.62	122.2
1998	395 288	0.29	151.9	977 212	18.68	19.12	129.2
1999	408 386	0.24	156.9	988 662	19.65	19.88	130.7
2000	390 185	0.22	149.9	1 022 983	20.59	20.13	135.2
2001	367 218	0.26	141.1	959 698	19.75	20.58	126.9
2002	389 574	0.35	149.7	1 013 767	23.61	23.29	134.0
2003	447 450	0.18	163.0	1 073 940	24.07	22.41	134.0
2004	442 252	0.14	165.8	1 090 069	24.03	22.05	126.0
2005	416 407	0.21	155.8	1 043 916	17.84	17.09	148.6
2006	429 243	0.22	162.1	1 092 182	26.32	24.10	149.4

4.3.4.3 Time Series Consistency/Planned improvements

The time series of fertilizer production is not consistent with respect to activity data. Whereas the date obtained from STATISTIK AUSTRIA for the period from 1990 to 1994 cover data for the total production in Austria the data for the period 1995 to 2004 reflect only the production of the largest Austrian producer. It is planned to prepare a consistent time series.

4.3.4.4 Recalculations

No recalculations have been required for this version of the inventory.

4.3.5 Chemical Industry – Other: Ethylene Production (2.B.5)

4.3.5.1 Source Category Description

Emission: CH_4

Key Source: *No*

Ethylene is made by steam cracking of petrochemical feedstocks. This production process leads to fugitive methane emissions.

This source is only a minor source of CH_4 emissions in Austria; in 2006 emissions contributed 0.01% to national total emissions.

4.3.5.2 Methodological Issues

Emissions were estimated using the IPCC default methodology.

Activity data are the capacity of the only ethylene producing plant in Austria and amount to 350 000 t Ethylene per year until 2005. In 2006 the capacity of the ethylene plant was expanded to 500 000 t. The IPCC default emission factor of 1 g CH_4/kg Ethylene production was used to calculate the emissions that amount to 350 tonnes CH_4 until 2005 and 500 tonnes CH_4 for 2006.

4.3.5.3 Recalculations

No recalculations have been required for this version of the inventory.

4.4 Metal Production (CRF Source Category 2.C)

4.4.1 Iron and Steel (2.C.1)

4.4.1.1 Source Category Description

Emissions: CO_2, CH_4

Key Category: *Yes* (CO_2)

In Austria iron and steel production is concentrated mainly at two integrated sites operated by the same company. This company is the only company operating blast furnaces in Austria. Additionally there are some companies operating electric arc furnaces, contributing about 10% to total steel production in Austria.

In this category only process specific CO_2 emissions are reported, emissions due to combustion in iron and steel industry are reported in the energy sector (Category *1.A.2.a*).

Process specific CO_2 emissions result from the use of reducing agent in pig iron production in blast furnaces and steel production in electric arc furnaces (use of electrodes) as well as from steel production (lowering the carbon content of steel compared to pig iron in electric arc furnaces and basic oxygen furnaces respectively).

Also CH_4 emissions from rolling mills and from electric arc furnaces are reported in this category.

CO_2 emissions from iron and steel production is an important key category of the Austrian greenhouse gas inventory because of its contribution to the total inventory level for all years of the inventory (ranking between six to nine) and because of its contribution to the trend.

In the year 2006, CO_2 emissions from production of iron and steel contributed 5.6% to total greenhouse gas emissions in Austria (see Chapter 1.5).

CH_4 emissions from this category are negligible; the contribution to national total emissions in 2006 was 0.0001%.

Table 106 presents total CO_2 and CH_4 emissions from the production of iron and steel for the period from 1990 to 2006. CO_2 emissions from *Iron and Steel Production* decrease from 1990 to 1992 and then increase steadily following the trend of pig iron production. In 2006 emissions were 44% above the level of 1990.

Table 106:Total CO_2 and CH_4 emissions from iron and steel 1990–2006.

Year	**CO_2 [Gg]**	**CH_4 [Gg CO_2 eq]**
1990	3 546	0.047
1991	3 509	0.039
1992	3 075	0.045
1993	3 145	0.051
1994	3 411	0.054
1995	3 921	0.057
1996	3 703	0.050
1997	4 100	0.059
1998	3 900	0.063
1999	3 759	0.061
2000	4 202	0.068
2001	4 159	0.069
2002	4 607	0.068
2003	4 523	0.072
2004	4 446	0.077
2005	4 995	0.079
2006	5 089	0.081

4.4.1.2 Methodological Issues

General Remark

Total CO_2 emissions from the two main integrated iron and steel production sites in Austria are reported directly by industry until 2002. They are calculated by applying a very detailed mass balance approach for carbon. Process specific emissions[25] are calculated by the Umweltbundesamt according to the IPCC good practice guidance; these emissions are subtracted from total CO_2 emissions reported by the company. The remaining emissions are reported in the energy sector as emissions due to combustion in category *1.A.2.a Iron and Steel*.

Thus, some shortcomings of the methodology applied for calculating process specific CO_2 emissions do not have an effect on national total emissions but only on the split between process specific and combustion specific emissions (for example only carbonatious ore was considered for calculating the split of process specific and combustion specific CO_2 emissions from blast furnaces whereas the carbon content of other ore used was not considered; however, the detailed mass balance approach used by the operator does consider all carbon introduced to the process, thus also considering ore other than carbonatious ore).

For the years 2003 and 2004 total CO_2 emissions were not reported by industry, thus they were estimated using information from the national energy balance and from the years before (see below and description of category *1.A.2.a*).

For 2005 and 2006 verified CO_2 emissions, reported under the ETS, were taken for the inventory. These data cover CO_2 emissions from pig iron and basic oxygen furnace steel.

CO_2 emissions from blast furnace pig iron production

CO_2 emissions were calculated following closely the IPCC GPG guidelines Tier 2 approach, applying the default emission factor of table 3.6 of the IPCC GPG:

*CO_2 Emissions = Mass of reducing agent * 3.1 t CO_2/ t reducing agent + (Mass of Carbon in the Ore – Mass of Carbon in the Crude Iron) * 44/12*

The mass of reducing agent (coke) was taken from the national energy balance (see Annex 4). According to a national study (HIEBLER et al.) 56.3% of coke used in blast furnaces is actually needed as reducing agent, this part is reported as non-energy use in the national energy balance[26].

This non-energy use is used for calculating CO_2 emissions from pig iron production in blast furnaces with the equation presented above, as this is assumed to be more accurate than the approach of the GPG where total mass of reducing agent is considered as non-energy use and the resulting emissions as process specific emissions.

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[25] Process specific emissions considered are CO_2 emissions resulting from the use of reducing agent in pig iron production in blast furnaces and CO_2 emissions from steel production resulting from the lowering of the carbon content of steel compared to pig iron in basic oxygen furnaces as well as CO_2 emissions from limestone use in blast furnaces. The latter is reported under 2.A.3

[26] Because of the methodology of the energy balance, the reported amount of non-energy use is not always exactly 56.3%, that's why for calculating emissions total coke use in blast furnaces was taken from the energy balance and from this amount 56.3% was considered as non-energy use.

Only carbonatious ore was considered for the calculation as no statistical data was available for the amount of other ore[27] (however, the carbon content of iron oxide is only small). Carbon content of the ore was calculated assuming pure ore, thus the factor used for calculating the mass of carbon in the ore was based on the stochiometric ratio of carbon in $FeCO_3$:

*Mass of Carbon in the Ore = Mass of ore * 12/116*

Mass of ore used in pig iron production for the years 1990 to 1995 was taken from national statistics (statistical yearbook of STATISTIK AUSTRIA), the value of 1995 was also used for 1996 and 1997. From 1998–2002 the mass of ore was directly reported by industry; for 2003 the value of the Steel statistical yearbook 2004 was used (IISI 2004). The value for 2004 was estimated with the pig iron production, multiplied by the mean proportion iron ore/pig iron from the years 2000–2003. The value for 2005 and 2006 corresponds to the background data (for consistency reasons just carbonatious ore) given in the ETS report.

Mass of carbon in pig iron was calculated by applying the IPCC default value of 4% carbon in crude steel.

Pig iron production data for 1990 and 1995 to 2001 was taken from national statistics (statistical yearbook of STATISTIK AUSTRIA), data for 1991 to 1994 was taken from www.worldsteel.org; for 2002–2006 pig iron production data were directly reported by industry; activity data reported from industry are validated in the time series in comparison with data from National Statistics, with which they are consistent.

For 2005 and 2006 CO_2 emissions from non-carbonatious ore and other additives were taken into account additionally. This information became available from background data reported under the ETS. Again it has to be stressed that this additional accounting does not affect total CO_2 emissions, but only improves the accuracy of the split made between process and combustion specific emissions.

Activity data, calculated CO_2 emission data as well as the implied emission factor for CO_2 emissions from pig iron production are presented in Table 107. The trend in IEF values from Pig iron production fluctuates, because CO_2 emissions follow closely the coke input (more than 97% of CO_2 emissions originate from coke input). Coke input (non-energy-use) from the national energy balance shows a different trend to Pig iron production. The reason for this to some extend could be the imperfect separation of total coke input in energy and non-energy use in the national energy balance and the use of other reducing agents that are not directly allocated.

Table 107:Activity data, emissions and implied emission factors for CO_2 emissions from pig iron production 1990–2006.

Year	Coke [kt]	Ore [kt]	Pig Iron [kt]	CO_2 [Gg]	IEF CO_2 [t/kt Pig Iron]
1990	872	2 225	3 444	3 043	883
1991	878	2 092	3 442	3 011	875
1992	793	1 629	3 074	2 625	854
1993	815	1 627	3 070	2 693	877
1994	893	1 695	3 320	2 923	880

[27] Carbonatious ore is mined in Austria, thus it is reported in the statistical yearbook.

Year	Coke [kt]	Ore [kt]	Pig Iron [kt]	CO_2 [Gg]	IEF CO_2 [t/kt Pig Iron]
1995	1 012	2 071	3 888	3 352	862
1996	941	2 071	3 432	3 201	933
1997	1 070	2 071	3 972	3 519	886
1998	1 037	1 810	4 032	3 309	821
1999	1 001	1 734	3 912	3 186	814
2000	1 125	1 879	4 320	3 568	826
2001	1 113	1 875	4 380	3 518	803
2002	1 251	1 925	4 669	3 925	841
2003	1 200	2 119	4 677	3 838	821
2004	1 177	2 100	4 861	3 733	768
2005	1 332	2 038	5 458	4 186	767
2006	1 357	2 130	5 565	4 263	766

CO_2 emissions from basic oxygen furnace steel production

CO_2 emissions from steel production, which corresponds to steel production at the two integrated sites operating basic oxygen furnaces (BOF), were calculated following the IPCC GPG guidelines Tier 2 approach:

*CO_2 Emissions = (Mass of Carbon in the Crude Iron used for Crude Steel – Mass of Carbon in the Crude Steel) * 44/12*

For the years 1990 to 2001 activity data for electric steel production was subtracted from total steel production in Austria taken from national statistics (statistical yearbook of STATISTIK AUSTRIA) to obtain steel production of the two integrated sites operating blast furnaces. For 2002 to 2006 steel production of the two integrated sites operating blast furnaces was directly reported by industry.

The average carbon content of 0.15% for steel was obtained from the operator of the two integrated sites; as mentioned above, the IPCC default value was used for the carbon content of pig iron (4%).

CO_2 and CH_4 emissions from electric arc furnace steel production

Emissions were estimated using a country specific methodology.

CO_2 emissions for the year 2003 have been reported by each electric steel site in Austria. The IEF calculated for this year (52 kg/t steel) was also used to calculate emissions from the years before and for 2004. For 2005 and 2006 verified CO_2 emissions, reported under the ETS, were taken for the inventory.

For calculating CH_4 emissions an emission factor of 5 g CH_4/Mg electric steel was applied. An emission factor for VOC emissions from production of steel in Austria was taken from a study published by the Austrian chamber of commerce, section industry (WINDSPERGER & TURI 1997). It was assumed that total VOC emissions are composed of 10% CH_4 and 90% NMVOC (expert judgement Umweltbundesamt).

Activity data were obtained from the *Association of Mining and Steel* and thus represent plant specific data.

CH_4 emissions from rolling mills

Emissions were estimated using a country specific methodology.

The emission factor for VOC emissions from rolling mills (1 g VOC/Mg steel) was reported directly by industry and thus represents plant specific data. It was assumed that VOC emissions are composed of 10% CH_4 and 90% NMVOC (expert judgement Umweltbundesamt).

Activity data as used for calculating CO_2 emissions from steel production (see above) was applied.

Table 108 presents steel and electric steel production, CO_2 and CH_4 emissions and implied emission factors as well as total CO_2 emissions from this sector.

Table 108:Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from Steel Production 1990–2006.

Year	Steel Production				Electric Steel Production			Total CH_4 [Mg]	Total CO_2 [Gg]
	Steel [kt]	CO_2 [Gg]	IEF CO_2 [t/kt]	CH_4 [Mg]	Electric Steel [kt]	CO_2 [Gg]	CH_4 [Mg]		
1990	3 921	484	123	0.39	370	20	1.85	2.24	503
1991	3 896	483	124	0.39	290	15	1.45	1.84	499
1992	3 592	431	120	0.36	361	19	1.80	2.16	450
1993	3 738	430	115	0.37	411	22	2.05	2.43	451
1994	3 968	465	117	0.40	431	23	2.15	2.55	488
1995	4 538	545	120	0.45	454	24	2.27	2.72	569
1996	4 032	481	119	0.40	396	21	1.98	2.38	502
1997	4 718	557	118	0.47	466	25	2.33	2.80	581
1998	4 801	565	118	0.48	503	27	2.51	2.99	592
1999	4 722	548	116	0.47	486	26	2.43	2.90	573
2000	5 183	605	117	0.52	541	29	2.70	3.22	634
2001	5 346	613	115	0.53	546	29	2.73	3.26	642
2002	5 647	654	116	0.56	538	28	2.69	3.26	682
2003	5 707	655	115	0.57	568	30	2.84	3.41	685
2004	5 901	680	115	0.59	614	32	3.07	3.66	713
2005	6 408	763	119	0.64	624	45	3.12	3.76	808
2006	6 487	778	120	0.65	640	49	3.20	3.85	827

4.4.1.3 Source specific QA/QC

Coke input from the energy balance is compared with coke input reported by the operator. Pig iron and steel production figures are compared with international published data (International Iron and Steel Institute) to ensure completeness. For 2005 and 2006 detailed information on the carbon mass balance applied by the company to calculate total emissions from pig iron and BOF steel were available due to the ETS. Thus it was possible to validate CO_2 emissions with this background data.

4.4.1.4 Uncertainty Assessment

Iron and steel industry is considered dependent of the energy sector, because the major share of CO_2 emissions results from the use of fossil fuel as reducing agent. Thus, the same uncertainty values like for solid fuel combustion in large point sources have been applied, namely 0.5% for activity data and 0.5% for emission factor; this leads to an overall uncertainty for CO_2 emissions of 0.7% (WINIWARTER 2008).

4.4.1.5 Recalculations

No recalculations have been required for this version of the inventory.

4.4.2 Ferroalloys Production (2.C.2)

4.4.2.1 Source Category Description

Emissions: *CO_2*

Key source: *No*

Ferroalloy production involves a metallurgical reduction process which results in CO_2 emissions.

This source is only a minor source of CO_2 emissions in Austria: in 2006, emissions from this source contribute 0.02% to national total emissions.

4.4.2.2 Methodological Issues

Emissions were estimated using the IPCC Tier 1b methodology.

According to publications from the *British Geological Survey* (BRITISH GEOLOGICAL SURVEY 2001, 2005–2007) Austria produce ferro-molybdenum, ferro-vanadium and ferro-nickel. Activity data from 1995 to 2005 were directly taken from these publications. As no data were available for 1990–1994 the value from 1995 was taken for these years. For 2006 the trend 1990–2005 was extrapolated.

The emission factor for ferro-nickel of 1.36 t CO_2/t product was taken from (SJARDIN 2003) and applied to all ferroalloys as no specific emission factors for ferro-molybdenum and ferro-vanadium were available.

Table 109 presents activity data and CO_2 emissions from ferroalloy production.

Table 109:Activity data and emissions from ferroalloy production 1990–2006.

Year	Ferroalloy production [kt]	CO_2 emissions [Gg]
1990	15.3	20.8
1991	15.3	20.8
1992	15.3	20.8
1993	15.3	20.8
1994	15.3	20.8
1995	15.3	20.8
1996	13.8	18.8
1997	14.2	19.3

Year	Ferroalloy production [kt]	CO_2 emissions [Gg]
1998	14.1	19.2
1999	13.9	18.9
2000	13.9	18.9
2001	13.3	18.1
2002	12.6	17.1
2003	12.3	16.7
2004	12.4	16.9
2005	13.8	18.7
2006	12.4	16.9

4.4.2.3 Recalculations

Activity data for the year 2005 has been updated since the last submission.

4.4.3 Aluminium Production (2.C.3)

4.4.3.1 Source Category Description

Emissions: PFCs and CO_2

Key Source: Yes (PFCs, CO_2)

This category includes emissions of CO_2 and PFCs from aluminium production. Primary aluminium production in Austria was terminated in 1992.

The two PFCs, tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6) are emitted from the process of primary aluminium smelting. They are formed during the phenomenon known as the anode effect (AE).

CO_2 emissions arise from the consumption of the anode in the production process.

This category is a key source for PFC emissions because of the contribution to the total level of greenhouse gas emissions in the years 1990 to 1992; and a key source for both PFC and CO_2 emissions due to its trend.

Table 110 presents PFC and CO_2 emissions from primary aluminium production for the period from 1990 to 1992.

Table 110:PFC emissions from primary aluminium production from 1990 to 1992.

	1990	1991	1992
PFC emission [Gg CO_2-equivalent]	1 050	1 050	418
CO_2 emissions [Gg]	158	158	63

4.4.3.2 Methodological Issues

CO_2 emissions were calculated by applying the IPCC default emission factor of 1.8 t CO_2/t aluminium produced taken from the IPCC guidelines (Table 2.16).

PFC emissions were estimated using the IPCC Tier 3b methodology. The specific CF_4 emissions (and C_2F_6 emissions respectively) of the anode effect were calculated by applying the following formula (BARBER 1996), (GIBBS & JACOBS 1996), (TABERAUX 1996):

kg CF_4/t_{Al} = (1.7 x AE/pot/day x F x AE_{min})/CE

Where:

AE/pot/day	*= frequency of occurrence of the anode effect (dependent on type of oxide supply (1,2/day)*
t_{Al}	*= effective production capacity per year [t]*
AE_{min}	*= anode effect duration in minutes (5 min)*
F	*=fraction of CF_4 in the anode gas (13%)*
CE	*= current efficiency (85%)*
1.7	*=constant resulting from Faraday's law*

In Austria so called "Søderberg" anodes were used. The frequency of the anode effect (AE/pot/day) was about 1.2 per day. The duration of the anode effect (AE_{min}) was in the range of 4 to 6 minutes. The average fraction of CF_4 formed in percent of the anode gas (F) can be determined as a function of the duration of the anode effect. International values are about 10% after two minutes, 12% after three minutes and after that there is only a marginal increase. Therefore for Austrian aluminium production a CF_4 fraction in the anode gas of 13% was assumed.

Because C_2F_6 is formed only during the first minute of the anode effect, the rate of C_2F_6 is the higher the shorter the duration of the anode effect is. For the aluminium production in Austria the rate of C_2F_6 is about 8% and the current efficiency (CE) about 85.4%.

Activity data were taken from national statistics (88 021 t for 1990 and 1991, and 35 000 t in 1992).

By inserting these data into the formula mentioned above an emission factor of 1.56 kg CF_4/t aluminium was calculated.

4.4.3.3 Source specific QA/QC

Country specific parameters were compared with international data.

4.4.3.4 Uncertainty Assessment

The uncertainty for the PFC emission factors ("Søderberg" process) is between 30–80% according to the IPCC GPG (p.3.43). Activity data do not influence the uncertainty of emissions, because PFCs are formed during the anode effect that is associated with the EF. Assuming a mean value for the emission factor, the uncertainty of PFC emissions is 50%.

Uncertainty of CO_2 emissions is assumed to be 2%, mainly deriving from AD uncertainty (WINIWARTER 2008).

4.4.3.5 Recalculations

No recalculations have been required for this version of the inventory.

4.4.4 SF_6 Used in Aluminium and Magnesium Foundries (2.C.4)

4.4.4.1 Source Category Description

Emissions: *SF_6*

Key Source: *Yes (SF_6)*

This category includes emissions of SF_6 from magnesium and aluminium foundries.

This source is a key source because of its contribution to total emissions in the years 1991 to 1997 and to the trend of emissions in the trend assessment.

In the base year (1990), SF_6 emission from aluminium and magnesium foundries contributed 0.3% to the total amount of greenhouse gas emissions in Austria, in the year 2006 no emissions arose from this category (see Table 93).

Table 111 presents SF_6 emissions from magnesium and aluminium foundries for the period from 1990 to 2006.

As can be seen in the table below, SF_6 emissions have been fluctuating during the period, but the overall trend has been decreasing SF_6 emissions; from 1990 to 2000 they decreased by 97%. This decreasing trend is explained by technological advances and the replacement of SF_6 by other substances used for surface protection. For the years 2001 and 2002 the value of 2000 was used due to lack of more up to date data; since 2003 the use of SF_6 in foundries is prohibited in Austria.

Table 111:SF_6 emissions from magnesium and aluminium foundries 1990–2006.

Year	SF_6 emissions [Gg]
1990	0.0106
1991	0.0116
1992	0.0106
1993	0.0116
1994	0.0156
1995	0.0185
1996	0.0256
1997	0.0146
1998	0.0069
1999	0.0009
2000	0.0003
2001	0.0003
2002	0.0003
2003–2006	0

4.4.4.2 Methodological Issues

Emissions were estimated following the IPCC methodology.

Information about the amount of SF_6 used was obtained directly from the aluminium producers in Austria and thus represents plant-specific data (for verification data was checked against data from SF_6 suppliers). Actual emissions of SF_6 equal potential emissions and correspond to the annual consumption of SF_6.

The amount of Magnesium cast, SF_6 emissions and the implied emission factors are presented in Table 112. For the years 1996–1998 the value from 1995 is reported because the categories in the statistics changed and no activity data for Magnesium cast as reported in the previous years was available.

Table 112:Magnesium cast, SF_6 emissions and IEF 1990–1999.

Year	Magnesium cast [t]	SF_6 emissions [t]	IEF SF_6 [kg/t]
1990	3 080	10.0	3.2
1991	2 814	11.0	3.9
1992	2 693	10.0	3.7
1993	2 491	11.0	4.4
1994	3 281	15.0	4.6
1995	3 377	17.9	5.3
1996	3 377	25.0	7.4
1997	3 377	14.0	4.1
1998	3 377	6.1	1.8
1999	3 600	0.2	0.1

4.4.4.3 Source specific QA/QC

The amount of SF_6 used is cross-checked with data from SF_6 suppliers. All IEFs are within the range of the Norsk Hydro survey (0.1 to 11 kg/t Mg) cited in the IPCC GPG (p.3.47).

4.4.4.4 Uncertainty Assessment

According to the IPCC GPG (p 3.49) the uncertainty associated with plant SF_6 use data is low (5%).

4.4.4.5 Recalculations

No recalculations have been required for this version of the inventory.

4.5 Consumption of Halocarbons and SF_6 (CRF Source Category 2.F)

4.5.1 Source Category Description

This category includes the following emission sources: refrigeration and air conditioning equipment, foam blowing, fire extinguishers, aerosols, solvents semiconductor manufacture, electrical equipment and other sources (noise insulation windows, tyres and research).

There is no production of Halocarbons in Austria.

The year 1990 was chosen as base year for HFC, PFC and SF_6 emissions.

Potential emissions are reported as sums under category *2.F*, for estimates of actual emissions please refer to the respective sub-categories.

Emission Trends

For the source *Consumption of Halocarbons and* SF_6 greenhouse gas emissions are more than four times higher in 2006 than in the base year 1990. This was mainly due to strongly increasing emissions from the use of HFCs as substitutes for ozone depleting substance (*ODS Substitutes*).

Potential and actual emissions per substance group is presented in Table 113, emissions by sub sector and gas are presented in Table 114 and Table 115.

In 2006 actual SF_6 emissions exceed potential emissions. This is due to emissions from disposal of noise insulating windows.

Table 113:Potential and actual emissions of IPCC Category 2 F per substance group [Gg CO_2e] 1990–2006.

	HFCs [Gg CO_2e]		PFCs [Gg CO_2e]		SF_6 [Gg CO_2e]		Total [Gg CO_2e]	
Year	**Potential**	**Actual**	**Potential**	**Actual**	**Potential**	**Actual**	**Potential**	**Actual**
1990	47.42	23.03	32.28	29.05	586.57	249.24	666.27	301.33
1991	60.39	45.21	40.99	36.89	839.14	376.12	940.52	458.23
1992	62.98	48.68	56.70	45.08	903.00	444.51	1 022.68	538.26
1993	347.41	157.34	58.41	52.90	966.86	516.47	1 372.67	726.71
1994	371.24	206.83	64.77	58.61	1 127.73	612.86	1 563.74	878.30
1995	727.58	267.34	75.99	68.69	1 216.26	696.06	2 019.82	1 032.09
1996	982.72	346.84	73.24	66.20	942.80	607.41	1 998.77	1 020.45
1997	1 122.46	427.42	107.20	96.75	1 098.77	770.98	2 328.43	1 295.15
1998	1 181.44	494.89	110.71	44.65	1 268.99	743.80	2 561.14	1 283.34
1999	1 302.90	542.20	191.14	64.44	1 027.51	661.74	2 521.55	1 268.37
2000	1 538.92	596.26	243.28	72.21	983.99	625.67	2 766.19	1 294.14
2001	1 869.98	694.45	285.95	82.02	1 025.89	628.97	3 181.82	1 405.44
2002	1 898.92	781.07	316.48	86.73	1 030.86	633.19	3 246.27	1 500.99
2003	1 923.12	862.75	380.60	102.39	812.96	593.52	3 116.68	1 558.66
2004	1 874.79	896.56	340.98	125.68	657.13	513.12	2 872.89	1 535.37
2005	1 463.44	907.68	351.35	125.22	485.67	286.50	2 300.46	1 319.40
2006	1 336.59	857.80	380.99	135.67	414.22	480.24	2 131.80	1 473.71

Key Sources

For the key source analysis emission data of this category were aggregated as suggested in the IPCC GPG:

- 2.F.1/2/3/4/5 ODS (Ozone Depleting Substances) Substitutes (HFCs),
- 2.F.7 Semiconductor Manufacture (HFCs, PFCs and SF_6),
- 2.F.8 Electrical Equipment (SF_6) and
- 2.F.9 Other Sources of SF_6 (SF_6)

Three of these sources have been identified as key sources:

2.F.1/2/3/4/5 ODS (Ozone Depleting Substances) Substitutes (HFCs) because of its contribution to total emissions in the years 1995 to 2006 and to the trend of emissions. In the year 2006 HFC emissions from ODS contributed 0.9% to the total amount of greenhouse gas emissions in Austria, in the base year (1990) 0.0% (see Table 93).

2.F.7 Semiconductor Manufacture (HFCs, PFCs and SF_6) because of its contribution to the total inventory's level in the years 1992–2006 and to the trend of emissions of the total greenhouse gas inventory. In the year 2006 emissions from this category contributed 0.3% to the total amount of greenhouse gas emissions in Austria (0.2% in 1990).

2.F.9 Other Sources of SF_6 (SF_6) because of its contribution to total emissions in the years 1997, 1998 and 2000. In the year 2006 emissions from this category contributed 0.3% to the total amount of greenhouse gas emissions in Austria (0.2% in 1990).

For further information on key categories see chapter 1.5).

4.5.2 Methodological Issues

A study has been contracted out to determine the consumption data and emissions from 1990–2000 for all uses of FCs (BICHLER et al. 2001). In this study, bottom up data for consumption per sector were compared with top-down data from importers and retailers of FCs as well as with data from the national statistics (import/export statistics).

The study also included projections until 2010, these were used to estimate emissions from 2001–2006 for the subcategories *2.F.1 Refrigeration and Air conditioning equipment*, *2.F.3 Fire Extinguishers* and *2.F.9 Other sources of SF_6.* For the sub-categories *2.F.7 Semiconductor Manufacture* and *2.F.8 Electrical Equipment* data for these years were available due to the Austrian reporting obligation (see below). The sub-category *2.F.2 Foam blowing* was re-evaluated in a new contracted study (OBERNOSTERER et al 2004). Austrian estimates of emissions from the sources *2.F.4 Aerosols* and *2.F.5 Solvents* are based on a European evaluation of emissions from this sector (HARNISCH & SCHWARZ 2003), subsequently disaggregated to provide a top-down Austrian estimate.

Data about consumption of HFC, PFC and SF_6 were determined from the following sources:

- data from national statistics
- data from associations of industry
- direct information from importers and end users

Since 2004 there is also a reporting obligation under the Austrian FC-regulation[28] for users of FCs in the following applications: refrigeration and air-conditioning, foam blowing, semiconductor manufacture, electrical equipment, fire extinguishers and aerosols. Data is either reported electronically with a system set up by the Umweltbundesamt or per mail (electronic or letter) to the Ministry for Environment (these reports are then forwarded to the Umweltbundesamt to be brought together with data from the electronic system).

The first reporting year is 2003, from this year on the end users of FCs are obliged to report annually about the amounts used and recycled. Theoretically, almost the whole activity data used for inventory preparation is covered by the reporting obligation. However, especially the refrigeration sector is very complex, there are numerous small enterprises, and not all of them are organised in an industry association, they are hard to reach and to inform about the reporting obligation. That's why not all enterprises reported their consumption, and the results of the first reporting years could not be used for these applications; however, for the next submission results will be considered as far as possible.

[28] „Industriegas-Verordnung (HFKW-FKW-SF6-VO)" Federal Law Gazette II No. 447/2002

Emissions for all subcategories were estimated using a country specific methodology; emission factors are based on information of experts from the respective industries (except emissions from aerosols and solvents, where IPCC default emission factors are used). For most sources emissions are calculated from annual stocks using emission factors. Additionally emissions can occur during production or disposal of Halocarbons or SF_6 containing products. Annual stocks correspond to the amounts of FCs stored in applications in the year before, minus emissions of the year before, plus consumption of the considered year. Potential emissions correspond to the amounts consumed in the considered year.

The following subchapters present emission factors and data sources used for the respective subcategories.

Table 114:Emissions of IPCC Category 2.F by source 1990–1999.

GHG	GWP	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2.F.1 Refrigeration and Air Conditioning Equipment												
HFC-32	650	t	0.00	0.00	0.00	0.00	0.02	0.09	0.19	0.39	0.68	1.02
HFC-125	2 800	t	0.00	0.00	0.00	0.00	0.03	1.47	5.73	10.96	14.26	15.07
HFC-134a	1 300	t	1.35	2.12	2.83	4.14	6.11	21.76	41.51	60.79	82.01	99.66
HFC-152a	140	t	0.00	0.00	0.00	0.00	0.00	0.06	0.33	0.57	0.72	0.61
HFC-143a	3 800	t	0.00	0.00	0.00	0.00	0.00	0.39	2.52	5.59	7.92	8.94
Gg CO_2e			**1.76**	**2.75**	**3.68**	**5.38**	**8.03**	**33.95**	**79.78**	**131.30**	**177.16**	**206.45**
2.F.2 Foam Blowing												
HFC-134a	1 300	t	0.00	0.00	0.00	75.88	107.41	129.82	151.24	170.37	188.06	197.97
HFC-152a	140	t	0.00	0.00	0.00	37.37	52.90	63.94	73.85	82.61	90.64	94.82
Gg CO_2e			**0.00**	**0.00**	**0.00**	**103.88**	**147.04**	**177.72**	**206.95**	**233.05**	**257.17**	**270.64**
2.F.3 Fire Extinguishers												
HFC-23	11 700	t	0.00	0.00	0.00	0.10	0.25	0.38	0.56	0.74	0.95	1.15
HFC-227ea	2 900	t	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.15	0.24	0.35
C4F10	7 000	t	0.00	0.00	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.03
Gg CO_2e			**0.00**	**0.00**	**0.35**	**1.50**	**3.18**	**4.78**	**7.02**	**9.30**	**12.05**	**14.74**
2.F.4 Aerosols												
HFC-unspecified	Gg CO_2e		18.88	38.44	39.58	40.11	40.71	41.64	42.58	43.53	44.71	46.25
Gg CO_2e			**18.88**	**38.44**	**39.58**	**40.11**	**40.71**	**41.64**	**42.58**	**43.53**	**44.71**	**46.25**
2.F.5 Solvents												
HFC-43-10mee	1 300	t	0.36	0.73	0.75	0.76	0.77	0.79	0.80	0.82	0.85	0.87
Gg CO_2e			**0.46**	**0.94**	**0.97**	**0.99**	**1.00**	**1.02**	**1.05**	**1.07**	**1.10**	**1.14**
2.F.7 Semiconductor Manufacture												
HFC-unspecified	Gg CO_2e		1.93	3.07	4.44	5.81	7.18	8.53	9.74	9.43	2.96	3.23
PFC-unspecified	Gg CO_2e		29.05	36.89	44.73	52.57	58.30	68.39	65.92	96.48	44.40	64.19
SF_6	23 900	t	4.27	7.33	9.98	12.64	15.29	17.94	13.74	20.41	18.01	16.17
Gg CO_2e			**133.08**	**215.20**	**287.79**	**360.38**	**430.86**	**505.68**	**403.95**	**593.76**	**477.80**	**453.93**
2.F.8 Electrical Equipment												
SF_6	23 900	t	0.86	0.91	0.95	1.00	1.05	1.09	1.13	1.13	1.14	1.21
Gg CO_2e			**20.59**	**21.69**	**22.79**	**23.89**	**24.98**	**26.07**	**26.91**	**27.07**	**27.22**	**28.86**
2.F.9 Other sources of SF6												
SF_6	23 900	t	5.30	7.50	7.66	7.97	9.31	10.09	10.55	10.71	11.97	10.31
Gg CO_2e			**126.56**	**179.20**	**183.10**	**190.58**	**222.49**	**241.23**	**252.21**	**256.06**	**286.13**	**246.36**

Table 115:Emissions of IPCC Category 2.F by source 2000–2006.

GHG	GWP	Unit	2000	2001	2002	2003	2004	2005	2006
2.F.1 Refrigeration and Air Conditioning Equipment									
HFC-32	650	t	1.86	2.64	3.40	4.11	4.84	5.53	6.18
HFC-125	2 800	t	19.81	27.62	34.85	41.51	47.78	53.52	58.81
HFC-134a	1 300	t	119.00	136.73	151.46	168.53	184.45	206.17	219.61
HFC-152a	140	t	0.66	0.70	0.74	0.78	0.81	0.84	0.86
HFC-143a	3 800	t	12.49	19.98	26.87	33.21	39.11	44.47	49.41
Gg CO_2e			**258.94**	**332.81**	**398.89**	**464.30**	**525.43**	**590.60**	**642.07**
2.F.2 Foam Blowing									
HFC-134a	1 300	t	193.95	194.63	195.55	196.64	166.95	122.46	73.01
HFC-152a	140	t	108.26	244.25	349.19	430.92	526.17	572.83	414.77
Gg CO_2e			**267.30**	**287.21**	**303.10**	**315.96**	**290.70**	**239.40**	**152.98**
2.F.3 Fire Extinguishers									
HFC-23	11 700	t	1.34	1.53	1.72	1.90	1.90	1.90	1.90
HFC-227ea	2 900	t	0.54	0.78	1.08	1.43	1.76	2.07	2.37
C4F10	7 000	t	0.03	0.03	0.03	0.03	0.03	0.03	0.02
Gg CO_2e			**17.51**	**20.41**	**23.44**	**26.59**	**27.53**	**28.43**	**29.28**
2.F.4 Aerosols									
HFC-unspecified	Gg CO_2e		47.79	49.26	50.16	50.40	47.18	43.57	26.67
Gg CO_2e			**47.79**	**49.26**	**50.16**	**50.40**	**47.18**	**43.57**	**26.67**
2.F.5 Solvents									
HFC-43-10mee	1 300	t	0.90	0.92	1.16	1.40	1.42	1.45	1.49
Gg CO_2e			**1.17**	**1.20**	**1.50**	**1.82**	**1.85**	**1.89**	**1.94**
2.F.7 Semiconductor Manufacture									
HFC-unspecified	Gg CO_2e		3.78	3.78	4.18	3.88	4.06	3.98	5.03
PFC-unspecified	Gg CO_2e		71.98	81.80	86.52	102.20	125.49	125.04	135.50
SF_6	23 900	t	13.86	13.86	14.02	15.77	15.87	7.05	7.04
Gg CO_2e			**407.08**	**416.90**	**425.79**	**483.04**	**508.87**	**297.56**	**308.69**
2.F.8 Electrical Equipment									
SF_6	23 900	t	1.22	1.23	1.26	1.32	1.41	1.52	1.59
Gg CO_2e			**29.09**	**29.36**	**30.05**	**31.46**	**33.67**	**36.30**	**38.06**
2.F.9 Other sources of SF_6									
SF_6	23 900	t	11.10	11.23	11.22	7.74	4.19	3.42	11.47
Gg CO_2e			**265.25**	**268.28**	**268.04**	**185.09**	**100.14**	**81.66**	**274.03**

4.5.2.1 2.F.1 Refrigeration and Air Conditioning Equipment

Consumption data was obtained directly from the most important importers of refrigerants. The stocks of the different subcategories were estimated using information from the most important refrigerant retailers/ importers and experts from the refrigeration branch.

The following table describes what kind of refrigeration and air-conditioning equipment has been considered in which sub-category, and which refrigerants have been used in the respective sub-category in Austria.

From the annual stocks emissions are estimated using emission factors based on expert judgement from experts of the refrigeration branch. The emission factors are presented in Table 116. Annual stocks refer to total stock in Austria, thus import and export of pre-filled equipment is considered indirectly (but not separately).

Remaining refrigerants in products at decommissioning have been estimated. Until 2006 decommissioning becomes relevant for Commercial Refrigeration, Transport and Mobile Air Conditioning (busses and freight vehicles). The estimates have been made taking into account the life-time of refrigeration and air-conditioning equipment (or vehicles in the case of mobile-air conditioning) and the year in which HFC usage in the respective sub-category began. The assumptions for calculating emissions from disposal were for (1) Commercial refrigeration and Transport: 20% disposal loss factor (IPCC GPG p 3.105) and for (2) Mobile air conditioning: until 2001 75%, from 2002 on 25% disposal loss factor[29].

Generally emissions from disposal can be considered to be low, as cooling devices are recycled in Austria, and the refrigerant is usually recovered[30]. There is production of fridges and freezers in Austria (equipment filled at the production site), however emissions from production have not been estimated and are considered to be minor (as emissions from larger devices that are filled after installation clearly dominate total emissions from this sub-category).

Table 116: Description of sub-categories of 2 F 1 Refrigeration and Air Conditioning Equipment and emission factors used.

Sub-category	Description	Used Refrigerants	Emission factors [% of stocks]
Domestic Refrigeration	fridges and freezers at homes	134a	1.5%
Commercial Refrigeration	fridges and freezers in shops	134a	1.5%
Transport Refrigeration	chilled loading space of trucks, ships and rail	134a	10%
Industrial Refrigeration	mainly cooling devices for food trade, also including cooling devices for industrial machines (oil-cooling)	134a, 401a, 402a, 404a, 407c	10% until 1999, 8% since 2000
Stationary Air-Conditioning	industrial cooling in chemical industries, food processing and air-conditioning of office buildings, etc.;	134a, 404a, 407c	as industrial
	imported "ready to plug in" mobile refrigeration systems;		6%
	heat pumps;		1%
Mobile Air-Conditioning	mobile air-conditioning in passenger cars,	134a	15%
	busses, freight vehicles and rail.		5%

401a, 402a, 404a and 407c are blends containing HFC-32, HFC-125, HFC-134a, HFC-143a and/or HFC-152a, the two former also contain HCFCs.

[29] Since 2002 there is a regulation that old vehicles have to be taken back by retailers for recycling/recovering ("Altfahrzeugeverordnung", BGBl. II Nr. 407/2002 i.d.F. BGBl. II Nr. 168/2005)

[30] There is a regulation that old cooling devices have to be taken back by retailers for recycling/recovering ("Verordnung über die Rücknahme von Kühlgeräten" BGBl. Nr. 408/1992 i.d.F. BGBl. II Nr. 440/2001)

4.5.2.2 2.F.2 Foam Blowing and XPS/PU Plates

HFC emissions from this sub-category are based on a study on HFC used in foam blowing (OBERNOSTERER et al. 2004), that was subcontracted by the Umweltbundesamt.

Soft foam

HFC 134a and HFC 152a are used as blowing agents for PU soft foam since 1993 in Austria. The consumption of PU foam cans was estimated using information from the construction industry. An average charge of HFC blowing agent of 85g per can was assumed.

For calculating emissions it is assumed that 50% of the blowing agent is emitted in the first year, and the rest within the following three years. This assumption is based on information from producers.

Hard foam

Emissions were calculated from the total consumption of XPS/PU plates in Austria – about 60% of the XPS/PU plates are imported. The consumption per capita of XPS/PU plates in Austria is higher than in all other European countries.

XPS Plates

HFC 134a and HFC 152a are used as blowing agents in XPS hard foam in Austria since 1995 and 2000, respectively. Production data and information about the used blowing agent were obtained from Associations of Industry (construction industry) and from producers.

Based on expert judgement it was assumed that HFC 134a has a market share of 10% (since 2000, before 15%) and HFC 152a of 40% (until 2003 60%). In both cases the blowing agent content in the foam is 6.5%.

For HFC 134a it was assumed that 1.2% per year is emitted through diffusion, for HFC 152a it is assumed that 24.2% per year is emitted through diffusion. These assumptions are based on information from producers.

PU hard foam

HFC 134a, HFC 245fa and HFC 365mfc are used as blowing agents in PU hard foams (Sandwich, foil-clad and tube) in Austria since 2000. Production data and information about the used blowing agent were obtained from producers and literature.

Based on expert judgement it was assumed that HFC 134a has a market share of 25% for Sandwich foam and 10% for foil-clad foam. In both cases the blowing agent content in the foam is 3%. For HFC 245fa and HFC 365mfc a market share of 5% each for tube foam and a blowing agent content of 12% were assumed.

For HFC 134a it was assumed that about 0.4% per year is emitted through diffusion; for HFC 245fa and HFC 365mfc a diffusion factor of 2.3% was assumed.

HFC 245fa and HFC 365mfc are F-gases that are not regulated under the Convention; this is why emissions of these gases are not included in national totals, but reported in CRF Table 9(b) as additional GHG.

4.5.2.3 2.F.3 Fire Extinguishers

Consumption data were obtained directly from the producers of fire extinguishers.

From 1992 to 1995 1.000 t of C_4H_{10} for the use in fire extinguishers in Austria was sold.

HFC-23 and HFC-227ea in fire extinguishers were first introduced to the Austrian market in 1993 and 1996, respectively.

Based on expert judgement it was assumed that actual emissions are 5% of annual stocks, these emissions include leakage and tests.

4.5.2.4 2.F.4 Aerosols/Metered Dose Inhalers

Information about HFC (HFC 134a) use for technical and medical sprays was obtained for the years 2000, 2003–2006 from producers due to the reporting obligation under the Austrian FC-regulation. Information about HFC use in Novelty Sprays was taken from a European evaluation of emissions from this sector (HARNISCH & SCHWARZ 2003) for the years 1995 and 2001, subsequently disaggregated to provide a top-down Austrian estimate. The other years for HFC use in technical, medical and novelty sprays were estimated using the Austrian GDP as indicator.

Emissions were estimated according to the IPCC Guidelines assuming that 50% are emitted in the first year and the rest in the second year.

4.5.2.5 2.F.5 Solvents

Information about HFC-43-10mee used as Solvent was taken from a European evaluation of emissions from this sector (HARNISCH & SCHWARZ 2003) for the years 2001 and 2002, subsequently disaggregated to provide a top-down Austrian estimate. The other years were estimated using the Austrian GDP as indicator.

Emissions were estimated according to the IPCC Guidelines assuming that 50% are emitted in the first year and the rest in the second year.

4.5.2.6 2.F.7 Semiconductor Manufacture (HFC, PFC, SF_6)

All consumption data and data about actual emissions from semiconductor manufacture are based on direct information from industry. Because of the confidentiality claimed for consumption data in this industry emissions are reported in the CRF only for the sum of HFC and PFC. Gases and their applications are presented below:

SF_6: Isolation-gas for high-voltage measurement/Process-gas for plasma-etching

CF_4, C_2F_6, C_3F_8, C_4F_8: Process-gas for plasma-etching/Cleaning chemical vapor deposition

CHF_3: Process-gas for plasma-etching

Emissions are calculated according to the formula presented below:

Emissions = Consumption(1-emission control technology) * efficiency factor * uptime*

Typical ranges of these parameters are: for emission control technology 0.01–0.95, for efficiency factor 0.75–0.95, and for uptime 0.9. The emission control technology applied is high temperature combustion and elution of HF with typical efficiencies of 65–95% for latest years.

Between 1997/1998 one semiconductor manufacture quadrupled his exhaust air purification capacity reducing emissions remarkable. The emission increases of CF_4, C_2F_6 and SF_6 in the other years are due to increasing semiconductor production.

4.5.2.7 2.F.8 Electrical Equipment (SF_6)

Information on SF_6 stocks in electrical equipment in 2003–2006 were obtained from energy suppliers and industrial facilities (as mentioned above, there is a reporting obligation for operators of SF_6 filled equipment since 2004). For the time series information on new equipment per year and the average SF_6 content per equipment type was used; this information was obtained from energy suppliers and experts from industry.

SF_6 emissions were calculated based on the assumption that there are no emissions during first filling on site (furthermore, smaller equipment is already filled during manufacture); based on information from experts from industry, it was thus estimated that emissions during service and leakage are 1% of annual stocks.

4.5.2.8 2.F.9 Other Sources of SF_6

Noise insulating windows

Activity data were estimated based upon information from experts from industry.

The average consumption of SF_6 was calculated by multiplying the area of SF_6 filled insulate glass produced by the average SF_6 consumption per square meter glass (11 litre SF_6/m^2 – 8 litre filling plus 3 litre losses). The calculated volume was multiplied by a density of 6.18 g/litre.

The actual emissions are the sum of emissions during production and leakage, which is estimated to be 1% of the original SF_6 filling. Emissions at disposal became relevant in 2006, because the average life time is estimated to be 25 years and the first SF_6 filled windows were introduced in Austria in 1980. They are calculated by assuming that the remaining quantity of SF_6 in windows produced in 1980 is emitted this year.

Tyres

Information on the amount of SF_6 used for filling tyres was obtained from SF_6 retailers. Emissions were calculated as one third per year for the three years following consumption.

Shoes

Emissions from the imported amount of shoes with SF_6 filling was obtained from the producer. It was assumed that all SF_6 is emitted at the end of the lifetime of these shoes, which was estimated to be 3 years.

Research

SF_6 is used in research in electron microscope and other equipment, the annual consumption was estimated to be 100 kg per year until the total estimated stock of 500 kg was reached (1996), emissions are estimated to be 20 kg per year (after 1996 consumption = emissions).

4.5.3 Source specific QA/QC

The total consumption of HFC and PFC (potential emissions) since 1990 was checked against import/export statistics to verify the trend. For this comparison only fluorinated (hydro)carbons that are used for production in Austria have been considered as potential emissions. The numbers from the Import/Export statistics are the sum of KN8 29033010 (fluorides) and KN8 29033080A (other fluoride or bromide derivatives of acyclic hydrocarbons). Figure 18 shows that the numbers from the Import/Export statistics agree largely with the total consumption and the trend is definitely verified by this comparison. The deviations that appear as overestimation in potential emissions are explained by the fact that the categories of the statistics are not well defined. Thus it is possible that importers report not always in the above mentioned categories but in other categories that include very generally halogen derivates of acyclic hydrocarbons.

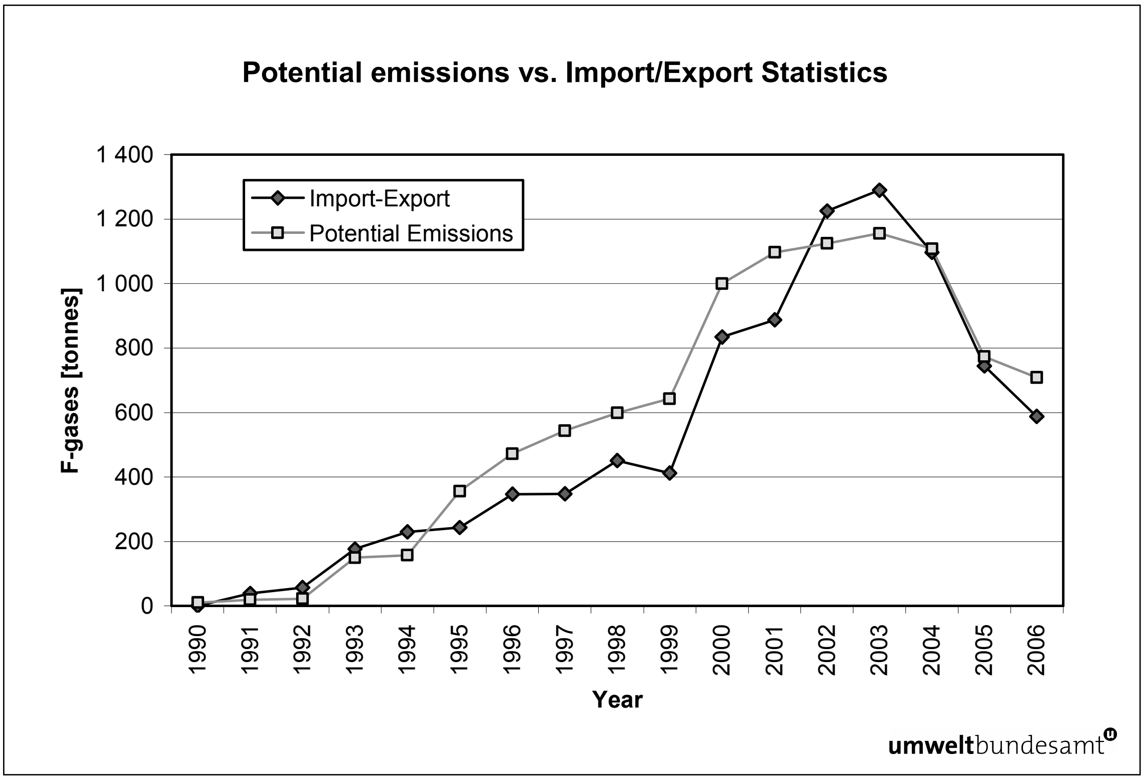

Figure 18: Comparison of potential emissions and Import/Export statistics.

4.5.4 Uncertainty estimate

For the key sources an uncertainty estimate was made:

2.F.1/2/3/4/5 ODS Substitute

Activity data uncertainty is estimated to be 20%, as on the one hand total consumption figures are adjusted with import/export statistics but on the other hand the categories of the statistics do not always distinguish between HFCs and HCFCs for example, resulting in a higher uncertainty.

Apart from the uncertainty of the activity data the following uncertainties occur for emissions from this source:

i. the uncertainty of disaggregating total consumption to sub sectors (which has an effect on emissions as the emission factors used for the different sub categories differ significantly). However, the foam blowing sub sector is small, there are only a few producers that have to be considered and information was available from most of them.
ii. the uncertainty of disaggregation from substance groups (eg. from the import/export statistics) into substances (which affects total GHG emissions because the GWPs differ significantly)
iii. the uncertainty of the emission factors.

The uncertainty of the emission factor is considered to be dominating, it is estimated to be 50%; the other uncertainties were considered to be negligible compared to the emission factor uncertainty.

2.F.7 Semiconductor Manufacture

Activity data (consumption) uncertainty is estimated to be low (5%) because information from all considered producers is used for inventory preparation. The uncertainty for emission factors is estimated to be 10%. This leads to a combined uncertainty of emissions of 11.2%.

2.F.9 Other Use of SF_6

According to emissions, the most important sub source is noise insulating windows. The uncertainty for activity data is estimated to be 25%, emission factor uncertainty is assumed to be relatively high (50%), because it is based on several assumptions.

4.5.5 Recalculations

Update of activity data:

2.F.3. Fire Extinguishers: the stocks of C_4F_{10} and HFC 23 were updated since 1993.

2.F.4. Aerosols and 2.F.5 Solvents:
Potential emissions were updated for the years 2003–2005 according to recalculations of the Austrian GDP in these years.

2.F.7. Semiconductor Manufacture: Potential emissions were updated for 2003 to 2005. The correction of a transcription error concerning confusion of C_4F_{10} with C_4F_8 lead to slightly different emissions due to different GWPs for 2002 onwards.

2.F.8. Electrical equipment: Potential emissions were updated for 2005.

Improvements of methodologies and emission factors:

2.F.2. Foam Blowing: HFC 245fa and HFC 365mfc emissions, previously reported as unspecified mix of HFC, were excluded from the GHG Inventory totals, because they are not fluorinated gases as defined in the CRF. They are now reported in CRF Table 9(b) as additional GHG.

Table 117:Recalculation difference of HFC and SF_6 emissions from category 2.F 1993–2005.

Year	HFC emissions [Gg CO_2e]	PFC emissions [Gg CO_2e]	SF6 emissions [Gg CO_2e]	Total [Gg CO_2e]
1993	0.00	-0.02	0.00	-0.02
1994	0.00	-0.03	0.00	-0.03
1995	0.00	-0.05	0.00	-0.05
1996	0.00	-0.06	0.00	-0.06
1997	0.00	-0.08	0.00	-0.08
1998	0.00	-0.09	0.00	-0.09
1999	0.00	-0.11	0.00	-0.11
2000	0.00	-0.12	0.00	-0.12
2001	-0.65	-0.13	0.00	-0.78
2002	-1.34	-0.14	0.00	-1.48
2003	-2.06	-0.15	0.00	-2.21
2004	-3.06	10.96	0.61	8.50
2005	-3.86	7.26	-0.27	3.12

4.5.6 Planned Improvements

As already mentioned above, for the next submission more results from the reporting obligation concerning the use of FCs will be considered as far as possible. Furthermore a new survey is planned covering consumption and emissions in all sub-categories, with a special focus on emissions occuring from manufacturing/installation and disposal. Results of this new survey are expected to be available for the submission in 2010.

5 SOLVENT AND OTHER PRODUCT USE (CRF SOURCE CATEGORY 3)

5.1 Sector Overview

This chapter describes the methodology used for calculating greenhouse gas emissions from solvent use in Austria. Solvents are chemical compounds, which are used to dissolve substances as paint, glues, ink, rubber, plastic, pesticides or for cleaning purposes (degreasing). After application of these substances or other procedures of solvent use most of the solvents are released into air. Because solvents consist mainly of NMVOC, solvent use is a major source for anthropogenic NMVOC emissions in Austria. Once released into the atmosphere NMVOCs react with reactive molecules (mainly HO-radicals) or high energetic light to finally form CO_2.

Estimations for N_2O emissions from other product use (anaesthesia and aerosol cans) are also addressed in this chapter.

5.1.1 Emission Trends

In the year 2006, 0.4% of total GHG emissions in Austria (385 Gg CO_2 equivalents) originated from *Solvent and Other Product Use*. 57% of these emissions were indirect CO_2 emissions, 43% were accounted for by N_2O emissions.

Figure 19 and Table 118 present the trend in total greenhouse gas emissions by subcategories.

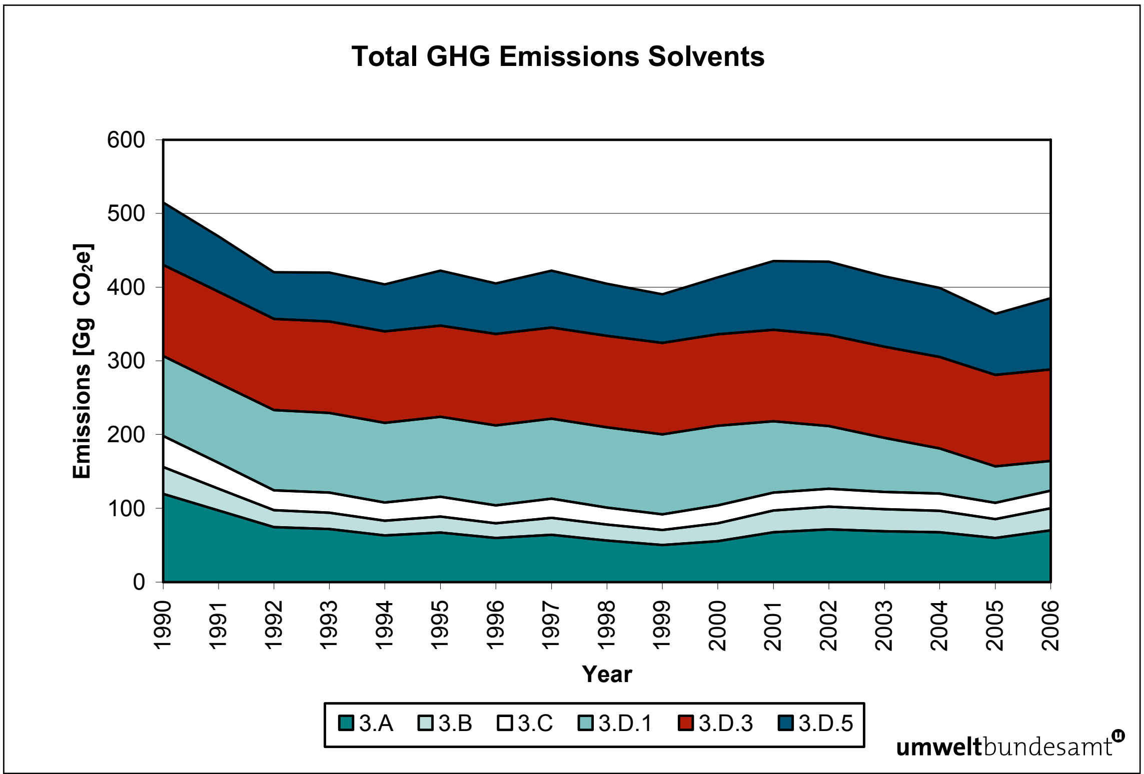

Figure 19: Total greenhouse gas emissions and trend from 1990–2006 by subcategories of Category 3 Solvent and Other Product Use.

Table 118: Total greenhouse gas emissions and trend from 1990–2006 by subcategories of Category 3 Solvent and Other Product Use.

GHG	Total	3.A	3.B	3.C	3.D	3.D.1	3.D.3	3.D.5
		Solvent	***Solvent***	***Solvent***		***Use of N_2O***		***Solvent***
	[Gg CO_2 equivalent]							
1990	515.17	119.69	36.11	42.25	317.13	108.50	124.00	84.63
1991	469.27	97.02	29.53	35.02	307.69	108.50	124.00	75.19
1992	420.24	74.37	22.85	27.48	295.54	108.50	124.00	63.04
1993	419.85	71.67	22.23	27.13	298.82	108.50	124.00	66.32
1994	404.04	63.28	19.84	24.58	296.35	108.50	124.00	63.85
1995	422.38	67.46	21.38	26.91	306.62	108.50	124.00	74.12
1996	405.31	59.76	20.15	24.21	301.20	108.50	124.00	68.70
1997	422.59	63.93	22.91	26.31	309.43	108.50	124.00	76.93
1998	404.74	56.29	21.45	23.56	303.45	108.50	124.00	70.95
1999	390.87	50.26	20.34	21.40	298.87	108.50	124.00	66.37
2000	413.52	55.73	23.97	24.16	309.66	108.50	124.00	77.16
2001	435.81	67.69	29.12	24.56	314.45	96.72	124.00	93.73
2002	434.56	71.55	30.78	24.22	308.01	84.94	124.00	99.07
2003	414.92	69.02	29.69	23.48	292.73	73.16	124.00	95.57
2004	399.10	67.60	29.08	23.44	278.98	61.38	124.00	93.60
2005	363.74	59.70	25.68	22.08	256.27	49.60	124.00	82.67
2006	385.29	70.10	30.16	23.66	261.37	40.30	124.00	97.07
Trend 2005–2006	*6%*	*17%*	*17%*	*7%*	*2%*	*-19%*	*0%*	*17%*
Trend 1990–2006	*-25%*	*-41%*	*-16%*	*-44%*	*-18%*	*-63%*	*0%*	*15%*

Greenhouse gas emissions in this sector decreased by 25% between 1990 and 2006, due to decreasing solvent and N_2O use as well as due to the positive impact of the enforced laws and regulations in Austria:

- Solvent Ordinance: for limitation of emission of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products in order to combat acidification and ground-level ozone
- *Federal Law Gazette II No. 398/2005[31], amendment of Federal Law Gazette 872/1995[32]; amendment of Federal Law Gazette 492/1991[33] (implementation of Council Directive 2004/42/CE)*

[31] Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Begrenzung der Emissionen flüchtiger organischer Verbindungen durch Beschränkung des Inverkehrsetzens und der Verwendung organischer Lösungsmittel in bestimmten Farben und Lacken (Lösungsmittelverordnung 2005 – LMV 2005), BGBl. II Nr. 398/2005; Umsetzung der Richtlinie 2004/42/EG

[32] Verordnung des Bundesministers für Umwelt über Verbote und Beschränkungen von organischen Lösungsmitteln (Lösungsmittelverordnung 1995 – LMVO 1995), BGBl 872/1995

- Ordinance for paint finishing system (surface technology systems): for limitation of emission of volatile organic compounds due to the use of organic solvents by activities such as surface coating, painting or varnishing of different materials and products along the entire chain in the painting process in order to combat acidification and ground-level ozone
- *Federal Law Gazette 873/1995*[34]*, amendment of Federal Law Gazette 27/1990*[35]
- Federal Ozone Law: establishes by various measures a reduction in emissions of ozone precursors NO_x and NMVOC
- *Federal Law Gazette 309/1994; amendment of Federal Law Gazette 210/1992*[36]
- Ordinance for industrial facilities and installations applying chlorinated hydrocarbon: for limitation of emission of chlorinated organic solvents from industrial facilities and installations applying chlorinated hydrocarbon
- *Federal Law Gazette 865/1994*[37]
- Convention on Long-range Transboundary Air Pollution (LRTAP)[38], extended by eight protocols from which the following have relevance
  - The 1988 Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes[39]
  - The 1991 Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes[40]
  - The 1998 Protocol on Persistent Organic Pollutants (POPs)[41]
  - The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone; 21 Parties.[42]

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[33] Verordnung des Bundesministers für Umwelt, Jugend und Familie über Verbote und Beschränkungen von organischen Lösungsmitteln (Lösungsmittelverordnung), BGBl. Nr. 492/1991

[34] Verordnung des Bundesministers für wirtschaftliche Angelegenheiten über die Begrenzung der Emission von luftverunreinigenden Stoffen aus Lackieranlagen in gewerblichen Betriebsanlagen (Lackieranlagen-Verordnung), BGBl. Nr. 873/1995

[35] Verordnung des Bundesministers für wirtschaftliche Angelegenheiten vom 26. April 1989 über die Begrenzung der Emission von chlorierten organischen Lösemitteln aus CKW-Anlagen in gewerblichen Betriebsanlagen (CKW-Anlagen-Verordnung), BGBl. Nr. 27/1990

[36] Bundesgesetz über Maßnahmen zur Abwehr der Ozonbelastung und die Information der Bevölkerung über hohe Ozonbelastungen, mit dem das Smogalarmgesetz, BGBl. Nr. 38/1989, geändert wird (Ozongesetz)

[37] Verordnung des Bundesministers für wirtschaftliche Angelegenheiten über die Begrenzung der Emission von chlorierten organischen Lösemitteln aus CKW-Anlagen in gewerblichen Betriebsanlagen (CKW-Anlagen-Verordnung 1994), BGBl. Nr. 865/1994

[38] Entered into force 14 February 1991; ratified by Austria 16 December 1982; See for more information UMWELTBUNDESAMT (2006): Informative Inventory Report. Vienna.

[39] Entered into force 14 February 1991; ratified by Austria 15 January 1990; BGBl. Nr. 273/1991

[40] Entered into force 29 September 1997; ratified by Austria 23 August 1994; Bekämpfung von Emissionen flüchtiger organischer Verbindungen oder ihres grenzüberschreitenden Flusses samt Anhängen und Erklärung, BGBl. III Nr. 164/1997

[41] Entered into force on 23 October 2003; ratified by Austria 27 August 2002

[42] Entered into force on 17 May 2005; signed by Austria 1 December 2000

- Ordinance for volatile organic compounds (VOC) due to the use of organic solvents in certain activities and installations;
- *Federal Law Gazette II No. 301/2002[43], amended by Federal Law Gazette[44]*
- Council Directive 1999/13/EC[45] of March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations
- Council Directive 2004/42/CE[46] of the European Parliament and of the Council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC
- Ordinance on the limitation of emission during the use of solvents containing lightly volatile halogenated hydrocarbons in industrial facilities and installations
- *Federal Law Gazette II No. 411/2005[47]*

In emission intensive activity areas such as coating, painting, and printing as well as in the pharmaceutical industry several measures were implemented:

- Primary measures
  - complete substitution of certain solvents
  - Reduction of the solvent content by changing the composition of solvent containing products
  - technological change from solvent emitting processes to low or non-solvent emitting processes
  - implementation of resources saving procedures and techniques
  - installation of new equipments and facilities and shutdown of old equipments and facilities
  - avoidance of fugitive emissions
- Secondary measures
  - Waste gas collection and waste gas purification, whereas the solvents in the exhaust air are precipitated and either recycled if applicable or destructed.
  - raising of environmental awareness
  - compliance with emission limit values for exhaust gas
  - compilation of solvent balance
  - compilation of solvent reduction plan

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[43] Verordnung des Bundesministers für Wirtschaft und Arbeit zur Umsetzung der Richtlinie 1999/13/EG über die Begrenzung der Emissionen bei der Verwendung organischer Lösungsmittel in gewerblichen Betriebsanlagen (VOC-Anlagen-Verordnung – VAV) BGBL II Nr. 301/2002

[44] Änderung der VOC-Anlagen-Verordnung – VAV, BGBl. II Nr. 42/2005

[45] Richtlinie 1999/13/EG des Rates vom 11. März 1999 über die Begrenzung von Emissionen flüchtiger organischer Verbindungen, die bei bestimmten Tätigkeiten und in bestimmten Anlagen bei der Verwendung organischer Lösungsmittel entstehen

[46] Richtlinie 2004/42/EG des Europäischen Rates vom 21. April 2004 über die Begrenzung von Emissionen flüchtiger organischer Verbindungen aufgrund der Verwendung organischer Lösemittel in bestimmten Farben und Lacken und in Produkten der Fahrzeugreparaturlackierung sowie zur Änderung der Richtlinie 1999/13/EG

[47] Verordnung des Bundesministers für Wirtschaft und Arbeit über die Begrenzung der Emissionen bei der Verwendung halogenierter organischer Lösungsmittel in gewerblichen Betriebsanlagen (HKW-Anlagen-Verordnung – HAV) BGBl. II Nr. 411/2005

But also the N_2O use has significantly decreased due to shorter duration of anaesthesia during operations and more regional anaesthetics than general anaesthesia.

Table 119 presents the trend in total greenhouse gas emissions by gas.

Table 119:Trend in greenhouse gas emissions of Category 3 Solvent and Other Product Use 1990–2006.

GHG	CO_2 emission [Gg CO_2 equivalent]	N_2O emission [Gg CO_2 equivalent]	Total [Gg CO_2 equivalent]
1990	282.67	232.50	515.17
1991	236.77	232.50	469.27
1992	187.74	232.50	420.24
1993	187.35	232.50	419.85
1994	171.54	232.50	404.04
1995	189.88	232.50	422.38
1996	172.81	232.50	405.31
1997	190.09	232.50	422.59
1998	172.24	232.50	404.74
1999	158.37	232.50	390.87
2000	181.02	232.50	413.52
2001	215.09	220.72	435.81
2002	225.62	208.94	434.56
2003	217.76	197.16	414.92
2004	213.72	185.38	399.10
2005	190.14	173.60	363.74
2006	220.99	164.30	385.29
Trend 2005–2006	*16%*	*–5%*	*6%*
Trend 1990–2006	*–22%*	*–29%*	*–25%*

5.1.2 Key Sources

The key category analysis is presented in Chapter 1.5. This chapter includes information about the key sources in the IPCC Sector *3 Solvents*. CO_2 emissions of this source have been identified as key category.

Table 120:Key sources of category Solvent and Other Product Use.

IPCC Category	Source Categories	Key Sources*	
		GHG	KS-Assessment
3	Solvent and Other Product Use	CO_2	LA 90, 93–94

LA06 = Level Assessment 2006

TA = Trend Assessment

5.1.3 Completeness

Table 121 gives an overview of the IPCC categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this sub-category have been estimated.

Table 121: Overview of subcategories of IPCC Category 3 Solvents and Other Product Use: transformation into SNAP Codes and status of estimation.

IPCC Category		SNAP		CO_2	N_2O
3.A	Paint application	0601	Paint application	✓	NA
3.B	Degreasing and Dry Cleaning	0602	Degreasing, dry cleaning and electronics	✓	NA
3.C	Chemical Products, Manufacture and Processing	0603	Chemical products manufacturing and processing	✓	NA
3.D	Other	0604	Other use of solvents and related activities	✓	NA
		0605	Use of HFC, N2O, NH3, PFC and SF6	NA	✓

5.2 CO_2 Emissions from Solvent and Other Product Use (IPCC Sector 3 A, 3 B, 3 C and 3 D 5)

5.2.1 Methodology Overview

CO_2 emissions from solvent use were calculated from NMVOC emissions of this sector. As a first step the quantity of solvents used and the solvent emissions were calculated.

To determine the quantity of solvents used in Austria in the various applications, a bottom up and a top down approach were combined. Figure 20 to Figure 22 present an overview of the methodology.

The top down approach provided total quantities of solvents used in Austria. The share of the solvents used for the different applications and the solvent emission factors have been calculated on the basis of the bottom up approach. By linking the results of bottom up and top down approach, quantities of solvents annually used and solvent emissions for the different applications were obtained.

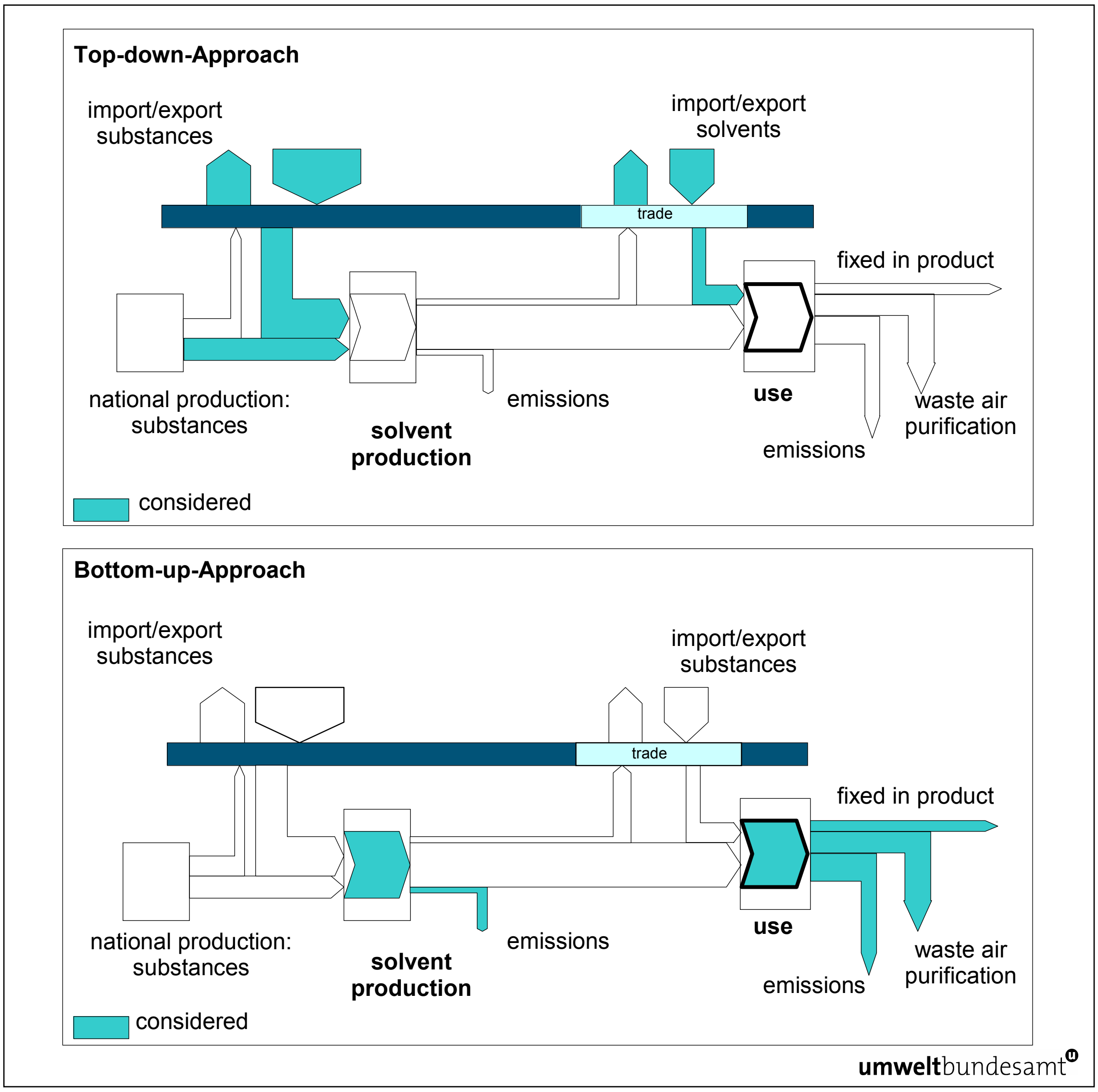

Figure 20: Top-down-Approach compared to Bottom-up-Approach.

Top-down – CRF Sector 3

Import/Export Organic Substances
Inland Solvent production – solvent content
Imp/Exp Solvent products – solvent content
Solvent use
Non solvent use
Solvent Activity

Combination Top down - bottom up							Bottom-up					
Solvent Share				Solvent Emissions			Solvent Emission Factor			Solvent Activity		
CRF Sector 3	CRF Sector 3A-3D	SNAP Level 3		CRF Sector 3	CRF Sector 3A-3D	SNAP Level 3	CRF Sector 3	CRF Sector 3A-3D	SNAP Level 3	CRF Sector 3	CRF Sector 3A-3D	SNAP Level 3
	3 A, Paint application	060101	manufacture of automobiles				58%	45%	57%	100%	35.7%	1.2%
		060102	car repairing						89%			0.7%
		060103	construction and buildings						88%			3.0%
		060104	domestic use						89%			1.4%
		060105	coil coating						53%			3.5%
		060107	wood coating						67%			3.4%
		060108	Other industrial paint application						30%			22.5%
	3 B, Degreasing and Dry Cleaning	060201	Metal degreasing					55%	45%		12.6%	5.8%
		060202	Dry cleaning						85%			0.3%
		060203	Electronic components manufacturing						44%			1.2%
		060204	Other industrial cleaning						68%			5.2%
	3 C, Chemical Products, Manufacture and Processing	060305	Rubber processing					13%	94%		15.8%	0.4%
		060306	Pharmaceutical products manufacturing						26%			6.2%
		060307	Paints manufacturing						4%			
		060308	Inks manufacturing						5%			
		060309	Glues manufacturing						20%			
		060310	Asphalt blowing						1%			0.5%
		060311	Adhesive, magnetic tapes, films and photographs						94%			0.0%
		060312	Textile finishing						88%			0.0%
		060314	Other						16%			8.5%
	3 D, Other	060403	Printing industry					73%	66%		36.0%	8.4%
		060404	Fat, edible and non edible oil extraction						20%			0.2%
		060405	Application of glues and adhesives						64%			0.4%
		060406	Preservation of wood						99%			0.4%
		060407	Under seal treatment and conservation of vehicles						85%			0.1%
		060408	Domestic solvent use (other than paint application)						84%			16.6%
		060411	Domestic use of pharmaceutical products (k)						94%			4.3%
		060412	Other (preservation of seeds,...)						35%			5.5%

Figure 21: Combination of Top-down-Approach compared to Bottom-up-Approach for 2006.

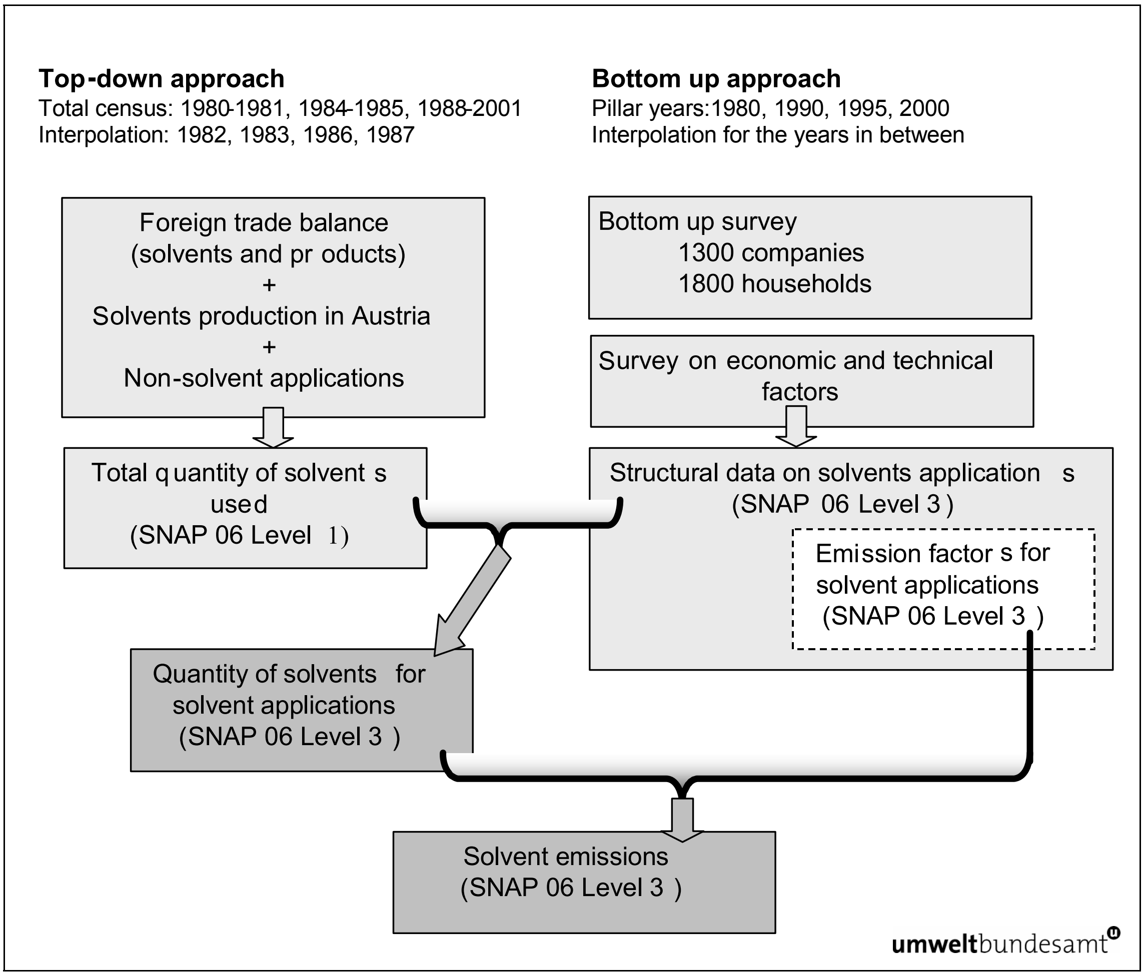

Figure 22: Overview of the methodology for solvent emissions.

A study (WINDSPERGER et al. 2002a) showed that emission estimates only based on the top down approach overestimate emissions because a large amount of solvent substances is used for "non-solvent-applications". "Non-solvent application" are applications where substances usually are used as feed stock in chemical, pharmaceutical or petrochemical industry (e.g. production of MTBE, formaldehyde, polyester, biodiesel, pharmaceuticals etc.) and where therefore no emissions from "solvent use" arise. However, there might be emissions from the use of the produced products, such as MTBE which is used as fuel additive and finally combusted, these emissions for example are considered in the transport sector.

Additionally the comparison of the top-down and the bottom-up approach helped to identify several quantitatively important applications like windscreens wiper fluids, antifreeze, moonlighting, hospitals, deicing agents of aeroplanes, tourism, cement- respectively pulp industry, which were not considered in the top-down approach.

5.2.2 Top down Approach

The top-down approach is based on

1. import-export statistics (foreign trade balance)
2. production statistics on solvents in Austria
3. a survey on non-solvent-applications in companies (WINDSPERGER et al. 2004a)
4. survey on the solvent content in products and preparations at producers and retailers (WINDSPERGER et al. 2002a)

ad (1) and (2): Total quantity of solvents used in Austria were obtained from import-export statistics and production statistics provided by STATISTIK AUSTRIA.

Nearly a full top down investigation of substances of the import-export statistics from 1980 to 2002 was carried out (data in the years 1982, 1983, 1986 and 1987 were linearly interpolated). A main problem was that the methodology of the import-export statistics changed over the years. In earlier years products and substances had been pooled to groups and whereas the current foreign trade balance is more detailed with regard to products and substances. It was necessary to harmonise the time series in case of deviations.

There are only a few facilities producing solvents in Austria. Therefore due to confidentiality the Statistic Austria provided the data in an aggregated form. The solvents production fluctuated especially in the last years considerably.

ad (3): In the study on the comparison of top down and bottom up approach (WINDSPERGER et al. 2002a) the amount of solvent substances used in "non-solvent-applications" was identified. The 20 most important companies in this context were identified and asked to report the quantities of solvents they used over the considered time period in „non-solvent-applications".

ad (4): Relevant producers and retailers provided data on solvent content in products and preparations. As the most important substance groups alcohols and esters were identified.

5.2.3 Bottom up Approach

In a first step an extensive survey on the use of solvents in the year 2000 was carried out in 1 300 Austrian companies (WINDSPERGER et al. 2002b). In this survey data about the solvent content of paints, cleaning agents etc. and on solvents used (both substances and substance categories) like acetone or alcohols were collected.

Information about the type of application of the solvents was gathered, divided into the three categories "final application", "cleaner" and "product preparation" as well as the actual type of waste gas treatment, which was divided into the categories "open application", "waste gas collection" and "waste gas treatment".

For every category of application and waste gas treatment an emission factor was estimated to calculate solvent emissions in the year 2000 (see Table 122).

Table 122:Emission factors for NMVOC emissions from Solvent Use.

Category	Factor
final application	1.00
cleaner	0.85
product preparation	0.05
open application	1.00
waste gas collection	0.50
waste gas treatment	0.20

In a second step a survey in 1 800 households was made (WINDSPERGER et al. 2002a) for estimating the domestic solvent use (37 categories in 5 main groups: cosmetic, do-it-yourself, household cleaning, car, fauna and flora). Also, solvent use in the context of moonlighting besides commercial work and do-it-yourself was calculated.

The comparison of top down and bottom up approach helped to identify several additional applications, that make an important contribution to the total amount of solvents used. Thus in a third step the quantities of solvents used in these applications such as windscreens wiper fluids, antifreeze, hospitals, de-icing agents of aeroplanes, tourism, cement- respectively pulp industry, were estimated in surveys.

The outcome of these three steps was the total stock of solvents used for each application in the year 2000 (at SNAP level 3) (WINDSPERGER et al. 2002a).

To achieve a time series the development of the economic and technical situation in relation to the year 2000 was considered. It was distinguished between "general aspects" and "specific aspects" (see tables below). The information about these defined aspects were collected for three pillar years (1980, 1990, 1995) and were taken from several studies (SCHMIDT et al. 1998, BARNERT 1998) and expert judgements from associations of industries (chemical industry, printing industry, paper industry) and other stakeholders. On the basis of this information calculation factors were estimated. With these factors and the data for solvent use and emission of 2000 data for the three pillar years was estimated. For the years in between data was linearly interpolated.

Table 123:General aspects and their development.

General aspects	1980	1990	1995	2000
efficiency factor solvent cleaning	250%	150%	130%	100%
efficiency factor application	150%	110%	105%	100%
solvent content of water-based paints	15%	12%	10%	8%
solvent content of solvent-based paints	60%	58%	55%	55%
efficiency of waste gas purification	70%	75%	78%	80%

Table 124:Specific aspects and their development: distribution of the used paints (water based-paints – solvent-based paints) and part of waste gas purification (application – purification).

SNAP category	description	year	Distribution of used paints		Part of waste gas treatment	
			Solvent based paints	Water based paints	application	purification
060101	manufacture of automobiles	2000	73%	27%	10%	0%
		1995	80%	20%	8%	0%
		1990	90%	10%	5%	0%
		1980	100%	0%	0%	0%
060102	car repairing	2000	51%	49%	62%	1%
		1995	55%	45%	60%	0%
		1990	75%	25%	10%	0%
		1980	85%	15%	5%	0%

SNAP category	description	year	Distribution of used paints		Part of waste gas treatment	
			Solvent based paints	Water based paints	application	purification
060107	wood coating	2000	46%	54%	46%	3%
		1995	60%	40%	45%	2%
		1990	85%	15%	10%	0%
		1980	100%	0%	0%	0%
060108	Other industrial paint application	2000	97%	3%	90%	46%
		1995	99%	1%	87%	45%
		1990	100%	0%	26%	20%
		1980	100%	0%	0%	0%
060201	Metal degreasing	2000	92%	8%	75%	0%
		1995	95%	5%	65%	0%
		1990	100%	0%	10%	0%
		1980	100%	0%	0%	0%
060403	Printing industry	2000			44%	17%
		1995			29%	10%
		1990			10%	5%
		1980			0%	0%
060405	Application of glues and adhesives	2000			58%	0%
		1995			53%	0%
		1990			15%	0%
		1980			0%	0%
060103	Paint application : construction and buildings	2000	91%	9%	19%	4%
		1995	93%	7%	15%	2%
		1990	100%	0%	5%	0%
		1980	100%	0%	0%	0%
060105	Paint application : coil coating	2000	100%	0%	63%	0%
		1995	100%	0%	60%	0%
		1990	100%	0%	25%	0%
		1980	100%	0%	0%	0%
060406	Preservation of wood	2000	83%	17%	0%	0%
		1995	85%	15%	0%	0%
		1990	95%	5%	0%	0%
		1980	100%	0%	0%	0%
060412	Other (preservation of seeds,…)	2000	100%	0%	90%	0%
		1995	100%	0%	80%	0%
		1990	100%	0%	10%	0%
		1980	100%	0%	0%	0%

Table 125: Specific aspects and their development: changes in the number of employees compared to the year 2000.

SNAP		Changes in the number of employees compared to the year 2000			
		1980	**1990**	**1995**	**2000**
0601	Paint application				
060101	manufacture of automobiles	88%	82%	72%	100%
060102	car repairing	94%	98%	96%	100%
060103	construction and buildings	96%	90%	102%	100%
060104	domestic use	separate analysed			
060105	coil coating	99%	113%	107%	100%
060107	wood coating	107%	109%	112%	100%
060108	industrial paint application	122%	112%	106%	100%
0602	Degreasing, dry cleaning and electronics				
060201	Metal degreasing	151%	113%	83%	100%
060202	Dry cleaning	63%	75%	88%	100%
060203	Electronic components manufacturing	143%	122%	104%	100%
060204	Other industrial cleaning	33%	77%	56%	100%
0603	Chemical products manufacturing and processing				
060305	Rubber processing	110%	101%	102%	100%
060306	Pharmaceutical products manufacturing	118%	112%	97%	100%
060307	Paints manufacturing	118%	112%	97%	100%
060308	Inks manufacturing	118%	112%	97%	100%
060309	Glues manufacturing	118%	112%	98%	100%
060310	Asphalt blowing	124%	120%	120%	100%
060311	Adhesive, magnetic tapes, films and photographs	33%	57%	76%	100%
060312	Textile finishing	241%	171%	132%	100%
060314	Other	117%	112%	98%	100%
0604	Other use of solvents and related activities				
060403	Printing industry	129%	125%	111%	100%
060404	Fat, edible and non edible oil extraction	129%	116%	112%	100%
060405	Application of glues and adhesives	239%	156%	104%	100%
060406	Preservation of wood	108%	105%	100%	100%
060407	Under seal treatment and conservation of vehicles	97%	102%	103%	100%
060408	Domestic solvent use (other than paint application	separate analysed			
060411	Domestic use of pharmaceutical products (k)				
060412	Other (preservation of seeds,…)	108%	105%	101%	100%

A comprehensive summary on the methodology for the year 2000 can also be found in the Austrian Informative Inventory Report (UMWELTBUNDESAMT 2007).

5.2.4 Combination Top down – Bottom up approach and updating

To verify and adjust the data the solvents given in the top down approach and the results of the bottom up approach were differentiated by 15 defined categories of solvent groups (see below Table 126). The differences between the quantities of solvents from the top down approach and bottom up approach respectively are lower than 10%. Table 126 shows the range of the differences in the considered pillar years broken down to the 15 substance categories.

Table 126:Differences between the results of the bottom up and the top down approach.

	Acetone	Methanol	Propanol	Solvent naphta	Paraffins	Alcohols	Glycols	Ester	Aromates	Ether	org. acids	Ketones	Aldehydes	Amines	cycl. Hydrocarb.	Others	Sum of Diff-erences [kt/a]
2000																	-14
1995																	-2
1990																	14
1980																	-18

	difference less than 2 kt/a
	difference 2–10 kt/a
	difference greater than 10 kt/a

As the data of the top down approach were obtained from national statistics, they are assumed to be more reliable than the data of the bottom up approach. That's why the annual quantities of solvents used were taken from the top down approach while the share of the solvents for the different applications (on SNAP level 3) and the solvent emission factors have been calculated on the basis of the bottom up approach. The following tables (Table 127 and Table 128) present activity data and implied emission factors.

The inventory has been updated with data from (WINDSPERGER et al. 2004b) since the study (WINDSPERGER et al. 2002) has been published. The data of the Austrian air emission inventory 2007 is based upon a current estimation, which is generally higher than the data of the year 2000, because in the year 2000 the use of wind screen washing fluid in housholds was not included.

The CO_2 emissions for 2002 to 2006 are calculated with the "emission factors" t CO_2/t NMVOC of the year 2000 and the NMVOC emission of the respective projection year. Compared to the data reported in the survey there is a lower reduction because of the higher estimated emissions of housholds (SNAP 060408).

Table 127:Activity data of Category 3 Solvent and other product use [Mg].

IPCC	3.A	3.A	3.A	3.A	3.A	3.A	3.A	3.A
SNAP		**060101**	**060102**	**060103**	**060104**	**060105**	**060107**	**060108**
Unit	**Mg Solvent**							
1990	55 450	1 811	1 009	3 882	4 600	5 706	7 103	31 339
1991	49 437	1 535	900	3 585	3 607	5 124	6 217	28 469
1992	42 141	1 240	768	3 162	2 654	4 398	5 200	24 719
1993	45 302	1 260	827	3 514	2 399	4 761	5 484	27 057
1994	45 124	1 182	824	3 614	1 938	4 775	5 356	27 435
1995	52 220	1 283	955	4 315	1 718	5 564	6 075	32 310
1996	49 331	1 304	905	4 080	1 668	5 186	5 548	30 640
1997	52 586	1 493	968	4 353	1 829	5 450	5 701	32 792
1998	47 044	1 432	869	3 897	1 683	4 803	4 902	29 458
1999	42 851	1 396	794	3 554	1 578	4 305	4 275	26 949
2000	47 985	1 671	893	3 983	1 820	4 739	4 565	30 314
2001	58 286	2 030	1 085	4 838	2 211	5 756	5 545	36 822
2002	61 610	2 145	1 147	5 114	2 337	6 085	5 861	38 921
2003	59 431	2 070	1 106	4 933	2 254	5 869	5 654	37 545
2004	58 210	2 027	1 083	4 832	2 208	5 749	5 538	36 774
2005	51 410	1 790	957	4 267	1 950	5 077	4 891	32 478
2006	60 365	2 102	1 123	5 011	2 290	5 962	5 743	38 135

IPCC	3.B	3.B	3.B	3.B	3.B
SNAP		**060201**	**060202**	**060203**	**060204**
Unit	**Mg Solvent**				
1990	16 472	9 391	466	2 540	4 075
1991	14 406	7 969	413	2 153	3 871
1992	12 041	6 448	350	1 740	3 503
1993	12 685	6 560	375	1 767	3 983
1994	12 378	6 164	371	1 657	4 186
1995	14 027	6 704	427	1 799	5 097
1996	14 008	6 635	418	1 697	5 258
1997	15 775	7 408	461	1 807	6 099
1998	14 902	6 941	427	1 615	5 919
1999	14 326	6 622	403	1 469	5 832
2000	16 924	7 766	468	1 643	7 047
2001	20 557	9 433	568	1 996	8 560
2002	21 729	9 971	601	2 110	9 048
2003	20 961	9 618	580	2 035	8 728
2004	20 530	9 421	568	1 993	8 549
2005	18 132	8 320	501	1 760	7 550
2006	21 291	9 770	589	2 067	8 865

IPCC	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C
SNAP		060305	060306	060307	060308	060309	060310	060311	060312	060314
Unit	Mg Solvent									
1990	123 768	991	8 391	59 952	7 173	4 203	1 348	3	159	41 548
1991	115 918	864	6 978	54 971	6 930	4 168	1 173	3	133	40 698
1992	107 979	720	5 519	49 990	6 687	4 133	975	3	105	39 847
1993	101 904	755	5 470	45 010	6 444	4 098	1 022	3	105	38 997
1994	95 251	734	4 987	40 029	6 201	4 063	991	3	96	38 147
1995	89 617	828	5 237	35 048	5 958	4 028	1 116	4	102	37 296
1996	89 460	750	5 619	34 486	5 795	4 126	989	4	89	37 602
1997	90 263	764	6 739	33 924	5 632	4 225	980	4	87	37 908
1998	89 630	650	6 729	33 362	5 469	4 323	808	4	71	38 214
1999	89 135	560	6 797	32 799	5 306	4 421	671	4	57	38 520
2000	90 444	589	8 394	32 237	5 143	4 520	674	5	56	38 826
2001	91 353	715	10 196	30 375	6 335	1 551	819	6	68	41 288
2002	87 208	756	10 777	26 171	6 031	446	865	6	72	42 082
2003	83 221	729	10 396	23 982	5 201	441	835	6	69	41 562
2004	85 114	715	10 183	25 802	5 868	385	818	6	68	41 270
2005	82 455	631	8 993	25 128	6 854	417	722	5	60	39 645
2006	83 408	741	10 560	23 998	4 957	443	848	6	70	41 785

IPCC	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5
SNAP		060403	060404	060405	060406	060407	060408	060411	060412
Unit	Mg Solvent								
1990	43 887	14 941	541	824	687	221	14 041	5 055	7 577
1991	40 081	13 214	464	709	609	199	13 460	4 633	6 793
1992	34 983	11 174	380	582	516	172	12 279	4 058	5 822
1993	38 483	11 914	392	602	552	187	14 065	4 478	6 293
1994	39 207	11 770	374	576	546	188	14 874	4 576	6 303
1995	46 388	13 509	413	639	629	221	18 214	5 430	7 333
1996	44 909	12 564	369	602	595	203	18 262	5 273	7 041
1997	49 082	13 172	370	640	636	211	20 642	5 780	7 631
1998	45 042	11 578	309	570	571	183	19 567	5 320	6 944
1999	42 108	10 350	261	518	522	162	18 871	4 987	6 437
2000	48 417	11 359	267	578	586	175	22 361	5 752	7 339
2001	58 811	13 797	324	702	712	213	27 161	6 987	8 914
2002	62 164	14 584	343	742	752	225	28 710	7 385	9 423
2003	59 966	14 068	331	716	726	217	27 695	7 124	9 090
2004	58 734	13 779	324	701	711	212	27 126	6 978	8 903
2005	51 873	12 170	286	619	628	187	23 957	6 163	7 863
2006	60 909	14 290	336	727	737	220	28 130	7 236	9 233

Table 128:Implied NMVOC emission factors for Solvent Use 1990–2006.

IPCC	3.A	3.A	3.A	3.A	3.A	3.A	3.A
SNAP	060101	060102	060103	060104	060105	060107	060108
Unit	kg/Mg Solvent						
1990	940.36	976.21	920.40	884.57	841.40	937.21	782.41
1991	880.78	973.33	904.60	885.50	789.62	892.55	700.76
1992	821.77	970.05	888.68	885.83	738.06	848.08	619.16
1993	762.70	967.35	872.51	886.62	686.20	803.43	537.53
1994	703.89	964.81	856.67	887.00	634.55	758.78	455.91
1995	644.58	961.26	840.56	887.66	582.85	714.07	374.28
1996	630.37	948.07	848.28	887.89	572.31	705.66	360.18
1997	616.21	934.92	855.96	887.37	561.47	697.25	346.09
1998	601.96	921.75	863.74	887.70	550.91	688.70	332.00
1999	588.11	908.06	871.13	887.83	540.07	680.23	317.90
2000	573.31	894.74	878.99	887.36	529.44	671.63	303.82
2001	573.31	894.74	878.99	887.36	529.44	671.63	303.82
2002	573.31	894.74	878.99	887.36	529.44	671.63	303.82
2003	573.31	894.74	878.99	887.36	529.44	671.63	303.82
2004	573.31	894.74	878.99	887.36	529.44	671.63	303.82
2005	573.31	894.74	878.99	887.36	529.44	671.63	303.82
2006	573.31	894.74	878.99	887.36	529.44	671.63	303.82

IPCC	3.B	3.B	3.B	3.B
SNAP	060201	060202	060203	060204
Unit	kg/Mg Solvent			
1990	934.83	950.64	680.31	722.70
1991	859.83	937.05	642.82	717.64
1992	784.89	922.86	605.75	712.53
1993	710.06	906.67	568.19	707.51
1994	634.98	894.88	531.08	702.34
1995	560.11	880.56	493.61	697.27
1996	537.30	873.21	483.21	693.80
1997	514.71	867.68	472.05	690.28
1998	492.00	861.83	460.68	686.60
1999	469.34	856.08	449.97	682.96
2000	446.69	850.43	438.83	679.44
2001	446.69	850.43	438.83	679.44
2002	446.69	850.43	438.83	679.44
2003	446.69	850.43	438.83	679.44
2004	446.69	850.43	438.83	679.44
2005	446.69	850.43	438.83	679.44
2006	446.69	850.43	438.83	679.44

IPCC	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C
SNAP	060305	060306	060307	060308	060309	060310	060311	060312	060314
Unit	kg/Mg Solvent								
1990	985.87	462.52	53.64	50.75	200.10	10.39	1 000.00	886.79	224.37
1991	981.48	420.46	52.63	50.79	200.10	10.23	1 000.00	879.70	219.10
1992	976.39	378.51	51.61	50.70	200.10	10.26	666.67	885.71	213.84
1993	973.51	336.75	50.59	50.74	200.10	9.78	1 000.00	885.71	208.55
1994	968.66	294.77	49.56	50.80	200.10	10.09	1 000.00	885.42	203.29
1995	963.77	252.82	48.56	50.69	200.10	9.86	750.00	882.35	198.01
1996	958.67	253.96	45.93	50.73	199.95	10.11	750.00	887.64	190.57
1997	952.88	254.93	43.30	50.78	200.00	10.20	1 000.00	885.06	183.13
1998	946.15	255.91	40.70	50.65	200.09	9.90	1 000.00	873.24	175.67
1999	941.07	256.88	38.08	50.70	199.95	10.43	1 000.00	894.74	168.20
2000	935.48	257.92	35.46	50.55	200.00	10.39	800.00	892.86	160.74
2001	935.48	257.92	35.46	50.55	200.00	10.39	800.00	892.86	160.00
2002	935.48	257.92	35.46	50.55	200.00	10.39	800.00	892.86	160.00
2003	935.48	257.92	35.46	50.55	200.00	10.39	800.00	892.86	160.00
2004	935.48	257.92	35.46	50.55	200.00	10.39	800.00	892.86	160.00
2005	935.48	257.92	35.46	50.55	200.00	10.39	800.00	892.86	160.00
2006	935.48	257.92	35.46	50.55	200.00	10.39	800.00	892.86	160.00

IPCC	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5
SNAP	060403	060404	060405	060406	060407	060408	060411	060412
Unit	kg/Mg Solvent							
1990	859.05	192.24	860.44	989.81	846.15	838.54	940.85	916.72
1991	824.81	193.97	826.52	990.15	849.25	838.93	940.86	818.93
1992	790.50	194.74	792.10	990.31	848.84	839.32	940.86	721.40
1993	756.17	196.43	759.14	990.94	850.27	839.67	940.82	623.71
1994	721.92	197.86	723.96	990.84	851.06	840.06	941.00	525.94
1995	687.54	200.97	690.14	990.46	850.68	840.40	940.88	428.34
1996	681.47	200.54	679.40	991.60	852.22	840.65	940.83	411.59
1997	675.37	200.00	668.75	992.14	848.34	840.96	940.83	395.10
1998	669.29	200.65	659.65	991.24	852.46	841.16	940.79	378.46
1999	663.19	199.23	648.65	990.42	845.68	841.40	941.05	361.81
2000	657.10	202.25	638.41	991.47	851.43	841.69	940.72	345.28
2001	657.10	202.25	638.41	991.47	851.43	841.69	940.72	345.28
2002	657.10	202.25	638.41	991.47	851.43	841.69	940.72	345.28
2003	657.10	202.25	638.41	991.47	851.43	841.69	940.72	345.28
2004	657.10	202.25	638.41	991.47	851.43	841.69	940.72	345.28
2005	657.10	202.25	638.41	991.47	851.43	841.69	940.72	345.28
2006	657.10	202.25	638.41	991.47	851.43	841.69	940.72	345.28

5.2.5 Calculation of CO_2 emissions from Solvent Emissions

The basis for the calculation of the carbon dioxide emissions were the quantities of solvent emissions differentiated by the 15 groups of substances (acetone, methanol, propanol, solvent naphtha, paraffins, alcohols, glycols, ester, aromates, ketones, aldehydes, amines, organic acids, cyclic hydrocarbons, and others). Substance specific carbon dioxide factors for these 15 substance groups have been created (see Table 129) on the basis of the carbon content and the stoichiometrically formed CO_2.

Table 129:Substance specific carbon dioxide emission factors.

Substances	CO_2 factor [kg CO_2/kg substance]	Substances	CO_2 factor [kg CO_2/kg substance]
Acetone	2.28	Glycols	1.82
Aldehydes	2.44	Ketones	2.45
Alcohols	1.91	Methanol	1.38
Alcohols/Propanols	2.20	Paraffins	3.14
Aromates	3.33	Residuals	0.92
Cydic Hydrocarbons	3.14	Solvent naphta	3.14
Ester	2.16	Glycols	1.82

The amount of carbon dioxide emissions was disaggregated to SNAP level 3 according to the share of solvents used and solvent emissions that were calculated in the context of the bottom up approach. In Table 130 the carbon dioxide emissions of Category 3 Solvent and Other Product Use for the years 1990 to 2006 are shown.

Table 130:CO_2 emission of Category 3 Solvent and Other Product Use 1990–2006.

IPCC	3.A	3.A	3.A	3.A	3.A	3.A	3.A	3.A
SNAP		060101	060102	060103	060104	060105	060107	060108
Unit	Gg							
1990	119.69	4.75	2.60	10.15	10.86	13.65	17.79	59.89
1991	97.02	3.72	2.33	9.28	8.29	11.35	14.71	47.34
1992	74.37	2.75	1.97	7.98	5.93	8.93	11.51	35.31
1993	71.67	2.55	2.08	8.58	5.27	8.85	11.34	33.00
1994	63.28	2.15	2.02	8.42	4.24	8.04	10.24	28.18
1995	67.46	2.18	2.36	9.95	4.04	8.83	11.18	28.93
1996	59.76	2.08	2.11	9.10	3.77	7.76	9.67	25.27
1997	63.93	2.38	2.29	10.07	4.25	8.22	10.07	26.64
1998	56.29	2.25	2.05	9.17	3.95	7.17	8.62	23.09
1999	50.26	2.15	1.85	8.48	3.72	6.33	7.46	20.27
2000	55.73	2.55	2.09	9.75	4.35	6.95	7.99	22.06
2001	67.69	3.10	2.53	11.84	5.28	8.44	9.71	26.80
2002	71.55	3.28	2.68	12.51	5.58	8.92	10.26	28.32
2003	69.02	3.16	2.58	12.07	5.38	8.60	9.90	27.32
2004	67.60	3.10	2.53	11.82	5.27	8.43	9.70	26.76
2005	59.70	2.73	2.23	10.44	4.66	7.44	8.56	23.64
2006	70.10	3.21	2.62	12.26	5.47	8.74	10.05	27.75

IPCC	3.B	3.B	3.B	3.B	3.B
SNAP		060201	060202	060203	060204
Unit			Gg		
1990	36.11	23.28	0.51	4.33	7.99
1991	29.53	17.99	0.49	3.38	7.67
1992	22.85	13.07	0.44	2.49	6.85
1993	22.23	11.85	0.48	2.30	7.60
1994	19.84	9.76	0.49	1.93	7.67
1995	21.38	9.59	0.59	1.94	9.26
1996	20.15	8.71	0.56	1.71	9.17
1997	22.91	9.56	0.64	1.81	10.90
1998	21.45	8.64	0.61	1.59	10.61
1999	20.34	7.93	0.58	1.41	10.43
2000	23.97	9.04	0.69	1.55	12.70
2001	29.12	10.98	0.84	1.88	15.42
2002	30.78	11.61	0.89	1.98	16.30
2003	29.69	11.20	0.85	1.91	15.73
2004	29.08	10.97	0.84	1.87	15.40
2005	25.68	9.68	0.74	1.66	13.60
2006	30.16	11.37	0.87	1.94	15.97

IPCC	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C
SNAP		060305	060306	060307	060308	060309	060310	060311	060312	060314
Unit						Gg				
1990	42.25	2.87	8.35	8.94	0.65	2.26	0.05	0.01	0.34	18.79
1991	35.02	2.50	6.30	7.15	0.57	2.05	0.04	0.01	0.28	16.15
1992	27.48	2.06	4.44	5.39	0.47	1.75	0.03	0.01	0.22	13.13
1993	27.13	2.13	3.88	5.11	0.49	1.86	0.03	0.01	0.22	13.42
1994	24.58	2.02	3.04	4.42	0.46	1.82	0.03	0.01	0.20	12.58
1995	26.91	2.31	2.81	4.62	0.53	2.14	0.04	0.01	0.22	14.25
1996	24.21	1.99	2.92	3.95	0.48	2.02	0.03	0.01	0.18	12.63
1997	26.31	2.07	3.61	4.07	0.51	2.30	0.03	0.01	0.18	13.52
1998	23.56	1.77	3.64	3.43	0.46	2.16	0.03	0.01	0.15	11.92
1999	21.40	1.53	3.68	2.92	0.41	2.05	0.02	0.01	0.12	10.65
2000	24.16	1.63	4.59	3.08	0.46	2.43	0.02	0.01	0.12	11.82
2001	24.56	1.98	5.57	2.90	0.57	0.83	0.03	0.01	0.15	12.51
2002	24.22	2.09	5.89	2.50	0.54	0.24	0.03	0.01	0.16	12.75
2003	23.48	2.02	5.68	2.29	0.47	0.24	0.03	0.01	0.15	12.60
2004	23.44	1.98	5.56	2.46	0.53	0.21	0.03	0.01	0.15	12.51
2005	22.08	1.75	4.91	2.40	0.62	0.22	0.02	0.01	0.13	12.02
2006	23.66	2.05	5.77	2.29	0.45	0.24	0.03	0.01	0.15	12.66

IPCC	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5
SNAP		**060403**	**060404**	**060405**	**060406**	**060407**	**060408**	**060411**	**060412**
Unit					**Gg**				
1990	84.63	29.68	0.34	2.17	1.86	0.42	26.36	10.89	12.91
1991	75.19	24.91	0.30	1.76	1.66	0.39	25.92	10.17	10.08
1992	63.04	19.80	0.24	1.36	1.39	0.34	23.59	8.90	7.42
1993	66.32	19.80	0.25	1.32	1.47	0.37	26.57	9.72	6.82
1994	63.85	18.17	0.24	1.17	1.41	0.36	27.11	9.66	5.72
1995	74.12	20.16	0.27	1.26	1.64	0.43	33.08	11.53	5.75
1996	68.70	17.72	0.23	1.12	1.49	0.38	31.84	10.76	5.16
1997	76.93	18.80	0.24	1.20	1.64	0.41	36.92	12.12	5.60
1998	70.95	16.41	0.20	1.06	1.48	0.36	35.18	11.25	5.00
1999	66.37	14.52	0.17	0.95	1.36	0.32	33.93	10.58	4.54
2000	77.16	15.94	0.18	1.06	1.55	0.36	40.60	12.37	5.11
2001	93.73	19.36	0.21	1.29	1.89	0.43	49.31	15.02	6.21
2002	99.07	20.46	0.23	1.36	2.00	0.46	52.13	15.88	6.56
2003	95.57	19.74	0.22	1.32	1.92	0.44	50.28	15.32	6.33
2004	93.60	19.33	0.21	1.29	1.89	0.43	49.25	15.00	6.20
2005	82.67	17.07	0.19	1.14	1.66	0.38	43.50	13.25	5.47
2006	97.07	20.05	0.22	1.34	1.95	0.45	51.07	15.56	6.43

Table 131:Implied CO_2 Emission factors for Category 3 Solvent and Other Product Use 1990–2006.

IPCC	3.A	3.A	3.A	3.A	3.A	3.A	3.A
SNAP	**060101**	**060102**	**060103**	**060104**	**060105**	**060107**	**060108**
Unit				**kg/Mg Solvent**			
1990	2.62	2.58	2.61	2.36	2.39	2.50	1.91
1991	2.43	2.59	2.59	2.30	2.22	2.37	1.66
1992	2.22	2.56	2.52	2.23	2.03	2.21	1.43
1993	2.02	2.52	2.44	2.20	1.86	2.07	1.22
1994	1.82	2.45	2.33	2.19	1.68	1.91	1.03
1995	1.70	2.47	2.30	2.35	1.59	1.84	0.90
1996	1.59	2.33	2.23	2.26	1.50	1.74	0.82
1997	1.60	2.37	2.31	2.32	1.51	1.77	0.81
1998	1.57	2.35	2.35	2.35	1.49	1.76	0.78
1999	1.54	2.33	2.39	2.35	1.47	1.74	0.75
2000	1.53	2.33	2.45	2.39	1.47	1.75	0.73
2001	1.53	2.33	2.45	2.39	1.47	1.75	0.73
2002	1.53	2.33	2.45	2.39	1.47	1.75	0.73
2003	1.53	2.33	2.45	2.39	1.47	1.75	0.73
2004	1.53	2.33	2.45	2.39	1.47	1.75	0.73
2005	1.53	2.33	2.45	2.39	1.47	1.75	0.73
2006	1.53	2.33	2.45	2.39	1.47	1.75	0.73

IPCC	3.B	3.B	3.B	3.B
SNAP	060201	060202	060203	060204
Unit	kg/Mg Solvent			
1990	2.48	1.10	1.70	2.48
1991	2.26	1.19	1.57	2.26
1992	2.03	1.25	1.43	2.03
1993	1.81	1.29	1.30	1.81
1994	1.58	1.31	1.16	1.58
1995	1.43	1.37	1.08	1.43
1996	1.31	1.34	1.01	1.31
1997	1.29	1.39	1.00	1.29
1998	1.24	1.42	0.98	1.24
1999	1.20	1.44	0.96	1.20
2000	1.16	1.47	0.94	1.16
2001	1.16	1.47	0.94	1.16
2002	1.16	1.47	0.94	1.16
2003	1.16	1.47	0.94	1.16
2004	1.16	1.47	0.94	1.16
2005	1.16	1.47	0.94	1.16
2006	1.16	1.47	0.94	1.16

IPCC	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C	3.C
SNAP	060305	060306	060307	060308	060309	060310	060311	060312	060314
Unit	kg/Mg Solvent								
1990	1.96	2.89	0.99	0.15	0.09	0.54	0.03	2.33	2.13
1991	1.98	2.89	0.90	0.13	0.08	0.49	0.03	2.00	2.11
1992	1.96	2.85	0.80	0.11	0.07	0.42	0.03	2.00	2.10
1993	1.91	2.82	0.71	0.11	0.08	0.45	0.03	2.00	2.08
1994	1.83	2.75	0.61	0.11	0.07	0.45	0.03	2.00	2.06
1995	1.82	2.79	0.54	0.13	0.09	0.53	0.03	2.00	2.13
1996	1.74	2.66	0.52	0.11	0.08	0.49	0.03	2.00	2.03
1997	1.79	2.71	0.54	0.12	0.09	0.54	0.03	2.25	2.09
1998	1.79	2.72	0.54	0.10	0.08	0.50	0.03	2.25	2.10
1999	1.79	2.73	0.54	0.09	0.08	0.46	0.03	2.25	2.14
2000	1.80	2.77	0.55	0.10	0.09	0.54	0.03	2.00	2.20
2001	1.80	2.77	0.55	0.10	0.09	0.54	0.03	2.00	2.20
2002	1.80	2.77	0.55	0.10	0.09	0.54	0.03	2.00	2.20
2003	1.80	2.77	0.55	0.10	0.09	0.54	0.03	2.00	2.20
2004	1.80	2.77	0.55	0.10	0.09	0.54	0.03	2.00	2.20
2005	1.80	2.77	0.55	0.10	0.09	0.54	0.03	2.00	2.20
2006	1.80	2.77	0.55	0.10	0.09	0.54	0.03	2.00	2.20

IPCC	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5	3.D.5
SNAP	060403	060404	060405	060406	060407	060408	060411	060412
Unit	kg/Mg Solvent							
1990	1.99	0.64	2.63	2.71	1.89	1.88	2.15	1.70
1991	1.89	0.64	2.49	2.72	1.95	1.93	2.20	1.48
1992	1.77	0.64	2.34	2.70	1.97	1.92	2.19	1.27
1993	1.66	0.64	2.19	2.66	1.96	1.89	2.17	1.08
1994	1.54	0.64	2.03	2.59	1.93	1.82	2.11	0.91
1995	1.49	0.66	1.97	2.61	1.95	1.82	2.12	0.78
1996	1.41	0.63	1.86	2.51	1.89	1.74	2.04	0.73
1997	1.43	0.64	1.88	2.58	1.94	1.79	2.10	0.73
1998	1.42	0.65	1.86	2.60	1.96	1.80	2.11	0.72
1999	1.40	0.65	1.84	2.61	1.98	1.80	2.12	0.70
2000	1.40	0.66	1.84	2.65	2.03	1.82	2.15	0.70
2001	1.40	0.66	1.84	2.65	2.03	1.82	2.15	0.70
2002	1.40	0.66	1.84	2.65	2.03	1.82	2.15	0.70
2003	1.40	0.66	1.84	2.65	2.03	1.82	2.15	0.70
2004	1.40	0.66	1.84	2.65	2.03	1.82	2.15	0.70
2005	1.40	0.66	1.84	2.65	2.03	1.82	2.15	0.70
2006	1.40	0.66	1.84	2.65	2.03	1.82	2.15	0.70

5.2.6 Uncertainty Assessment

In the latest study on uncertainties of the Austrian inventory (WINIWARTER 2008) (see Chapter 1.7) the uncertainties of solvent emissions in Austria were determined, and were compared with the results of the detailed analysis of solvent emissions in Austria (WINDSPERGER et al. 2004) (see also NIR 2006). Differences between bottom-up and top-down methodology to estimate emissions were calculated at less than 10%, which is compatible with expert estimates on the uncertainties presented for national statistics. Additional uncertainty has been attributed to the released fraction of solvents employed, reflecting an emission factor (solvents are released as volatile organic compounds, which eventually are converted into CO_2 in the atmosphere).

Using the WINDSPERGER et al. (2004) data, an uncertainty of 5% is attributed to the activity data, and 10% to the emission factor of solvents. According to WINDSPERGER et al. (2004), the uncertainty should decrease and the overall quality improve between 1990 and current data. But according to WINIWARTER (2008) a general decrease in the quality of the import-export statistics, and a decrease in the released fraction of solvents (reflecting the emission factor) over the years results in a constant uncertainty.

In Table 132 and Table 133 the results of the studies are presented whereas the results of WINIWARTER (2008) are used for calculating the total uncertainty of the Austrian GHG inventory.

Table 132:Uncertainties of Sector 3 Solvent and other product use (WINDSPERGER et al. 2004).

	1990	1995	2000
Uncertainty solvent emissions	-21 to +24%	-18 to +21%	-13 to +14%

Table 133:Uncertainties of Sector 3 Solvent and other product use (WINIWARTER 2008).

IPCC Source category	Gas	AD	EF	Combined
			Uncertainty [%]	
3: Solvent and other product use	CO_2	5.0	10.0	11.2

5.3 N_2O Emissions from Solvent and Other Product Use (IPCC Sector 3.D.1, 3.D.2 and 3.D.3)

	3.D.1 Use of N_2O for anaesthesia	3.D.3 Use of N_2O in aerosol cans	3.D.2 Use of N_2O in fire extinguishers
GHG key category	no	no	not ocurring
gas	N_2O emission from the use of anaesthesia	N_2O emission from the use of aerosol cans	–
activity	N_2O-consumption of anaesthesia	N_2O -consumption in aerosol cans	N_2O is not flammable, but has oxidising properties. There is no evidence of this gas being used in fire extinguishers in Austria.
	Due to new industry inquiries (ÖIGV 2007) the amount of N_2O used for anaesthesia was updated for the years 2001–2006.	It is assumed that the use of N_2O for aerosol cans is constant at 400 tons per year. This estimate is based on expert judgement and industry inquiries (ÖIGV 2007).	
method	A specific methodology for these activities has not been prepared yet.[48]		–
	100% of N_2O used for anaesthesia is released into atmosphere	100% of N_2O used for aerosol cans is released into atmosphere	
emission factor	activity data = emission 1.00 Mg N_2O/Mg product use		–

Table 134:N_2O-consumption of anaesthesia and N_2O-consumption in aerosol cans.

	3.D.1	3.D.3
	use of N_2O for anaesthesia	use of N_2O in aerosol cans
Unit	Mg	
1990	350	400
1991	350	400
1992	350	400
1993	350	400
1994	350	400
1995	350	400

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	3.D.1	3.D.3
	use of N_2O for anaesthesia	use of N_2O in aerosol cans
Unit	Mg	
1996	350	400
1997	350	400
1998	350	400
1999	350	400
2000	350	400
2001	312	400
2002	274	400
2003	236	400
2004	198	400
2005	160	400
2006	130	400

5.3.1 Uncertainty Assessment for N_2O Emissions from Solvent and Other Product Use

Direct use of N_2O has been specifically collected from industry experts in Austria. According to (WINIWARTER 2008) pursuant to (RAMIREZ et al. 2006) an uncertainty of 20% for the amount of N_2O is used. In contrast to Ramirez, it is assumed that virtually all of the N_2O actually used is also fully released thus no additional uncertainty is applied.

Table 135:Uncertainties of Sector 3.D Solvent and other product use.

IPCC Source category	Gas	AD	EF	Combined
			Uncertainty [%]	
3: Solvent and other product use	N_2O	20.0	0	20.0

5.4 Recalculation for Emissions from Solvent and Other Product Use

The reasons for recalculation are updates of activity data:

3.A, 3.B, 3.C and 3.D.5: NMVOC emissions from solvent use have been updated using short-term economic data provided by Statistik Austria.

The tables below show the recalculation difference of emissions from Sector 3 Solvent and Other Product Use and its subcategories with respect to the previous submission.

Table 136:Recalculation difference with respect to submission 2007.

CO_2 Emission		Absolute difference [Gg]			Relative difference [Δ%]	
		2003	2004	2005	1990	2005
3	Solvent and Other Product Use	32.10	32.03	12.74	=	7%
3 A	Paint application	12.81	13.08	6.88	=	13%
3 B	Degreasing and dry cleaning	4.57	4.22	1.08	=	4%
3 C	Chemical products, manufacture and processing	-1.92	-1.75	-2.57	=	-10%
3 D 5	Other solvent use	16.65	16.48	7.35	=	10%

N_2O Emission		Absolute difference [Gg]			Relative difference [Δ%]	
		2003	2004	2005	1990	2005
3	Solvent and Other Product Use	0.00	0.00	0.00	=	=
3 D 1	Use of N_2O for anaesthesia	0.00	0.00	0.00	=	=
3 D 2	N_2O from fire extinguishers	NO	NO	NO		
3 D 3	N_2O from aerosol cans	0.00	0.00	0.00	=	=
3 D 4	Other Use of N_2O	NO	NO	NO		

6 AGRICULTURE (CRF SOURCE CATEGORY 4)

6.1 Sector Overview

This chapter gives information about the estimation of greenhouse gas emissions from sector *Agriculture* in correspondence to the data reported under the IPCC Category 4 in the Common Reporting Format.

The following sources exist in Austria: domestic livestock activities with enteric fermentation and manure management, agricultural soils and agricultural residue burning.

Applied methods are in line with the 1996 Revised IPCC Guidelines and are based on following studies commissioned by the Umweltbundesamt: (GEBETSROITHER et al. 2002, AMON et al. 2002, and STREBL et al. 2002).

These studies are not published. A detailed description of the applied methods is given in this report.

To give an overview of Austria's agricultural sector some information is provided below (according to the 2003 Farm Structure Survey – full survey) (BMLFUW 2007):

Agriculture in Austria is small-structured: 190 400 farms are managed, 61% of these farms manage less than 20 ha, whereas only 4% of the Austrian farms manage more than 100 ha cultivated area. 74 600 holdings are classified as situated in less favoured areas. Related to the federal territory Austria has the highest share of mountainous areas in the EU (70%).

The agricultural area comprises 3.3 million hectares that is a share of ~ 41% of the total territory (forestry ~ 46%, other area ~ 13%). The shares of the different agricultural activities are as follows:

- 42% arable land
- 28% grassland (meadows mown several times and seeded grassland)
- 28% extensive grassland (meadows mown once, litter meadows, rough pastures, Alpine pastures and mountain meadows)
- 2% other types of agricultural land-use (vineyards, orchards, house gardens, vine and tree nurseries)

6.1.1 Emission Trends

In the year 2006 the sector *Agriculture* contributed 8.7% to the total of Austria's greenhouse gas emissions (without LULUCF). The trend of GHG emissions from 1990 to 2006 shows a decrease of 14.0% for this sector (see Figure 23 and Table 138) due to a decrease in activity data.

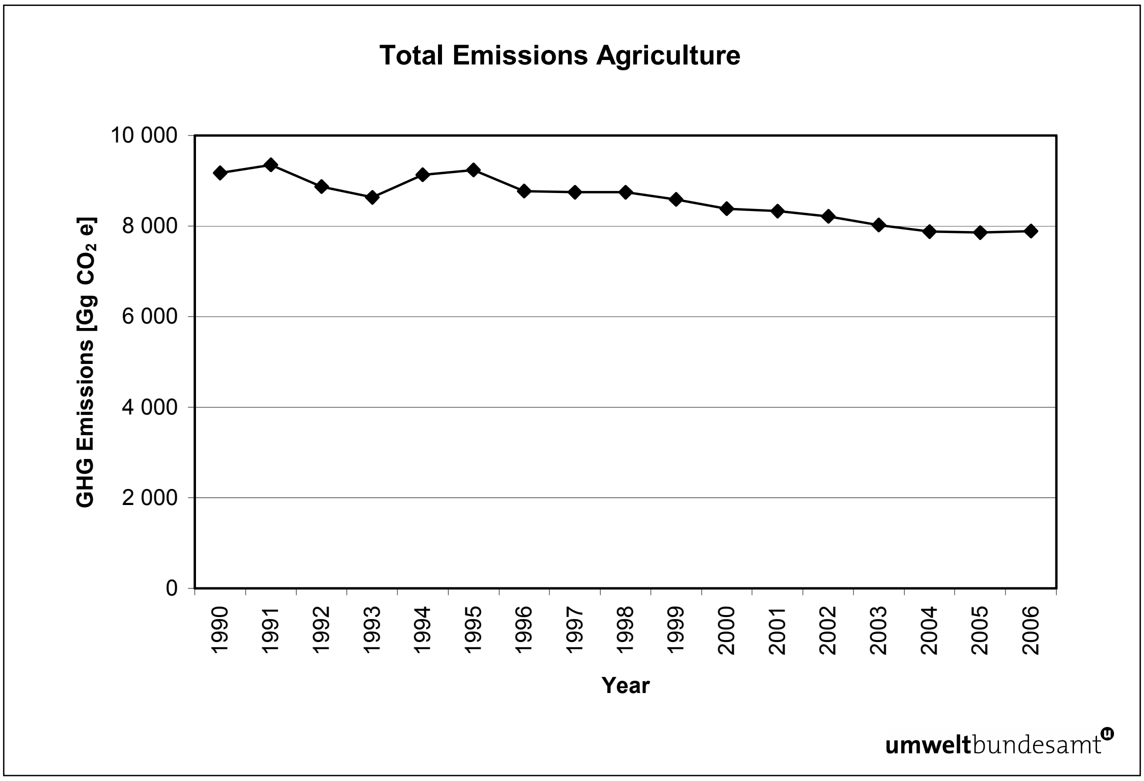

Figure 23: Trend of total GHG emissions from Agriculture.

The fluctuations in the time series shown in Figure 23 are mainly due to fluctuations of N_2O emissions from agricultural soils.

Emission trends per gas

CH_4 emissions from IPCC Category *4 Agriculture* decreased by 15.2% since the base year mainly due to lower emissions from *Enteric Fermentation* and *Manure Management*. N_2O emissions decreased by 12.5% mainly due to lower emissions from *Agricultural Soils (direct and indirect emissions)*. The trend is presented in Table 137.

Table 137:Emissions of greenhouse gases and their trend from 1990–2006 from Category 4 Agriculture.

Year	GHG emissions [Gg]	
	CH_4	N_2O
1990	230.02	13.99
1991	226.80	14.80
1992	218.33	13.81
1993	218.81	13.03
1994	219.12	14.62
1995	220.14	14.89
1996	216.81	13.60
1997	213.78	13.72
1998	212.92	13.79
1999	208.82	13.54
2000	206.62	13.05
2001	204.44	13.02
2002	200.09	12.93
2003	198.54	12.43
2004	196.89	12.07
2005	195.70	12.08
2006	194.99	12.24
Trend 90–06	*-15.2%*	*-12.5%*

Emission trends per sector

Table 138 presents total GHG emissions and trend 1990–2006 from *Agriculture* by subcategories as well as the contribution to the overall inventory emissions. Important sub-sectors are *4.A Enteric Fermentation* (3.5%) and *4.D Agricultural Soils* (3.2%) followed by *4.B Manure Management* (1.9%).

Table 138:Total GHG emissions and trend 1990–2006 by subcategories of Agriculture.

Year	GHG emissions [Gg CO_2 equivalent] by sub categories				
	4	4.A	4.B	4.D	4.F
1990	9 168.74	3 761.65	2 065.40	3 339.95	1.74
1991	9 351.60	3 709.11	2 038.44	3 602.34	1.72
1992	8 866.42	3 547.66	1 985.45	3 331.65	1.65
1993	8 634.39	3 546.56	1 995.68	3 090.52	1.63
1994	9 134.50	3 565.63	1 983.77	3 583.41	1.69
1995	9 240.12	3 594.32	1 996.91	3 647.18	1.71
1996	8 769.95	3 543.71	1 960.11	3 264.44	1.68
1997	8 743.21	3 481.65	1 947.38	3 312.40	1.77
1998	8 746.55	3 453.79	1 955.31	3 335.73	1.72
1999	8 583.14	3 419.53	1 891.11	3 270.74	1.76
2000	8 384.71	3 399.28	1 852.83	3 130.96	1.65
2001	8 329.98	3 349.15	1 849.44	3 129.64	1.74

Year	GHG emissions [Gg CO_2 equivalent] by sub categories				
	4	4.A	4.B	4.D	4.F
2002	8 209.37	3 288.46	1 800.89	3 118.28	1.74
2003	8 021.07	3 253.22	1 795.65	2 970.62	1.58
2004	7 876.41	3 246.87	1 764.27	2 862.90	2.38
2005	7 854.41	3 220.21	1 756.83	2 875.75	1.62
2006	7 889.33	3 209.78	1 749.93	2 928.16	1.46
Share in Austrian Total 2006	8.7%	3.5%	1.9%	3.2%	0.0%
Trend 1990–2006	*-14.0%*	*-14.7%*	*-15.3%*	*-12.3%*	*-16.2%*

As can be seen in Figure 24 and Table 138 the trend concerning emissions from all categories is decreasing. The reason for the continuous decrease of emissions from categories *4.A Enteric Fermentation* and *4.B Manure Management* is due to a decrease in livestock numbers (cattle and swine). Fluctuations of emissions from *4.D Agricultural Soils* are mainly due to varying underlying activity data (sales figures of mineral fertilizers).

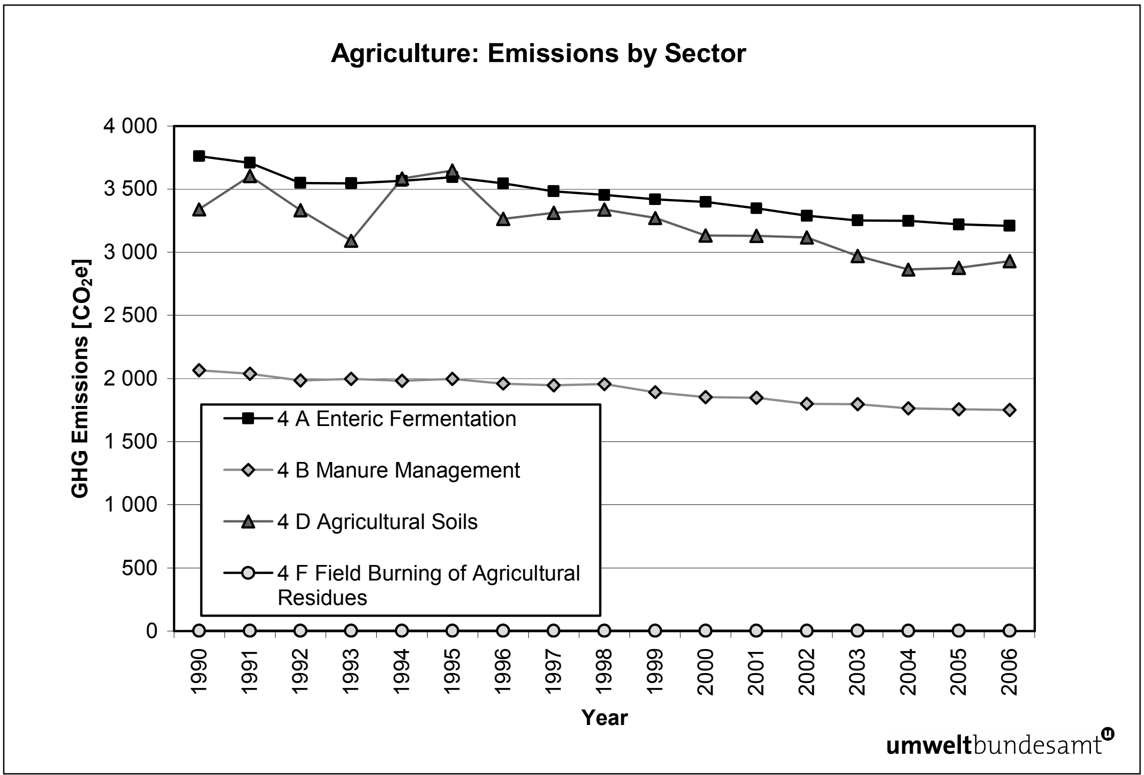

Figure 24: Emission trends of sub-sectors of Agriculture.

As can be seen in Table 139, in 2006 about 41% of emissions from sector *Agriculture* originate from source category *4.A Enteric Fermentation*. Source category *4.D Agricultural Soils* contributes around 37%, source category *4.B Manure Management* contributes another 22%. Source category *4.F Field Burning of Agricultural Wastes* contributes only a negligible part (0.02% in 2005).

Table 139:Total greenhouse gas emissions and share of subcategories of Agriculture, 1990 and 2006.

	GHG emissions [%] by sub categories				
Year	**4**	**4.A**	**4.B**	**4.D**	**4.F**
1990	100.0%	41.0%	22.5%	36.4%	0.0%
2005	100.0%	40.7%	22.2%	37.1%	0.0%

6.1.2 Key Categories

The key category analysis is presented in Chapter 1.5. This chapter includes information about the key sources in the IPCC Sector *4 Agriculture*. Key sources within this category are presented in Table 140.

Table 140:Key sources of Category 4 Agriculture.

IPCC Category	Source Categories	Key Sources	
		GHG	**KS-Assessment***
4.A.1	Cattle	CH_4	LA90-LA06, TA
4.B.1	Cattle	N_2O	LA90-LA06, TA
4.B.1	Cattle	CH_4	LA90-LA06, TA
4.B.8	Swine	CH_4	LA90-LA06
4.D.1	Direct Soil Emissions	N_2O	LA90-LA06, TA
4.D.2	Pasture, Range and Paddock Manure	N_2O	LA93, LA94
4.D.3	Indirect Emissions	N_2O	LA90-LA06, TA

6.1.3 Methodology

For the sub sectors *4.A Enteric Fermentation, 4.B Manure Management* and *4.D Agricultural Soils* IPCC Tier 1 methods and IPCC default emission factors were used, except for key sources of these sub sectors (sub categories *Cattle* of *4.A* as well as *Cattle* and *Swine* of *4.B*) where the more detailed Tier 2 method and country specific emission factors were used.

For the calculation of emissions from category *4.A.9 Poultry* the IPCC Tier 2 method with Swiss emission factors (Gross Energy Intake, Methane Conversion Rate) was used. It is assumed that Swiss conditions are very similar to Austrian conditions.

As recommended in the Centralized Review 2003 for the estimation of emissions from category *4.F Field Burning of Agricultural Wastes* the IPCC methodology using default values was applied.

6.1.4 Quality Assurance and Quality Control (QA/QC)

Data were checked for transcription errors between input data and calculation sheets. Calculations were examined focusing on units/scale and formulas. Quality Control following the GPG is described in the chapters of the sub sectors. A description of the QMS (Quality Management System) is presented in Chapter 1.6.

6.1.5 Uncertainty Assessment

Animal numbers, in accordance to WINIWARTER & ORTHOFER (2000) were estimated at 10% uncertainty and considered statistically independent. Uncertainties of emission factors for CH_4 emissions of enteric fermentation, according to AMON et al. (2002) were considered 20% for cattle and sheep (representing ruminants) and 30% for all other animals. This is consistent with more detailed knowledge for those animals that contribute more to the emissions. The respective uncertainty factors are considered correlated. Based on the identical animal numbers, uncertainties of emission factors for CH_4 from manure were assessed at 70% (AMON et al. 2002), and for N_2O emissions a lognormal distribution with a low at 50% and a high of 200% of the best estimate was chosen derived from IPCC, 2000 (note: "low" stands for the 2.5-percentile and "high" for the 97.5-percentile of the distribution).

RYPDAL & WINIWARTER (2001) noted that the largest contributor to uncertainty for several existing GHG inventories is N_2O emissions from soils. Thus it is worthwhile to consider this source in some more detail – even if no real improvement of the situation should be expected at this time. While IPCC (2000) assumes two orders of magnitude as the uncertainty margin, re-evaluation of basically the same data leads to a considerable improvement of the situation to estimated 30%-300% of the best estimate, lognormal distribution (IPCC 2006). This range is closer but still higher compared to the one estimated by WINIWARTER & RYPDAL (2001), who assumed uncertainty in a triangular distribution between 50 and 200%. In the latest Austrian study (WINIWARTER 2008) for the emission factor of N_2O from soils an uncertainty of 150% was applied. Uncertainty contributions of the activity (combined from agricultural area and average N-fertilizer input) at about 5% is almost negligible in this context.

The IPCC methodology (IPCC 2006) recommends separate treatment of direct and indirect emissions. Indirect emissions in this context are again soil emissions, which occur after evaporation/leaching of N from the soil to which fertilizer originally has been applied to. Uncertainties of emission factors of indirect emissions are not significantly different from those of direct emissions, and the underlying processes (microbial nitrification/denitrification) are identical. Thus it was decided to treat the uncertainties of direct and indirect emissions as being correlated.

Table 141 presents uncertainties for emissions as well as for activity data and the EFs of the key categories of Sector Agriculture according to the error propagation method (Tier 1).

Table 141:Uncertainties of Emissions and Emission Factors (Key Categories Agriculture).

Categories		CH_4 Emissions	N_2O Emissions	EF CH_4	EF N_2O
4.A.1	Cattle	+/- 22.4%	–	+/- 20%	–
4.B.1	Cattle	+/- 70.7%	+/- 100,5%	+/- 70%	+/- 100%
4.B.8	Swine	+/- 70.7%	–	+/- 70%	–
4.D.1	Direct Soil Emissions	–	+/- 150.1%	–	+/- 150%
4.D.2	Indirect Soil Emissions	–	+/- 150.1%	–	+/- 150%
4.D.3	Pasture, Range & Paddock	–	+/- 150.1%	–	+/- 150%
Activity Data					
Animal Population		+/- 10%			
Area Data & Fertilizer Input (combined)		+/- 5%			

6.1.6 Recalculations

4.D.1 and 4.D.3 – N_2O emissions from animal manure applied to soils

The revision of the share of dairy cattle held in loose (32%) and tied housing systems (68%) within the NH_3 inventory resulted in slightly lower direct N_2O emissions from animal manure applied to soils and slightly higher indirect N_2O emissions. The new data on housing system distribution is based on (AMON et al. 2007).

4 D 1 – Crop Residue:

N contents of crops were revised, resulting in higher N_2O emissions from 1990 onwards.

6.1.7 Completeness

Table 142 gives an overview of the IPCC categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this sub-category have been estimated.

Table 142: Overview of subcategories of Category Agriculture: transformation into SNAP Codes and status of estimation.

IPCC Category		SNAP		CH_4	N_2O
4.A	**ENTERIC FERMENTATION**	**1004**	**ENTERIC FERMENTATION**	✓	**NA**
4.A.1	Cattle	–	–	✓	NA
4.A.1.a	Dairy Cattle	100401	Dairy cows	✓	NA
4.A.1.b	Non-Dairy Cattle	100402	Other cattle	✓	NA
4.A.2	Buffalo	100414	Buffalos	NO	NO
4.A.3	Sheep	100403	Ovines	✓	NA
4.A.4	Goats	100407	Goats	✓	NA
4.A.5	Camels and Lamas	100413	Camels	NO	NO
4.A.6	Horses	100405	Horses	✓	NA
4.A.7	Mules and Asses	100406	Mules and asses	IE[1)]	NA
4.A.8	Swine	100404	Fattening pigs	✓	NA
4.A.9	Poultry	100408 /09/10	Laying hens, broilers, other poultry	✓	NA
4.A.10	Other	100415	Deer	✓	NA
4.B.	**MANURE MANAGEMENT**	**1005**	**MANURE MANAGEMENT REGARDING ORGANIC COMPOUNDS**	✓	**NO**
		1009	**MANURE MANAGEMENT REGARDING NITROGEN COMPOUNDS**	**NO**	✓
4.B.1	Cattle	–	–	✓	✓
4.B.1.a	Dairy Cattle	100501	Dairy cows	✓	✓
4.B.1.b	Non-Dairy Cattle	100502	Other cattle	✓	✓
4.B.2	Buffalo	100514	Buffalos	NO	NO

IPCC Category		SNAP		CH_4	N_2O
4.B.3	Sheep	100505	Ovines	✓	✓
4.B.4	Goats	100511	Goats	✓	✓
4.B.5	Camels and Lamas	100513	Camels	NO	NO
4.B.6	Horses	100506	Horses	✓	✓
4.B.7	Mules and Asses	100506	Mules and asses	IE[2)]	IE[2)]
4.B.8	Swine	100503	Fattening pigs	✓	✓
4.B.9	Poultry	100507 /08/09	Laying hens, broilers, Other poultry (ducks, gooses,…)	✓	✓
4.B.10	Other Livestock	100515	Deer	✓	✓
4.B.11	Anaerobic		Anaerobic	NO	NO
4.B.12	Liquid Systems		Liquid Systems	IE[3)]	✓
4.B.13	Solid Storage		Solid Storage and Dry Lot	IE[3)]	✓
4.B.14	Other		Other management/ manure without bedding	IE[3)]	✓
4.C	**RICE CULTIVATION**	**100103** **100103**	**Rice Field (with fertilizers)** **Rice Field (without fertilizers)**	**NO**	**NO**
4.D	**AGRICULTURAL SOILS**	**1001** **1002**	**CULTURES WITH FERTILIZERS** **CULTURES WITHOUT FERTILIZERS**	**NO**	✓
4.D.1	Direct Soil Emissions	1001/ 1002	Cultures with and without fertilizers	NO	✓
4.D.2	Pasture, Range and Paddock Manure	1002	Cultures without fertilizers	NO	✓
4.D.3	Indirect Emissions	1001/ 1002	Cultures with and without fertilizers	NO	✓
4.E	**PRESCRIBED BURNING OF SAVANNAS**	**–**	**–**	**NO**	**NO**
4.F	**FIELD BURNING OF AGRICULTURAL RESIDUES**	**1003**	**ON-FIELD BURNING OF STUBBLE, STRAW, …**	✓	✓
4.F.1	Cereals	100301	Cereals	✓	✓
4.F.2	Pulses	100302	Pulse	NO	NO
4.F.3	Tubers and Roots	100303	Tuber and Root	NO	NO
4.F.4	Sugar Cane	100304	Sugar Cane	NO	NO
4.F.5	Other: Vine	100305 [0907]	Other: Open burning of agricultural wastes (except 1003)	✓	✓

[1)] *included in* 4.A.6 Horses*, SNAP 100406*

[2)] *included in* 4.B.6 Horses*, SNAP 100506*

[3)] *CH_4 emissions included in 4.B.1 to 4.B.10*

6.1.8 Planned Improvements

Planned Improvements are presented in the respective subcategories of this chapter.

6.2 Enteric Fermentation (CRF Source Category 4.A)

This chapter describes the estimation of CH_4 emissions from *Enteric Fermentation*. In 2006 78.4% of agricultural CH_4 emissions arose from this source category.

6.2.1 Source Category Description

CH_4 emissions amounted to 179.1 Gg in the "Kyoto" base year and have decreased by 14.7% to 152.8 Gg in 2006. Almost all emissions of category 4 A (93.8% in 2006) are caused by cattle farming. The contribution of *Dairy Cattle* (4 A 1 a) decreased from 49.3% in 1990 to 39.7% in 2006.

Table 143:Greenhouse gas emissions from Enteric Fermentation by sub categories 1990–2006.

Year	CH_4 emissions [Gg] per Livestock Category								
	4 A	**4 A 1 a**	**4 A 1 b**	**4 A 3**	**4 A 4**	**4 A 6**	**4 A 8**	**4 A 9**	**4 A 10**
	Total	**Dairy**	**Non Diary**	**Sheep**	**Goats**	**Horses**	**Swine**	**Poultry**	**Other**
1990	179.13	88.32	81.24	2.48	0.19	0.89	5.53	0.18	0.30
1991	176.62	85.72	81.11	2.61	0.20	1.04	5.46	0.19	0.30
1992	168.94	82.55	76.54	2.50	0.20	1.11	5.58	0.18	0.30
1993	168.88	81.40	77.19	2.67	0.24	1.17	5.73	0.19	0.30
1994	169.79	81.12	78.40	2.74	0.25	1.20	5.59	0.18	0.30
1995	171.16	72.07	88.53	2.92	0.27	1.30	5.56	0.18	0.32
1996	168.75	71.81	86.31	3.05	0.27	1.32	5.50	0.17	0.33
1997	165.79	74.83	80.11	3.07	0.29	1.34	5.52	0.19	0.45
1998	164.47	76.37	77.28	2.89	0.27	1.36	5.72	0.18	0.40
1999	162.83	73.79	78.82	2.82	0.29	1.47	5.15	0.19	0.31
2000	161.87	66.64	85.28	2.71	0.28	1.47	5.02	0.15	0.31
2001	159.48	65.12	84.41	2.56	0.30	1.47	5.16	0.16	0.31
2002	156.59	65.06	81.91	2.43	0.29	1.47	4.96	0.16	0.31
2003	154.92	62.27	82.84	2.60	0.27	1.57	4.87	0.17	0.33
2004	154.61	60.66	84.31	2.62	0.28	1.57	4.69	0.17	0.33
2005	153.34	60.87	82.78	2.61	0.28	1.57	4.75	0.17	0.33
2006	152.85	60.67	82.64	2.50	0.27	1.57	4.71	0.17	0.33
Share 2006	100%	39.7%	54.1%	1.6%	0.2%	1.0%	3.1%	0.1%	0.2%
Trend 1990–2006	*–14.7%*	*–31.3%*	*1.7%*	*0.8%*	*42.2%*	*77.0%*	*–14.9%*	*–5.7%*	*11.0%*

The overall reduction is caused by a decrease in total numbers of animals. However, in the case of dairy cows the reduction of animals is partly counterbalanced by an increase in emissions per animal (because of the increasing milk yield of milk cattle and the connected gross energy intake since 1990). The high increase of mother cattle numbers is responsible for the increase of emissions from non-dairy cattle. CH_4 emissions from the sub-category *Cattle* are a key source.

6.2.2 Methodological Issues

The IPCC Tier 1 Method was applied for *Swine, Sheep, Goats, Horses* and *Other Animals*.

For *Cattle* the more detailed "Tier 2" method was applied. The IPCC "Tier 2" method is based on the "Tier 1" method, but it uses specific emission factors for different livestock sub-categories.

The IPCC Guidelines don't provide methodologies for the categories *Poultry* and *Other*.

In Austria, the animal category *Other* corresponds to deer. For the estimation of CH_4 emissions from category *4 A 10* the IPCC default emission factor of sheep was used, as sheep is the most similar livestock category to deer.

For the calculation of emissions from category *4 A 9 Poultry* the IPCC Tier 2 method with Swiss emission factors (Gross Energy Intake, Methane Conversion Rate) was used. It is assumed that Swiss conditions are very similar to Austrian conditions.

Activity data

The Austrian official statistics (STATISTIK AUSTRIA 2006) provides national data of annual livestock numbers on a very detailed level. These data are based on livestock counts held in December each year[49].

In Table 144 and Table 145 applied animal data are presented. Background information to the data is listed below:

From 1990 onwards: The continuous decline of *dairy cattle* numbers is connected with the increasing milk yield per cow: For the production of milk according to Austria's milk quota every year a smaller number of cows is needed.

1991: A minimum counting threshold for *poultry* was introduced. Farms with less than 11 poultry were not considered any more. However, the contribution of these small farms is negligible, both with respect to the total poultry number and to the trend.

The increase of the *soliped* population between 1990 and 1991 is caused by a better data collection from riding clubs and horse breeding farms.

1993: New characteristics for *swine and cattle* categories were introduced in accordance with Austria's entry into the European Economic Area and the EU guidelines for farm animal population categories. In 1993 part of the "*Young cattle < 1 yr*" category was included in the "*Young cattle 1–2 yr*" category. This shift is considered to be insignificant: no inconsistency in the emission trend of "Non-Dairy Cattle" category was recorded.

In the same year "*Young swine < 50 kg*" were shifted to "*Fattening pigs > 50 kg*" (before 1993 the limits were 6 months and not 50 kg which led to the shift) causing distinct inconsistencies in time series. Following a recommendation of the Centralized Review 2003, the age class split for *swine* categories of the years 1990–1992 was adjusted using the split from 1993.

[49] For cattle livestock counts are also held in June, but seasonal changes are very small (between 0% and 2%). Livestock counts of sheep are only held in December (sheep is only a minor source for Austria and seasonal changes of the population are not considered relevant).

1993: For the first time other animals e.g. *deer (but not wild living animals)* were counted. Following the recommendations of the Centralized Review 2004, to ensure consistency and completeness animal number of 1993 was used for the years 1990 to 1992.

1995: The financial support of suckling cow husbandry increased significantly in 1995 when Austria became a Member State of the European Union. The husbandry of suckling cows is used for the production of veal and beef; the milk yield of the cow is only provided for the suckling calves. Especially in mountainous regions with unfavourable farming conditions, suckling cow husbandry allows an extensive and economic reasonable utilisation of the pastures. Suckling cow husbandry contributes to the conservation of the traditional Austrian alpine landscape.

1996–1998: The market situation affected a decrease in veal and beef production, resulting in a declining suckling cow husbandry. Farmers partly used their former suckling cows for milk production. Thus, dairy cow numbers slightly increased at this time. Reasons are manifold: Changing market prices, BSE epidemic in Europe and change of consumer behaviour, milk quota, etc.

1998–2002: increasing/ decreasing *swine* numbers: The production of swine has a high elasticity to prices: Swine numbers are changing due to changing market prices very rapidly. Market prices change due to changes in costumer behaviour, saturation of swine production, epidemics, etc.

Table 144:Domestic livestock population and its trend 1990–2006 (I).

Year	Population size [heads] *							
	Livestock Category							
	Dairy	Non Dairy	Suckling Cows > 2 yr	Young Cattle < 1 yr	Young Cattle 1–2 yr	Cattle > 2 yr	Sheep	Goats
1990	904 617	1 679 297	47 020	925 162	560 803	146 312	309 912	37 343
1991	876 000	1 658 088	57 333	894 111	555 432	151 212	326 100	40 923
1992	841 716	1 559 009	60 481	831 612	521 078	145 838	312 000	39 400
1993	828 147	1 505 740	69 316	705 547	572 921	157 956	333 835	47 276
1994	809 977	1 518 541	89 999	706 579	573 177	148 786	342 144	49 749
1995	706 494	1 619 331	210 479	691 454	564 352	153 046	365 250	54 228
1996	697 521	1 574 428	212 700	670 423	537 382	153 923	380 861	54 471
1997	720 377	1 477 563	170 540	630 853	514 480	161 690	383 655	58 340
1998	728 718	1 442 963	154 276	635 113	496 159	157 415	360 812	54 244
1999	697 903	1 454 908	176 680	630 586	488 283	159 359	352 277	57 993
2000	621 002	1 534 445	252 792	655 368	466 484	159 801	339 238	56 105
2001	597 981	1 520 473	257 734	658 930	455 712	148 097	320 467	59 452
2002	588 971	1 477 971	244 954	640 060	449 932	143 025	304 364	57 842
2003	557 877	1 494 156	243 103	641 640	446 121	163 292	325 495	54 607
2004	537 953	1 513 038	261 528	646 946	441 397	163 167	327 163	55 523
2005	534 417	1 476 263	270 465	628 426	436 303	141 069	325 728	55 100
2006	527 421	1 475 498	271 314	631 529	434 991	137 664	312 375	53 108
Trend 90–06	*-41.7%*	*-12.1%*	*477.0%*	*-31.7%*	*-22.4%*	*-5.9%*	*0.8%*	*42.2%*

* *adjusted age class split for swine as recommended in the centralized review (October 2003)*

The FAO agricultural data base (FAOSTAT) provides worldwide harmonized data (FAO AGR. STATISTICAL SYSTEM 2001). In the case of Austria, these data come from the national statistical system (Statistik Austria). However, there are inconsistencies between these two data sets. Analysis shows that there is often a time gap of one year between the two data sets. FAOSTAT data are seemingly based on the official Statistik Austria data but there is an annual attribution error. In the Austrian inventory Statistik Austria data is used, they are the best available.

Table 145:Domestic livestock population and its trend 1990–2006 (II).

Year	Population size [heads] *				
	Livestock Category				
	Horses	**Swine**	**Fattening Pig > 50 kg**	**Swine for breeding > 50 kg**	**Young Swine < 50 kg**
1990	49 200	3 687 981	1 308 525	382 335	1 997 120
1991	57 803	3 637 980	1 290 785	377 152	1 970 044
1992	61 400	3 719 653	1 319 744	385 613	2 014 296
1993	64 924	3 819 798	1 355 295	396 001	2 068 502
1994	66 748	3 728 991	1 323 145	394 938	2 010 908
1995	72 491	3 706 185	1 312 334	401 490	1 992 361
1996	73 234	3 663 747	1 262 391	398 633	2 002 723
1997	74 170	3 679 876	1 268 856	397 742	2 013 278
1998	75 347	3 810 310	1 375 037	386 281	2 048 992
1999	81 566	3 433 029	1 250 775	343 812	1 838 442
2000	81 566	3 347 931	1 211 988	334 278	1 801 665
2001	81 566	3 440 405	1 264 253	350 197	1 825 955
2002	81 566	3 304 650	1 187 908	341 042	1 775 700
2003	87 072	3 244 866	1 243 807	334 329	1 666 730
2004	87 072	3 125 361	1 159 501	317 033	1 648 827
2005	87 072	3 169 541	1 224 053	315 731	1 629 757
2006	87 072	3 139 438	1 197 124	321 828	1 620 486
Trend 90–06	*77.0%*	*-14.9%*	*-8.5%*	*-15.8%*	*-18.9%*

* *adjusted age class split for swine as recommended in the centralized review (October 2003)*

Table 146:Domestic livestock population and its trend 1990–2006 (III).

Year	Population size [heads] *			
	Livestock Category			
	Poultry	**Chicken**	**Other Poultry**	**Other**
1990	13 820 961	13 139 151	681 810	37 100
1991	14 397 143	13 478 820	918 323	37 100
1992	13 683 900	12 872 100	811 800	37 100
1993	14 508 473	13 588 850	919 623	37 100
1994	14 178 834	13 265 572	913 262	37 736
1995	13 959 316	13 157 078	802 238	40 323

Year	Population size [heads] *			
	Livestock Category			
	Poultry	Chicken	Other Poultry	Other
1996	12 979 954	12 215 194	764 760	41 526
1997	14 760 355	13 949 648	810 707	56 244
1998	14 306 846	13 539 693	767 153	50 365
1999	14 498 170	13 797 829	700 341	39 086
2000	11 786 670	11 077 343	709 327	38 475
2001	12 571 528	11 905 111	666 417	38 475
2002	12 571 528	11 905 111	666 417	38 475
2003	13 027 145	12 354 358	672 787	41 190
2004	13 027 145	12 354 358	672 787	41 190
2005	13 027 145	12 354 358	672 787	41 190
2006	13 027 145	12 354 358	672 787	41 190
Trend 90–06	*-5.7%*	*-6.0%*	*-1.3%*	*11.0%*

* *.adjusted age class split for swine as recommended in the centralized review (October 2003)*

Information about the extent of organic farming in Austria was provided in the Austrian INVEKOS[50] database (KIRNER & SCHNEEBERGER 1999), which was established to account for the financial support for sustainable agriculture including organic farming. INVEKOS data were used to calculate the share of animals that are subject to organic farming practices. However, INVEKOS data were available only for the years 1997 to 2000, and these data referred only to aggregated livestock categories. Furthermore, the INVEKOS data are not fully compatible with the Statistik Austria data because they rely on different data reporting periods.

The data gaps in the INVEKOS data sets (insufficiently detailed animal categories, lack of data for 1990–1996) were filled through expert judgments and trend extrapolations using surrogate data (e.g. the development of organic farming).

For all major animal categories the average share of organic farming in the 1997–2000 period was calculated from the INVEKOS data. This average share was then allocated to all animal sub-categories, assuming a default ratio between all sub-categories (e.g. assuming that the cattle in organic and conventional farming have the same ratios of dairy cattle, suckling cows, calves etc.).

Table 147 shows the results of the shares of organic farming in the relevant livestock categories for 1990, 1997–2000 and 2006:

[50] INVEKOS (Integriertes Verwaltungs- und Kontrollsystem, Integrated Administration and Control System) contains data about the regional distribution, land use, and the number of animals per farm. The INVEKOS is managed by the Federal Ministry of Agriculture, Forestry, Environment and Water Management.

Table 147:Share of cattle population under organic farming systems (calculations based on INVEKOS data).

IPCC Category	**% organic**	**% organic**	**% organic**
	1990	**1997–2000**	**2006**
CATTLE	1%	15%	17%
Dairy Cattle > 2 yr	1%	15%	15%
Suckling Cows > 2 yr	2%	25%	28%
Cattle > 2 yr	1.5%	20%	15%
Young Cattle < 1 yr	1%	13%	15%
Young Cattle 1–2 yr	1%	12%	15%

For the years 1990–1996, a trend extrapolation using surrogate data was made, namely the number of farms that apply organic farming practices (BMLFUW 2001). These data for expansion development of organic farming in Austria were applied to derive a trend of the animal population numbers in organic farming for the years 1990–1996 where no other relevant data were available. For the years 2001 to 2003 the data for 2000 was used. From 2004 onwards INVEKOS data of organic cattle population as reported in the so called 'Green Reports' of the ministery of agriculture (BMLFUW 2007) was used.

6.2.2.1 Cattle (4.A.1)

Key Source: Yes (CH_4)

CH_4 emissions from *Enteric Fermentation – Cattle* (sum of dairy and non-dairy cattle) is a key source due to the contribution to total greenhouse gas emissions in Austria and also due to its contribution to the total inventory's trend. In the year 2006, emissions from *Enteric Fermentation – Cattle* contributed 3.3% to total greenhouse gas emissions in Austria.

CH_4 Emissions were calculated using the IPCC Tier 2 methodology. Activity data were obtained from national statistics and are presented in Table 144 and Table 145.

Emission Factors

Country specific emission factors were used. They were calculated from the specific *gross energy intake* and the *methane conversion rate* (GPG, Equation 4.14).

$EF = (GE * Y_m * 365\ days/yr)/55.65$ MJ/kg

Y_m *Methane conversion rate*

The methane conversion rate (Y_m) was taken from the IPCC recommended value for "*all other cattle*" (0.06 +/- 8.3%) because there are few if any feedlot cattle with a high-energy diet (i.e. with 90% or more of the diet in form of concentrates) in Austria.

Country specific values for the Gross Energy Intake were applied. The estimation was done separately for *Dairy* and *Non-Dairy* cows.

GE Gross Energy Intake of Dairy Cows (4.A.1.a):

Austrian specific values for dairy cows were derived from feed intake data and energy content of feed (forage and concentrate) in dependency of annual milk yields (GRUBER & STEINWIDDER 1996). Following a recommendation of the Centralized Review 2004 in the year 2005 Austrian N excretion values and energy intake data were recalculated by Dr. Erich M. Pötsch from the Agricultural Research and Education Centre (AREC) Raumberg-Gumpenstein (PÖTSCH 2005), (GRUBER & PÖTSCH 2006).

Table 148:Revised energy intake data for diary cattle in Austria (PÖTSCH 2005).

Annual milk yield	**kg/cow/yr**	**3 000**	**3 500**	**4 000**	**4 500**	**5 000**	**5 500**	**6 000**
energy intake	MJ NEL* day^{-1}	5.6	5.7	5.7	5.8	5.9	6.0	6.0
forage intake	kg dry matter day^{-1}	13.9	14.0	14.0	13.9	13.8	13.8	13.8
concentrate intake	kg dry matter day^{-1}	0.4	0.7	0.9	1.3	1.8	2.3	2.8
net energy intake	MJ NEL* day^{-1}	80.3	82.8	85.3	88.5	91.7	95.8	99.8
Gross Energy Intake	MJ GE day^{-1}	235.3	242.6	249.8	259.2	268.7	280.7	292.3

* *net energy lactation*

Austrian dairy cattle show average milk yields from 3 791 kg/cow (1990) to 5 903 kg/cow (2006). The time series of average milk yields per dairy cow was taken from national statistics and are presented in Table 149. For dairy cattle there was a 17.8% increase of GE intake between 1990 and 2006 due to the increase of the milk yield per dairy cow in this time. The resulting emission factor is presented in the following table:

Table 149:Annual milk yield, Gross Energy Intake and Emission Factors of Dairy Cattle 1990–2006.

Year	**Milk Yield**	**Gross Energy Intake**	**Emission Factor**
	[kg/cow*yr]	**[MJ/head*day]**	**[kg CH_4/head*yr]**
1990	3 791	248.10	97.64
1991	3 862	248.66	97.86
1992	3 934	249.22	98.07
1993	4 005	249.77	98.29
1994	4 076	254.50	100.15
1995	4 619[1)]	259.23	102.01
1996	4 670	261.59	102.94
1997	4 787	263.95	103.87
1998	4 924	266.32	104.80
1999	5 062	268.68	105.73
2000	5 210	272.69	107.31
2001	5 394	276.71	108.89
2002	5 487	280.72	110.47
2003	5 638	283.62	111.61
2004	5 802	286.52	112.75
2005	5 783	289.42	113.89
2006	5 903	292.32	115.04

1) *From 1995 onwards data have been revised by Statistik Austria.*

Up to the early 1990ies Austrian dairy husbandry was determined by traditional Austrian green feeding and traditional Austrian races. From the mid 1990ies onwards milk production has been intensified: diets with higher energy concentration were fed and the share of high yield breeds (e.g. Holstein Friesian) in dairy farming was increased.

GE Gross Energy Intake of Non-Dairy Cattle (4.A.1.b):

Suckling cows:

The husbandry of suckling cows is used for the production of veal and beef. The milk yield of the cow is only provided for the suckling calves. As a rule of thumb under the national circumstances in Austria 10 kg milk are needed for 1 kg gain in weight for a calve. A new born calve has around 40 kg and suckles until it weighs about 350 kg.

The study "Mutterkuh und Ochsenhaltung 2003" in which 56 holdings in Styria, Lower Austria, Carinthia and Salzburg were investigated, reports daily rates of weight increases of 1 020 g (2002) and 1 060 g (2003). Calves were suckled about 300 days (GRABNER et al. 2004). An experiment based on measurements made from 1978 to 1987 (STEINWENDER & GOLD 1989) shows similar results: The daily increase of weight of young bulls was 1 225 g and of young cows 1 044 g.

In an study (STEINWIDDER et al. 2006) with Austrian suckling cows (Simmental) the influence of duration of suckling period (6 months and 9 months) on milk yield and body weight of cows and weight gain of calves was determined. Cows were fed with forage of low quality. Anyhow, the milk yield of the 1st lactating suckling cows was on a high level: For the period of 6 month suckling a milk yield of 2 040 kg, for the period of 9 month suckling a milk yield of 3 329 kg per cow has been measured. The daily gains of the beef cattle (Simental x Limousin steers and heifers) were 1.22 and 1.26 kg for the 180 or 270 days of suckling period, respectively. The experiment (2004 to 2008) is still is ongoing.

According to an article in the Swiss agricultural journal UFA-Revue 2005 (HEIM, P. 2005), measurements show that in mother cow husbandry a milk yield of 3 000kg is needed to achieve a daily gain in weight of one kg.

Thus, in the Austrian Greenhouse Gas Emission Inventory for the period from 1990 to 2006 a constant average milk yield of 3 000 kg was applied, resulting in a Gross Energy Intake of 235.3 MJ per suckling cow and day (see Table 148).

Other non dairy cattle categories:

Gross Energy Intake for all other cattle categories were calculated from typical Austrian diets. Animal nutrition expert Andreas Steinwidder worked out animal diets as shown in Table 150 and Table 151 (AMON et al. 2002).

These livestock categories show distinct differences in organic and conventional diets. Thus, in this section a differentiation between both production systems was worked out. Gross Energy Intake was calculated using the methodology as described in (GRUBER & STEINWIDDER 1996).

Table 150: Typical Austrian diets and gross energy intake of Non-Dairy Cattle, conventional production system.

CONVENTIONAL	**cattle < 1 year**	**cattle 1–2 years**	**non dairy cattle > 2 years**
live weight	210 kg	530 kg	600 kg
animal diet	15% green feeding	20% green feeding	40% green feeding
	20% hay	15% hay	20% hay
	30% grass silage	30% grass silage	30% grass silage
	35% maize silage	35% maize silage	10% maize silage
forage intake [kg dry matter day^{-1}]	2.5	7.4	8.2
concentrate intake [kg dry matter day^{-1}]	2	2	1
Gross Energy Intake [(MJ GE (kg dry matter)$^{-1}$]	84.4	167.0	163.4

Table 151: Typical Austrian diets and gross energy intake of Non-Dairy Cattle, organic production system.

ORGANIC	**cattle < 1 year**	**cattle 1–2 years**	**non dairy cattle > 2 years**
live weight	190 kg	480 kg	580 kg
animal diet	35% green feeding	40% green feeding	40% green feeding
	20% hay	15% hay	15% hay
	45% grass silage	45% grass silage	45% grass silage
forage intake [kg dry matter day^{-1}]	2.9	7.5	8
concentrate intake [kg dry matter day^{-1}]	1	1	1
Gross Energy Intake [(MJ GE (kg dry matter)$^{-1}$]	72.1	151.1	159.9

As no major changes in diets of *Non-Dairy Cattle* occurred in the period from 1990–2006, methane emissions from enteric fermentation of *Non-Dairy Cattle* are calculated with a constant gross energy intake for the whole time series. The resulting emission factor is presented in the following table:

Table 152: Emission Factors and Gross Energy Intake of Non-Dairy Cattle 1990–2006.

IPCC Category	**Farming type**	**Gross Energy Intake [MJ/head*day]**	**Calculated Emission Factor [kg CH_4/head.yr]**
Suckling Cows > 2 yr	con/org	235	93
Cattle > 2 yr	conventional	163	64
Cattle > 2 yr	organic	160	63
Young Cattle < 1 yr	conventional	84	33
Young Cattle < 1 yr	organic	72	28
Young Cattle 1–2 yr	conventional	167	66
Young Cattle 1–2 yr	organic	151	59

6.2.2.2 Sheep (4 A 3), Goats (4 A 4), Horses (4 A 6) Swine (4 A 8), Poultry (4 A 9) and Other (4 A 10)

Key Source: No

As presented in Table 143, CH_4 emissions from *Sheep, Goats, Horses, Swine, Poultry* and *Other (deer)* are only minor emission sources of category *4 A Enteric Fermentation*. Together they contributed 6.2% to total emissions from this category in 2006. The most important sub source is *Swine*, with a contribution of 3.1%, followed by *Sheep* (1.6%), *Horses* (1.0%), *Other Livestock/Deer* and *Goats* with each 0.2% and finally *Poultry* with 0.1%. (figures are also presented in Table 143).

Emissions (except *Poultry*) were estimated using the IPCC Tier 1 methodology.

As sheep is the most similar animal category to deer, emissions from deer were estimated applying the default emission factor of sheep. For all swine categories an emission factor of 1.5 kg/head*yr was used. Default emission factors were taken from the IPCC Guidelines and are presented in the following table:

Table 153:IPCC Default Emission Factors for Categories estimated by Tier 1.

IPCC Category	Emission Factor* (Developed Countries) [kg CH_4/head*yr]	IPCC Category	Emission Factor* (Developed Countries) [kg CH_4/head*yr]
4 A 3 Sheep (+Deer)	8	4 A 6 Horses	18
4 A 4 Goats	5	4 A 8 Swine	1.5

** Source: IPCC Reference Manual p.4.10*

The IPCC Guidelines don't provide methodologies for the estimation of emissions from *Poultry*.

For the calculation of emissions from category *4 A 9 Poultry* the IPCC Tier 2 method with Swiss values (Gross Energy Intake (GE), Methane Conversion Rate (Y_m)) was used. It is assumed that Swiss conditions are very similar to Austrian conditions.

Y_m: 0.09%

GE: 2.18 MJ/head/yr (Swiss 2002 value)

Swiss values (see Swiss NIR (SAEFL 2004)) are based on (MINONZIO 1998), a compilation of scientific literature and research of agricultural CH_4 emissions.

Activity data were obtained from national statistics and are presented in Table 144 and Table 145.

6.2.3 Uncertainties

Uncertainties are presented in Table 141.

6.2.4 Recalculations

No recalculations have been required for this version of the inventory.

6.2.5 Planned Improvements

From 2005 to 2007, a comprehensive investigation of Austria's agricultural practice was carried out by the Department of Sustainable Agricultural Systems – Division of Agricultural Engineering, University of Natural Resources and Applied Life Sciences, Vienna. It is planned to use the updated figures to prepare the Austrian Greenhouse Gas Emission Inventory, submission 2009.

6.3 Manure Management (CRF Source Category 4.B)

This chapter describes the estimation of CH_4 and N_2O emissions from animal manure. In 2006 21.4% of the agricultural CH_4 emissions and 23.1% of the agricultural N_2O emissions were caused by this source category.

6.3.1 Source Category Description

From 1990 to 2006 CH_4 emissions from *Manure Management* decreased by 17.5% to 41.7 Gg. This is mainly due a decrease of the livestock categories cattle and swine.

Table 154:CH_4 Emissions from Manure Management 1990–2006.

	CH_4 emissions from Manure Management [Gg]								
	Livestock Categories								
	4.B Total	**4.B.1.a Dairy**	**4.B.1.b Non Dairy**	**4.B.3 Sheep**	**4.B.4 Goats**	**4.B.6 Horses**	**4.B.8 Swine**	**4.B.9 Poultry**	**4.B.10 Other/ Deer**
1990	50.49	17.60	10.36	0.06	0.00	0.07	21.32	1.08	0.01
1991	49.78	17.07	10.40	0.06	0.00	0.08	21.03	1.12	0.01
1992	49.02	16.42	9.86	0.06	0.00	0.09	21.50	1.07	0.01
1993	49.39	16.19	9.83	0.06	0.01	0.09	22.08	1.13	0.01
1994	48.86	15.89	9.93	0.07	0.01	0.09	21.77	1.11	0.01
1995	48.48	13.91	11.47	0.07	0.01	0.10	21.83	1.09	0.01
1996	47.55	13.76	11.28	0.07	0.01	0.10	21.31	1.01	0.01
1997	47.48	14.23	10.55	0.07	0.01	0.10	21.35	1.15	0.01
1998	47.94	14.43	10.19	0.07	0.01	0.10	22.02	1.12	0.01
1999	45.47	13.85	10.46	0.07	0.01	0.11	19.84	1.13	0.01
2000	44.23	12.38	11.49	0.06	0.01	0.11	19.25	0.92	0.01
2001	44.46	11.98	11.19	0.06	0.01	0.11	20.12	0.98	0.01
2002	43.05	11.86	10.82	0.06	0.01	0.11	19.20	0.98	0.01
2003	43.15	11.27	11.13	0.06	0.01	0.12	19.54	1.02	0.01
2004	41.82	10.89	11.37	0.06	0.01	0.12	18.35	1.02	0.01
2005	41.93	10.85	10.97	0.06	0.01	0.12	18.90	1.02	0.01
2006	41.68	10.74	10.92	0.06	0.01	0.12	18.81	1.02	0.01
Share 2006	*100%*	*25.8%*	*26.2%*	*0.1%*	*0.0%*	*0.3%*	*45.1%*	*2.4%*	*0.0%*
Trend 1990–2006	*-17.5%*	*-39.0%*	*5.4%*	*0.8%*	*42.2%*	*77.0%*	*-11.8%*	*-5.7%*	*11.0%*

From 1990 to 2006 the N_2O emissions from *Manure Management* decreased by 13.0% to 2.8 Gg. Emissions of cattle dominate the trend. The reduction of diary cows is partly counterbalanced by an increase in emissions per animal (because of the increasing gross energy intake, milk production and N excretion of diary cattle since 1990).

Table 155: N_2O Emissions from Manure Management 1990–2006.

	N_2O emissions from Manure Management [Gg]								
	Livestock Categories								
	4 B	**4 B 1 a**	**4 B 1 b**	**4 B 3**	**4 B 4**	**4 B 6**	**4 B 8**	**4 B 9**	**4 B 10**
	Total	**Dairy**	**Non Dairy**	**Sheep**	**Goats**	**Horses**	**Swine**	**Poultry**	**Other/ Deer**
1990	3.24	1.55	1.38	0.01	0.00	0.00	0.25	0.05	0.00
1991	3.20	1.52	1.37	0.01	0.00	0.00	0.25	0.06	0.00
1992	3.08	1.47	1.30	0.01	0.00	0.00	0.25	0.05	0.00
1993	3.09	1.46	1.31	0.01	0.00	0.00	0.26	0.06	0.00
1994	3.09	1.44	1.33	0.01	0.00	0.00	0.26	0.06	0.00
1995	3.16	1.33	1.50	0.01	0.00	0.00	0.26	0.05	0.00
1996	3.10	1.32	1.47	0.01	0.00	0.00	0.25	0.05	0.00
1997	3.07	1.38	1.36	0.01	0.00	0.00	0.25	0.06	0.00
1998	3.06	1.42	1.32	0.01	0.00	0.00	0.26	0.06	0.00
1999	3.02	1.38	1.34	0.01	0.00	0.00	0.23	0.06	0.00
2000	2.98	1.24	1.45	0.01	0.00	0.00	0.23	0.05	0.00
2001	2.95	1.22	1.44	0.01	0.00	0.00	0.24	0.05	0.00
2002	2.89	1.21	1.40	0.01	0.00	0.00	0.23	0.05	0.00
2003	2.87	1.17	1.41	0.01	0.00	0.00	0.23	0.05	0.00
2004	2.86	1.14	1.44	0.01	0.00	0.00	0.22	0.05	0.00
2005	2.83	1.13	1.41	0.01	0.00	0.00	0.22	0.05	0.00
2006	2.82	1.13	1.41	0.01	0.00	0.00	0.22	0.05	0.00
Share 2006	*100%*	*40.1%*	*50.0%*	*0.2%*	*0.0%*	*0.0%*	*7.8%*	*1.8%*	*0.0%*
Trend 1990–2006	*-13.0%*	*-27.2%*	*2.5%*	*0.8%*	*42.2%*	*77.0%*	*-11.9%*	*-5.5*	*11.0%*

6.3.2 Methodological Issues

The IPPC-Tier 2 methodology is applied to estimate CH_4 emissions from manure management of cattle and swine as these are key sources. This method requires detailed information on animal characteristics and the manner in which manure is managed. Sheep, goats, horses and other soliped, chicken, other poultry and other animals are of minor importance in Austria, therefore the CH_4 emissions of these livestock categories are estimated with the Tier 1 approach.

For the estimation of N_2O emissions a Tier 1 methodology is used. N_2O emissions are calculated on the basis of N excretion per animal and waste management system.

Data on the distribution of Austria's manure management system were taken from (KONRAD 1995). In this study data on existing Austrian conditions were derived from a research survey carried out on 720 randomly-chosen agricultural enterprises in the years 1989–1992.

Activity data

(STATISTIK AUSTRIA 2006) provides national data of annual livestock numbers on a very detailed level (see Table 144 and Table 145).These data are basis for the estimation.

The animal numbers of *Young Swine* were not taken into account because the emission factors for *Breeding Sows* already includes nursery and growing pigs (SCHECHTNER 1991).

6.3.2.1 Estimation of CH_4 Emissions

CH_4 emissions of cattle and swine are estimated with the Tier 2 approach. This method requires detailed information on animal characteristics and the manner in which manure is managed. The following formula has been used (GPG, Equation 4.17):

$$EF_i = VS_i * 365\ [days\ yr^{-1}] * B_{0i} * 0.67\ [kg\ m^{-3}] * \Sigma_{jK}\ MCF_{jK} * MS\%_{ijK}$$

EF_i	= annual emission factor (kg) for animal type i (e.g. dairy cows)
VS_i	= Average daily volatile solids excreted (kg) for animal type i
B_{0i}	= maximum methane producing capacity (m³ per kg of VS) for manure produced by animal type I
MCF_{jK}	= methane conversion factors for each manure management system j by climate region K
$MS\%_{ijK}$	= fraction of animal type i`s manure handled using manure systems j in climate region K

Cattle (4.B.1)

Key Source: Yes (CH_4, N_2O)

B_{0i} Values

IPCC default values were used (Appendix B, IPCC Guidelines, Reference Manual)

MCF Values

The default MCF values for 'cool climate regions' presented in the IPCC Guidelines' Reference Manual (table 4-8) were used. For liquid systems the revised GPG default value of 39% was applied.

According the guidelines, cool climates have an average temperature below 15°C. The average temperature in Austria varies from 8.4°C in Klagenfurt to 10.5°C in Vienna (ZAMG, Jahrbuch 2004).

Manure Management Systems

In Austria national statistics on manure management systems are not available. Inventory data is based on a comprehensive survey carried out by (KONRAD 1995). The manure management system distribution is used for the whole period from 1990–2006 (see Table 156).

Table 156:Manure Management System distribution in Austria: Cattle.

Livestock category	Liquid/Slurry [%]	Solid Storage [%]	Pasture/range/paddock [%]
dairy cattle summer	16.7[1)]	62.0[1)]	21.3[1)]
dairy cattle winter	21.2[1)]	78.8[1)]	–
dairy cattle winter/summer	18.95[1)]	70.4[1)]	10.65[1)]
suckling cows summer	16.7[1)]	62.0[1)]	21.3[1)]
suckling cows winter	21.2[1)]	78.8[1)]	–
suckling cows winter/summer	18.95[1)]	70.4[1)]	10.65[1)]
cattle 1–2 years summer	7.7[1)]	39.9[1)]	52.4[1)]
cattle 1–2 years winter	16.2[1)]	83.8[1)]	–
cattle 1–2 years winter/summer	11.95[2)]	61.85[2)]	26.2[2)]
cattle < 1 year	28.75[1)]	71.25[1)]	–
non dairy cattle > 2 years	48.6[1)]	51.4[1)]	–

1) *"Die Rinder-, Schweine- und Legehennenhaltung in Österreich aus ethologischer Sicht" (KONRAD 1995)*

2) *Estimation of Dipl.-Ing. Alfred Pöllinger (Federal Research Institute, Gumpenstein) following (KONRAD 1995)*

MMS are distinguished for *Dairy Cattle*, *Suckling Cows* and *Cattle 1–2 years* in "summer situation" and "winter situation" (Table 156). During the summer months, a part of the manure from these livestock categories is managed in "pasture/range/paddock". The value for "pasture/range/paddock" is estimated as follows: During summer, 14.1% of Austrian dairy cows and suckling cows are on alpine pastures 24 hours a day. 43.6% are on pasture for 4 hours a day and 42.3% stay in the housing for the whole year (KONRAD 1995). "Alpine pasture" and "pasture" are counted together as MMS "pasture/range/paddock". As "pasture" only lasts for about 4 hours a day, only 1/6 of the dairy cow pasture-% (43.6%) is added to the total number. This results in 21.3% "pasture/range/paddock" during summer. In winter, "pasture/range/paddock" does not occur in Austria. Summer and winter both last for six months (AMON et al. 2002).

VS Values

Austrian specific values for dairy cows are calculated in dependency of annual milk yields and corresponding feed intake data (gross energy intake, feed digestibility, ash content, see Table 148 and Table 157). Within the revision of Austrian N excretion values (following a recommondation of the Centralized Review 2005) in the year 2005 energy intake data and VS excretion data of *dairy* and *suckling cows* were recalculated (PÖTSCH 2005 following GRUBER & STEINWIDDER 1996).

Table 157:VS excretion of Austrian dairy cattle (PÖTSCH 2005 following GRUBER & STEINWIDDER 1996).

Milk yield	[kg/yr]	3 000	3 500	4 000	4 500	5 000	5 500	6 000
GE intake	[MJ/day]	235.32	242.55	249.77	259.23	268.68	280.72	292.32
feed digestibility	[%]	65.7	66.0	66.3	67.3	68.2	69.1	70.0
ash content	[%]	11	11	11	11	11	11	11
VS excretion [kg $cow^{-1}day^{-1}$]		3.90	3.98	4.06	4.09	4.12	4.18	4.23

A time series of VS excretion of dairy cattle was calculated by interpolation of these data (see Table 158).

For the calculation of VS excretion of suckling cows for the years 1990–2005 an average milk yield of 3 000 kg was applied (see Table 157). As already mentioned in Chapter 6.2 data is based on several Austrian and Swiss studies (STEINWENDER & GOLD 1989, GRABNER et al. 2004, STEINWIDDER et al. 2006 and HEIM, P. 2005).

Table 158:VS excretion of Austrian diary cows for the period 1990–2006.

Year	**Milk Yield**	**VS**
	[kg/cow*yr]	**[kg/cow*day]**
1990	3 791	4.04
1991	3 862	4.05
1992	3 934	4.05
1993	4 005	4.06
1994	4 076	4.07
1995	4 619[1)]	4.09
1996	4 670	4.10
1997	4 787	4.11
1998	4 924	4.11
1999	5 062	4.12
2000	5 210	4.14
2001	5 394	4.16
2002	5 487	4.18
2003	5 638	4.20
2004	5 802	4.21
2005	5 783	4.22
2006	5 903	4.23

[1)] *From 1995 onwards data have been revised by Statistik Austria.*

Austrian specific values on VS excretion for all other cattle categories were calculated from typical Austrian diets under organic and conventional management (according to Andreas Steinwidder, see Table 150).

As no major changes in diets of *Non-Dairy Cattle* occurred in the period from 1990–2006, methane emissions from manure management of *Non-Dairy Cattle* are calculated with a constant gross energy intake and thus constant VS excretion rate for the whole time series.

The VS excretion rate was calculated from feed intake following the formula presented in the IPCC guidelines (Reference Manual, Equation 4.15):

$$VS\ [kg\ dm\ day^{-1}] = Intake\ [MJ\ day^{-1}] * (1kg\ (18.45\ MJ)^{-1}) * (1- DE\%/100) * (1- ASH\%/100)$$

VS = VS excretion per day on a dry weight basis

Dm = dry matter

Intake = daily average gross energy feed intake [MJ day^{-1}]

DE% = digestibility of feed in per cent

ASH% = ash content of manure in per cent

Table 159 presents data for the calculation of VS excretion of the livestock categories *Non-Dairy Cattle*.

Table 159:Austrian VS excretion rates of Non-Dairy Cattle, conventional and organic production system.

	cattle < 1 year		cattle 1–2 years		n. dairy cattle > 2 years	
	Conv.	**Org.**	**Conv.**	**Org.**	**Conv.**	**Org.**
feed digestibility [%]	76	75	73	73	73	73
ash content [%]	12.0	12.0	11.5	11.5	11.0	11.0
Gross energy intake [MJ GE (kg dry matter)$^{-1}$]	84.36	72.06	166.96	151.14	163.44	159.93
VS excretion [kg head^{-1} day^{-1}]	0.97	0.86	2.16	1.96	2.13	2.08

The VS values of Organic Systems are not significantly different from those of the Conventional Systems. Uncertainty is estimated to be ± 20%.

Swine (4.B.8)

Key Source: Yes (CH_4)

B_0 and MCF Values

IPCC default values were used.

Manure management System

The comprehensive survey carried out by (KONRAD 1995) already mentioned above was used.

Table 160:Manure management distribution in Austria: Swine.

Livestock category	Liquid/Slurry [%]	Solid Storage [%]	Pasture/ range/paddock [%]
breeding sows	70[2]	30[2]	–
fattening pigs	71.9[1]	28.1[1]	–

[1)] *"Die Rinder-, Schweine- und Legehennenhaltung in Österreich aus ethologischer Sicht" (KONRAD 1995)*

[2)] *Expert estimation of Dipl.-Ing. Alfred Pöllinger (Federal Research Institute, Gumpenstein)*

VS excretion

VS excretion of *Swine* was estimated from country-specific data on VS content in the manure (SCHECHTNER 1991). Changes in animal performance of *Swine* are not reported for Austria. Thus, VS excretion rates of *Swine* were kept constant for the whole time series.

Table 161:VS excretion from Austrian swine, calculated with (SCHECHTNER 1991).

Livestock category	Manure Production given in Schechtner (1991)	Calculated manure production [t head^{-1} yr^{-1}]	VS content in manure [kg (t manure)$^{-1}$]	VS excretion [kg head^{-1} day^{-1}]
breeding sows	4 t sow^{-1}yr^{-1}	4.00	75	0.82
fattening pigs	0.63 t pig^{-1} 120 days^{-1}	1.92	55	0.29

Animal numbers of *Young Swine* were not taken into account because the emission factors for *Breeding Sows* already include nursery and growing pigs (SCHECHTNER 1991).

Sheep (4.B.3), Goats (4.B.4), Horses (4.B.6), Poultry (4.B.9) and Other Livestock/ Deer (4.B.10)

Key Source: No

CH_4 emissions from *Manure Management* for *Sheep, Goats, Horses, Poultry* and *Other Livestock/Deer* are estimated with the Tier 1 approach.

Default emission factors were taken from the IPCC guidelines (Table 4-5 of the Reference Manual). CH_4 emissions were estimated multiplying these emission factors by national animal numbers.

Table 162:CH_4 emissions from manure management systems for Sheep, Goats, Horses and Other Soliped, Chicken, Other Poultry and Other Livestock/ Deer in Austria.

Livestock category	Emission Factor [kg CH_4 per head per yr]	Livestock category	Emission Factor [kg CH_4 per head per yr]
Sheep	0.19	Chicken	0.078
Goats	0.12	Other Poultry[1]	0.078
Horses & other soliped	1.39	Other Livestock/ Deer	0.19

[1)] *the IPCC guidelines do not differentiate between laying hens and other poultry. The same emission factor was applied to both livestock categories.*

The Austrian inventory does not distinguish between *Horses* and *Mules and Asses*. As *Mules and Asses* are only of very little importance in Austria, CH_4 emissions from manure of horses and other soliped were estimated with the default emission factors for *Horses*.

In Austria the animal category *Other Animal* corresponds to deer (held in pastures). As sheep is the most similar animal category to deer, emissions from deer were estimated applying the default emission factor of sheep.

6.3.2.2 Estimation of N_2O Emissions

Key Source: 4 B 1

Following the guidelines, all emissions of N_2O taking place before the manure is applied to soils are reported under *Manure Management*.

For the estimation of N_2O emissions from manure management systems only a Tier 1 approach is available. The IPCC Guidelines method for estimating N_2O emissions from manure management entails multiplying the total amount of N excretion (from all animal species/categories) in each type of manure management system by an emission factor for that type of manure management system. Emissions are then summed over all manure management systems (see formulas below).

N excretion per animal waste management system:

$$Nex_{(AWMS)} = \sum_{(T)}[N_{(T)} \times Nex_{(T)} \times AWMS_{(T)}]$$

$Nex_{(AWMS)}$ = N excretion per animal waste management system [kg yr^{-1}]

$N_{(T)}$ = number of animals of type T in the country

$Nex_{(T)}$ = N excretion of animals of type T in the country [kg N $animal^{-1}$ yr^{-1}]

$AWMS_{(T)}$ = fraction of $Nex_{(T)}$ that is managed in one of the different distinguished animal waste management systems for animals of type T in the country

T = type of animal category

N_2O emission per animal waste management system:

$$N_2O_{(AWMS)} = \sum[Nex_{(AWMS)} \times EF_{3(AWMS)}]$$

$N_2O_{(AWMS)}$ = N_2O emissions from all animal waste management systems in the country [kg N yr^{-1}]

$Nex_{(AWMS)}$ = N excretion per animal waste management system [kg yr^{-1}]

$EF_{3(AWMS)}$ = N_2O emissions factor for an AWMS [kg N_2O-N per kg of Nex in AWMS]

AWMS

The animal waste management system distribution data applied to estimate N_2O emissions from *Manure Management* is the same as used for the estimation of CH_4 emissions from *Manure Management* (see Table 156 and Table 160).

N excretion

As recommended in the Centralized Review 2004, in the year 2005 Austrian N excretion values were reviewed and recalculated. The revised values consider the typical agricultural practice in Austria. Especially N excretion rates of dairy and suckling cows are higher now (see Table 163):

Table 163:Austria specific N excretion values of dairy cows for the period 1990–2006 and for 1980.

Year	Milk yield [kg yr^{-1}]	*Nitrogen excretion [kg/animal*yr]*	*Year*	Milk yield [kg yr^{-1}]	*Nitrogen excretion [kg/animal*yr]*
1980	3 518	74.16	1998	4 924	86.82
1990	3 791	76.62	1999	5 062	88.06
1991	3 862	77.26	2000	5 210	89.39
1992	3 934	77.90	2001	5 394	91.05
1993	4 005	78.54	2002	5 487	91.88
1994	4 076	79.18	2003	5 638	93.24
1995	4 619[1)]	84.07	2004	5 802	94.72
1996	4 670	84.53	2005	5 783	94.55
1997	4 787	85.58	2006	5 903	95.63

1) From 1995 onwards data have been revised by Statistik Austria, which led to significant higher milk yield data of Austrian dairy cows.

N excretion values as shown in Table 163 and Table 164 are based on the following literature: (GRUBER & PÖTSCH 2006, PÖTSCH et al. 2005, STEINWIDDER & GUGGENBERGER 2003, UNTERARBEITSGRUPPE N-ADHOC 2004 and ZAR 2004).

According to the requirements of the European nitrate directive, the Austrian N excretion data were recalculated following the guidelines of the European Commission. The revised nitrogen excretion coefficients were calculated based on following input parameters:

Cattle: Feed rations represent data of practical farms consulting representatives of the working groups "Dairy production". These groups are managed by well-trained advisors. Their members, i.e. farmers, regularly exchange their knowledge and experience. Forage quality is based on field studies, carried out in representative grassland and dairy farm areas. The calculations depend on feeding ration, gain of weight, nitrogen and energy uptake, efficiency, duration of livestock keeping etc.

Sheep and goats: life weight, daily gain of weight, degree of pregnancy or lactating, feeding rations.

Pigs: breeding pigs, piglets, boars, fattening pigs: number and weight of piglets, daily gain of weight, energy content of feeding, energy and nitrogen uptake, N-reduced feeding.

Poultry: feeding ration, duration of keeping, nitrogen uptake, nitrogen efficiency.

Horses: feeding ration per horse category, weight of horses.

Table 164:Austria specific N excretion values of other livestock categories.

Livestock category	***Nitrogen excretion* [kg/animal*yr]**
suckling cows[1)]	69.5
cattle 1 – 2 years	53.6
cattle < 1 year	25.7
cattle > 2 years	68.4
breeding sows	29.1
fattening pigs	10.3
sheep	13.1
goats	12.3
horses	47.9
chicken[2)]	0.52
other poultry[3)]	1.1
other livestock/ deer[4)]	13.1

1) *annual milk yield: 3 000 kg*

2) *weighted average of hens and broilers*

3) *weighted average of turkeys and other (ducks, gooses)*

4) *N-ex value of sheep applied*

Livestock numbers per category can be found in Table 144 and Table 145, manure management system distribution for *cattle* and *swine* can be found in Table 156 and Table 160. For the other livestock categories it is presented in the following table (Table 165).

Table 165: Distribution of manure management systems in Austria: Sheep, Goats, Horses, Poultry and Other Animals (KONRAD 1995).

Livestock category	Liquid/Slurry [%]	Solid Storage [%]	Pasture/range/ paddock [%]	Other Management System [%]
Sheep	0	2	87	11
Goats	0	0	96	4
Horses	0	0	96	4
Poultry (Chicken and Other Poultry)	1	13	2	84
Other Animals	0	0	96	4

Emission factors

Emission factors for animal waste management systems *Liquid/Slurry*, *Solid Storage*, *Pasture/Range/Paddock* and *Other Systems* were taken from the IPCC guidelines (IPCC GUIDELINES 1997, REFERENCE MANUAL, Table 4-22).

Table 166: IPCC default values for N_2O emission factors from animal waste per animal waste management system.

Animal Waste Management System	Emission Factor [kg N_2O-N per kg N excreted]
Liquid/Slurry	0.001
Solid Storage	0.020
Pasture/Range/Paddock	0.020
Other Systems	0.005

6.3.3 Uncertainties

Uncertainties are presented in Table 141.

6.3.4 Recalculations

No recalculations have been done.

6.3.5 Planned Improvements

In 2007 a comprehensive investigation of Austria's agricultural practice was carried out by the Department of Sustainable Agricultural Systems – Division of Agricultural Engineering, University of Natural Resources and Applied Life Sciences, Vienna. It is planned to use the updated figures to prepare the Austrian Greenhouse Gas Emission Inventory, submission 2009.

6.4 Agricultural Soils (CRF Source Category 4.D)

6.4.1 Source Category Description

N_2O emissions from the source categories *4.D.1 Direct Soil Emissions, 4.D.2 Pasture, Range and Paddock Manure* and *4.D.3 Indirect Soil Emissions* are a key source.

In 2006 76.9% of total N_2O emissions from *Agriculture* (54.1% of total Austrian N_2O emissions) originated from *Agricultural Soils*, the rest originates from *4.B Manure Management* and a very small share from *4.F Field Burning of Agricultural Residues*.

Emissions from this category contributed 3.2% (2 928.2 Gg CO_2 equivalents) to Austria's total greenhouse gas emissions in the year 2006. This is 37.1% of total GHG emissions of the sector *Agriculture*.

The trend of N_2O emissions from this category is decreasing: in 2006 emissions were 12.4% below 1990 levels.

Table 167 presents N_2O emissions of *Agricultural Soils* by sub-category as well as their trends and their share in total N_2O emissions.

Table 167:N_2O emissions from Category 4.D, 1990–2006.

	N_2O emissions [Gg]										
	IPCC Categories										
Year	**4 D Total**	**4 D 1 Direct Soil Emissions**	**Synthetic Fertilisers**	**Organic Fertiliser**	**Crop Residue**	**N-fixing Crops**	**Sewage Sludge**	**4 D 2 Pasture**	**4 D 3 Indir. Soil Emissions**	**Nitrogen Leaching**	**Athm. Deposition**
1990	10.75	5.82	2.62	2.28	0.57	0.33	0.02	0.70	4.22	3.56	0.67
1991	11.60	6.38	3.07	2.27	0.65	0.36	0.02	0.72	4.50	3.84	0.66
1992	10.73	5.91	2.60	2.20	0.63	0.46	0.02	0.70	4.12	3.48	0.64
1993	9.94	5.39	2.05	2.22	0.64	0.45	0.03	0.74	3.81	3.19	0.62
1994	11.53	6.47	2.88	2.22	0.89	0.45	0.03	0.74	4.32	3.69	0.63
1995	11.74	6.56	2.92	2.26	1.04	0.32	0.03	0.77	4.40	3.76	0.64
1996	10.50	5.69	2.42	2.22	0.68	0.34	0.03	0.77	4.04	3.42	0.62
1997	10.65	5.84	2.45	2.23	0.72	0.40	0.03	0.77	4.05	3.45	0.60
1998	10.73	5.92	2.47	2.22	0.77	0.43	0.03	0.75	4.06	3.45	0.62
1999	10.52	5.83	2.35	2.18	0.87	0.39	0.03	0.75	3.94	3.35	0.60
2000	10.07	5.48	2.30	2.12	0.65	0.37	0.03	0.73	3.86	3.26	0.60
2001	10.07	5.52	2.28	2.11	0.74	0.36	0.03	0.72	3.83	3.24	0.59
2002	10.03	5.52	2.34	2.06	0.71	0.38	0.03	0.70	3.81	3.23	0.58
2003	9.56	5.17	2.12	2.07	0.57	0.39	0.03	0.71	3.67	3.10	0.57
2004	9.21	5.01	1.86	2.05	0.67	0.40	0.03	0.71	3.49	2.93	0.56
2005	9.25	5.04	1.90	2.03	0.65	0.42	0.03	0.71	3.51	2.95	0.56
2006	9.42	5.19	1.93	2.02	0.76	0.45	0.03	0.70	3.52	2.96	0.57
Share 2006	*100%*	*55.2%*	*20.5%*	*21.5%*	*8.1%*	*4.8%*	*0.3%*	*7.4%*	*37.4%*	*31.4%*	*6.0%*
Trend 90–06	*-12.4%*	*-10.8%*	*-26.4%*	*-11.1%*	*32.9%*	*37.2%*	*25.1%*	*-0.5%*	*-16.6%*	*-16.9%*	*-15.3%*

CH_4 emissions from Agricultural Soils originate from sewage sludge spreading on agricultural soils. They contribute only a negligible part of Austria's total methane emissions (0.1% or 0.41 Gg CH_4 2006). This is about 0.2% of total CH_4 from sector *Agriculture*.

Table 168:CH_4 emissions from Category 4 D, 1990–2006.

	CH_4 emissions [Gg] IPCC Category	
Year	**4.D total**	**Other direct emissions (sewage sludge)**
1990	0.33	0.33
1991	0.33	0.33
1992	0.31	0.31
1993	0.47	0.47
1994	0.40	0.40

	CH_4 emissions [Gg] IPCC Category	
Year	**4.D total**	**Other direct emissions (sewage sludge)**
1995	0.44	0.44
1996	0.45	0.45
1997	0.45	0.45
1998	0.45	0.45
1999	0.45	0.45
2000	0.45	0.45
2001	0.43	0.43
2002	0.38	0.38
2003	0.41	0.41
2004	0.37	0.37
2005	0.37	0.37
2006	0.41	0.41
Share 2006	*100.0%*	*100.0%*
Trend 90–06	*25.1%*	*25.1%*

6.4.2 Methodological Issues

The IPCC Tier 1a and – where applicable – Tier 1b method was applied and IPCC default emission factors were used.

Table 169:N_2O emissions factors for Agricultural Soils.

Category	Emission Factor [t N_2O-N/t N]	Source
4.D.1 Direct Soil Emissions		
Synthetic Fertilizers (mineral fert.)	0.0125	IPCC GPG (Table 4.17)
Animal Waste applied to soils		
N-fixing Crops		
Crop Residue		
Sewage Sludge Spreading		
4.D.2 Pasture, Range and Paddock Manure		
Grazing Animals	0.02/ t N_{exGRAZ}	IPCC Guidelines (Table 4.22)
4.D.3 Indirect Soil Emissions		
Athmospheric Deposition	0.01/ t of volatized nitrogen	IPCC GPG (Table 4.18)
Nitrogen Leaching (and Run-off)	0.0025/ t N-loss by leaching	IPCC GPG (Table 4.18)

For agricultural sewage sludge application on fields also CH_4 emissions were estimated (country specific method).

Activity Data

Data for necessary input parameters (activity data) were taken from the following sources:

Table 170:Data sources for nitrogen input to Agricultural Soils.

Category	Data Sources
4.D.1 Direct Soil Emissions	
Synthetic Fertilizers (mineral fert.)	Mineral fertilizer consumption: Grüne Berichte (BMLFUW 2007) [1)]; urea application in Austria: Sales data RWA, 2007 [2)]
Animal Waste applied to soils	The amount of manure left for spreading was calculated within source category 4 B following (AMON et al. 2002)
N-fixing Crops	Cropped area legume production: (BMLFUW 2007) [1)]
Crop Residue	Harvested amount of agricultural crops: (BMLFUW 2007) [1)]
Sewage Sludge Spreading	Water Quality Report 2000 (PHILIPPITSCH et al. 2001), Report on sewage sludge (SCHARF et al. 1997), Austrian report on water pollution control (GEWÄSSERSCHUTZBERICHT 2002), National Austrian Waste Water Database, data query November 2007
4.D.2 Pasture, Range and Paddock Manure	
Grazing Animals	Calculations within source category 4 B are based on (AMON et al. 2002)
4.D.3 Indirect Soil Emissions	
Athmospheric Deposition	The amount of manure left for spreading was calculated within source category 4 B following (AMON et al. 2002). Mineral fertilizer data: (BMLFUW 2007)
Nitrogen Leaching (and Run-off)	see above (synthetic fertilizers, animal waste, sewage sludge)

[1)] *http://www.gruenerbericht.at and http://www.awi.bmlf.gv.at*

[2)] *RWA: Raiffeisen Ware Austria*

Mineral Fertilizer Application

Detailed data about the use of different kind of fertilizers are available until 1994, because until then, a fertilizer tax („Düngemittelabgabe") had been collected. Data about the total mineral fertilizer consumption are available for amounts (but not for fertilizer types) from the statistical office (Statistik Austria) and from an agricultural marketing association (Agrarmarkt Austria, AMA). Annual sales figures about urea are available for the years 1994 onwards from a leading fertilizer trading firm (RWA). These sources were used to get a time series of annual fertilizer application distinguishing urea fertilizers and other N-fertilizers ("mineral fertilizers").

The S&A report 2004 noticed high inter-annual variations in N_2O emissions of sector 4 D mineral fertilizer use. These variations are caused by the effect of storage: Fertilizers have a high elasticity to prices. Sales data are changing very rapidly due to changing market prices. Not the whole amount purchased is applied in the year of purchase. The fertilizer tax intensivied this effect at the beginning of the 1990ies. Considering this effect, the arithmetic average of each two years is used as fertilizer application data.

In the in-country review 2007 it was recommended to consider revising the time series by determining actual fertilizer use in accordance with the IPCC good practice guidance.

Austria considered this recommendation of the ERT. Investigations showed that data on the actual fertilizer use are not available in Austria. Therefore it has been decided to continue to use the official fertilizer sales data as input data for the emission inventory.

The time series for fertilizer consumption is presented in Table 171.

Table 171:Mineral fertilizer N consumption in Austria 1990–2006 and arithmetic average of each two years.

Year	Annual Nutrient Sales Data [t N/yr]	of which Urea	Data Source	Weighted Nutrient Consumption [t N/yr]	Weighted Urea Consumption [t N/yr]
1989	133 304	1 700	FAO		
1990	140 379	3 965	estimated, GB[1)]	136 842	2 833
1991	180 388	3 965	GB[1)]	160 384	3 965
1992	91 154	3 886	GB[1)]	135 771	3 926
1993	123 634	3 478	GB[3)], RWA[2)]	107 394	3 682
1994	177 266	4 917	GB[3)], RWA[2)]	150 450	4 198
1995	128 000	5 198	GB[4)], RWA[2)]	152 633	5 058
1996	125 300	4 600	GB[5)], RWA[2)]	126 650	4 899
1997	131 800	6 440	GB[6)], RWA[2)]	128 550	5 520
1998	127 500	6 440	GB[6)], RWA[2)]	129 650	6 440
1999	119 500	6 808	GB[6)], RWA[2)]	123 500	6 624
2000	121 600	3 848	GB[6)], RWA[2)]	120 550	5 328
2001	117 100	3 329	GB[6)], RWA[2)]	119 350	3 589
2002	127 600	4 470	GB[6)], RWA[2)]	122 350	3 900
2003	94 400	6 506	GB[6)], RWA[2)]	111 000	5 488
2004	100 800	7 293	GB[6)], RWA[2)]	97 600	6 900
2005	99 700	7 673	GB[6)], RWA[2)]	100 250	7 483
2006	103 700	11 310	GB[6)], RWA[2)]	101 700	9 491

1) *(BMLFUW 2000)*
2) *Raiffeisen Ware Austria, sales company*
3) *(BMLFUW 2003)*
4) *(BMLFUW, 2005)*
5) *(BMLFUW, 2006a)*
6) *(BMLFUW, 2007)*

Values of Table 171 differ from the numbers given in CRF table 4.D 'Nitrogen input from application of synthetic fertilizers'. In the CRF table 4.D NH_3-N and NO_x-N volatilisation losses occuring during fertilizer application are subtracted.

Legume Cropping Areas

The yearly numbers of the legume cropping areas were taken from official statistics (BMLFUW 2007).

Table 172:Cropped area legume production, 1990–2006.

	Areas [ha]			
Year	**peas**	**soja beans**	**horse/field beans**	**clover hey, lucerne, …**
1990	40 619	9 271	13 131	57 875
1991	37 880	14 733	14 377	65 467
1992	43 706	52 795	14 014	64 379
1993	44 028	54 064	1 064	68 124
1994	38 839	46 632	10 081	72 388
1995	19 133	13 669	6 886	71 024
1996	30 782	13 315	4 574	72 052
1997	50 913	15 217	2 783	75 976
1998	58 637	20 031	2 043	76 245
1999	46 007	18 541	2 333	75 028
2000	41 114	15 537	2 952	74 266
2001	38 567	16 336	2 789	72 196
2002	41 605	13 995	3 415	75 429
2003	42 097	15 463	3 465	78 813
2004	39 320	17 864	2 835	83 349
2005	36 037	21 429	3 549	88 973
2006	32 652	25 013	4 555	97 549

Harvest Data

Harvest data were taken from (BMLFUW 2007) and the datapool of (BUNDESANSTALT FÜR AGRARWIRTSCHAFT 2007) and are presented in Table 173.

Table 173:Harvest Data I, 1990–2006.

	Harvest [1 000 t]								
	corn	**wheat**	**rye**	**barley**	**oats**	**maize (corn)**	**potato**	**sugar beet**	**fodder beet**
1990	5 290	1 404	396	1 521	244	1 620	794	2 494	171
1991	5 045	1 375	350	1 427	226	1 571	790	2 522	173
1992	4 323	1 325	278	1 342	185	1 118	738	2 605	119
1993	4 206	1 018	292	1 100	191	1 524	886	2 994	129
1994	4 436	1 255	319	1 184	172	1 421	594	2 561	103
1995	4 452	1 301	314	1 065	162	1 474	724	2 886	85
1996	4 493	1 240	156	1 083	153	1 736	769	3 131	62
1997	5 009	1 352	207	1 258	197	1 842	677	3 012	59
1998	4 771	1 342	236	1 212	164	1 646	647	3 314	72
1999	4 806	1 416	218	1 153	152	1 700	712	3 217	70
2000	4 490	1 313	183	855	118	1 852	695	2 634	47
2001	4 827	1 508	214	1 012	128	1 771	695	2 773	43
2002	4 745	1 434	171	861	117	1 956	684	3 043	40
2003	4 246	1 191	133	882	129	1 708	560	2 485	33
2004	5 295	1 719	213	1 007	139	1 945	693	2 902	33
2005	4 880	1 453	164	880	128	2 021	763	3 133	17
2006	4 440	1 396	94	914	131	1 746	655	2 493	22

Table 174:Harvest Data II, 1990–2006.

	Harvest [1 000 t]								
Year	**silo-green maize**	**clover-hey**	**rape**	**sunflower**	**soja bean**	**horse-/ fodder bean**	**peas**	**vege-tables**	**oil pumkin**
1990	4 289	717	102	57	18	41	145	273	3
1991	4 252	797	128	72	37	37	133	277	4
1992	3 523	587	126	79	81	31	137	227	4
1993	4 220	628	125	104	103	29	107	230	3
1994	4 152	743	217	92	105	27	134	246	3
1995	3 996	823	268	61	31	17	60	302	5
1996	3 918	858	121	44	27	10	93	297	8
1997	3 940	962	129	44	34	6	162	349	8
1998	3 865	1 014	128	57	51	5	178	313	11
1999	3 729	1 025	193	64	50	6	140	399	6
2000	3 531	1 440	125	55	33	7	97	361	6
2001	3 035	1 349	147	51	34	7	112	391	7
2002	3 285	1 395	129	58	35	9	96	406	9
2003	3 026	1 425	78	71	39	9	93	376	10
2004	3 374	1 474	121	78	45	8	122	414	5
2005	3 600	1 515	104	81	61	10	90	384	8
2006	3 546	1 635	137	85	65	12	90	392	11

Sewage Sludge Application on Fields

Agriculturally applied sewage sludge data were taken from Water Quality Report 2000 (PHILIPPITSCH et al. 2001), Report on sewage sludge (SCHARF et al. 1997) and (GEWÄSSERSCHUTZBERICHT 2002). For 2001 to 2006 data from the National Austrian Waste Water Database operated by the Umweltbundesamt was used (data query 2007).

The federal provinces (Bundesländer) Niederösterreich, Oberösterreich and Tirol did not report 2005 data. For these Bundesländer the values of 2004 have been used for the year 2005. The federal provinces Steiermark and Tirol did not report 2006 data, therefore the 2005 data has been used for the year 2006.

Table 175:Amount of sewage sludge (dry matter) produced in Austria, 1990–2006.

Year	**Total [t dm]**	**agriculturally applied [t dm]**	**agriculturally applied [%]**
1990	161 936	31 507	19.5
1991	161 936	31 507	19.5
1992	200 000	30 000	15.0
1993	300 000	45 000	15.0
1994	350 000	38 500	11.0
1995	390 500	42 400	10.9
1996	390 500	42 955	11.0

Year	Total [t dm]	agriculturally applied [t dm]	agriculturally applied [%]
1997	390 500	42 955	11.0
1998	392 909	43 220	11.0
1999	392 909	43 220	11.0
2000	392 909	43 220	11.0
2001	398 800	41 600	10.4
2002	322 096	36 065	11.2
2003	315 130	39 186	12.4
2004	294 942	35 357	12.0
2005	290 110	35 541	12.3
2006	243 249	39 514	16.2

6.4.2.1 Direct Soil Emissions (4.D.1)

Key Source: Yes (N_2O)

Direct Soil Emissions is the most important sub-category of *4.D Agricultural Soils.* 55.2% (5.2 Gg in 2006) of N_2O emissions from *Agricultural Soils* arise from this sub-category (see Table 167).

N_2O emissions from following sub-sources were estimated:

- *Synthetic fertilizers* (mineral fertilizers and urea)
- *Animal waste* (manure collected in stables and applied to soils)
- Biological *nitrogen fixation* through legumes
- *Incorporation of Crop residues* after harvest
- Application of *sewage sludge* on agricultural soils

The nitrogen input is corrected for gaseous losses through volatilization of NH_3 and NO_X.

Nitrogen input from all sources is calculated using IPCC Tier 1a (GPG, equation 4.20/ 4.21) and the emission factor of 1.25% (IPCC GPG, p.4.54, 4.60). The calculation is described in the following subchapters. The conversion from N_2O-N to N_2O emissions is performed by multiplication with (44/28).

This method estimates total direct N_2O emissions, irrespective of type of soils, of land use (e.g. grassland and cropland soils) and of vegetation, irrespective of the nitrogen compounds (e.g. organic, inorganic nitrogen), and irrespective of climatic factors.

Nitrogen input through application of synthetic (mineral) N fertilizers

The method applied for calculation of the emissions is IPCC Tier 1a (GPG, Equation 4.22):

$$F_{SN} = N_{FERT} * (1 - Frac_{GASF})$$

F_{SN} = *Annual amount of synthetic fertilizer nitrogen applied on soils, corrected for volatile N-losses [t N]*

N_{FERT} = *Annual amount of nitrogen in synthetic fertilizers (mineral and urea) applied on soils [t N] – (see Table 171)*

$Frac_{GASF}$ =*Fraction of nitrogen lost through gaseous emissions of NH_3 and NO_x [t/t] – 0.023 for mineral fertilizers and 0.153 for urea fertilizers (EEA 1999) p.1 010–15, table 5.1.*

Nitrogen input through application of animal manure

The method applied is IPCC Tier 1b but with Austria specific consideration of nitrogen losses (NH_3-N, NO_x-N, N_2O-N).

With regard to a comprehensive treatment of the nitrogen budged, Austria established a link between the ammonia and nitrous oxide emissions inventory. This procedure enables the use of country specific data, which is more accurate than the use of the default value for $Frac_{gasm}$.

According to the IPCC method nitrogen from manure that is used as a biofuel should be subtracted, but this is irrelevant for Austria because in Austria manure is not used as a biofuel at all.

Nitrogen left for spreading

After storage, manure is applied to agricultural soils. Manure application is connected with NH_3 and N_2O losses that depend on the amount of manure N.

From total N excretion by Austrian livestock, the following losses were subtracted:

- N excreted during grazing
- NH_3-N losses from housing
- NH_3-N losses during manure storage
- N_2O-N losses from manure management

The remaining N is applied to agricultural soils.

NH_3-N losses from housig and storage were calculated following the CORINAIR EMEP – methodology (detailed methodology for cattle and swine). This procedure enables the use of country specific data, which is more accurate than the use of the default value for $Frac_{gasm}$.

Table 176 presents the calculated amounts of nitrogen left for spreading from 1990 to 2006.

Table 176:Animal manure left for spreading on agricultural soils per livestock category 1990–2006 (I).

year	Nitrogen left for spreading [Mg N per year]							
	IPCC Livestock Categories							
	total	dairy cattle	suckling cows	cattle 1–2 a	cattle < 1 a	cattle > 2 a	sows	fattening pigs
1990	141 271	55 395	2 398	18 215	19 501	8 193	8 525	10 334
1991	140 940	54 007	2 924	18 041	18 846	8 468	8 409	10 194
1992	136 344	52 241	3 084	16 925	17 529	8 167	8 598	10 423
1993	137 847	51 741	3 535	18 609	14 872	8 845	8 829	10 704
1994	137 429	50 938	4 589	18 617	14 893	8 332	8 806	10 450
1995	140 023	47 098	10 733	18 330	14 575	8 570	8 952	10 364
1996	137 709	46 680	10 847	17 454	14 131	8 619	8 888	9 970
1997	138 091	48 733	8 697	16 711	13 297	9 054	8 868	10 021
1998	137 403	49 928	7 867	16 116	13 387	8 815	8 613	10 860
1999	134 901	48 424	9 010	15 860	13 292	8 924	7 666	9 878
2000	131 389	43 670	12 891	15 152	13 814	8 949	7 453	9 572
2001	130 720	42 762	13 143	14 802	13 889	8 293	7 808	9 985
2002	127 729	42 437	12 491	14 614	13 491	8 009	7 604	9 382
2003	128 189	40 726	12 397	14 490	13 525	9 144	7 454	9 823
2004	127 181	39 830	13 337	14 337	13 636	9 137	7 069	9 157
2005	125 892	39 433	13 792	14 171	13 246	7 900	7 040	9 667
2006	125 265	39 300	13 836	14 129	13 312	7 709	7 176	9 455

Table 177:Animal manure left for spreading on agricultural soils per livestock category 1990–2006 (II).

year	Nitrogen left for spreading [Mg N per year]						
	IPCC Livestock Categories						
	total	chicken	other poultry	sheep	goats	horses/ solipeds	other animals
1990	141 271	8 100	1 057	5 909	712	2 225	708
1991	140 940	8 309	1 424	6 217	781	2 614	708
1992	136 344	7 935	1 259	5 948	752	2 776	708
1993	137 847	8 377	1 426	6 365	902	2 935	708
1994	137 429	8 178	1 416	6 523	949	3 018	720
1995	140 023	8 111	1 244	6 964	1 034	3 278	769
1996	137 709	7 530	1 186	7 261	1 039	3 311	792
1997	138 091	8 600	1 257	7 314	1 113	3 354	1 073
1998	137 403	8 347	1 189	6 879	1 035	3 407	961
1999	134 901	8 506	1 086	6 716	1 106	3 688	746
2000	131 389	6 829	1 100	6 468	1 070	3 688	734
2001	130 720	7 339	1 033	6 110	1 134	3 688	734
2002	127 729	7 339	1 033	5 803	1 103	3 688	734
2003	128 189	7 616	1 043	6 206	1 042	3 937	786
2004	127 181	7 616	1 043	6 237	1 059	3 937	786
2005	125 892	7 616	1 043	6 210	1 051	3 937	786
2006	125 265	7 616	1 043	5 955	1 013	3 937	786

Values of Table 176 differ from the numbers given in CRF table 4.D 'Nitrogen input from manure applied to soils'. In the CRF table 4.D additionally NH_3-N and NO_x-N volatilisation losses occuring during manure application are subtracted.

A more detailed description of the method applied is given in the report "Austria's Informative Report 2007 – Submission under the UNECE Convention on Long-range Transboundary Air Pollution". Austria's Informative Report 2008 will be published in May 2008.

Losses of Ammonia (NH_3-N) occur during animal housing (1), the storage of manure (2) and the application of organic fertilizers on agricultural soils (3). For the field spreading of manure NO_x-N losses were calculated (4).

Following a recommendation of the in-country review 2007, in the NIR 2008 more information on the calculation of volatilization ratios is included (see below).

1) NH_3 emissions from housing (cattle and swine)

Table 178 gives NH_3 emission factors for emissions from animal housing. As far as possible, Swiss default values as given in the CORINAIR guidelines (EEA 1999) have been chosen. If no CORINAIR emission factors from Switzerland were available, the CORINAIR German default values were used.

Table 178:Emission factors for NH_3 emissions from animal housing.

Manure management system	CORINAIR Emission factor [kg NH_3-N (kg N excreted)$^{-1}$]
Dairy cattle, tied systems, liquid slurry system	0.040
Dairy cattle, tied systems, solid storage system	0.039
Diary cattle, loose houses, liquid slurry system	0.118
Diary cattle, loose houses, solid storage system	0.118
Other cattle, loose houses, liquid slurry system	0.118
Other cattle, loose houses, solid storage system	0.118
Fattening pigs, liquid slurry system	0.150
Fattening pigs, solid storage system	15% of total N + 30% of the remaining TAN
Sows plus litter, liquid slurry system	0.167
Sows plus litter, solid storage system	0.167

2) NH_3 emissions from manure storage

NH_3 emissions from storage are estimated from the amount of N left in the manure when the manure enters the storage. This amount of N is calculated as following:

From total N excretion the N excreted during grazing and the NH_3-N losses from housing (see above) are subtracted. The remaining N enters the store.

Cattle and Swine

TAN content in excreta

The detailed method makes use of the total ammoniacal nitrogen (TAN) when calculating emissions. TAN content for Austrian cattle and swine manure is given in SCHECHTNER 1991.

Table 179:TAN content for Austrian cattle and swine manure (SCHECHTNER 1991).

Manure	TAN content for Austria [%]	Manure	TAN content for Austria [%]
cattle – solid storage system	15.0	pig – solid storage system	19.5
cattle – liquid slurry system	50.0	pig – liquid slurry system	65.0

NH_3 emission factors

During manure storage, NH_3 is lost. These losses are estimated with CORINAIR default emission factors given in *Table 180*.

Table 180:NH_3 emission factors for manure storage.

Manure storage system	CORINAIR Emission factor [kg NH_3-N (kg TAN)$^{-1}$]
Cattle, liquid slurry system	0.15
Cattle, solid storage system	0.30
Pigs, liquid slurry system	0.12
Pigs, solid storage system	0.30

Sheep, Goats, Horses, Poultry and Other Animals

The CORINAIR simple methodology uses an average emission factor per animal for each livestock category. Table 181 presents the recommended ammonia emission factors for the different livestock categories given in the CORINAIR guidelines (EEA 1999). Emission factors include emissions from housing and storage.

Table 181:CORINAIR default ammonia emission factors (simple methodology).(1)

NFR	Livestock category	NH_3 loss housing [kg NH_3 $head^{-1}$ yr^{-1}]	NH_3 loss storage [kg NH_3 $head^{-1}$ yr^{-1}]
4.B.3	Sheep(2)	0.24	
4.B.4	Goats(2)	0.24	
4.B.6	Horses (mules and asses included)	2.9	
4.B.9	Laying hens	0.19	0.03
4.B.9	Other Poultry (ducks, geese, turkeys)	0.48	0.06
4.B.13	Other animals	0.24	

(1) *Emissions are expressed as kg NH_3 per animal, as counted in the annual agricultural census*

(2) *The emission factors are calculated for female adult animals; the emissions of the young animals are included in the given values.*

The CORINAIR guidelines do not give default values for NH_3 emissions from the livestock category *Other Animals*. In Austria deer dominates this livestock category. As sheep is the most similar livestock category to deer, for *Other Animals* the NH_3 emission factor of sheep is used.

3) NH_3-N volatilisation losses occuring during manure application:

CORINAIR default NH_3 emission factors for spreading of slurry and farmyard manure (expressed as share of TAN) have been applied:

- Cattle .... spreading of liquid slurry on grassland........0.60
- Pigs........................ spreading of liquid slurry on arable land 0.25
- Cattle and Pigs ...... spreading of solid manure (arable land).....0.90

4) NO_X-N volatilisation losses occuring during manure application

NO_x-N-losses from animal waste spreading were estimated using a conservative emission factor of 1% of manure nitrogen (FREIBAUER & KALTSCHMITT 2001).

Nitrogen input through biological fixation

The amount of N-input to soils via N-fixation of legumes (F_{BN}) was estimated on the basis of the cropping areas and specific consideration of nitrogen fixation rates of all relevant N-fixing crops:

$$F_{BN} = LCA * B_{Fix}/1\ 000$$

F_{BN} = *Annual amount of nitrogen input to agricultural soils from N-fixation by legume crops [t]*

LCA = *Legume cropping area [ha]*

B_{Fix} = *Annual biological nitrogen fixation rate of legumes [kg/ha]*

Activity values (LCA) for the years 1990–2006 can be found in Table 172.

Values for biological nitrogen fixation (120 kg N/ ha for peas, soja beans and horse/field beans and 160 kg N/ ha for clover-hey, respectively) were taken from a study made by the Umweltbundesamt (GÖTZ 1998); these values are constant over the time series.

(GÖTZ 1998) represents average data for Austria, which were used for calculating the Austrian Nitrogen Surface balance according to the OECD method. In the study available Austrian data and coefficients were put together, including literature and expert opinions from the Austrian "Fachbeirat für Bodenfruchtbarkeit und Bodenschutz" (advisory board for soil fertility and soil protection of the Federal Ministry for Agriculture and Forestry, Environment and Water Management). This advisory board is a platform of agricultural experts, which publishes regularly the "Richtlinien für die sachgerechte Düngung" (Austrian fertilizer recommendations).

Nitrogen input from incorporation of crop residues

The method applied for calculation of the emissions is the IPCC Tier 1b method. During harvest crops and by-products (e.g. like cereal straw) are removed from fields, but stubble, roots or beet leaves are left on the field. Incorporated crop residues release nitrogen during decay. The amount of crop residues is calculated on the basis of the harvest statistics.

Official data for annual yield for different agricultural products were adjusted for dry matter (e.g. cereals have a dry matter content of 86% at harvest) and multiplied by appropriate Austrian empirical factors for average ratios between crops and residues (GÖTZ 1998). The residues that are removed from the fields during harvest (such as cereal straw or leaves of fodder beet) are subtracted. Also considered is the loss of nitrogen that is lost if residues are burned on the fields.

The amount of nitrogen was calculated using the following formula:

$$F_{CR} = CY * dm * ExF * Frac_{NCR} * (1 – Frac_{CRR} – Frac_{CRB})$$

F_{CR} = *Annual nitrogen input to soils from crop residues left on fields [t N]*

CY = *Annual crop yield [t] (Table 173)*

dm = *Dry matter fraction [t/t] (GÖTZ 1998)*

ExF = *Expansion factor that describes the ratio of crop residues per harvested crop [t/t], (GÖTZ 1998)*

$Frac_{NCR}$ =*Fraction of nitrogen in dry matter of crop residues [t N/t] (GÖTZ 1998)*

$Frac_{CRR}$ = *Fraction of crop residues removed by harvest [t/t] (LÖHR 1990)*

$Frac_{CRB}$ =*Fraction of crop residue that is burned on field [t/t] (see chapter 6.5)*

Harvest data were taken from (BMLFUW 2007) and the datapool of (BUNDESANSTALT FÜR AGRARWIRTSCHAFT 2007) and are presented in Table 173. The other parameters used are presented in the following table:

Table 182:Input parameters used to estimate emissions from crop residues.

	Dm [t/t]	ExF [t/t]	$Frac_{NCR}$ [t N/t d.m.]	$Frac_{CRR}$ [t/t]	$Frac_{CRB}$ [t/t]
Wheat	0.86	1.0	0.005	0.7	0.0042
Rye	0.86	1.4	0.005	0.7	0.0042
Barley	0.86	1.1	0.005	0.7	0.0042
Oats	0.86	1.5	0.005	0.7	0.0042
Maize (corn)	0.50	1.4	0.005	0.0	0.0000
Potato	0.30	0.3	0.120	0.0	0.0000
Sugarbeet	0.45	0.8	0.007	0.0	0.0000
Fodderbeet	0.20	3.0	0.014	1.0	0.0000
Maize (silo)	0.30	0.0	0.014	1.0	0.0000
Clover-hay	0.86	0.0	0.018	1.0	0.0000
Rape	0.86	21	0.009	0.0	0.0000
Sunflower	0.86	2.5	0.009	0.0	0.0000
Sojabean	0.40	1.5	0.023	0.0	0.0000
Fodderbean	0.40	1.5	0.025	0.0	0.0000
Peas	0.40	1.0	0.038	0.0	0.0000
Vegetables	0.20	0.8	0.015	0.0	0.0000
Oil pumpkin	0.80	72.0	0.015	0.0	0.0000

Values were taken from (GÖTZ 1998) and had been worked out by Austrian Experts (Ministery of Agriculture, Fachbeirat für Bodenschutz und Bodenfruchtbarkeit – advisory board for soil fertility and soil protection of the Federal Ministry for Agriculture and Forestry, Environment and Water Management).

In 2007 the figures of the N fractions of agricultural crops have been recalculated. The reason for the recalculation is that up to now the applied N contents of several crops obtained from (GÖTZ 1998) were partially not adjusted to dry matter basis. Hence, the recalculation led to higher N values for different crop products (N fixing crops and other). The low average N fractions of Austrian crops have been noted by the S & A Report 2006.

In the submission 2008 in additional table 4.D for the fraction of nitrogen in N-fixing crops ($Frac_{NCRBF}$) the arithmetic mean of 0.026 is reported. For the fraction of nitrogen in non-N-fixing crops ($Frac_{NCRO}$) the arithmetic mean of 0.009 is reported. These values are now closer to the IPCC default values of 0.03 ($Frac_{NCRBF}$) and 0.015 ($Frac_{NCRO}$).

Nitrogen input through use of sewage sludge

N_2O emissions

The method applied for the calculation of the emissions is IPCC Tier 1b with a default emission factor of 1.25% N_2O-N per Mg N input to agricultural soils.

In Austria fertilisation by sewage sludge is very small. In 2006 N_2O emissions from sewage sludge contributed only 0.3% of N_2O emissions from category 4 D Agricultural Soils.

N content data of sewage sludge was obtained from (SCHARF et al. 1997). The study contains sewage sludge analyses carried out by the Umweltbundesamt. Digested sludge samples from 17 municipal sewage sludge treatment plants taken in winter 1994/1995 were investigated with regard to more than one hundred inorganic, organic and biological parameters in order to get an idea of the quality of municipal sewage sludge. Following this study a mean value of 3.9% N in dry matter was taken.

In 2007 the N-content value of sewage sludge was reexamined. The comparison with national Studies (ZESSNER, M. 1999) and (ÖWAV-Regelblatt Nr. 17 – Landwirtschaftliche Verwertung von Klärschlamm 2004 – www.oewav.at) approved the value of 3.9% N/dm.

The amount of nitrogen input from agriculturally applied sewage sludge was calculated according following formula:

$$F_{SSlu} = SSlu_N * SSlu_{agric}$$

F_{SSlu} = *Annual nitrogen input to soils by agriculturally applied sewage sludge [t N]*

$SSlu_N$ = *Nitrogen content in dry matter [%] – 3.9%*

$SSlu_{agric}$ = *Annual amount of sewage sludge agriculturally applied [t/t] (see Table 175)*

Annual nitrogen input from sewage sludge applied on agricultural soils is presented in Table 175.

CH_4 emissions

According to the Institute for Applied Ecology (DETZEL et al. 2003) and (SCHÄFER 2002) the average carbon content of sewage sludge amounts about 300 kg carbon per ton sewage sludge. While 48% of the carbon remains in the soil, 52% are emitted to air. 5% of this emitted carbon is emitted as CH_4. Consequential about 10.4 kg methane is emitted per ton sewage sludge.

6.4.2.2 Pasture, Range and Paddock Manure (4.D.2)

Key Source: Yes (N_2O)

Following the IPCC Guidelines, N_2O emissions resulting from nitrogen input through excretions of grazing animals (directly dropped onto the soil) were calculated under *Manure Management* but reported under *Agricultural Soils*.

$$F_{GRAZ} = N_{exGRAZ} * EF_{GRAZ}$$

F_{GRAZ} = *N_2O emissions induced by nitrogen excreted from grazing animals, expressed as N_2O-N [t N].*

N_{exGRAZ} = *Nitrogen excreted during grazing (amount of animal manure nitrogen produced by grazing animals and directly dropped on agricultural soils during grazing) [t N] – see Table 183*

EF_{GRAZ} = *A constant emission factor for N_2O from manure of grazing animals has been used [t N_2O-N/t N], – 0.02 (IPCC GUIDELINES 1997), workbook table 4-8*

Table 183:Nitrogen excreted during grazing (N_{exGRAZ}) 1990–2006.

Year	N excretion grazing [kg/animal/yr]	Year	N excretion grazing [kg/animal/yr]
1990	22 422	1999	23 774
1991	22 881	2000	23 192
1992	22 177	2001	22 797
1993	23 428	2002	22 384
1994	23 700	2003	22 589
1995	24 570	2004	22 576
1996	24 381	2005	22 504
1997	24 359	2006	22 306
1998	23 819		

6.4.2.3 Indirect Soil Emissions (4.D.3)

Key Source: Yes (N_2O)

According to IPCC definition, indirect N_2O emissions are caused by atmospheric deposition of nitrogen and by nitrogen leaching from soils.

N_2O emissions through atmospheric nitrogen deposition

Emissions were calculated following IPCC Tier 1a (GPG, Equation 4.31):

$$F_{AD} = [(N_{FERT} * Frac_{GASF}) + (N_{ex} * Frac_{GASM})] * EF_{AD}$$

F_{AD} = N_2O emissions from atmospheric deposition, expressed as N_2O-N [t N]

N_{FERT} = Nitrogen in mineral fertilizers applied on soils [t N] (see Table 171)

$Frac_{GASF}$ = Fraction of nitrogen lost from mineral fertilizer application through gaseous emissions of NH_3 and NO_x. [t/t] – 0.023 for mineral fertilizers and 0.153 for urea fertilizers (EEA 1999) p.1 010–15, table 5.1.

N_{ex} = Total nitrogen annually produced in animal waste management systems [t N] (N excretion values see Table 163, Table 164)

$Frac_{GASM}$ = Fraction of animal manure that is volatized as NH_3 or NO_x [t/t] (adopted from calculations of NH_3 and NO_x emissions following the CORINAIR methodology)

EF_{AD} = N_2O emission factor (constant over the time series) for emissions from atmospheric deposition: tons of N_2O-nitrogen released per ton of volatized nitrogen – 0.01 [t/t] (IPCC GUIDELINES 1997)

Total N excretion by livestock that volatizes ($Frac_{GASM}$) includes:

- NH_3-N losses from housing, storage, grazing
- NH_3-N and NO_x-N losses from animal waste application

Table 184:N-losses and $Frac_{Gasm}$ 1990 to 2006.

Year	Total N-losses	$Frac_{Gasm}$
	[t N/yr]	(N_{losses}/Nex_{total})
1990	39 022	0.22
1991	37 935	0.22
1992	36 831	0.22
1993	36 470	0.21
1994	36 133	0.21
1995	36 700	0.21
1996	35 707	0.21
1997	34 796	0.20
1998	35 374	0.21
1999	34 414	0.21
2000	34 447	0.21
2001	34 582	0.21
2002	33 856	0.21
2003	32 961	0.21
2004	32 563	0.21
2005	32 278	0.21
2006	32 453	0.21

Calculated N losses are between 20% and 22% of total N excretion, which is consistent with the IPCC default value (20%).

Ammonia emissions for Cattle and Swine were calculated following the CORINAIR detailed methodology (EEA 1999), for the other livestock categories the CORINAIR simple methodology was used.

Following (EEA 1999), the NO_X emissions were estimated according to the assumption from (FREIBAUER & KALTSCHMITT 2001) that 1% of the manure nitrogen left for spreading N_{LFS} (see Table 176) is emitted as NO_X-N.

A detailed description of the method applied for NH_3 and NO_x is given in the report 'Austria's Informative Report 2007 – Submission under the UNECE Convention on Long-range Transboundary Air Pollution'. Austria's Informative Report 2008 will be published in May 2008.

N_2O emissions through nitrogen leaching losses

The method applied for emission calculation is IPCC Tier 1b.

Following IPCC recommended values, leaching losses from nitrogen fertilizers are estimated to be about 30% of the nitrogen inputs from synthetic fertilizer use, livestock excretion, and sewage sludge application. N_2O emissions are then estimated as 2.5% of the leaching losses, as suggested by the IPCC.

The calculation follows the following formular:

$$E\text{-}N_2O_{LL} = (F_{FERT} + N_{exLFS} + N_{exGRAZ} + F_{SSlu}) * Frac_{LEACH} * EF\text{-}N_2O_{LL}$$

$E\text{-}N_2O_{LL}$ = N_2O emissions from leaching losses, expressed as N_2O-N [t N]

F_{FERT} = Annual amount of nitrogen in synthetic fertilizers (mineral and urea) applied on soils [t N] (see Table 171)

N_{exLFS} = Annual amount of nitrogen in animal excreta left for spreading on agricultural soils, corrected for losses during manure management [t N] (see Table 176)

N_{exGRAZ} = Annual amount of animal manure nitrogen produced by grazing animals and directly dropped on agricultural soils during grazing [t N] (see Table 183)

F_{SSlu} = Annual nitrogen input from sewage sludge applied on agricultural soils [t N] (see Chapter 4 D 1 – Nitrogen input through the use of sewage sludge)

$Frac_{LEACH}$ = Fraction of nitrogen applied on soils that leaches (0.3 [t/t] following IPCC GUIDELINES 1997, REFERENCE MANUAL, TABLE 4-24)

$EF\text{-}N_2O_{LL}$ = Emission factor for N_2O from leaching, expressed as N_2O-N (0.025 [t/t] following IPCC GUIDELINES 1997, WORKBOOK TABLE 4-18)

6.4.3 Uncertainties

Uncertainties are presented in Table 141.

6.4.4 Recalculations

4.D.1 Crop Residues

In 2007 the figures of the N fractions of agricultural crops have been recalculated. The N contents of several crops obtained from (GÖTZ 1998) were adjusted to dry matter basis, which led to higher N values for different crop products (N fixing crops and other). The low average N fractions of Austrian crops have been noted by the S & A Report 2006. The resulting new values are now closer to the IPCC default values of 0.03 ($Frac_{NCRBF}$) and 0.015 ($Frac_{NCRO}$).

Table 185:Difference to submission 2006 of N_2O emissions from Category 4 D Agricultural Soils.

	N_2O emissions [Gg]	
	4 D Total	**4 D 1 Crop Residue**
1990	0.14	0.14
1991	0.17	0.17
1992	0.17	0.17
1993	0.16	0.17
1994	0.28	0.28
1995	0.34	0.34
1996	0.17	0.17
1997	0.18	0.18
1998	0.18	0.18
1999	0.26	0.26

N_2O emissions [Gg]		
	4 D Total	4 D 1 Crop Residue
2000	0.17	0.17
2001	0.20	0.20
2002	0.17	0.18
2003	0.11	0.11
2004	0.16	0.16
2005	0.14	0.14

6.4.5 Planned Improvements

2007 a comprehensive investigation of Austria's agricultural practice was carried out by the Department of Sustainable Agricultural Systems – Division of Agricultural Engineering, University of Natural Resources and Applied Life Sciences, Vienna. It is planned to use the updated figures to prepare the Austrian Greenhouse Gas Emission Inventory, submission 2009.

6.5 Field Burning of Agricultural Residues (CRF Source Category 4.F)

6.5.1 Source Category Description

This category comprises burning straw from cereals and residual wood of vinicultures on open fields in Austria.

Burning agricultural residues on open fields in Austria is legally restricted by provincial law and since 1993 additionally by federal law and is only occasionally permitted on a very small scale. Therefore the contribution of emissions from the category *Field Burning of Agricultural Waste* to the total emissions is very low.

In the year 2006 total emissions from this category amounted to 1.5 Gg CO_2 equivalent, this is a share of 0.02% in total GHG emissions from *Sector Agriculture*. CH_4 and N_2O emissions for the years from 1990 to 2006 are presented in Table 186.

Table 186:Emissions from Category 4 F Field Burning 1990–2006.

	CH_4	N_2O
1990	0.07	0.001
1991	0.07	0.001
1992	0.06	0.001
1993	0.06	0.001
1994	0.06	0.001
1995	0.07	0.001
1996	0.06	0.001
1997	0.07	0.001
1998	0.07	0.001
1999	0.07	0.001
2000	0.06	0.001

	CH_4	N_2O
2001	0.07	0.001
2002	0.07	0.001
2003	0.06	0.001
2004	0.09	0.002
2005	0.06	0.001
2006	0.06	0.001
Trend 1990–2006	*-16.1%*	*-16.5%*
Share in Agriculture	*0.03%*	*0.01%*

6.5.2 Methodological Issues

6.5.2.1 Cereals (4.F.1)

Key Source: No

Following a recommendation of the Centralized Review 2003 the IPCC method with default emission factors was applied.

According to the *Presidential Conference of the Austrian Chambers of Agriculture* (personal communication to Dr. Reindl 2006), in Austria's most important cereal production areas about 1 920 ha were burnt in 2006. The extrapolation to Austria's total cereal production area results in 2 010 ha burnt in 2006. This value was applied for the national inventory and corresponds to about 0.3% of total area under cereals 2006. For 1990 an average value of 2 500 ha was indicated (Dr. Reindl 2004).

Following the guidelines, a default value of 0.90 for fraction oxidised was used. For cereals the default values of wheat were taken (IPCC GPG Table 4-17). For dry matter fraction an Austrian specific value of 0.86 was used (LÖHR 1990).

6.5.2.2 Other (4.F.5)

Key Source: No

This category comprises burning residual wood of vinicultures on open fields in Austria.

A simple method (Emission = Activity x Emission Factor) using country specific emission factors was applied.

Activity data (viniculture area) are taken from the Statistical Yearbooks 1992–2002 (Statistik Austria) and the "Green Reports" of (BMLFUW 2007). According to an expert judgement from the *Federal Association of Viniculture* (Bundesweinbauverband Österreich) the amount of residual wood per hectare viniculture is 1.5 to 2.5 t residual wood and the part of it that is burnt is estimated to be 1 to 3%. For the calculations the upper limits (3% of 2.5 t/ha) have been used resulting in a factor of 0.075 t burnt residual wood per hectare viniculture area.

Table 187:Activity data for 4 F Field Burning of Agricultural Waste 1990–2006.

Year	Viniculture Area [ha]	Burnt Residual Wood [t]
1990	58 364	4 377
1991	58 364	4 377
1992	58 364	4 377
1993	57 216	4 291
1994	57 216	4 291
1995	55 628	4 172
1996	55 628	4 172
1997	52 494	3 937
1998	52 494	3 937
1999	51 214	3 841
2000	51 214	3 841
2001	51 214	3 841
2002	51 214	3 841
2003	47 572	3 568
2004	47 572	3 568
2005	50 119	3 759
2006	50 119	3 759

The emission factors (4 828 g CH_4 /Mg and 49.7 g N_2O/Mg burnt wood) were calculated by multiplying the emission factors of 7 kg N_2O/ TJ and 680 g CH_4 /TJ (STANZEL et al. 1995) by a calorific value of 7.1 MJ/kg burnt wood which corresponds to burning wood logs in poor operation furnace systems.

7 LAND USE, LAND USE CHANGE AND FORESTRY (CRF SOURCE CATEGORY 5)

7.1 Sector Overview

This category comprises GHG emissions and removals arising from land use, land use change and forestry.

The following table presents emissions and removals from this sector by sub categories.

Table 188:Emissions and removals from Sector 5 LULUCF by sub categories[1)] in Gg CO_2 equivalents.

	Greenhouse gas emissions/removals [Gg CO_2 equivalent]						
	5 Total	A Forest land	B Crop land	C Grass land	D Wet lands[2)]	E Settle ments[2)]	F Other land[2)]
1990	-14 593	-16 154	1 564	-842	189	-160	810
1991	-20 510	-22 195	1 564	-830	205	-82	829
1992	-15 489	-17 131	1 572	-821	221	-178	849
1993	-19 376	-21 105	1 603	-816	237	-164	868
1994	-18 003	-19 786	1 613	-833	243	-74	833
1995	-17 369	-18 765	1 616	-958	244	-251	744
1996	-12 388	-13 796	1 687	-980	282	-281	701
1997	-21 132	-22 649	1 708	-1 002	288	-134	657
1998	-19 330	-20 548	1 725	-1 024	261	-357	614
1999	-23 666	-24 940	1 757	-1 035	271	-315	596
2000	-18 286	-19 500	1 771	-1 046	281	-370	578
2001	-21 011	-22 174	1 741	-1 007	290	-421	561
2002	-17 237	-18 355	1 823	-1 112	298	-433	543
2003	-18 594	-19 808	1 892	-1 092	306	-418	525
2004	-18 755	-19 780	1 789	-1 174	315	-415	512
2005	-18 388	-19 753	1 851	-1 081	307	-210	498
2006	-18 422	-19 729	1 877	-1 149	329	-234	484
Trend BY–2006	*26.2*	*22.1*	*20.0*	*36.5*	*74.3*	*46.1*	*-40.2*

[1)] *Other GHG are also considered, therefore the totals are different compared to the totals in the CRF tables.*

[2)] *Only land use conversions are reported*

As the table shows, the Sector *Land Use, Land Use Change and Forestry* is a net sink in Austria.

An important sub category is *5.A Forest Land*, in particular its sub source *5.A.1 Forest Land remaining Forest Land*. This category, category *5.C Grassland* and *5.E Settlements* are a net sink for CO_2, whereas the other sub categories are sources of CO_2 emissions. However, total emissions arising from the other sub categories amount 11–19% of removals from *5.A Forest Land*.

7.1.1 Emission Trends

In 2002, which is the last year with measured data of the important sector 5.A, removals from that category corresponded to 21.1% of total GHG in Austria (without LULUCF), compared to 20.4% in the base year. The removals increased by 26.2% from the base year to 2006, mainly due to an increase of the carbon stock in forest land.

In order to be consistent with the IPCC GPG for LULUCF the land use transition matrix had been changed for all LUC categories by following and reporting the area in conversion status for 20 years. After the 20 years they are accounted in the remaining categories. Consequently, the figures of previous NIRs and submissions differ from the figures in this report.

7.1.2 Methodology

For the sub categories 5.D.2 Land converted to Wetlands, 5.E.2 Land converted to Settlements and 5.F.2 Land converted to Other land improved methodologies have been applied which are not yet officially approved by the accreditation body – however, the approval is scheduled for early 2008.

The methodologies for estimating emissions from LUC from and to these land use categories are described in the sub chapters 7.2, 7.3, 7.4, 7.5, 7.6 and 7.7. Following the methodology of the actual emission/removal calculations, all land use changes from forest land (which are sub categories of 5 B – 5 F) are included in the methodological description of *5 A 2 Land converted to Forest Land*. The 2001 is the media year of the last national forest inventory period, which was carried out between 2000 and 2002.

The derivation of a complete time series from 1990 to 2006 on areas remaining in a land use category and areas affected by LUC since 1970 (1960 for perennial cropland) required the compilation of activity data obtained from different statistical surveys.

The keypoints of the applied compilation technique are as follows:

- Consistency with respect to the Austrian area (use of sub-category „Other land")
- Consistency within and across years in sub-sectors
- Hierarchical treatment of data sources:
  - 1st hierarchy: Systematically measured statistics are considered to have highest reliability (e.g. NFI forest area)
  - 2nd hierarchy: Land use statistics based on land register and land use surveys for EU-funding are given higher hierarchy than estimates for land use (agricultural areas)
  - 3rd hierarchy: Estimates for land use based on specific information are given higher priority than mere estimates on likelihood basis (e.g. bogs in 5.D)
  - 4th hierarchy: Estimates on likelihood basis are given higher priority than data gaps (e.g. no LUC from wetland to cropland)
  - 5th hierarchy: Data gaps (5.F „Other land")

Table 189 presents land use data and data for land use changes for the year 1990 and 2001 for the total area of Austria as used for the calculations. The year 2001 is of concern as it represents the middle of the years of the last national forest inventory period 2000/02 and gives therefore the most recently measured figures on the area that are forested.

Table 189:Land use and LUC data for Austria for the year 1990 and 2001.

Area in ha	1990	2001	Diff 1990–2001
5.A Forest land – total area	3 891 333	3 960 000	68 667
productive forest	3 332 667	3 371 000	38 333
non-productive forest	558 667	589 000	30 333
1. Forest land remaining forest land productive forest	3 170 671	3 322 853	152 182
2. Land converted to forest land	386 591	260 681	-125 910
2.1 Cropland converted to forest land	61 855	41 709	-20 146
2.2 Grassland converted to forest land	228 089	153 802	-74 287
2.3 Wetland converted to forest land	19 330	13 034	-6 295
2.4 Settlement converted to forest land	54 123	36 495	-17 627
2.5 Other Land converted to forest land	23 195	15 641	-7 555
5.B Cropland – total area	1 507 533	1 460 067	-47 466
1. Cropland remaining cropland	1 000 606	931 734	-68 873
perennial converted to annual	9 451	9 419	-32
annual converted to perennial	11 309	12 294	984
2. Land converted to cropland	506 927	528 333	21 407
2.1 Forest Land converted to cropland	9 650	6 759	-2 892
2.2 Grassland Land converted to cropland	495 750	519 752	24 003
grassland converted to perennial cropland	1 526	1 822	296
2.3 Wetland Land converted to cropland	NO	NO	–
2.4 Settlement converted to cropland	NO	NO	–
2.5 Other Land converted to Cropland	NO	NO	–
5.C. Grassland – total area	1 992 765	1 929 902	-62 863
1. Grassland remaining grassland	1 391 963	1 353 476	-38 487
2. Land converted to grassland	600 802	576 426	-24 376
2.1 Forest land converted to grassland	102 294	71 641	-30 653
2.2 Arable land converted to grassland	496 412	502 069	5 657
2.3 Wetland land converted to grassland	2 097	2 717	620
2.4 Settlement converted to grassland	NO	NO	–
2.5 Other land converted to grassland	NO	NO	–
5 D Wetlands – total area	133 068	139 874	6 806
1. Wetlands remaining wetlands	124 579	121 923	-2 656
2. Land converted to wetlands	8 489	17 952	9 463
2.1 Forest land converted to wetlands	5 790	4 055	-1 735
2.2 Arable land converted to wetlands	–	–	–
2.3 Grassland converted to wetlands	2 699	11 764	9 065
2.4 Settlement converted to wetlands	NO	NO	–
2.5 Other land converted to wetlands	–	2 132	2 132

Area in ha	1990	2001	Diff 1990–2001
5 E Settlements – total area	384 065	461 461	77 396
1. Settlements remaining settlements	193 482	284 246	90 764
2. Land converted to settlements	190 583	177 215	-13 368
2.1 Forest land converted to settlements	28 951	20 276	-8 675
2.2 Arable land converted to settlements	38 113	51 894	13 781
2.3 Grassland converted to settlements	106 661	60 290	-46 371
2.4 Wetlands converted to settlements	NO	NO	–
2.5 Other land converted to settlements	16 858	44 755	27 897
5 F Other land – total area	471 292	428 751	-42 540
2.1 Forest land converted to other land	46 322	32 441	-13 881
Total area	**8 380 056**	**8 380 056**	**–**

7.1.3 Completeness

Table 190 gives an overview of the new IPCC categories included in this chapter and the corresponding sub-divisions for which the actual calculations are made. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions/removals from this sub-category have been estimated; for LULUCF CO_2 emissions/removals are estimated. Only the N_2O emissions resulting from conversion from grassland to cropland have been calculated.

Table 190: IPCC categories according to the IPCC-Good Practice Guidance for Land-Use, Land-Use Change and Forestry.

IPCC categories[51]/ Sub division for calculation	Description	Status for CO_2	Other GHG
5 A	Forest land	✓	
5.A.1	Forest land remaining forest land	✓	
Coniferous	Increase, decrease, net change of carbon stock	✓	
Deciduous	Increase, decrease, net change of carbon stock	✓	
	Net carbon stock change in dead organic matter	✓	
	Net carbon stock change in soils	✓	
5.A.2	Land converted to forest land	✓	
5.A.2.1	Cropland converted to forest land	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.A.2.2	Grassland converted to forest land	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.A.2.3	Wetlands converted to forest land	✓	
	Carbon stock change in biomass	✓	

51 IPCC categories – applied according to the "Good Practice Guidance for LULUCF (2003)"

IPCC categories[51]/ Sub division for calculation	**Description**	**Status for CO_2**	**Other GHG**
	Carbon stock change in soils	✓	
5.A.2.4	Settlements converted to forest land	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.A.2.5	Other land converted to forest land	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.B	Cropland	✓	
5.B.1	Cropland remaining cropland	✓	
Annual remaining annual	*Carbon stock change in living biomass*	✓	
Annual remaining annual	*Carbon stock change in soils*	✓	
Annual converted to perennial	*Carbon stock change in living biomass*	✓	
Annual converted to perennial	*Carbon stock change in soils*	✓	
Perennial converted to annual	*Carbon stock change in living biomass*	✓	
Perennial converted to annual	*Carbon stock change in soils*	✓	
5.B.2	Land converted to cropland	✓	
5.B.2.1	Forest land converted to cropland	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.B.2.2	Grassland converted to cropland	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soils	✓	✓ N_2O
5.B.2.3	Wetland converted to cropland	NO	
5.B.2.4	Settlements converted to cropland	NO	
5.B.2.5	Other land converted to cropland	NO	
5.C	Grassland	✓	
5.C.1	Grassland remaining grassland	✓	
	Carbon stock change in soils	✓	
5.C.2	Land converted to grassland	✓	
5.C.2.1	Forest land converted to grassland	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.C.2.2	Cropland converted to grassland	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5.C.2.3	Wetland converted to grassland	NO	
5.C.2.4	Settlements converted to grassland	NO	
5.C.2.5	Other land converted to grassland	NO	
5.D	Wetlands	✓	

IPCC categories[51]/ Sub division for calculation	Description	Status for CO_2	Other GHG
5.D.2.1	Forest land converted to wetlands	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5.D.2.2	Cropland converted to wetlands	NO	
5.D.2.3	Grassland converted to wetlands	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5.D.2.4	Settlements converted to wetlands	NO	
5.D.2.5	Other land converted to wetlands	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5.E	Settlements		
5.E.2.1	Forest land converted to settlements	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5.E.2.2	Cropland converted to settlements	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5.E.2.3	Grassland converted to settlements	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5.E.2.4	Wetlands converted to settlements	NO	
5.E.2.5	Other land converted to settlements	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5.F	Other Land		
5.F.2.1	Forest land converted to other land	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5.F.2.2	Cropland converted to other land	NO	
5.F.2.3	Grassland converted to other land	NO	
5.F.2.4	Wetlands converted to other land	NO	
5.F.2.5	Settlements converted to other land	NO	
5(IV) 5 B Limestone $CaCO_3$: Total amount applied	CO_2 emissions due to liming of cropland and grassland	✓	
5(IV) 5 B Limestone $CaCO_3$: Carbon	CO_2 emissions due to liming of cropland and grassland	✓	
5(V) 5 A 1 BiomassBurn_contr.	Biomass Burning: Controlled: Forest land remaining forest land	NO	NO
5(V) 5 A 1 BiomassBurn_wildfires	Biomass Burning: Wildfires: Forest land remaining forest land	IE [(1)]	✓ N_20 ✓ CH_4

(1) CO_2 emissions caused by wildfires (CRF Table 5(V)) are included in the category 5.A.1.. Data on the area affected by wildfires are available for the years 1990 to 2002.

7.2 Forest Land (5.A)

3.96 Mio ha (47.2%) of Austria are forest land (BFW 2004a). The sustaining of the Austrian forests in the past helped to restore an important carbon stock in the Austrian landscape and to avoid net CO_2 emissions to the atmosphere from the Sector LULUCF: In 1990 the Austrian forests represented a carbon stock of 320 ± 42 Mt carbon from biomass and 463 ± 185 Mt carbon from soil, i.e. humus layer plus mineral soil to 50 cm depth. This total carbon stock represents approximately 40 times the Austrian CO_2 equivalent emissions of the greenhouse gases CO_2, CH_4 and N_2O in the year 1990 (WEISS et al. 2000).

Emission/Removal trends of Forest Land

With regard to forest land the annual net CO_2 removals under sector 5 of the reported period 1990–2006[52] range from 13 796 Gg CO_2 to 24 940 Gg CO_2 (mean: 19 775 Gg CO_2). The most relevant parts derive from the sub-category 5.A.1 (Forest Land remaining Forest Land), whereas land use changes to forests (5.A.2) and from forests (5.B.2 to 5.F.2) have only minor influence on the net CO_2 balance.

For the years since 2003 the means for the last period (2000 to 2002) of the National Forest Inventory (NFI) have been reported.

The reported CO_2 emissions from forest soils have to be considered with a very high uncertainty (-0.4–0.5 Mt C/year) whereas removals of dead wood in general have a minor influence on the totals of sector 5 (about 600 Gg CO_2).

As already reported in previous submissions, changes in the Austrian forest biomass also resulted in a net carbon sink in the years before 1990. In the period 1961 to 1989 the mean annual net carbon sink amounted to 12 031 Gg CO_2 (from 5 085 Gg CO_2 to 17 755 Gg CO_2). Between 1990 and 2002 the net carbon sink of this category ranges between 16% and 31% of the total CO_2 equivalent emissions without LULUCF of the GHGs CO_2, CH_4 and N_2O in this period.

According to the new reporting tables for Land Use, Land Use Change and Forestry increments and losses at areas of land use change to and from forests (incl. also non-productive forests) must be taken into account. Compared to the submission 2007 significant differences in the figures of the LUC categories result from following and reporting the area in conversion status for 20 years in the LUC categories.

Details on the methodology, uncertainty assessment, quality assurance, quality control and verification are given in each sub chapter.

For the reported period 1990 to 2006 the total annual net CO_2 removals (biomass and soil) from land use changes to forest range from about 2,770 Gg CO_2 to 5,054 Gg CO_2. The total annual emissions (biomass and soil) from land use changes from forests vary between 1,295 Gg CO_2 and 2,282 Gg CO_2. These figures are in the order of approximately ± 7 to 30% of the annual net CO_2 removals under sector 5.

[52] For the years 2003 to 2006 the means for the last period (2000 to 2002) of the National Forest Inventory (NFI) have been reported

Table 191: CO_2 removals/emissions from IPCC Category 5 for Forest Land from 1990–2006.

	GHG removals/emissions [Gg CO_2]									*Trend BY–2006*
	1990	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	*%*
5	-14 593	-23 666	-18 286	-21 011	-17 237	-18 594	-18 755	-18 388	-18 422	26.2
5.A	-16 154	-24 940	-19 500	-22 174	-18 355	-19 808	-19 780	-19 753	-19 729	22.1
5.A.1	-11 511	-21 550	-16 239	-19 043	-15 355	-16 937	-16 944	-16 952	-16 959	47.3
5.A.2	-4 643	-3 391	-3 261	-3 131	-3 001	-2 871	-2 836	-2 802	-2 770	-40.3
5 Forestland Conv	2 145	1 558	1 517	1 475	1 433	1 391	1 359	1 327	1 295	-39.7
5A1_BiomassBurn_wild_CO_2	IE	IE	IE	IE	IE	IE	IE	IE	IE	
5A1_BiomassBurn_wild_CH_4	0.012	0.001	0.003	0.002	0.012	0.004	0.004	0.004	0.004	NA
5A1_BiomassBurn_wild_N_2O	0.0002	0.0000	0.0000	0.0000	0.0002	0.0001	0.0001	0.0001	0.0001	NA

7.2.1 Forest Land remaining Forest Land (5.A.1)

7.2.1.1 Methodological Issues

Activity data

A national method is applied which follows the IPCC – Good Practice Guidelines for Land Use, Land Use Change and Forestry, Tier 3 (2003). The use of country specific conversion factors and biomass functions for tree branches, needles and below ground biomass provide more accurate and appropriate figures for the Austrian forests. The main basis of the estimates are measured data for the forest area, volume increment and drain (harvest and other losses) of the growing stock (for both stem wood over bark with a diameter at breast height > 5 cm) according to the Austrian National Forest Inventory (NFI – (SCHIELER et al. 1995; BFW 2004a,b; WINKLER 1997)). The NFI was carried out in the periods 1961–70, 1971–80, 1981–85, 1986–90, 1992–96 and 2000–02.

The NFI uses a permanently below ground marked 4 x 4 km grid across all of Austria with four permanent sample plots of 300 m^2 size at each grid point. In addition to the NFI harvest data, which are based on measurements in the forests, further harvest statistics exist: the annually reported records of wood felled and the Austrian wood balance (BITTERMANN & GERHOLD 1995), (BMLF 1964–2003). These statistics are not based on measured data. Therefore, it is assumed that the NFI provides more accurate figures on the drain and for this reason the estimates are based on NFI harvest figures. However, the results of the other statistics are used to derive "relative harvest indices for individual years" (see below). In addition, the absolute harvest figures of these statistics are also included in the uncertainty analysis to guarantee an overall consistency of the calculated figures (see below).

Further comments for a better understanding of the NFI increment and drain data

The NFI increment and drain data include all possible reasons for biomass increments and losses in the forests. This means that biomass increments due to abandonment of managed land and re-growth by forests or biomass losses due to e.g. traditional (non-commercial) fuel wood consumption, forest land conversion, forest fires (wild-fires) and other damages are already considered in calculations based on the NFI data.

In order to fulfil the requirements of the reporting format and to report on the category "Forest land remaining forest land (5 A 1)", estimates of the emissions and removals due to annual land use changes from and to forests are subtracted from the totals based on the total increment and drain. The approaches on calculating CO_2 emissions and removals related to land use changes are described in more detail in chapter 7.2.2.

The NFI provides mean values for annual increment and harvest for the individual periods. The measured annual means of increment and harvest provided by the NFI have been attached to the year in the middle of an observation period and not – to the year in the middle of an inventory period. This methodological approach reflects the fact that the mean annual increment and harvest which are detected in a certain NFI period are the results of the respectively changes in the observation period (which is the time span of the actual NFI period and the NFI period before, and not only the actual NFI period).

In a next step, these NFI means are converted with relative indices[53] to obtain annual data of increment and harvest (instead of using the means or interpolated values for single years). For harvest these relative indices are derived from further national statistics on harvest which are the annually reported records of wood felled (BMLF 1964–2003) and the wood balance (BITTERMANN & GERHOLD 1995). For increment, representative Austrian sets of tree ring cores (HASENAUER et al. 1999a, b; BFW 2005, pers. comm.) are used to calculate the relative indices. These indices are available until 2002. This method allows accurate estimates for individual years for the category 5 A 1. The figures for annual growth and for annual harvest differ year by year for several reasons (e.g. weather conditions; timber demand and prices, wind throws). Such reasons for different growth and different harvest in individual years explain the high annual variations in the CO_2 net removals by the Austrian forests.

Conversion factors, biomass functions

Shrinkage values, wood densities (absolute dry) and C contents for all tree species in Austria are used to convert the increment and harvest of m^3 stem wood over bark (o.b.) which is measured by the NFI into t carbon increment and t carbon harvest of the stemwood o.b.

The below given mean conversion factors are based on the species composition of increment and harvest in Austria and on values for the shrinkage and wood densities for all individual tree species (compiled in (KOLLMANN 1982, LOHMANN 1987)) (see Table 192). These conversion factors are calculated for each inventory period and separately for increment and harvest respectively. Between the inventories they show only minor differences (< 1%).

Further details on the approach and methodology are given in (WEISS et al. 2000).

Table 192: Conversion factors for the stemwood o.b. of the Austrian forests; mean of several NFIs (WEISS et al. 2000).

Conversion factors	Coniferous	Deciduous
m^3 o.b. to t dm (stemwood)	0.39	0.53
t dm to t C (stemwood)	0.50	0.48

[53] Values for the relative variation in the individual years of the time series

Biomass functions (BF)

The increment and harvest of the other tree compartments (branches, needles, roots) are estimated with the help of biomass functions (BF,Table 193) and C contents for these tree compartments (coniferous: 0.47, deciduous: 0.48). The biomass functions were derived with the help of numerous single tree data from Austrian forest sites (see literature given below). These estimates are carried out with all single tree data of the individual NFIs at the Federal Office and Research Centre for Forests. Only the evergreen biomass is estimated (leaves of deciduous trees become part of the soil C pool within one year).

Table 193:Used biomass functions.

Tree species	Tree parts	Input parameter	Literature
Norway spruce (Douglas fir and other coniferous species than listed below)	Branches, needles	Dbh, height, crown ratio	(ECKMÜLLNER 2006)
Fir	Branches, needles	Dbh, crown ratio	(LEDERMANN & NEUMANN 2006)
Pine	Branches, needles	Dbh, height, crown ratio	(ECKMÜLLNER 2006)
Larch	Branches	Dbh, height, crown ratio	(RUBATSCHER et al. 2006)
Beech	Branches	Dbh, crown ratio	(LEDERMANN& NEUMANN 2006)
Oak	Branches	Dbh, crown ratio	(LEDERMANN& NEUMANN 2006)
Oak (coppice)	Branches	Dbh, crown ratio	(HOCHBICHLER et al. 2006)
Hornbeam	Branches	Dbh, crown ratio	(LEDERMANN& NEUMANN 2006)
Ash	Branches	Dbh, crown ratio	(GSCHWANTNER & SCHADAUER 2006)
Other hardwood deciduous species	Branches	Dbh, crown ratio	(GSCHWANTNER & SCHADAUER 2006)
Poplar	Branches	Dbh, crown ratio	(GSCHWANTNER & SCHADAUER 2006)
Other weed tree species	Branches	Dbh, crown ratio	(GSCHWANTNER & SCHADAUER 2006)
All	Roots	Dbh	(WIRTH et al. 2004), (OFFENTHALER & HOCHBICHLER 2006)

The use of these biomass functions leads to the following changes in the biomass expansion ratios total tree biomass/stemwood biomass in comparison to estimates before NIR 2006:

Table 194:Average expansion ratios total tree biomass/stemwood biomass for the Austrian forests for the period 1990–2002; old figures from (WEISS et al. 2000), new figures from (BFW 2006, pers. comm.).

Expansion ratio t dm stemwood → t dm whole tree (incl. also below ground biomass)	Coniferous		Deciduous	
	Old	new	old	new
increment	1.45	1.75	1.46	1.77
harvest	1.54	1.62	1.50	1.63

The resulting mean annual biomass increments and harvests of the other tree biomass compartments (needles, branches, roots) for the individual NFI periods are converted to figures for single years in the same way as described for stemwood (see above).

The time series of measured values for individual years ends with the year 2002. For the following years the mean values for the last inventory period (2000/02) are reported. This procedure is carried out for the following reasons:

The extrapolation of trends for increment and harvest from the inventory period 1986/90 to the 90ies led to figures, which had to be strongly revised downwards after the inventory period 1992/96. One of the main reasons was that increment did not increase as in the years before. The use of mean values for increment and for harvest, which are based on the last NFI results, for years after the last NFI provides more probable figures than an extrapolation of trends that is rather uncertain. This is particularly true for increment that strongly depends on weather conditions, but also for harvest, when e.g. storm fellings are taken into account.

Dead wood

The estimates on C-stock changes in dead wood include only standing dead wood, because any inclusion of lying dead wood would cause a double accounting (the estimates for "harvest" include all losses of tree biomass in forests, also for instance the falling of standing dead trees). Since national data on the stock of dead wood are available from the NFI a Tier 3 method was applied.

On average of all tree species the stock of dead wood is 4.5 m^3/ha for the inventory period 1992/96 and 6.1 m^3/ha for the inventory period 2000/02. Between the two periods 1986/90 to 1992/96 an increase of 10% of dead wood is estimated.

For the calculation of the C-stock changes the conversion factors for stemwood as shown in Table 192 were used. These conversion factors do not include any estimates for roots and branches of the dead trees. The rationale in behind is that dead roots are already part of the soil C pool and dead trees have usually only a negligible branch mass. It was assumed that the ratio between deciduous and coniferous dead wood is equal to the deciduous/coniferous ratio of the living trees.

The results of the NFI obviously show an increase of dead wood in Austria. However, the annual net C-stock changes amount to about 600 Gg CO_2, which is only a minor part of the total C-balance of sector 5.

Soil

As already mentioned in the introduction, (WEISS et al. 2000) estimated carbon-stocks of the Austrian forest soils are based on data of the Austrian forest soil survey (humus layers and mineral soil layers 0–50 cm were sampled at the grid points of an 8.7 x 8.7 km grid across all Austria in the period 1987 to 1989; BFW 1992). The changes in the carbon content of the soils are very small and slow and so far no reassessments of the Austrian soil inventories have taken place that would allow estimates for the carbon stock changes of the soils which are based on measured data. Therefore, modelling approaches were used to estimate the carbon stock change of the Austrian forest soils in the period 1961 to 1996 (WEISS et al. 2000). According to these estimates it is assumed that the Austrian forest soils were a carbon sink of about 10% of the net carbon sink of the forest biomass in the period 1961–1996. For the time period 1990 to 2006 these estimates resulted in a C stock increase of 0.5 Mt C per year (0.7 Mt C if temperature change is not considered). Main reasons for this estimated increase of the forest soil C pool in Austria were the increase in forest area (former land use changes to forests and the related higher C input to the soils), an increase in litter fall due to the biomass increase per ha in the Austrian forests and a higher input of harvest residues into the soil due to the increase in harvest.

However, these results have to be considered as hypothetical because repeated soil measurements are missing, which would help to verify the modelled carbon stock changes. An actual repetition of a soil inventory in England and Wales detected a decrease in soil C stocks independent from the land use. The authors assume an important influence of climate change in their findings (BELLAMY et al. 2005). For all these reasons, we follow the Tier 1 approach of the IPCC GPG and assume that the soil C pool of sector 5.A.1 (forests remain forests) did not change (0). The uncertainty of this assumption is estimated pragmatically to range from -0.4 to +0.5 Mt C per year. The positive end of this range is based on the totals of our estimates (see above). For the negative end the totals of only the C stock reducing impacts in our estimates are considered (e.g. temperature rise, increase in un-stocked forest area).

A re-assessment of the forest soil inventory is currently ongoing on selected sites. In addition, there is a project to derive models with the help of these measured data, with the available data of the NFIs on the changes of the organic humus layer as well as with relevant information in literature. This altogether will allow an improvement of the estimates for the carbon stock changes in the forest soils.

Biomass burning

The controlled burning of managed forest is not carried out in Austria. CO_2 emissions caused by biomass burning due to wildfires are included in sector *5.A.1 Forest land remaining forest land*, as already reported in previous reports. Estimates of emissions from non-CO_2 gases from this category are reported. According to the IPCC (GPG 2003) a TIER 1 method following the equation 3.2.20 was applied.

$$\text{Lfire (t GHG)} = A*B*C*D*10^{-6}$$

- A area burnt (ha)
- B mass of available fuel, kg dm ha^{-1}
- C combustion efficiency
- D emission factor

Data on the area affected by wildfires are available for the years 1990 to 2002. For the next following years the mean value of area affected between 1990 and 2002 was calculated and taken under consideration. According to the references in the IPCC GPG a mean value of 19.8 t/ha biomass consumption and a combustion efficiency of 0.45 was applied. The emission factors for N_2O and CH_4 where also taken from table 3.A.1.16 (IPCC GPG 2003).

However, the amounts of N_2O and CH_4 emissions caused by biomass burning due to wildfires are negligible, as they range between 0.001 and 0.2 gG CO_2 equivalents. This is due to the small area concerned (8–200 ha/year).

7.2.1.2 QA/QC, Verification, Uncertainty Assessment

The NFI is based on a very comprehensive quality assurance system which allows the exact identification of the right location of the grid and sample points, guarantees the repeated measurement of the right trees (permanent marked grid) and indicates at once implausible figures for individual parameters during the measurements on site and any missing trees compared to the period before (further details are given in (SCHIELER & HAUK 2001)).

The calculation of the data for category 5 A 1 is embedded in the overall QA/QC-system of the Austrian GHG inventory (see Chapter 1.6).

An uncertainty estimate for the Carbon stock changes of living biomass has been carried out several years ago (WEISS et al. 2000) (see Table 195). In the meanwhile, the calculation method has been changed and for the first time locally specific biomass functions for Austria are used. These changes likely reduce the uncertainties given in Table 195. A new uncertainty assessment is planned for the future.

This previous calculation of the uncertainty of the reported data for category 5.A.1 (biomass) took into account:

- The statistical uncertainty of the forest inventory,
- The uncertainty related to the calculation of annual data,
- The uncertainty related to the missing consistency of different statistics[54]
- and the uncertainty of each conversion and expansion factor.

The estimates of the uncertainty included a consistency approach with other national statistics. This approach went far beyond the usual approach of uncertainty estimates which are only based on single statistics or single input data (Table 195), details are described in (WEISS et al. 2000)). Error propagation was used to calculate the overall uncertainty, which was on average ±30% for the annual net change of biomass C stocks between 1961 and 1996.

Table 195:Relative uncertainties of the previous biomass estimates of sector 5.A.1 (WEISS et al. 2000).

	Relative uncertainties [%]				
	Forest inventory	**Uncertainty related to the calculation of annual data and to the necessary consistency of different statistics**	**Conversion factor „m^3 o.b. → t dm“**	**Conversion factor „t dm stemwood → t dm whole tree“**	**Conversion factor „t dm → t C“**
Increment	2.0	3.2	11.1	6.5	2.0
Harvest	3.5	12.2			

7.2.1.3 Recalculations

The figures of the area "Forest land remaining forest land" have been revised for the whole time series. In accordance with the IPCC GPG (2003) the area in conversion status is followed and reported for 20 years. These changes resulted in a decrease of the area of remaining forest land compared to the previous submission (on average 3.5%) and consequently, had an impact on the figures of the amount of CO_2 removals of the subcategory 5.A.

[54] e.g.: There are three different Austrian statistics for annual harvest: measured harvest according to NFI, national annual records of wood felled, and the national wood balance.

7.2.2 Land Use Changes to Forest Land (5.A.2)

7.2.2.1 Methodological Issues

Since data on land use changes from and to Forest Land derive from the same data sets the methodology and activity data are described for both land use change activities from and to forests in this chapter.

Activity data

Areas were land use changes to and from forests take place are generally very small in Austria. By means of the NFI, which follows a regular grid of 4 x 4 km (see also chapter 7.2.1.1) land use changes can only be observed by chance and therefore the number of grid points with observed land use change is small. Therefore the estimates for land use changes from and to forest uses have a significantly higher uncertainty compared to the uncertainty for the total forest land (see below).

In case a land use change has been observed at an inventory point of the last NFI (2000/02) the type of the neighbouring non-forest land was recorded. The evaluation of 2/3 of such forest boundary points led to the land use statistic shown in the Table 196 and Table 197. It is assumed, that the other third follows the same distribution.

The total increase of forest area between the NFI 1991/96 and 2000/02 was 68 000 ha (total forest area). The loss of forest area for the same period was calculated with about 32 000 ha, leading to a net increase of the total forest area of about 36 000 ha (19 000 ha for the productive forest) between these NFIs.

Table 196:Land use changes to forest (%, ha)observed for the period 2000/02; based on (BFW 2004a).

Categories of land use changes according to the IPCC GPG 2003	Land use changes to forest land (% of total conversion to forest land)	Land use changes to forest land [1000 ha]
Cropland (5 A.2.1)	16.0	10.9
Grassland (5 A.2.2)	59.0	40.3
Wetlands (5 A.2.3)	5.0	3.4
Settlements (5 A.2.4)	14.0	9.6
Others (5 A.2.5)	6.0	4.1
Total	**100.0**	**68.3**

Table 197:Land use changes from forest (%, ha) observed for the period 2000/02; based on (BFW 2004a).

Categories of land use changes from forests according to the IPCC GPG 2003	Land use changes from forest land (% of total conversion of forest land)	Land use changes from forest land [1 000 ha]
Cropland (5 B.2.1)	5.0	1.6
Grassland (5 C.2.2)	53.0	16.8
Wetlands (5 D.2.3)	3.0	0.9
Settlements (5 E.2.4)	15.0	4.8
Others (5 F.2.5)	24.0	7.6
Total	**100.0**	**31.8**

As shown in Table 196 and Table 197 the land use changes to and from forests mainly appear from/to grassland sites (59% or 53%, respectively). The land use changes from or to other categories are far below this value and should only be seen as relative figures, due to a high degree of uncertainty (see 1.3.1.2).

For the years before 1997 back to 1970 it was assumed that the land use changes between two observation periods show the same ratio of distribution as in the latest inventory because only the total amount of forest increase and loss is available for previous NFI periods.

The annual increment of stemwood over bark (o.b.) on areas which have become forests was estimated with 3 m^3/ha.

The annual average loss of stemwood o.b. on lost forest areas was estimated with 60 m^3/ha on average for deciduous and coniferous trees.

Conversion factors

In Table 198 the conversion factors for the total above ground biomass (with no further division into coniferous and deciduous) is shown.

Table 198:Conversion factors for land use changes to forest land.

Conversion factors	Total biomass (conif. and dec.)
m^3 stemwood o.b.→ t dm whole tree (incl. also below ground biomass)	
increment	0.8
harvest	0.72
t dm whole tree → t C whole tree	0.49

Soil

The estimates of the soil C stock changes of land use change areas from and to forests follow the equation below and the same methodological approach as described in chapter 7.3.3.3.

$\Delta SOC = (SOC_O - SOC_{O\text{-}T})/20$

Δ SOC = average annual carbon stock change in Austrian cropland soils (t C ha^{-1} a^{-1}) over the first 20 years

SOC_O = carbon stock in Austrian soils after conversion (e.g forest land→121 t C ha^{-1})

$SOC_{O\text{-}T}$ = carbon stock in Austrian soils before conversion (e.g. area weighted mean value of soil C stocks from grassland converted to forest land: 102 t C ha^{-1})

annual change in carbon stock of mineral soils converted from and to forest land = Δ SOC * conversion area

The input data for forest soil C stocks represent 0–50 cm soil depth. Estimates for the soil C stock changes of and between the other land use categories are based on a soil depth of 0–30 cm (see chapter 7.3.3.3).

Therefore, the following soil C stocks (0–50 cm) have been used to calculate emissions/removals of LUC from and to forests:

- Forests: 121 t C/ha (WEISS et al. 2001)
- Cropland: 60 t C/ha, (GERZABEK et al. 2005)
- Vineyards: 58 t C/ha, (GERZABEK et al. 2005)

- Orchards/garden: land 78 t C/ha, (GERZABEK et al. 2005)
- Grassland (intensive use): 81 t C/ha, (GERZABEK et al. 2005)
- Grassland (extensive use) 119 t C/ha (GERZABEK et al. 2005).
- Bogs: 150 t C/ha (expert judgement)
- Surface waters and reed beds: 0 t C/ha (expert judgement)
- Settlements and traffic area (on average): 50 t C/ha (expert judgement)
- Alpine shrub lands: 119 t C/ha (KÖRNER et al. 1993)
- Rocks and stone slopes: 0 t C/ha (expert judgement)
- Other land uses: 30 t C/ha (expert judgement)

The values for forests, cropland and grassland represent averages which are based on Austrian soil inventories for forests (BFW 1992) and agricultural land (AMT DER STEIERMÄRKISCHEN LANDESREGIERUNG 1988–1996, AMT DER TIROLER LANDESREGIERUNG 1988, AMT DER OBERÖSTERREICHISCHEN LANDESREGIERUNG 1993, AMT DER SALZBURGER LANDESREGIERUNG 1993, AMT DER NIEDERÖSTERREICHISCHEN LANDEREGIERUNG 1994, AMT DER BURGENLÄNDISCHEN LANDESREGIERUNG 1996, AMT DER KÄRNTNER LANDESREGIERUNG 1999, compiled in the Austrian Soil Information System BORIS).

Based on these soil C stock data and the measured land use change areas by the NFI an area weighted mean value of soil C stock was calculated for each land use category of the IPCC GPG. Table

Table 199:Area weighted mean values for carbon stocks in mineral soils (0–50 cm) of land use change areas from and to forest land.

Land use categories (IPCC – GPG)	C-stocks (t ha^{-1}) in soils (0–50 cm)	
	LUC to forest land	LUC from forest land
Forest land	121	121
Cropland	61	62
Grassland	102	104
Wetland	30	0
Settlements	43	32
Other land	30	41

7.2.2.2 Uncertainty Assessment

The results of the NFI provide very accurate and reliable data on the increment, harvest, distribution of tree species and other characteristics of the Austrian forest as a whole. The regular grid of 4 x 4 km is an appropriate way to meet this information. It is obvious, that only a limited number of the observed grid points of the NFI by chance describe a forest boundary, where land use changes can be detected. In addition, the stock changes in soils due to LUC are based on accounting and discounting of representative mean values. Therefore a high uncertainty for the results of the sub categories on land use changes from and to forests must be considered (expert judgement: between 50 and 100%, depending on the other categories from or to which forest land changes).

7.2.2.3 Recalculations

The figures of the areas "Land converted to/from forests" have been revised for the whole time series. In accordance with the IPCC GPG (2003) the area in conversion status is followed and reported for 20 years. Information and data of the area of forest land back to 1970 were taken from the NFI. The ratio of land use changes to and from forests gained from the latest NFI (2000/02) was applied to the amount of total forest area increase and loss of the previous NFIs (1961–70, 1971–80, 1981–85, 1986–90).

In previous submissions a discount factor for C-stock changes in soil of 0.66 was applied for all land use change categories. Based on literature it was assumed that 2/3 of the soil C stock have a discounting time of 20 years (soil C with quick turnover) and 1/3 have a discounting time of centuries (soil C with a slow turnover). Also accounting from lower to higher C stocks due to LUC was estimated with the same factors. However, it was recommended by the ERT team to be consistent with the IPCC GPG and to use a default discounting/accounting time for all LUCs. Therefore, the total C-stock changes in soils are calculated for all land use categories using a discount time of 20 years.

7.3 Cropland (5.B)

In this category emissions/removals from cropland management are considered.

In 2006 1.45 Mio ha of Austria are arable land including annual and permanent crops (STATISTIK AUSTRIA 2007). The land use changes are derived from the IACS data base and amount to an average of 31.000 ha per year from 1990 to 2006. The annual emissions range between 1 816 Gg CO_2 equivalent and 2 144 Gg CO_2 equivalent. The source is mainly caused by soil C stock changes of land use change areas, while the variance is mainly caused by the changes of living biomass of perennial crops (orchards, vineyards..).

In sector 5.B the estimate of emissions from cropland remaining cropland, land converted to cropland and liming is carried out. For these categories, a recalculation in accordance with the IPCC GPG (2003) was accomplished for the whole time series. The area in conversion status is followed and reported now for 20 years. This leads to a large increase of the area of land converted to cropland and consequently, the figures of CO_2 emission/removals changed compared with the last submission.

During the in-country review of the initial report of Austria (February 2007) the ERT encouraged Austria to further improve the default values of biomass carbon stock in cropland. For the current submission the carbon stock of living biomass in cropland was recalculated by using country specific data from Statistic Austria (STATISTIK AUSTRIA 2007). For all annual crops mentioned in the Statistical Report the harvested yield as well as the yield of straw and leaves (potatoes, beets…) has been considered. The average mean of the yield of the crops for a time-period of 10 years has been calculated and weighted by the crop area. This leads to average carbon stocks of living biomass in cropland of 6.25 t C ha^{-1}. This country specific value is 25% higher than the IPCC-GPG (2003) default value.

For perennial cropland (Christmas trees, energy plants) also new carbon biomass stocks are applied (chapter 7.3.1.1).

These calculations were made for the individual years from 1990 to 2006.

Some management practices (e.g. slash and burn etc.) and some sub categories (categories 5 B 2 3, 5 B 2 4, 5 B 2 5) do not occur in Austria.

Emissions/Removals were estimated for the sub categories and related sources/sinks as shown in Table 200.

Table 200:Sources (or sinks) considered for cropland management.

Category/source or sink
5 B Cropland – total
5 B 1 Cropland remaining cropland
- carbon stock change in living biomass of perennial cropland
- carbon stock change due to changes in organic matter input (harvest residues) to cropland soils
- CO_2 emissions due to liming of cropland and grassland
5 B 2 Land converted to cropland
5 B 2 1 Forest land converted to cropland
5 B 2 2 Grassland converted to cropland
- carbon stock change in living biomass of annual/perennial cropland
- carbon stock change due to changes in organic matter input to cropland soils

Table 201:Activity data for cropland (1990–2006) in ha –conversion status 20 years.

	5.B Total cropland	**5.B.1.Cropland remaining Cropland**	**Perennial Cropland converted to Cropland**	**Cropland converted in perennial Cropland**	**5.B.2. Land converted to Cropland**	**2.1 Forest Land converted to cropland**	**2.2 Grassland converted to Cropland**	**Grassland converted to perennial cropland**	**2.3 Wetland converted to Cropland**	**2.4 settlement converted to cropland**	**2.5 Other Land converted to cropland**
1990	1 507 533	1 000 606	9 451	11 309	506 927	9 650	495 750	1 526	NO	NO	NO
1991	1 526 723	1 018 187	9 439	11 395	508 536	9 924	497 062	1 550	NO	NO	NO
1992	1 518 074	1 008 043	9 427	11 478	510 031	10 198	498 260	1 573	NO	NO	NO
1993	1 500 454	988 535	9 419	11 567	511 919	10 472	499 850	1 597	NO	NO	NO
1994	1 501 408	988 359	9 411	11 655	513 049	9 978	501 450	1 621	NO	NO	NO
1995	1 492 280	978 528	9 399	11 738	513 752	9 362	502 747	1 644	NO	NO	NO
1996	1 491 907	976 952	9 394	11 828	514 955	8 745	504 542	1 668	NO	NO	NO
1997	1 500 207	984 015	9 389	11 919	516 192	8 129	506 372	1 691	NO	NO	NO
1998	1 507 728	990 661	9 380	12 003	517 067	7 512	507 840	1 715	NO	NO	NO
1999	1 470 396	951 402	9 379	12 099	518 994	7 261	509 994	1 739	NO	NO	NO
2000	1 462 108	941 558	9 374	12 188	520 550	7 010	511 778	1 763	NO	NO	NO
2001	1 460 067	931 734	9 419	12 294	528 333	6 759	519 752	1 822	NO	NO	NO
2002	1 459 095	930 412	9 277	12 454	528 683	6 507	520 335	1 841	NO	NO	NO
2003	1 459 991	932 172	9 392	12 496	527 819	6 256	519 724	1 839	NO	NO	NO
2004	1 454 572	920 863	9 339	12 453	533 709	6 062	525 828	1 819	NO	NO	NO
2005	1 455 984	920 420	9 329	12 381	535 564	5 867	527 881	1 816	NO	NO	NO
2006	1 453 893	920 228	9 283	12 272	533 665	5 672	526 195	1 797	NO	NO	NO

7.3.1 Cropland remaining Cropland (5.B.1)

This section provides information about emissions/removals for cropland remaining cropland. For the estimates of the relevant areas annual crops and woody perennial species like orchard, vineyards, house gardens, tree nurseries and plantations for Christmas trees and biomass are considered according to GPG (IPCC 2003). Emissions were estimated applying the IPCC Tier 1 methodology, except for biomass carbon stocks of Christmas trees, energy crops and for soil carbon stocks where a country specific methodology was used. Below the source of activity data and in the following sub chapters the methodologies and emission factors used for the estimates are explained.

According to GPG (IPCC 2003) the emissions/removals of land use change from cropland to perennial cropland and vice versa have to be considered in this category.

The annual removals range between 320 Gg CO_2 and 91 Gg CO_2.

Table 202:Emissions from cropland management (1990–2006) in Gg CO_2.

	5 B Total Cropland	1 Cropland remaining Cropland	Liming	Perennial Cropland converted to Cropland	Cropland converted to perennial Cropland	2 Land converted to Cropland	2.1 Forest Land converted to Cropland	2.2 Grassland converted to Cropland	Grassland converted to perennial Cropland	N2O (in CO2 equiv)	2.3 Wetlands converted to Cropland	2.4 Settlements converted to Cropland	2.5 Other Land converted to Cropland
1990	1 816.24	-313.57	90.30	113.44	126.08	1 799.99	96.50	1 447.60	3.83	252.07	NO	NO	NO
1991	1 816.63	-319.81	91.06	114.17	127.00	1 804.21	98.47	1 449.12	3.88	252.74	NO	NO	NO
1992	1 825.31	-318.38	90.72	113.82	126.43	1 812.73	100.44	1 454.99	3.94	253.36	NO	NO	NO
1993	1 857.28	-296.71	90.69	112.93	125.10	1 825.27	102.41	1 464.70	3.99	254.17	NO	NO	NO
1994	1 867.75	-289.27	90.73	112.96	125.04	1 828.29	98.86	1 470.39	4.05	254.99	NO	NO	NO
1995	1 871.66	-280.13	91.97	111.90	123.48	1 824.44	84.91	1 479.77	4.10	255.66	NO	NO	NO
1996	1 943.97	-210.98	91.95	111.81	123.25	1 827.93	80.48	1 486.71	4.16	256.58	NO	NO	NO
1997	1 965.85	-192.46	92.08	111.76	123.08	1 831.38	76.05	1 493.61	4.22	257.51	NO	NO	NO
1998	1 983.60	-176.78	91.64	111.32	122.37	1 835.05	71.62	1 500.90	4.27	258.26	NO	NO	NO
1999	2 016.52	-151.01	91.63	111.30	122.23	1 842.37	69.82	1 508.86	4.33	259.37	NO	NO	NO
2000	2 031.04	-142.10	90.35	110.65	121.22	1 850.92	68.01	1 518.24	4.38	260.28	NO	NO	NO
2001	2 005.77	-130.99	90.27	121.08	124.35	1 801.06	66.21	1 465.92	4.59	264.34	NO	NO	NO
2002	2 087.38	-120.03	90.23	82.09	135.78	1 899.31	64.40	1 565.70	4.56	264.65	NO	NO	NO
2003	2 156.82	-109.87	90.27	128.42	102.18	1 945.82	62.60	1 614.38	4.51	264.34	NO	NO	NO
2004	2 056.39	-91.32	90.22	93.53	84.97	1 878.98	61.20	1 545.92	4.43	267.43	NO	NO	NO
2005	2 119.79	-91.93	90.28	102.54	78.92	1 939.98	59.80	1 607.26	4.45	268.47	NO	NO	NO
2006	2 144.37	-94.62	90.09	94.51	70.90	1 983.49	58.40	1 653.10	4.38	267.61	NO	NO	NO

Methodological Issues

Activity data

The data of the areas were taken from STATISTIK AUSTRIA (STATISTIK AUSTRIA 1990–2006). The area of cropland remaining cropland represents the total cropland area minus land converted to cropland.

Data for land use change between and within grassland and cropland were taken from IACS (Integrated Administrative Control System). This database for market organisation premiums and direct compensation for farmers is a central information system about agriculture. For the calculation of land use changes between and within grassland and cropland a sample representing more than 4.600 cadastral municipalities for the year 2001–2003 was taken to calculate the land use changes. From these results the land use changes in Austria were extrapolated (except for Alps and alpine meadows). From the land use change of these 3 years an average "land use factor" for cropland and grassland was calculated and applied for the years 1990–2006. On average, 92% of the agriculturally used areas showed no land use change, 1% represented cropland converted to grassland and 1.3% grassland converted to cropland.

IACS provides information for land use change of cropland (annual, perennial) and grassland. Land use change from and to wetland is insufficiently collected in IACS. Land use change from and to settlement and other land is not provided by IACS.

7.3.1.1 Changes of carbon stock in biomass of perennial cropland

The biomass of annual crops is not included in the estimation because it is harvested every year. Thus, there is no long term carbon storage.

The calculation of perennial crops includes orchards, vineyards, Christmas trees, energy crops and a share (50%) of house gardens which are assumed to be perennial.

According to Tier 1 GPG (2003) for perennial cultures as viticulture, horticulture and house gardens – a steady state of biomass increase in the first 30 years was assumed. 3.33% of these cultures are removed and cause emissions. For older cultures the annual increase of biomass is assumed to be equal to the losses by harvesting.

For Christmas trees and energy crops a country specific steady state of biomass increase in the first 10 years and 6 years respectively was assumed. The observation period started in 1960 based entirely on the data from Statistik Austria (Statistik 1960–1990). In the last submissions the data from 1960 to 1975 were taken from FAO and from 1976–1990 from Statistik Austria. However, a thorough analysis of the FAO data showed that these data are – in the long term – significantly higher compared to data of Statistik Austria. On request Statistik Austria also provided the data from 1960–1975 which will be the new basis for the calculations. As the time series from 1960´s showed some inconsistencies due to the intervals of full agricultural surveys and changes in data collection, the data of the time series were interpolated.

Table 203:Estimated area of perennial crops from 1990–2006 in ha.

	Viticulture	Horticulture	Garden	Energy crops	Christmas trees	Total area
1990	58 203	19 693	13 809	1 027	1 167	93 899
1991	57 462	19 248	12 943	1 210	1 306	92 169
1992	56 720	18 804	12 077	1 394	1 444	90 439
1993	55 979	18 359	11 211	1 577	1 583	88 709
1994	55 803	18 704	10 345	1 571	1 707	88 130
1995	55 627	19 049	9 479	1 565	1 830	87 550
1996	54 061	18 673	9 129	1 615	1 878	85 355
1997	52 494	18 297	8 778	1 665	1 925	83 159

	Viticulture	Horticulture	Garden	Energy crops	Christmas trees	Total area
1998	52 067	17 995	8 050	1 542	1 973	81 627
1999	51 641	17 694	7 321	1 420	2 020	80 096
2000	51 214	17 392	6 593	1 297	2 068	78 564
2001	50 304	17 120	6 609	1 403	1 962	77 398
2002	49 393	16 849	6 625	1 510	1 856	76 232
2003	48 483	16 577	6 641	1 616	1 750	75 066
2004	47 572	16 305	6 657	1 722	1 644	73 900
2005	48 846	15 851	5 924	1 711	1 846	74 177
2006	50 119	15 396	5 191	1 700	2 048	74 454

The fact that in this category biomass changes from a sink to a source is due to the area decrease of perennial cropland in the period 1990 to 2006 below the figures of the area in the period 1960–1976. Taking into account the rotation period for perennial cropland according to IPCC-GPG and country specific values this leads to losses in perennial biomass from 1990–2006. As the time series of perennial cropland area from 1960–1976 is relatively stable it causes a net sink in the first years of the 1990´s. Particularly, as the energy crop growing was assumed to start at 1990 (according to Statistik Austria) with a rotation period of 6 years. After the period the energy crops also cause emissions.

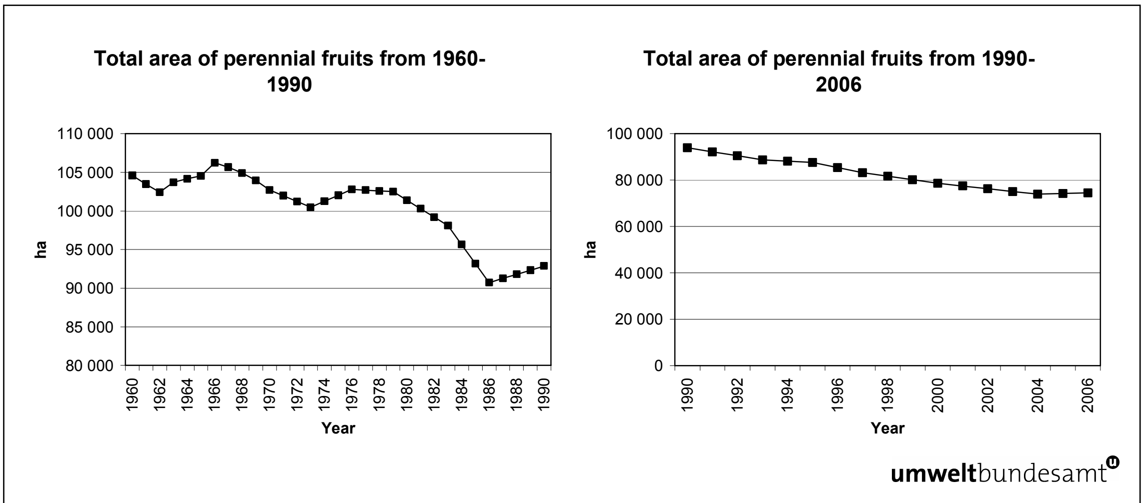

Figure 25: Change of the perennial cropland area from 1960–2006.

For calculating the carbon stock change of living biomass on perennial cropland the following formula was applied:

*Annual change in biomass = (area of perennial cropland * Carbon accumulation rate) – (area of perennial cropland before 30 years * 0.033 * biomass carbon stock at harvest)*

For the carbon accumulation rate the IPCC GPG default value of 2.1 t C $ha^{-1}yr^{-1}$ was used.

For the above ground biomass carbon stock at harvest the IPCC GPG default value of 63 t C ha^{-1} was used for garden, viticulture and horticulture.

For calculating the carbon stock change of living biomass from Christmas trees the following formula was applied:

*Annual change in biomass = (area of Christmas trees * Carbon accumulation rate) – (area of Christmas trees before 10 years * 0,1 * biomass carbon stock at harvest)*

According to literature (BMLFUW (2000a) and expert judgement for Christmas trees a country specific average value of 36 t C ha^{-1} for the carbon stock at harvest was used. The rotation period for Christmas trees is 10 years that leads to an accumulation rate of 3.6 t C ha^{-1} a^{-1}.

For calculating the carbon stock change of living biomass on energy crops the following formula was applied:

*Annual change in biomass of energy crops = (area * Carbon accumulation rate) – (area of energy crops before 6 years * 0,166 * biomass carbon stock at harvest)*

For energy crops also a country specific value of 30 t C ha^{-1} for the carbon stock at harvest was used (SPLECHTNA & GLATZEL 2005). The rotation period for energy crops is 6 years that leads to an accumulation rate of 5 t C ha^{-1} a^{-1}

Figures for the area of energy crops are available since 1990 (STATISTIK AUSTRIA 1991).

Table 204:Carbon biomass stock of perennial cropland.

Perennial crop	Carbon stock biomass (t C ha^{-1})	Rotation period (year)	Method
vine, orchards, garden	31	30	Tier 1 GPG (2003)
Christmas tree	3.6	10	Tier 2, country specific values
Energy crops	5	6	Tier 2, country specific values

7.3.1.2 Changes of carbon stocks in biomass of perennial cropland converted to annual cropland

The annual land use change from perennial cropland converted to annual cropland in 2006 was 397 ha.

For the calculation of the annual change in carbon stocks of living biomass of land converted to cropland the IPCC Tier 1 method -equation 3.3.8 was applied (IPCC 2003) – for annual cropland the country specific value was used:

*Annual change in biomass =annual area of converted land * ($L_{conversion}$ + ΔC_{growth})*

$L_{conversion} = C_{after} - C_{before}$

C_{after} *= carbon stock immediately after conversion is 0*

ΔC_{growth} *= country specific t value for annual crops carbon accumulation rate is 6,25 t C* $ha^{-1} yr^{-1}$

C_{before} *= IPCC default value for carbon stock of woody biomass before conversion is 63 t C* ha^{-1}

7.3.1.3 Changes of carbon stocks in biomass of annual cropland converted to perennial cropland

The annual land use change from annual cropland converted to perennial cropland in 2006 was 416 ha.

For the calculation of the annual change in carbon stocks in living biomass of land converted to cropland the IPCC Tier 1 method -equation 3.3.8- was applied (GPG; IPCC 2003) – for annual cropland the country specific value was used:

*Annual change in biomass =annual area of converted land * ($L_{conversion}$ + ΔC_{growth})*

$L_{conversion} = C_{after} - C_{before}$

C_{after} = *carbon stock immediately after conversion is 0*

ΔC_{growth} = *IPCC default value for perennial crops carbon accumulation rate is 2.1 t C ha^{-1}yr^{-1}*

C_{before} = *country specific value of carbon stock of annual crops before conversion is 6,25 t C ha^{-1}yr^{-1}*

7.3.1.4 Changes of carbon stock in mineral soils of cropland remaining cropland

According to the soil inventories in Austria organic soils are not occurring in arable land in Austria.

Emissions/removals were calculated using a country specific methodology. For the soil organic carbon content the Austrian specific average value of 50 t C/ ha for 0–30 cm depth of cropland was used which is based on the results of the Austrian soil inventory (GERZABEK et al. 2003, STREBL et al. 2003)

The methodology followed closely the GPG guidelines, where the IPCC formula includes a tillage factor (F_{MG}), a land use factor (F_{LU}) and an input factor (F_I) (table 3.3.4; IPCC 2003).

Average (weighted) management factors for Austria were calculated on basis of crop and management statistics of the Austrian agriculture (STATISTIK AUSTRIA 1985–2003, BMLFUW 1985–2003). Changes in agricultural management (e .g. increase of biological agriculture), tillage (e.g. crop residues remain on the fields) and crop rotation (increase of legumes and greening of arable areas) were considered since 1985.

Table 205:Weighted mean values of management factors.

factor	F_{LU} modified	F_{MG} modified	F_I modified
1985	0.820	1.035	0.966
1990	0.822	1.035	0.976
1995	0.829	1.039	0.977
2003	0.828	1.042	0.990

It was assumed that the Austrian specific reference value for arable land of 50 t C ha^{-1} represents the soil carbon stock of 1990. This assumption is supported by the fact that soil inventories were carried out between 1988 and 1996. The carbon stock changes of soil from 1990–2004 were calculated in consideration of the modified management factors. For the default inventory time of 20 years an increase from 50 t C ha^{-1} to 51.41 t C ha^{-1} was estimated.

The formula used for calculating the change in carbon stocks of cropland soils was:

$SOC_{1990+20} = SOC_{1990} + (SOC_{1990} \times ((Flu \times Fmg \times Fi)_{2003}/(Flu \times Fmg \times Fi)_{1990} \times 100)$

$\Delta\ SOC_{20} = (SOC_{1990+20} - SOC_{1990})/\ 20 = 0.07t\ C\ ha^{-1}\ a^{-1}$

Annual change in carbon stock of mineral soils in cropland remaining cropland = $\Delta\ SOC_{20}$ ** land area*

SOC_{1990}...50 t C ha^{-1}, Austrian specific soil carbon content per ha 0–30 cm for cropland in 1990 (GERZABEK et al. 2003)

$SOC_{1990+20}$...av. soil carbon stock per ha after 20 years based on different land management factors of 2003 compared to 1990 (calculated value 51.41 t C ha^{-1})

Δ SOC_{20}...average carbon stock change in Austrian cropland soils (t C ha^{-1} a^{-1}) over a period of 20 years

$(Flu \times Fmg \times Fi)_{1990}$...Management factor 1990

$(Flu \times Fmg \times Fi)_{2003}$...Management factor 2003

7.3.1.5 Changes of carbon stock in soils of perennial cropland converted to annual Cropland

The area in conversion status from perennial cropland to cropland for a time period of 20 years is rather stable and ranges from 9 451 ha to 9 283 ha for the period 1990 to 2006.

Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of perennial cropland. According to the Austrian soil inventories (GERZABEK et al. 2003) the C-stock of soils in perennial cropland is between 48–67 t C ha^{-1} (0–30 cm), with a weighted mean of 57 t C ha^{-1} .

According to IPCC GPG (Tier 1), the calculation steps for determining SOC_0, $SOC_{(0-T)}$ and net soil change per ha of area are as follows:

- Step 1: Select the reference carbon stock value (SOC_{REF}), based on climate and soil type, for each area of land being inventoried

  → not necessary as Austrian specific values were available.
- Step 2: Calculate the pre-conversion C stock (SOC_{0-T}) of land being converted into cropland, based on the reference carbon stock and management factors

  → average carbon stock in Austrian soils of perennial cropland 57 t C ha^{-1}
- Step 3: Calculate SOC_0 by repeating step 2 using the same reference carbon stock for Austrian cropland

  → average carbon stock in Austrian soils of annual cropland 50 t C ha-1
- Step 4: Calculate the average annual change in soil C stock for the area over the inventory period (20 years)
- Step 5: multiply the average annual change in soil C stock by the conversion area.

  $\Delta\ SOC = (SOC_O - SOC_{O-T})/\ 20 =- 0.35\ t\ C\ ha^{-1}\ a^{-1}$

  Annual land use change in carbon stock of mineral soils in perennial cropland converted to cropland=

  *Δ SOC * conversion area*

  Δ SOC_{20}...average carbon stock change in Austrian cropland soils (t C ha^{-1} a^{-1}) over a period of 20 years

7.3.1.6 Changes of carbon stock in soils of annual cropland converted to perennial Cropland

The area in conversion status from annual cropland to perennial cropland for a time period of 20 years ranges from 11 309 ha to 12 272 ha for the years 1990 to 2006.

Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of perennial cropland and annual cropland, respectively.

Annual land use change in carbon stock of mineral soils in perennial cropland converted to cropland=

Δ *SOC * conversion area*

$\Delta SOC = (SOC_O - SOC_{O\text{-}T})/ 20 = 0.35\ t\ C\ ha^{-1}\ a^{-1}$

ΔSOC_{20}...average carbon stock change in Austrian cropland soils (t C ha^{-1} a^{-1}) over a period of 20 years

SOC_O…… carbon stock change in Austrian annual cropland soils after conversion →57 t C ha^{-1}

$SOC_{O\text{-}T}$….. carbon stock change in Austrian cropland soils before conversion→ 50 t C ha^{-1}

Calculation steps see chapter 7.3.1.5

7.3.1.7 Liming

The application of lime to agricultural soils is a source of CO_2 emissions. There is no detailed data of lime application in Austria since 1994. Therefore, the estimated amount is based on expert judgement. Particularly with respect to lime quality (dolomite, $CaCO_3$) information is incomplete. For the estimation of CO_2 emissions from liming the calculation does not differentiate between cropland and grassland.

According to expert judgement the area for the calculation of liming comprises cropland (without perennial cropland), two and more cut meadows and cultivated pastures.

Table 206:Area with lime application in ha.

Land use (ha)	1990	2006
Cropland	1.406.394	1.377.251
Grassland	884.124	907.904
Total	2.290.518	2.285.155

The following assumptions were made:

- the recommended amount of lime that should be applied to cropland and grassland according to the Austrian advisory committee for good agricultural practices ("Fachbeirat für Bodenfruchtbarkeit") is 0.7 t ha^{-1} a^{-1}.
- own estimations (UMWELTBUNDESAMT 2004c) showed that only 32% of this recommended amount is actually applied
- additionally it has to be considered that about 60% of Austrian cropland and grassland need no liming as they are based on carbonate parent material

→ with these input data the estimated amount is 0.09 t lime ha^{-1} a^{-1}.

The GPG (IPCC 2003) procedure for calculating the CO_2 emissions was applied.

7.3.1.8 Uncertainty assessment

The uncertainty estimates are based on the uncertainty values for IPCC default values taken from the GPG (for most sources these default values were used), and on expert judgement and literature (GERZABEK et al. 2003).

- cropland area: +/-10% (based on expert judgement)
- converted area: annual cropland to perennial +/- 50%
- perennial cropland to annual cropland +/- 20%
- country specific data for carbon stock in cropland soils is +/- 5% and perennial cropland +/- 15%
- emission factors for biomass carbon stock default values according IPCC

The uncertainties of the converted area for the years 2001–2003 are the following:

Table 207:Uncertainties for areas of land use change (%).

	2001	2002	2003
Annual cropland to perennial	21	26	28
Perennial cropland to annual cropland	38	30	52
Grassland converted to cropland	7	7	9

The estimated total uncertainty for this category ranges between +40 and -130% (expert judgement).

The estimated total uncertainties for liming range between +/- 50% (expert judgement).

7.3.2 Forest Land converted to Cropland (5.B.2.1)

The methodology and activity data are described in chapter 7.2.2. For a time period of 20 years the area in conversion status from Forest Land to Cropland ranges from 5 672 ha to 10 472 ha for the period 1990 and 2006 causing annual emission rates due to the loss of biomass and C changes in soil from 58 Gg CO_2 to 102 Gg CO_2.

For the calculation of the annual change of carbon stocks in forest soils converted to cropland soils the IPCC Tier 2 approach is used. Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of forest land (121 t C/ha) and arable land (62 t C/ha, area weighted mean value of input data described in chapter 7.2.2).

7.3.3 Grassland converted to Cropland (5.B.2.2)

The average annual landuse change area from grassland to cropland from 1990–2006 is 26 742 ha. The area in conversion status for a time period of 20 years ranges from 495 750 ha to 526 195 ha for the period 1990 to 2006. Considering the area of the 20 year time period this leads to emissions between 1 447.6 and 1 653.1 Gg CO_2.

Methodological Issues

Activity data

Data for land use change from grassland to cropland were estimated from IACS as described in chapter 7.3.1. Activity data of grassland converted to cropland in the 20 year conversion status see Table 201.

Emissions were estimated applying a country specific methodology for both biomass carbon stocks and for soil carbon stocks.

7.3.3.1 Changes of carbon stock in biomass of grassland converted to annual cropland

The IPCC default root to shoot value was substituted by using country specific data from the Agricultural Research and Education Centre Raumberg-Gumpenstein (Höhere Bundeslehr- und Forschungsanstalt Raumberg-Gumpenstein). According to the research results the above ground biomass is 1.0 t dm ha^{-1} (0.5 t C ha^{-1}) and the root biomass is 4.2 t dm ha^{-1} (2.1 t C ha^{-1}). That leads to a country specific value for carbon stock of grassland biomass before conversion of 2.6 t C ha^{-1}.

For the calculation of the annual change in carbon stocks in living biomass of grassland converted to cropland the following formula was applied – GPG IPPC (equation 3.3.8):

*Annual change in biomass =annual area of converted land * (*$L_{conversion} + \Delta C_{growth}$*)*

$L_{conversion} = C_{after} - C_{before}$

ΔC_{growth}= country specific value for carbon accumulation rate in annual crops is 6.25 t C $ha^{-1}yr^{-1}$

C_{after} = carbon stock immediately after conversion is 0

C_{before} = country specific value for carbon stock of grassland biomass before conversion is 2.6 t C ha^{-1}

1.0 = t DM country specific above ground living biomass for grassland

0.5 = t C/t TM default carbon content of biomass

4.2 = t DM root grassland biomass

7.3.3.2 Changes of carbon stock in biomass of grassland converted to perennial cropland

The annual land use change area from grassland to perennial cropland in 2006 is 52 ha.

*Annual change in biomass =annual area of converted land * (*$L_{conversion} + \Delta C_{growth}$*)*

$L_{conversion} = C_{after} - C_{before}$

For the calculation the following values were used:

ΔC_{growth} = IPCC default value for carbon accumulation rate in perennial crops is 2.1 t C $ha^{-1}yr^{-1}$

C_{after} = carbon stock immediately after conversion is 0

C_{before}= country specific value for carbon stock of grassland biomass before conversion is 2.6 t C ha^{-1} (description see chapter 7.3.3.1).

The data in the CRF table represent the sum of grassland to annual cropland and grassland to perennial cropland. This will be reported more detailed in the next submission.

7.3.3.3 Changes of carbon stock in mineral soils of grassland converted to annual cropland

Only mineral soils were considered in this category assuming that grassland on organic soils was not converted to cropland (soil inventories have shown that cropland with organic soils does not exist in Austria).

Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of grassland and arable land. For the estimates Austrian specific values of 70 t C/ ha for 0–30 cm depth of grassland and 50 t C/ha for 0–30 cm depth of arable land were used (GERZABEK et al. 2003, STREBL et al. 2003). For the calculation of the annual change of carbon stocks in grassland soils converted to annual cropland soils the following formula according to IPCC GPG (2003) was applied (Calculation steps see chapter 7.3.1.5).

$\Delta SOC = (SOC_O - SOC_{O-T}) / 20 = -1.0\ t\ C\ ha^{-1}\ a^{-1}$

*annual change in carbon stock of mineral soils converted from grassland to cropland = Δ SOC * conversion area*

ΔSOC = average annual carbon stock change in Austrian cropland soils ($t\ C\ ha^{-1}\ a^{-1}$) over the first 20 years

SOC_O = carbon stock in Austrian cropland soils after conversion from grassland →50 $t\ C\ ha^{-1}$

SOC_{O-T} = carbon stock in Austrian grassland soils before conversion →70 $t\ C\ ha^{-1}$

7.3.3.4 Changes of carbon stock in mineral soils of grassland converted to perennial cropland

The average annual land use change area from grassland to perennial cropland ranges from 1 526 ha to 1 797 ha for the period 1990–2006 considering the area to be 20 years in the conversion category.

Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of grassland and perennial land. For the soil organic carbon content the Austrian specific values of 70 t C/ha for 0–30 cm depth of grassland and 57 t C/ha for 0–30 cm depth of perennial land were used (GERZABEK et al. 2003; STREBL et al. 2003). For the calculation of the annual change of carbon stocks in grassland soils converted to cropland soils the following formula was applied – IPCC Tier 1 (Calculation steps see chapter 7.3.1.5).

$\Delta SOC = (SOC_O - SOC_{O-T}) / 20 = -0.65\ t\ C\ ha^{-1}\ a^{-1}$

*annual change in carbon stock of mineral soils converted from grassland to perennial cropland = Δ SOC * conversion area*

ΔSOC = average annual carbon stock change in Austrian cropland soils ($t\ C\ ha^{-1}\ a^{-1}$) over the first 20 years

SOC_O = carbon stock in Austrian perennial cropland soils after conversion from grassland →57 $t\ C\ ha^{-1}$

SOC_{O-T} = carbon stock in Austrian grassland soils before conversion →70 $t\ C\ ha^{-1}$

The data in the CRF table represent the sum of grassland to annual cropland and grassland to perennial cropland – see comment above for biomass. This will be reported more detailed in the next submission.

7.3.3.5 N_2O emissions in soils of grassland converted to cropland

This chapter deals with the increase in N_2O emissions due to the conversion of grassland to cropland. The area of land converted (grassland to cropland and grassland to perennial cropland respectively) was taken from Table 201. The annual release of N_2O was calculated with IPCC default values (TIER 1) using equations 3.3.14 and 3.3.15. (IPCC 2003).

The C: N ratio in soil organic matter was assumed to be 12 (based on Austrian soil inventory data, BORIS).

7.3.3.6 Uncertainty assessment

The following uncertainties were estimated. They are based on uncertainty values for IPCC default values taken from the IPCC GPG and on expert judgement and literature (GERZABEK et al. 2003):

- cropland area: +/-10%
- converted area grassland to cropland: +/- 16%
- country specific data for carbon stock in cropland soils +/- 5% and in perennial cropland soils +/- 15%
- emission factors for biomass carbon stock default values according IPCC GPG guidance (2003):

Uncertainties from the converted area for the years 2001-2003 are listed in Table 207.

The total uncertainty of this category estimated by expert judgement is +/- 40%.

7.3.3.7 Recalculations

The figures of the areas "Land converted to cropland" had been revised for the whole time series. In accordance with the IPCC GPG (2003) the area in conversion status is followed and reported for 20 years. Information and data on the area of cropland back to 1970 were taken from the Statistics Austria.

These changes resulted in a decrease of the area of remaining cropland compared to the previous submission (on average 30%) and consequently had an impact on the figures of the amount of CO_2 removals of the subcategory 5.B.

For Christmas trees and energy crops new national figures for biomass carbon stocks were applied (details chapter 7.3.1.1)

The value for the carbon stock of annual cropland and grassland biomass before conversion was also improved by using country specific values (chapter 7.3.3.1).

In previous submissions a discount factor for C-stock changes for all land use categories of 0.66 was applied. Based on literature it was assumed that 2/3 of the soil C stock have a discounting time of 20 years (soil C with quick turnover) and 1/3 have a discounting time of centuries (soil C with a slow turnover). Also accounting from lower to higher C stocks due to LUC was estimated with the same factors. However, it was recommended by the ERT team to be consistent with the IPCC GPG and to use a default discounting/accounting time for all LUCs. Therefore, the total C-stock changes are calculated for all land use categories with 20 years without any further discount factor.

7.4 Grassland (5.C)

In this category emissions/removals from grassland management (grassland remaining grassland and land converted to grassland) are considered. In 2006, 1.79 Mio ha of Austria are grassland (STATISTIK AUSTRIA 2007)[55]. Total grassland includes one cut meadows; two and more cut meadows, cultivated pastures, litter meadows, rough pastures, alpine meadows and pastures and abandoned grassland.

During the in-country review of the initial report of Austria (February 2007) the ERT encouraged Austria to further improve the carbon stock in living biomass. The recalculation was done by using country specific grassland yield data from Statistic Austria (STATISTIK AUSTRIA 2007) and the Agricultural Research and Education Centre (AREC) Raumberg-Gumpenstein for a time period of 10 years (Höhere Bundeslehr- und Forschungsanstalt Raumberg-Gumpenstein-HBLFA).

The mean grassland yield of the categories one cut meadows, two cut meadows, litter meadows, rough pastures and cultivated pastures was calculated considering the area of the different grassland categories. The calculation led to an average yield of 6.2 t dm ha^{-1} for grassland under the Austrian situation, these are 3.10 t C ha^{-1}. This value is 1.5% higher than the GPG IPPC (2003) default value.

Table 208:Area weighted mean values of grassland biomass.

	area in ha (avg 10 year)	yield in t (avg 10 year)	weighted mean (t/ha)
one cut meadows	54 827	3.2	0.2
two and more cut	844 126	6.8	5.3
litter meadows	17 126	3.5	0.1
culture pastures	74 839	6.7	0.5
rough pastures	90 264	2.4	0.2
	weighted grassland yield (t dm/ha)		6.2
	C t/ha		3.1

The IPCC default root to shoot value was improved by using country specific data from the Agricultural Research and Education Centre Raumberg-Gumpenstein (Höhere Bundeslehr- und Forschungsanstalt Raumberg-Gumpenstein -HBLFA). According to the research results the above ground living biomass is 1.0 t dm ha^{-1} (0.5 t C ha^{-1}) and the root biomass is 4.2 dm ha^{-1} (2.1 t C ha^{-1}). This leads to a country specific value for carbon stock of grassland biomass before conversion of 2.6 t C ha^{-1}. The value is 15% lower than the GPG IPPC default value.

The annual removals of grassland in Austria range between 842 Gg CO_2 and 1 149 Gg CO_2 for the period from 1990 to 2006.

Some management practices (e.g. slash and burn etc.) and some sub categories (5 C 2 3, 5 C 2 4, 5 C 2 5) do not occur in Austria.

[55] This number differs from figures in table 189, because of the year refered to.

Table 209:Sources (or sinks) considered for grassland management.

Category/source or sink
5.C Grassland – total
5.C.1 Grassland remaining grassland
- carbon stock change due to changes in organic matter input to grassland soils
5.C.2 Land converted to grassland
5.C.2.1 Forest land converted to grassland
5.C.2.2 Cropland converted to grassland
- carbon stock change in living biomass of grassland
- carbon stock change due to changes in organic matter input (harvest residues) to grassland soils

Table 210:Activity data of grassland 1990–2006 in ha.

	C. Total Grassland	1. Grassland remaining Grassland	2. Land converted to Grassland	2.1 Forest Land converted to Grassland	2.2 Cropland converted to Grassland	2.2.perennial Cropland converted to Grassland	2.3 Wetlands converted to Grassland	2.4 Settlements converted to Grassland	2.5 Other Land converted to Grassland
1990	1 992 765	1 391 963	600 802	102 294	496 412	2 097	NO	NO	NO
1991	1 989 050	1 385 298	603 752	105 197	496 409	2 146	NO	NO	NO
1992	1 985 335	1 378 723	606 612	108 100	496 318	2 194	NO	NO	NO
1993	1 981 620	1 371 882	609 738	111 003	496 492	2 243	NO	NO	NO
1994	1 979 096	1 374 362	604 734	105 768	496 674	2 292	NO	NO	NO
1995	1 976 571	1 378 382	598 189	99 233	496 616	2 340	NO	NO	NO
1996	1 978 490	1 386 487	592 002	92 697	496 916	2 389	NO	NO	NO
1997	1 980 408	1 394 568	585 840	86 162	497 240	2 438	NO	NO	NO
1998	1 972 662	1 393 254	579 408	79 627	497 294	2 486	NO	NO	NO
1999	1 964 915	1 387 571	577 344	76 965	497 843	2 536	NO	NO	NO
2000	1 957 169	1 382 169	575 000	74 303	498 112	2 585	NO	NO	NO
2001	1 929 902	1 353 476	576 426	71 641	502 069	2 717	NO	NO	NO
2002	1 902 636	1 331 242	571 394	68 979	499 722	2 692	NO	NO	NO
2003	1 875 369	1 305 532	569 836	66 317	500 782	2 738	NO	NO	NO
2004	1 848 102	1 286 635	561 467	64 254	494 502	2 710	NO	NO	NO
2005	1 818 754	1 256 053	562 701	62 191	497 836	2 674	NO	NO	NO
2006	1 789 406	1 232 107	557 299	60 128	494 515	2 656	NO	NO	NO

Table 211:Emissions from grassland management in Gg CO_2.

	5 C Total Grassland	1. Grassland remaining Grassland	2. Land converted to Grassland	2.1 Forest Land converted to Grassland	2.2 Cropland converted to Grassland	2.2.a perenial cropland converted to Grassland	2.3 Wetlands converted to Grassland	2.4 Settlements converted to Grassland	2.5 Other Land converted to Grassland
1990	-841.71	39.11	-880.81	607.90	-1 518.08	29.36	NO	NO	NO
1991	-829.88	39.49	-869.37	616.98	-1 515.85	29.50	NO	NO	NO
1992	-821.31	39.87	-861.19	626.06	-1 516.52	29.27	NO	NO	NO
1993	-815.50	40.27	-855.77	635.15	-1 519.77	28.85	NO	NO	NO
1994	-832.68	40.12	-872.80	618.77	-1 520.32	28.75	NO	NO	NO
1995	-957.62	39.89	-997.51	497.44	-1 523.23	28.28	NO	NO	NO
1996	-980.01	39.42	-1 019.43	477.00	-1 524.57	28.14	NO	NO	NO
1997	-1 002.36	38.96	-1 041.32	456.56	-1 525.88	28.00	NO	NO	NO
1998	-1 024.47	39.03	-1 063.51	436.12	-1 527.37	27.74	NO	NO	NO
1999	-1 034.65	39.36	-1 074.01	427.79	-1 529.42	27.62	NO	NO	NO
2000	-1 045.90	39.67	-1 085.57	419.47	-1 532.33	27.29	NO	NO	NO
2001	-1 007.25	41.33	-1 048.58	411.14	-1 504.97	45.26	NO	NO	NO
2002	-1 112.01	42.61	-1 154.63	402.81	-1 568.48	11.04	NO	NO	NO
2003	-1 091.64	44.10	-1 135.74	394.49	-1 554.74	24.52	NO	NO	NO
2004	-1 174.06	45.19	-1 219.25	388.04	-1 615.96	8.67	NO	NO	NO
2005	-1 081.37	46.96	-1 128.33	381.58	-1 516.77	6.87	NO	NO	NO
2006	-1 148.69	48.34	-1 197.03	375.13	-1 582.80	10.65	NO	NO	NO

Methodological Issues

Activity data

The area of grassland remaining grassland represents the total grassland minus land converted to grassland. The area of land converted to grassland had been revised for the whole time series in accordance with the IPCC GPG (2003) (conversion status is 20 years). These changes resulted in a decrease (average 30%) of the area of remaining grassland. Accordingly, the emission/removal of sector 5 C changes compared to the previous submission.

The areas were estimated from national statistics of land use (STATISTIK AUSTRIA 1990–2006). The grassland data are collected in the Austrian farm structure surveys 1993, 1995 (full survey), 1999 (full survey) and 2003. For the years between the surveys the data have been interpolated.

Data for land use change were taken from IACS (description see chapter 7.3.1).

Emissions were estimated by applying country specific methodologies (Tier 2) for both biomass carbon stocks and soil carbon stocks.

7.4.1 Grassland remaining Grassland (5.C.1)

The area of grassland remaining grassland in 2006 was 1.2 Mio ha.

The annual emissions from grassland remaining grassland between 1990 and 2006 range from 39 Gg CO_2 to 48 Gg CO_2 including the emissions from mineral and organic grassland soils.

For the current submission the IPPC default value for carbon stock in living biomass was improved. The recalculation was done by using country specific grassland yield data from Statistic Austria (STATISTIK AUSTRIA 2007) and the Agricultural Research and Education Centre (AREC) Raumberg-Gumpenstein for a time period of 10 years (Höhere Bundeslehr- und Forschungsanstalt Raumberg-Gumpenstein -HBLFA).

The mean of the grassland yield of the categories one cut meadows, two cut meadows, littermeadws, rough pastures and cultivated pastures was calculated also considering the area of the different grassland categories. The calculation led to an average yield per year of 6.2 t dm ha^{-1} for grassland under the Austrian situation, these are 3.1 t C per ha and year.

The IPCC default root to shoot value was improved by using country specific data from the Agricultural Research and Education Centre Raumberg-Gumpenstein (Höhere Bundeslehr- und Forschungsanstalt Raumberg-Gumpenstein -HBLFA). According to the research results the above ground living biomass is 1.0 t dm ha^{-1} (0.5 t C ha^{-1}) and the root biomass is 4.2 t dm ha^{-1} (2.1 t C ha^{-1}). This leads to a country specific value for carbon stock of grassland biomass before conversion of 2.6 t C ha^{-1}.

7.4.1.1 Changes in carbon stocks in biomass of grassland remaining grassland

According to GPG (IPCC 2003) the biomass of grassland is not considered in the estimates (it is harvested every year thus there is no long term carbon storage).

7.4.1.2 Changes in carbon stocks in mineral soils of grassland remaining grassland

Emissions/removals were calculated using a country specific methodology. For the soil organic carbon content the Austrian specific average value of 70 t C/ ha for 0–30 cm depth of grassland was used (GERZABEK et al. 2003, STREBL et al. 2003). This value is based on the Austrian nation-wide soil inventories.

The methodology follows closely the formula presented by the IPCC guidelines which includes a tillage factor (F_{MG}), land use factor (F_{LU}) and input factor (F_I) (table 3.3.4).

These factors were applied to the Austrian situation and average management factors for Austria were estimated on basis of national statistics for the grassland management (STATISTIK AUSTRIA 1985–2003; BMLFUW 1985–2003). Improvements (e.g. increase of biological agriculture) were considered in the calculation since 1985.

Table 212:Weighted mean values of management factors for grassland soils.

factor	F_{LU} modified	F_{MG} modified	F_I modified
1985	1.000	1.062	1.048
1990	1.000	1.062	1.049
1995	1.000	1.064	1.052
2003	1.000	1.064	1.052

It was assumed that the Austrian specific average value of 70 t C ha^{-1} for grassland soil represents the soil carbon stock of 1990. Most Austrian soil inventories were carried out between 1989 and 1996. The carbon stock change of soil from 1990–2005 was calculated by using the management factors above. For the default inventory time of 20 years an increase from 70 t C ha^{-1} to 70.315 t C ha^{-1} was estimated.

The formula used for calculating the change in carbon stocks of grassland soils was the same as for cropland (see chapter 7.3.1.4).

Annual change in carbon stock of mineral soils in grassland remaining grassland = $\Delta\ SOC_{20}$ ** land area*

$\Delta\ SOC_{20} = (SOC_{1990+20} - SOC_{1990})/\ 20 = 0.0157$ t C $ha^{-1}\ a^{-1}$

The amount of lime applied to grassland was estimated together with cropland in chapter 7.3.1.7. Therefore the CO_2 emissions resulting from liming of grassland are included in category 5 B 1.

7.4.1.3 Changes in carbon stocks of organic soils of grassland remaining grassland

The area of organic grassland soils was estimated with data of the soil inventories of the Federal Provinces of Austria which are compiled in the Austrian Soil Information System – BORIS – (http://www.borisdaten.com). The carbon content from the upper soil horizon (weighted mean for 0–30 cm) was calculated out of 200 grassland sites. Sites with more than 17% C_{org} (NESTROY et al. 2000) were selected as "organic soils" and their area was extrapolated.

The estimation resulted in a total area of 12 954 ha organic grassland soils.

For the calculation of emissions from organic soils IPCC Tier 1 method was used. The emission factor of 2.5 t C $ha^{-1}\ a^{-1}$ for warm and temperate climate was chosen.

The calculated emission from organic grassland soils was 118.7 Gg CO_2.

7.4.2 Forest Land converted to Grassland (5.C.2.1)

The methodology and activity data are described in chapter 7.2.2. The area in conversion status from Forest Land to Grassland for a time period of 20 year ranges from 60 128 ha to 111 003 ha between the years 1990 and 2006. The main part of conversion takes place from forests to pasture causing annual emission rates due to the loss of biomass and C changes in soils from 375 Gg CO_2 to 635 Gg CO_2.

For the calculation of the annual change of carbon stocks in forest soils converted to grassland soils the IPCC Tier 2 approach is used. Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of forest land (121 t C ha^{-1}) and grassland soils (104 t C ha^{-1}, area weighted mean value of input data described in chapter 7.2.2).

7.4.3 Cropland converted to Grassland (5.C.2.2)

The average annual landuse change area from grassland to cropland from 1990–2006 is 26 171 ha. The area in conversion status for a time period of 20 years ranges from 496 412 ha to 494 515 ha between the years 1990 and 2006. Considering the area of the 20 years time period this leads to annual removals from 1 518 to 1 582 Gg CO_2 between 1990–2006.

7.4.3.1 Changes of carbon stock in biomass of cropland converted to grassland

For the current submission the carbon stock of living biomass in cropland was improved by using country specific data from Statistic Austria (STATISTIK AUSTRIA 2007). For all annual crops mentioned in the Statistical Report the harvested yield as well as the yield of straw and leaves (potatoes, beets…) has been considered. The average mean of the yield of the crops have been calculated and weighted by the crop area for a time period of 10 years. That leads to an average carbon stock of living biomass in cropland of 6.25 t C ha^{-1}.

For the calculation of the annual change in carbon stocks of living biomass of cropland converted to grassland the following formula was applied – IPCC GPG (equation 3.3.8).

*Annual change in biomass =annual area of converted land * ($L_{conversion}$ + ΔC_{growth})*

$L_{conversion} = C_{after} - C_{before}$

C_{after} = carbon stock immediately after conversion is 0

ΔC_{growth} = country specific value for grassland 3.10 t C $ha^{-1} yr^{-1}$

C_{before} = country specific value of carbon stock of annual crops before conversion is 6.25 t C $ha^{-1} yr^{-1}$

7.4.3.2 Changes of carbon stock in biomass of perennial cropland converted to grassland

The area in conversion status from perennial cropland converted to grassland for a time period of 20 years ranges from 2 097 ha to 2 656 ha between the year 1990 and 2006. Equation and default values are described in chapter 7.4.3.1.

C_{before}= IPCC default value of carbon stock of perennial crops before conversion is 63 t C $ha^{-1} yr^{-1}$

The data in the CRF table show the sum of biomass carbon stock changes of cropland converted to grassland and perennial cropland converted to grassland. This will be reported more detailed in the next submission.

7.4.3.3 Changes of carbon stock in mineral soil of cropland converted to grassland

The area in conversion status from cropland converted to grassland for a time period of 20 years ranges from 496 412 ha to 494 515 ha between the years 1990 and 2006.

The IPCC Tier 1 method with a four step approach was applied. The calculation steps for determining SOC_0, $SOC_{(0-T)}$ and net soil change per ha of area are as follows:

- Step 1: Selecting Austrian specific values for cropland before conversion →SOC_{O-T}
- Step 2: Selecting Austrian specific values for grassland after conversion → SOC_O
- Step 3: Calculation of average annual carbon stock change for the inventory period of 20 years.
- Step 4: Multiply the annual carbon stock change by the conversion area.

Average annual carbon stock change (t C $ha^{-1} a^{-1}$)= $(SOC_O - SOC_{O-T})/ 20 = 1.0$

SOC_O…… carbon stock in Austrian grassland soils after conversion →70 t C ha^{-1}

SOC_{O-T}….. carbon stock change in Austrian cropland soils before conversion→ 50 t C ha^{-1}

7.4.3.4 Changes of carbon stock in mineral soil of perennial cropland converted to grassland

The area in conversion status from perennial cropland converted to grassland for a time period of 20 years ranges from 2 097 ha to 2 656 ha between the years 1990 and 2006:

Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of perennial cropland. Equation and calculation steps see chapter 7.4.3.3.

$\Delta\ SOC = (SOC_O - SOC_{O\text{-}T})/20 = 0.65\ t\ C\ ha^{-1}\ a^{-1}$

*annual change in carbon stock of mineral soils converted from grassland to perennial cropland = Δ SOC * conversion area*

SOC_O…… carbon stock in Austrian grassland soils after conversion →70t C ha^{-1}

$SOC_{O\text{-}T}$…… carbon stock in Austrian perennial cropland soils before conversion →57 t C ha^{-1}

The data in the CRF table show the sum of soil carbon stock changes of cropland converted to grassland and perennial cropland converted to grassland respectively. This will be reported more detailed in the next submission.

7.4.4 Uncertainty assessment

The following uncertainties were estimated: They are based on uncertainty values for IPCC default values taken from the IPCC GPG, and on expert judgement and literature (GERZABEK et al. 2003):

- grassland area → +/-10%
- converted area: annual cropland to grassland +/- 15%
- perennial cropland to grassland +/- 23%
- country specific data for carbon stock in grassland soils is +/- 9%
- country specific data for carbon stock in perennial cropland soils +/- 15%
- emission factors for biomass carbon stock default values according IPCC (GPG 2003).

The uncertainties of the converted area for the years 2001–2003 are the following:

Table 213:Uncertainties of land area converted to grassland (%).

	2001	2002	2003
Perennial cropland to grassland	91	28	77
Annual cropland to grassland	7	6	6

The total uncertainties estimated by expert judgement are: for conversion from cropland to grassland +/- 30% and from perennial cropland to grassland +/- 120%.

7.4.4.1 Recalculations

The figures of the areas "Land converted to grassland" had been revised for the whole time series in accordance with the IPCC GPG (2003). The area in conversion status is followed and reported for 20 years. Information and data on the area of grassland back to 1970 were taken from the Statistics Austria.

These changes resulted in a decrease of the area of remaining cropland compared to the previous submission (on average 30%) and consequently, had an impact on the figures on the amount of CO_2 removals of the subcategory 5.C.

The value for carbon stock of grassland biomass before conversion was also improved using country specific research values (chapter 7.3.3.1).

In previous submissions, a discount factor for C-stock changes for all land use categories of 0.66 was applied. Based on literature it was assumed that 2/3 of the soil C stock have a discounting time of 20 years (soil C with quick turnover) and 1/3 have a discounting time of centuries (soil C with a slow turnover). Also accounting from lower to higher C stocks due to LUC was estimated with the same factors. However, it was recommended by the ERT team to be consistent with the IPCC GPG and to use the default discounting/accounting time for all LUCs. Therefore, the total C-stock changes are calculated for all land use categories with 20 years without any further discount factor.

7.5 Wetlands 5.D

In this category only emissions/removals from the sub-categories "Land converted to wetland" are considered.

The wetland area from 1990–2006 ranges from is 133 068 ha to 142 575 ha.

Table 214:Activity data of wetland 1990–2006 in ha.

	5 D Total Wetland	1. Wetland remaining Wetland	2. Land converted to Wetland	2.1 Forest Land converted to Wetlands	2.2 Cropland converted to Wetlands	2.3 Grassland converted to Wetlands	2.4 Settlements converted to Wetlands	2.5 Other Land converted to Wetlands
1990	133 068	124 579	8 489	5 790	NO	2 699	NO	–
1991	133 519	123 891	9 628	5 955	NO	3 674	NO	–
1992	133 970	123 203	10 767	6 119	NO	4 648	NO	–
1993	134 422	122 516	11 906	6 283	NO	5 623	NO	–
1994	134 873	122 289	12 584	5 987	NO	6 597	NO	–
1995	135 587	122 307	13 281	5 617	NO	7 664	NO	–
1996	136 302	122 325	13 977	5 247	NO	7 664	NO	1 066
1997	137 016	122 343	14 673	4 877	NO	7 664	NO	2 132
1998	137 731	122 362	15 369	4 507	NO	8 730	NO	2 132
1999	138 445	122 160	16 285	4 357	NO	9 796	NO	2 132
2000	139 160	121 959	17 200	4 206	NO	10 862	NO	2 132
2001	139 874	121 923	17 952	4 055	NO	11 764	NO	2 132
2002	140 589	121 886	18 703	3 904	NO	12 666	NO	2 132
2003	141 303	121 849	19 454	3 754	NO	13 568	NO	2 132
2004	142 018	121 812	20 206	3 637	NO	14 436	NO	2 132
2005	142 245	121 775	20 470	3 520	NO	14 818	NO	2 132
2006	142 575	121 738	20 837	3 403	NO	14 619	NO	2 814

Table 215:Emissions of wetland 1990–2006 in Gg CO_2.

	5 D Total Wetland	1. Wetland remaining Wetland	2. Land converted to Wetland	2.1 Forest Land converted to Wetlands	2.2 Cropland converted to Wetlands	2.3 Grassland converted to Wetlands	2.4 Settlements converted to Wetlands	2.5 Other Land converted to Wetlands
1990	188.67	NE	188.67	144.75	NO	43.93	NO	0.00
1991	204.83	NE	204.83	148.39	NO	56.43	NO	0.00
1992	220.98	NE	220.98	152.04	NO	68.94	NO	0.00
1993	237.13	NE	237.13	155.68	NO	81.45	NO	0.00
1994	243.07	NE	243.07	149.11	NO	93.96	NO	0.00
1995	243.70	NE	243.70	135.19	NO	108.51	NO	0.00
1996	281.84	NE	281.84	126.99	NO	98.35	NO	56.51
1997	287.56	NE	287.56	118.78	NO	98.35	NO	70.43
1998	260.62	NE	260.62	110.57	NO	122.20	NO	27.85
1999	270.96	NE	270.96	107.23	NO	135.88	NO	27.85
2000	281.30	NE	281.30	103.89	NO	149.56	NO	27.85
2001	289.53	NE	289.53	100.55	NO	161.14	NO	27.85
2002	297.77	NE	297.77	97.20	NO	172.71	NO	27.85
2003	306.00	NE	306.00	93.86	NO	184.29	NO	27.85
2004	314.55	NE	314.55	91.27	NO	195.43	NO	27.85
2005	307.34	NE	307.34	88.68	NO	190.81	NO	27.85
2006	337.67	NE	337.67	86.09	NO	187.62	NO	63.96

Methodological Issues

Activity data

The total wetland area was taken from the regional information derived from the Real Estate Database available since 1995 (BEV 2006). The change in the annual water body area was calculated from mean average increase (714 ha) of water bodies from the period 1990–2004. According to methodological changes in the inventory of the regional information derived from the Real Estate Database the real annual reported wetland area was taken since 2005. Due to the fact that the peat areas are protected in most Austrian provinces, it is assumed that there is no further draining of peat land. According to the peat land database of (STEINER & REITER 1992) a constant bog area of 22 239 ha was taken into account for the total reporting period.

The area in conversion status of land converted to wetland for a time period of 20 years ranges from 8 489 ha to 20 837 ha for the period 1990 to 2006.

7.5.1 Forest Land converted to Wetland (5.D.2.1)

The methodology and activity data are described in chapter 7.2.2. The area in conversion status from forest land to wetland for a time period of 20 years ranges from 3 403 ha to 6 283 ha between the years 1990 and 2006 causing annual emission rates due to the loss of biomass and C changes in soils from 86 Gg CO_2 to 156 Gg CO_2.

For the calculation of the annual change of carbon stocks in forest soils converted to wetland soils the IPCC Tier 2 approach is used. Emissions/removals were calculated by country specific values for carbon stocks in soils of forest land (121 t C/ha). Water bodies were estimated with 0 t/ha C-stock, bogs with 150 t C/ha (0–50 cm).

7.5.2 Cropland converted to Wetland (5.D.2.2)

It is assumed by expert judgment that no conversion occurs from cropland to wetland in Austria. The conversion areas are mainly from grassland or other land.

7.5.3 Grassland converted to Wetland (5.D.2.3)

7.5.3.1 Changes in carbon stocks in biomass of grassland converted to wetland

For the calculation of the annual change in carbon stocks of living biomass in grassland converted to wetland the following formula was applied – IPCC TIER 1 (equation 3.5.6 GPG)

Annual change in carbon stocks of living biomass in land converted to wetland (tones $C.y^{-1}$):

$$\Delta C_{LW\ flood} = (Sum\ A_i*(B_{after}-B_{before})$$

Ai = area of land converted annually to flooded land from original land use, ha

B_{before} = living biomass in land immediately before conversion to wetland = for grassland 2.6 t C $ha.y^{-1}$

B_{after} = living biomass in land immediately after conversion to wetland (default = 0 t C $ha.y^{-1}$)

7.5.3.2 Changes in carbon stocks in soil of grassland converted to wetland

The area in conversion status from grassland to wetland for a time period of 20 years showed an increase and ranges from 2 699 ha and 14 619 ha between 1990 and 2006.

Calculation:

$$\Delta C_{LW\ flood} = (Sum\ A_i*(B_{after}-B_{before})/20$$

Ai = area of land converted annually to flooded land from original land use, ha

B_{before} = carbon stock in soil immediately before conversion to wetland = for grassland 70 t C $ha.y^{-1}$

B_{after} = carbon stock in soil immediately after conversion to wetland (default = 0 t C $ha.y^{-1}$)

7.5.4 Settlement converted to Wetland (5.D.2.4)

By expert judgment it is assumed that in Austria no conversion from settlement to wetland occurs.

7.5.5 Other Land converted to Wetland (5.D.2.5)

The area in conversion status from other land to wetland for a time period of 20 years ranges from 1 066 ha to 2 814 ha for the period 1990 to 2006.

7.5.5.1 Changes in carbon stocks in biomass of other land converted to wetland

For the calculation of the annual change in carbon stocks of living biomass in other land converted to wetland the following formula was applied – IPCC Tier 1 (equation 3.5.6 GPG).

Annual change in carbon stocks of living biomass in land converted to wetland (tons $C.y^{-1}$):

$\Delta C_{LW\ flood} = (Sum\ A_i*(B_{after} - B_{before})$

A_i = area of land converted annually to flooded land from original land use, ha

B_{before} = living biomass in land immediately before conversion to wetland = for other land 10.89 t C $ha.y^{-1}$ see chapter 7.7

B_{after} = living biomass in land immediately after conversion to wetland (default = 0 t C $ha.y^{-1}$)

7.5.5.2 Changes in carbon stocks in soil of other land converted to wetland

Calculation:

$\Delta C_{LW\ flood} = (Sum\ A_i*(B_{after} - B_{before})/20$

A_i = area of land converted annually to flooded land from original land use, ha

B_{before} = carbon stock in soil immediately before conversion to wetland = for other land 71.24 t $C.ha.y^{-1}$ see chapter 7.7

B_{after} = carbon stock in soil immediately after conversion to wetland (default=0)

7.5.6 Uncertainty assessment

According to a first rough expert judgement, the uncertainty of this subcategory is -90 to +50% (expert judgement). This high uncertainty is mainly due to the unknown processes for the soil C stock after conversion.

7.5.7 Recalculations

The figures of the areas "Land converted to wetland" had been revised for the whole time series. In accordance with the IPCC GPG (2003) the area in conversion status is followed and reported for 20 years. Information and data on the area of wetland back to 1970 were taken from the Real Estate Database.

7.6 Settlements (5.E)

In this category only emissions/removals from the sub-categories "Land converted to settlement" are considered.

About 0.49 Mio ha of Austria's surface can be allocated to the IPCC land use category "Settlement" (BEV 2007). The area in conversion status from "Land converted to Settlement" for a time period of 20 years ranges from 312 568 ha to 483 955 ha between the years 1990 and 2006 causing annual removal rates due to C stock changes of biomass and soils from 74 Gg CO_2 to 433 Gg CO_2.

Methodological Issues

Activity data

The basis for the area that can be allocated to this land use category is the regional information derived from the real estate database (BEV 2007). The total settlement area comprises the following sub-categories: building land – sealed, partly sealed and unsealed area; parks and gardens; road, railway, track and excavation area and other, not further differentiated settlement area. For the years before 1980 data were extrapolated following a mean annual increase/decrease between the years 1980–1990.

The real estate database is updated in case of occasion; therefore a mean annual increase of the settlement area was calculated for the years 1970–1980 with 6 610 $ha.a^{-1}$, for the years 1981–2002 with 7 036 $ha.a^{-1}$, for the years 2003–2005 with 6 898 $ha.a^{-1}$. For the following years, so for 2006, the yearly reported data from the regional information are taken into consideration.

Obviously, the annual increase of settlement area results in a decrease of other land use categories. Therefore, the following criteria were set up to allocate to the categories of land use changes:

- Land use changes from forests are based on the statistical results of the NFI.
- Further increases of the settlement area were considered to come to the same relative parts from agricultural land and grassland.
- In cases where the changes from forest land and the decreases of cropland and grassland did not cover the increases of the settlement area, the remaining parts were taken from "Other land".

In compliance with this method the following land use changes to settlement area were derived for the period 1990 to 2006.

Table 216:Derived land use changes to settlements for the period 1990 to 2006 in ha.

	2.1 Forest land converted to settlement	2.2 Cropland converted to settlement	2.3 Grassland converted to settlement	2.4 Wetlands converted to settlements	2.5 Other land converted to settlements
1990	28 951	38 113	106 661	NO	16 858
1991	29 773	38 113	102 561	NO	22 157
1992	30 594	44 218	97 656	NO	22 157
1993	31 416	45 279	97 795	NO	22 157
1994	29 934	45 279	90 187	NO	28 646
1995	28 085	49 923	84 106	NO	28 646
1996	26 235	50 296	74 949	NO	35 994
1997	24 386	48 094	67 995	NO	43 715
1998	22 536	48 094	65 517	NO	44 755
1999	21 783	49 367	63 910	NO	44 755
2000	21 029	53 642	59 302	NO	44 755
2001	20 276	51 894	60 290	NO	44 755
2002	19 522	52 170	59 255	NO	44 755
2003	18 769	44 958	65 569	NO	44 755
2004	18 185	46 257	69 299	NO	39 768
2005	17 601	46 257	66 747	NO	42 364
2006	17 017	39 848	65 617	NO	48 809

Table 217:Emissions/removals from land use changes to settlement for the period 1990 to 2006 in Gg CO_2.

	2 Land converted to settlement	2.1 Forest land converted to settlement	2.2 Cropland converted to settlement	2.3 Grassland converted to settlement	2.4 Wetlands converted to settlements	2.5 Other land converted to settlements
1990	-160	486	-144	-435	NO	-67
1991	-82	498	-300	-404	NO	124
1992	-178	509	-208	-391	NO	-88
1993	-164	521	-196	-400	NO	-88
1994	-74	500	-356	-363	NO	146
1995	-251	445	-240	-343	NO	-114
1996	-281	420	-240	-376	NO	-85
1997	-134	394	-378	-285	NO	135
1998	-357	368	-378	-211	NO	-136
1999	-315	357	-238	-257	NO	-178
2000	-370	347	-324	-216	NO	-178
2001	-421	336	-395	-185	NO	-178
2002	-433	326	-404	-178	NO	-178
2003	-418	315	-353	-203	NO	-178
2004	-415	307	-334	-231	NO	-158
2005	-210	299	-364	-280	NO	135
2006	-234	291	-313	-275	NO	64

Calculation of the emissions

Biomass

Estimates about living biomass in settlement areas were based on the results of a scientific study carried out in Vienna (DÖRFLINGER et al. 1995). In this study the total living biomass was calculated for different ecological sub-systems in Vienna. For the reporting to this sector biomass data from the sub systems gardens, urban industrial areas and brown fields were taken into consideration. Based on the biomass data of trees, shrubs and ground vegetation an average biomass per ha settlement area was calculated. An average rotation period of 60 years for trees and 10 years for shrubs was defined by expert judgement to derive an average annual biomass increment. The biomass of ground vegetation is calculated as yearly C-pool.

The following stocks (t C ha^{-1}) and average annual increments (t C $ha^{-1}a^{-1}$) of biomass were calculated:

t C ha^{-1}				t C ha^{-1} a^{-1}			
trees	**shrubs**	**ground veg.**	**total**	**trees**	**shrubs**	**ground veg.**	**total**
31.4	1.2	1.5	34.1	0.52	0.12	1.5	2.14

Soil

For the calculation of the annual changes of carbon stocks in soils converted to settlement the IPCC approach of 20 years discounting of soil C stock changes is used in combination with country specific soil data.

The calculations of emissions from soils due to land use changes from forests to settlements are based on country specific values for carbon stocks in soils of forest land (121 t C ha^{-1}) and carbon stocks in mineral soils of settlement land (32 t C ha^{-1}, area weighted mean value of input data described in chapter 7.2.2). These C stocks refer to a soil depth of 0–50 cm.

For the calculation of emissions from soil C stocks changes due to land use changes from the other IPCC land use categories the following values were used (0–30 cm soil depth).

- Cropland: 50 t ha^{-1}
- Grassland: 70 t ha^{-1}
- Wetlands: 0 t ha^{-1}
- Other land: 71 t ha^{-1}

Uncertainty assessment

According to a first estimate based on expert judgement, the uncertainty of this category is ±70%.

7.6.1 Forest Land converted to Settlement (5.E.2.1)

The methodology and activity data are described in chapter 7.2.2. The area in conversion status from Forest Land to Settlement for a time period of 20 years ranges from 17 017 ha to 31 416 ha between the years 1990 and 2006 causing annual emission rates due to the loss of biomass and C changes in soils from 291 Gg CO_2 to 521 Gg CO_2.

For the calculation of the annual change of carbon stocks in forest soils converted to soils of settlements the IPCC Tier 2 approach is used. Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of forest land (121 t C ha^{-1}) and settlement areas (32 t C ha^{-1}, area weighted mean value of input data described in chapter 7.2.2).

7.6.2 Cropland converted to Settlement (5.E.2.2)

The area in conversion status from cropland to settlement for a time period of 20 years ranges from 38 113 to 53 642 ha in the years 1990–2006.

7.6.2.1 Changes in carbon stocks in biomass of cropland converted to settlement

For the calculation of the annual change in carbon stocks of living biomass in cropland converted to settlement the IPCC Tier 2 approach is used.

The annual removal rates due to increase of biomass on settlement area ranges from 144 to 404 Gg CO_2 in the years 1990 to 2006.

7.6.2.2 Changes in carbon stocks in soil of cropland converted to settlement

By expert judgement the carbon stocks on unsealed areas of settlement is estimated to be as high as in grassland soils (70 t ha^{-1}). Carbon stocks of sealed areas are set 0. Based on calcuations of the regional information derived from the real estate database national 2/3 of the settlement area is unsealed. That results in a carbon stock in soil for settlement area of 50 t ha^{-1} (= 2/3 * 70 t ha^{-1}) on average. The estimates for soil carbon stocks in cropland are also about 50 t ha^{-1}.

Consequently, no emissions or removals result from carbon stock changes in soils due to land use conversion from cropland to settlement.

7.6.3 Grassland converted to Settlement (5.E.2.3)

The area in conversion status from grassland to settlement for a time period of 20 years ranges from 59 255 to 106 661 ha in the years 1990–2006.

7.6.3.1 Changes in carbon stocks in biomass of grassland converted to settlement

For the calculation of the annual change in carbon stocks of living biomass in grassland converted to settlement the IPCC Tier 2 approach is used.

The annual removal rates due to increase of biomass on settlement area ranges from 395 to 827 Gg CO_2 in the years 1990–2006.

7.6.3.2 Changes in carbon stocks in soil of grassland converted to settlement

For the calculation of the annual change in carbon stocks of soils in grassland converted to settlement the IPCC Tier 2 approach is used.

The annual emission rates due to loss of soil carbon in soils ranges from 217 to 391 Gg CO_2 in the years 1990–2006.

7.6.4 Wetland converted to Settlement (5.E.2.4)

It is assumed by expert judgment that in Austria no conversion from wetland to settlement occurred in the years 1990–2006. This assumption is underpinned by law that protects most of the remaining natural wetlands in Austria as natural reservation area.

7.6.5 Other land converted to Settlement (5.E.2.5)

The area in conversion status from other land to settlement for a time period of 20 years ranges from 16 858 to 48 809 ha in the years 1990–2006.

7.6.5.1 Changes in carbon stocks in biomass of other land converted to settlement

For the calculation of the annual change in carbon stocks of living biomass in grassland converted to settlement the IPCC Tier 2 approach is used.

The annual removal/emission rates due to increase of biomass on settlement area ranges from -352 to 37 Gg CO_2 in the years 1990–2006.

7.6.5.2 Changes in carbon stocks in soil of other land converted to settlement

For the calculation of the annual change in carbon stocks of soils in grassland converted to settlement the IPCC Tier 2 approach is used.

The annual emission rates due to loss of soil carbon in soils ranges from 66 and 190 Gg CO_2 in the years 1990–2006.

7.6.6 Recalculations

The figures of the areas "Land converted to settlements" have been revised for the whole time series. In accordance with the IPCC GPG (2003) the area in conversion status is followed and reported for 20 years. Consequently, this resulted in higher figures for carbon stock changes (increases) in living biomass. Due to these changes and the fact that the subcategory "Settlement remaining settlement" needs not to be reported the subcategory 5.E.2 "Land converted to Settlement" has changed to a minor net carbon sink.

In previous submissions a discount factor for C-stock changes for all land use categories of 0.66 was applied. Based on literature it was assumed that 2/3 of the soil C stock have a discounting time of 20 years (soil C with quick turnover) and 1/3 have a discounting time of centuries (soil C with a slow turnover). Also accounting from lower to higher C stocks due to LUC was estimated with the same factors. However, it was recommended by the ERT team to be consistant with the IPCC GPG and to use a default discounting/accounting time for all LUCs. Therefore, the total C-stock changes are calculated for all land use categories using a discount time of 20 years.

7.7 Other Land 5.F

The soil carbon content and the biomass carbon content of other land were estimated by using data compiled in (KÖRNER et al. 1993) who estimated the C stock of the Austrian landscape.

Methodological Issues

Biomass

Estimations of living biomass in other land areas were based on the results of a study carried out by KÖRNER et al. (1993).

This study gives an overview of the constitution (mixture) of "other land" area. The study provides also information about the carbon stock of living biomass as well as about the soil carbon stock of the different plant societies and land use.

Table 218:Carbon content of living biomass and soil of other land.

	ha	biomass t C ha^{-1}	soil t C ha^{-1}
glacier, bolder	**109 200**	0	0
unproductive area	**168 900**		
alpine Urweiden	56 300	8.2	99.6
Schutt-Felsvegetation	56 300	0.4	13.3
Schneetälchengesellschaften	18 000	0.9	14.3
Spalierstrauch	18 800	7.6	83.6
Kahlflächen	18 700	0	0
abandoned alpine meadows	**243 200**	20.7	119

According to the share of the different land use areas (glaciers, unproductive area, abandoned alpine meadows) in the category other land a weighted mean for living biomass was calculated. The estimated amount for biomass is 10.89 t C per ha.

Soil

Estimates for the soil carbon stock in other land areas were also based on the results of a study carried out by KÖRNER et al. (1993).

According to the share of the different areas (glaciers, unproductive area, abandoned alpine meadows) in the category other land a weighted mean for the soil carbon stock of 71.24 t C per ha was calculated.

7.7.1 Forest Land converted to Other Land (5.F.2.1)

The methodology and activity data are described in chapter 7.2.2. The area in conversion status from Forest Land to Other land for a time period of 20 years ranges from 27 228 ha to 50 266 ha in the years 1990 to 2006 causing annual emission rates due to the loss of biomass and C changes in soils from 484 Gg CO_2 to 868 Gg CO_2.

For the calculation of the annual change of carbon stocks in forest soils converted to soils of other land the IPCC Tier 2 approach is used. Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of forest land (121 t C ha^{-1}) and other land (41 t C ha^{-1}, area weighted mean value of input data described in chapter 7.2.2).

7.8 QA/QC, Verification

The calculations of the data for category 5 are embedded in the overall QA/QC-system of the Austrian GHG inventory (see Chapter 1.6).

Important elements of QA/QC:

✓ Are the correct values used (check for transcription errors, …)?
✓ Check of plausibility of input data (time-series, order of magnitude, …)
✓ Is the data set complete for the whole time series?
✓ Check of calculations, units, ...
✓ Check of plausibility of results (time-series, order of magnitude, …)
✓ Correct transformation/transcription into CRF
✓ Where possible data is checked with data from other sources, order of magnitude checks, …
✓ Are all references clearly made?
✓ Are all assumptions documented?

7.9 Planned improvements

There is a steady re-evaluation and substitution of the used input parameters and the applied methods.

The following issues will be considered for the following submissions:

- Update of the estimates on the uncertainties of sector 5
- Improvement of the values for biomass C-stocks in viticulture and horticulture
- Model based approach for C-stock changes in soil for sector 5A1
- The data in CRF table 5.B represent the sum of grassland to annual cropland and grassland to perennial cropland. A subdivision will be included in the next submission.
- The data in CRF table 5.C show the sum of biomass carbon stock changes of cropland converted to grassland and perennial cropland converted to grassland. A subdivision will be included in the next submission.
- The data in the CRF table 5.C show the sum of soil carbon stock changes of cropland converted to grassland and perennial cropland converted to grassland respectively. A subdivision will be included in the next submission.

8 WASTE (CRF SECTOR 6)

8.1 Sector Overview

This chapter includes information on methods for estimating greenhouse gas emissions as well as references of activity data and emission factors concerning waste management and treatment activities reported under IPCC Category *6 Waste*.

The emissions addressed in this chapter include emissions from the IPCC categories 6 A Solid Waste Disposal on Land, 6 B Wastewater Handling, 6 C Waste Incineration and 6 D Other Waste (Compost Production).

Waste management and treatment activities are sources of methane (CH_4), carbon dioxide (CO_2) and nitrous oxide (N_2O) emissions.

8.1.1 Emission Trend

Overall greenhouse gas emissions from waste management and treatment activities during the year 2006 amounted to 2 197 Gg CO_2 equivalent (1990: 3 648). These are about 2.4% of total greenhouse gas emissions in Austria in 2006 and 4.6% in the base year. In 2006, greenhouse gas emissions from the waste sector were 39.8% below the level of the base year. Figure 26 presents the trend of GHG emissions from IPCC sector 6 Waste for the time period 1990 to 2006.

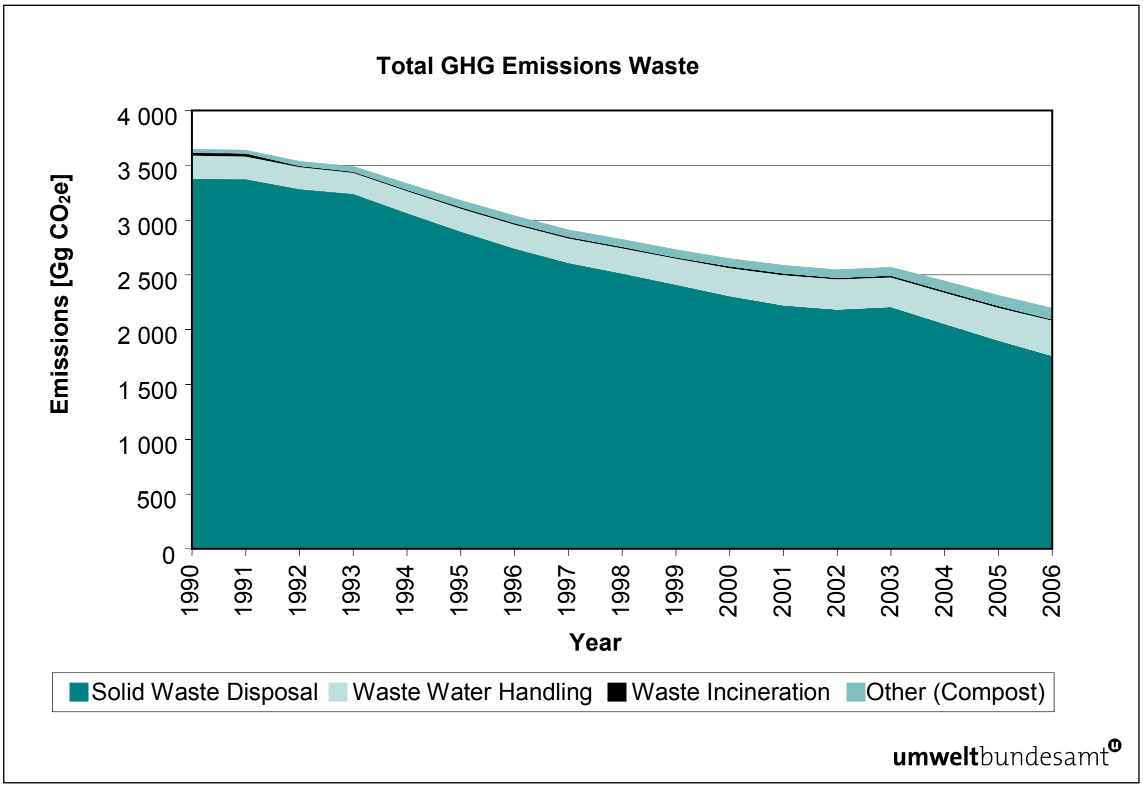

Figure 26: GHG emissions from IPPC Sector 6 Waste 1990–2006.

Table 219 presents the emission trend by GHG. The major greenhouse gas emissions from this sector are CH_4 emissions, which represent 83.5% of all emissions from this sector in 2006 followed by N_2O (15.9%) and CO_2 (0.6%).

CH_4 emissions

CH_4 emissions originate from all subcategories within the sector but the largest source is *Solid Waste Disposal on Land*, it contributes 95.9% of total CH_4 emissions from this sector.

The decrease of CH_4 emissions is a result of waste management policies. The amount of land filled waste and the implemented methane recovery systems have increased during the period, all influencing the amount of methane emitted.

N_2O emissions

N_2O emissions from the waste sector have remarkably increased over the considered period (see Table 219). In 2006, N_2O emissions from the Waste sector amounted to 350 Gg CO_2 equivalent. This was 165% above the level of the base year.

N_2O emissions mainly arise by about 80% from the category *Waste Water Handling* and by about 20% from *Other Waste (Compost production)*. In both categories emissions are increasing, while *Waste Incineration* (*Municipal Solid Waste* and *Waste Oil*) is a minor source of N_2O emissions.

CO_2 emissions

CO_2 emissions of the sector Waste decreased (see Table 219). In 2006, CO_2 emissions from this sector amounted to 12.3 Gg CO_2 equivalent, this was 54.4% below the level of the base year.

CO_2 emissions originate from *Waste Incineration* (*Municipal Solid Waste, Waste Oil and Hospital Waste*). The only plant incinerating municipal waste without energy recovery was shut down in 1991, which resulted in a drop of CO_2 emissions from 1991–1992.

Table 219:Emissions of greenhouse gases and their trend from 1990–2006 from category 6 Waste.

	CO_2 [Gg CO_2 e]	CH_4 [Gg CO_2 e]	N_2O [Gg CO_2 e]	Total [Gg CO_2 e]
1990	26.89	3 489.40	132.07	3 648.36
1991	23.40	3 483.03	132.60	3 639.02
1992	10.86	3 394.13	131.14	3 536.13
1993	10.60	3 348.71	133.16	3 492.46
1994	10.65	3 173.77	152.00	3 336.42
1995	10.97	3 003.78	168.29	3 183.04
1996	11.30	2 841.69	186.27	3 039.25
1997	11.62	2 704.30	195.41	2 911.33
1998	11.94	2 602.20	210.04	2 824.18
1999	12.26	2 493.00	227.48	2 732.74
2000	12.26	2 384.96	253.56	2 650.78
2001	12.26	2 295.16	281.68	2 589.10
2002	12.26	2 254.03	283.93	2 550.22

	CO_2 [Gg CO_2 e]	CH_4 [Gg CO_2 e]	N_2O [Gg CO_2 e]	Total [Gg CO_2 e]
2003	12.26	2 274.14	285.60	2 572.01
2004	12.26	2 122.34	312.33	2 446.93
2005	12.26	1 971.99	333.36	2 317.61
2006	12.26	1 835.26	349.52	2 197.05
Trend 1990–2006	*-54.39%*	*-47.40%*	*164.64%*	*-39.78%*

Emission trends by sources

Table 220 presents the greenhouse gas emissions for the different subcategories within the IPCC *Category 6 Waste*. As can be seen the dominant sub-category in the sector *6 Waste* is *6 A Solid Waste Disposal on Land*. In 2006, *Solid Waste Disposal on Land* contributed 80.1% to total greenhouse gas emissions of sector *Waste*.

Table 220: Total greenhouse gas emissions and trend from 1990–2006 by subcategories of Category 6 Waste.

CO_2 equivalent [Gg]	6 A	6 B	6 C	6 D	Total
1990	3 376.63	210.29	27.09	34.36	3 648.36
1991	3 369.98	209.46	23.58	36.00	3 639.02
1992	3 281.66	200.88	10.91	42.69	3 536.13
1993	3 235.80	192.82	10.64	53.20	3 492.46
1994	3 061.09	201.51	10.69	63.12	3 336.42
1995	2 893.60	211.73	11.01	66.70	3 183.04
1996	2 737.51	220.53	11.33	69.87	3 039.25
1997	2 607.54	223.29	11.66	68.84	2 911.33
1998	2 511.77	229.15	11.98	71.28	2 824.18
1999	2 406.74	238.76	12.30	74.93	2 732.74
2000	2 303.32	258.12	12.30	77.03	2 650.78
2001	2 218.07	279.55	12.30	79.17	2 589.10
2002	2 181.23	275.18	12.30	81.51	2 550.22
2003	2 205.90	270.53	12.30	83.28	2 572.01
2004	2 049.35	287.03	12.30	98.25	2 446.93
2005	1 896.61	303.46	12.30	105.23	2 317.61
2006	1 759.56	319.71	12.30	105.47	2 197.05
Trend 1990–2006	*-47.89%*	*52.04%*	*-54.57%*	*206.97%*	*-39.78%*

8.1.2 Key Categories

The methodology and results of the key category analysis is presented in 1.5. Table 221 summarizes the key categories in the IPCC Sector *6 Waste*.

Table 221:Key sources of Category 6 Waste.

IPCC Category	Source Categories	Key Sources	
		GHG	KS-Assessment
6.A	Managed Waste disposal on Land	CH_4	LA90-LA06 ; TA
6.B	Wastewater Handling	N_2O	TA

LA00 = Level Assessment 2000

TA = Trend Assessment BY–2006

In the base year, 4.4% of total greenhouse gas emissions originated from the 2 key categories of the waste sector compared to 2.2% in 2006. The key categories cover 93% of total GHG emissions from sector waste in 2006.

8.1.3 Methodology

Detailed information on the methodology can be found in the corresponding subchapters.

8.1.4 Uncertainty Assessment

In this submission uncertainty estimates based on expert judgement by Umweltbundesamt and according to WINIWARTER (2008) for the sub-categories *Solid Waste Disposal on Land* and *Wastewater Handling* are provided (see respective subchapter).

8.1.5 Recalculations

Recalculations have been made for the subcategories *6.A.1 Managed Waste Disposal on Land (*see (Table 231), for 6 B *Wastewater Handling* (see Table 234) and *6.D Other Waste* (compost) (see Table 242). For further information please refer to the respective subchapters.

8.1.6 Completeness

Table 222 gives an overview of the IPCC categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this sub-category have been estimated.

Table 222:Overview of subcategories of Category Waste: transformation into SNAP Codes and status of estimation.

IPCC Category	SNAP	CO_2	CH_4	N_2O
6 A SOLID WASTE DISPOSAL ON LAND				
6 A 1 Managed Waste Disposal	090401 Solid Waste Disposal on Land	NA	✓	NA
6 A 2 Unmanaged Waste Disposal	090402 Unmanaged Waste Disposal	NO	NO	NO
6 B WASTEWATER HANDLING				
6 B 1 Industrial Wastewater	091001 Wastewater treatment in industry	NA	NA	✓
6 B 2 Domestic and Commercial Wastewater	091002 Wastewater treatment in residential/commercial sect.	NA	✓	✓

IPCC Category	SNAP	CO_2	CH_4	N_2O
6 C WASTE INCINERATION				
	090201 Incineration of domestic or municipal waste	✓	✓	✓
	090207 Incineration of hospital wastes	✓	✓	✓
	090208 Incineration of waste oil	✓	NA	✓
6 D OTHER WASTE				
	091003 Sludge spreading	IE	IE	IE
	091005 Compost production	NA	✓	✓

In Austria all waste disposal sites are managed sites (also see Chapter 8.2.1.1); Sludge spreading is included in category 4.D.1.

8.2 Waste Disposal on Land (CRF Source Category 6.A)

8.2.1 Managed Waste Disposal on Land (CRF Source Category 6.A.1)

8.2.1.1 Source Category Description

Key Source: Yes

Emissions: CH_4

In Austria all waste disposal sites are managed sites (landfills).

In the year 2006 about 402 landfill sites received waste (see Table 223), whereas mainly the landfills for mass waste and residual waste are sources of CH_4 emissions. Landfills for excavated soil and construction waste serve for the depositing of excavated soil, construction waste, waste concrete and road-construction waste and are not relevant for GHG emissions. In comparison to last year the total number of landfills and also the number of each landfill type decreased.

Table 223:Number and type of landfill sites.

Landfills for	2002	2003	2004	2005	2006
mass waste	61	62	58	50	47
residual waste/treated waste	18	23	30	27	18
construction-waste	64	63	124	74	58
excavated-soil	108	211	454	340	279

The amount of deposited waste is taken into account from 1950 on. From 1950 to 1990 a steady increase occurred with a peak at 1989, which is due to the introduction of disposal fees. This fee originates from an Austrian Law for cleaning up contaminated sites with the objective to finance cleaning up and securing activities for contaminated site. As long as disposal fees were low, high amounts were deposited, which was the case in 1989. From 1990 to 1994 amounts of deposited waste decreased, as waste management was regulated by an own law – the Austrian

Waste Management Law[56] (1990). Due to this, waste separation and reuse and recycling activities respectively, increased. The potential of waste prevention and waste recycling was exhausted after 1994, so amounts of deposited waste did not decrease any further. The amount of deposited waste peaked in 2003, probably because from beginning of 2004 only pre-treated or harmless waste can be deposited (see Landfill Ordinance[57]).

The strong decrease after 2003 is due to the taking effect of the Landfill Ordinance, which only allows the disposal of treated waste and therefore leads to reduced waste volumes and masses, as well as decreased carbon content in deposited waste.

Table 224 presents CH_4 emissions from managed waste disposal on land as well as activity data of "Residual Waste" and "Non Residual Waste" for the period 1990–2006.

Table 224:Activity data for "*Residual Waste" and "Non Residual Waste"*, greenhouse gas emissions and implied emission factors *1990–2006.*

Year	Non Residual Waste [Mg/a]	Residual Waste [Mg/a]	Total Waste [Mg/a]	CH_4 Emissions [Mg]	IEF CH_4 [kg/Mg]
1990	664 536	1 995 747	2 660 283	160 792	60.4
1991	677 827	1 799 718	2 477 545	160 475	64.8
1992	691 383	1 614 157	2 305 541	156 269	67.8
1993	705 211	1 644 718	2 349 929	154 086	65.6
1994	719 315	1 142 067	1 861 382	145 766	78.3
1995	733 702	1 049 709	1 783 410	137 790	77.3
1996	748 376	1 124 169	1 872 545	130 358	69.6
1997	763 343	1 082 634	1 845 977	124 168	67.3
1998	778 610	1 081 114	1 859 724	119 608	64.3
1999	841 169	1 084 625	1 925 794	114 607	59.5
2000	843 780	1 052 061	1 895 841	109 682	57.9
2001	795 262	1 065 592	1 860 854	105 622	56.8
2002	812 080	1 174 543	1 986 623	103 868	52.3
2003	899 563	1 385 944	2 285 507	105 043	46.0
2004	356 973	282 656	639 629	97 588	152.6
2005	340 676	241 733	582 409	90 315	155.1
2006	345 406	251 112	596 519	83 789	140.5

[56] Abfallwirtschaftsgesetz 2002, BGBl. I Nr. 102/2002
[57] Verordnung über die Ablagerung von Abfällen (Deponieverordnung) BGBl. Nr. 164/1996 in der Fassung BGBl. II Nr. 49/2004

8.2.1.2 Methodological Issues

IPCC Tier 2 method is applied.

Until submission 2006, country specific methodologies were used (BAUMELER et al. 1998). In 2005 a national study (SCHACHERMAYER 2005) which showed that the IPCC tier 2 method is more appropriate and accurate. The change to IPCC tier 2 was also approved by the ERT during the in-country review of the initial report of Austria (February 2007).

Activity data – Residual waste

"Residual waste" corresponds to waste from households and similar establishments after separate collection directly deposited at landfills without any treatment. It originates from private households, administrative facilities of commerce, industry and public administration, kindergartens, schools, hospitals, small enterprises, agriculture, market places and other generation points covered by the municipal waste collecting system.

Only 7.7% of residual waste was deposited in 2004. The remaining part was recycled, incinerated or treated biologically. According to the recent federal waste management plans 2001 and 2006 recycling and treatment of waste from households and similar establishments was performed according to the following routes in 1989 and 2004 respectively:

Table 225:Recycling and treatment of waste from households and similar establishments (BUNDESABFALLWIRTSCHAFTSPLAN 2006).

Treatment	1989	2004
mechanical-biological treatment	16.7%	11.2%
thermal treatment (incineration)	5.9%	28.3%
treatment in plants for hazardous waste	0.4%	1.2%
recycling	12.9%	35.6%
recycling (biogenous waste)	1.0%	16.0%
direct deposition at landfills ("residual waste")	63.1%	7.7%

The quantities of "residual waste"

- From 1998 to 2006 data were taken from the database for solid waste disposals "Deponiedatenbank" ("Austrian landfill database"). According to the Landfill Ordinance[58], which came into force in 1997, the operators of landfill sites have to report how much and what kind of waste they receive at their landfill site annually to the *Umweltbundesamt,* where the data are stored in the database for solid waste disposals.
- From 1950 to 1997 data were calculated based on national studies (HACKL & MAUSCHITZ 1999, HÄUSLER 2001) and the respective Federal Waste Management Plans (BUNDESABFALLWIRTSCHAFTPLAN 1995, 2001).

However in the federal waste management plan and the national study (HACKL & MAUSCHITZ 1999) the amount of residual waste from administrative facilities of businesses and industries is not considered (data from 1960 to 1999) whereas it is reported by the operators of landfill sites from 1998 on and included in the "Deponiedatenbank". Thus to achieve a consistent time series

[58] Deponieverordnung, Federal Gazette BGBl. Nr 164/1996

the two overlapping years (1998 and 1999) were examined and the difference which represents the residual waste from administrative facilities of industries and businesses calculated. This difference was then applied to the years 1960 to 1997 according to the relative known change in data from residual waste from households. The amount of deposited Waste for 1950–1959 has been estimated for the first time in (HÄUSLER 2001).

Activity data – Non Residual Waste

"Non Residual Waste" is directly deposited waste other than residual waste but with biodegradable lots. Non Residual Waste comprises for example:

- bulky waste
- construction waste
- mixed industrial waste
- road sweepings
- sewage sludge
- rakings
- residual matter from waste treatment

The quantities of "non residual waste" from 1998 to 2006 were taken from the database for solid waste disposals "Deponiedatenbank" ("Austrian landfill database"), whereas only the amount of waste with biodegradable lots was considered. Table 226 presents a summary of all considered waste types and the corresponding identification numbers. For calculating the emissions of residual waste the waste types were aggregated to the categories wood, paper, sludge, other waste, bio waste, textiles, construction waste and fats.

There are no data available for the years before 1998. Thus extrapolation was done using the Austrian GDP (gross domestic product) per inhabitant (KAUSEL 1998) as indicator using a 20 year average value in order to get a more robust estimate.

Table 226:Considered types of waste.

Waste Identification No	Type of Waste	Waste Identification No	Type of Waste
200301	mixed municipal waste ("residual waste")	170204	Glass, plastic and wood containing or contaminated with dangerous substances
303	wastes from pulp. paper and cardboard production and processing	170903	other construction and demolition wastes (including mixed wastes) containing dangerous substances
1905	wastes from aerobic treatment of solid waste	170904	mixed construction and demolition waste
1908	wastes from wastewater treatment plants not otherwise specified	190805	sludge from treatment of urban wastewater
1909	wastes from the preparation of water intended for human consumption or water for industrial use	190809	grease and oil mixture from oil/water separation containing only edible oil and fats

Waste Identification No	Type of Waste	Waste Identification No	Type of Waste
1912	wastes from the mechanical treatment of waste (for example sorting. crushing. compacting. pelletising) not otherwise specified	200101/200102	paper and cardboard
20303	waste from solvent extraction	200108	biodegradable kitchen and canteen waste
30105	sawdust. shavings. cuttings. wood. particle board and veneer	200111	textiles
30304	de-inking sludge from paper recycling	200201	Bio-degradable wastes
30307	mechanically separated rejects from pulping of waste paper and cardboard	200302	waste from markets
30310	fibre rejects. fibre-. filler-. and coating sludge from mechanical separation	200307	bulky waste
40106	sludge. in particular from on-site effluent treatment containing chromium	190811–14	sludge from treatment of industrial wastewater
40109	waste from dressing and finishing	20 01 25	edible oil and fat
40221	wastes from unprocessed textile fibres	170201	wood
150103	wooden packaging	303	wastes from pulp. paper and cardboard production and processing

Methodology

Where available, country specific parameters are used and checked if they are in the proposed range of the IPCC guidelines. If country specific parameters were not available IPCC default values are taken. Table 227 summarises the parameters used plus the corresponding references.

Table 227:Parameters for Calculating CH_4 emissions of SWDS.

Waste category/ Parameters	residual waste	wood	paper	sludges	bulky waste and other waste	Bio-waste	textiles	Construct. waste	fats
Methane correction factor	1								
	IPCC default for managed SWDS								
Fraction of degradable organic carbon dissimilated DOC_F	0.6	0.5	0.55	0.77	0.55	0.77	0.55	0.55	0.77
	The DOC_F for residual waste reflects the recent increase of biogenic components (see Table 228). IPCC default taking into account national waste expertises.								
DOC	See Table 229	0.45	0.3	0.11	0.16	0.16	0.5	0.09	0.2
	(HACKL & MAUSCHITZ 1999) (ROLLAND & SCHEIBENGRAF 2003) (BUNDESABFALLWIRTSCHAFTSPLAN 2006)	(BAUMELER et al. 1998)							
Half life period	7	25	15	7	20	10	15	20	4
	National waste experts	(GILBERG et al. 2005)	(GILBERG et al. 2005)	Assumption: same as residual waste	IPCC default slow decay	Assumption: same as paper	Assumption: same as paper	IPCC default slow decay	(GILBERG et al. 2005)
Number of considered years	57 IPCC default including data for 3 to 5 half lives								
Fraction of CH_4 in Landfill Gas	0.55 Mean value cited in the literature, also within the IPCC range.								
Methane Oxidation in the upper layer	10% IPCC default								
Landfill gas recovery	See Figure 27 (ROLLAND & OLIVA 2004)								

Biodegradable organic carbon (DOC) of residual waste

The decrease during the 1990ies in DOC-content was due to the introduction of separate collection of bioorganic waste and paper waste. The amount of bio-waste that is collected separately increased over the time, while the organic share in residual waste decreased. This resulted in a change of waste composition with the effect of a decreasing DOC content. Since 2000 biogenic components in residual waste are increasing again, which is due to a decrease in home composting; depending on the public awareness this biogenic waste is either collected separately or is part of the residual waste. Furthermore evaluation of waste composition in 2004 is based on a very detailed analysis in contrast to the evaluation of 1999. This explains the strong decrease of the residual fraction, which is the fine fraction of waste that has not been further analysed.

A study (ROLLAND & SCHEIBENGRAF 2003) was undertaken in 2003 to estimate the carbon content in residual waste. The carbon content of different fractions was estimated by viewing literature on direct waste analyses. According to the changing waste composition the carbon content of residual waste (mixture of different waste fractions) over the time was calculated until 2003. For this years' submission the DOC value was updated for the year 2004 based on the most recent composition of residual waste. This new value resulted in updated values from 2001 to 2006. For 2004 and 2005, the same DOC values as for 2003 is used.

As can be seen Table 228 presents the composition of residual waste for several years between 1990 and 2004. On the basis of this information a time series for DOC was estimated (see Table 229). For the years before 1990, quantities according to a national study (HACKL & MAUSCHITZ 1999) were used.

Table 228: Composition of residual waste (ROLLAND & SCHEIBENGRAF 2003, BUNDESABFALLWIRTSCHAFTSPLAN 2006).

Residual waste	1990	1993	1996	1999	2004
	[% of moist mass]	[% of moist mass]	[% of moist mass]	[% of moist mass]	[% of moist mass]
Paper, cardboard	21.9	18.3	13.5	14	11
Glass	7.8	6.3	4.4	3	5
Metal	5.2	4.4	4.5	4.6	3
Plastic	9.8	9.3	10.6	15	10
Composite materials	11.3	11.3	13.8	–	8
Textiles	3.3	3.1	4.1	4.2	6
Hygiene materials	–	–	–	12	11
Biogenic components	29.8	34.4	29.7	17.8	37
Hazardous household waste	1.4	1.5	0.9	0.3	2
Mineral components	7.2	7.9	3.8	–	4
Wood, leather, rubber, other components	2.3	3.6	1.1	2.6	1
Residual fraction	–	–	13.6	26.5	2

Table 229: Time series of bio-degradable organic carbon content of directly deposited residual waste 1950–1989: (HACKL & MAUSCHITZ 1999), 1990–2000: (ROLLAND & SCHEIBENGRAF 2003); 2001–2006 update according to BUNDESABFALLWIRTSCHAFTSPLAN 2006).

Year	bio-degradable organic carbon [g/kg Waste (moist mass)]	Year	bio-degradable organic carbon [g/kg Waste (moist mass)]
1950–1959	240	1997	130
1960–1969	230	1998	130
1970–1979	220	1999	120
1980–1989	210	2000	120
1990	200	2001	132
1991	190	2002	144
1992	180	2003	157
1993	170	2004	169
1994	160	2005	169
1995	150	2006	169
1996	140		

Landfill gas recovery

In 2004, the *Umweltbundesamt* investigated the amount of annual collected landfill gas by questionnaires sent to landfill operators (ROLLAND & OLIVA 2004). The amount of collected and burnt landfill gas increased constantly over the time period (Figure 27). While for example the amount of the collected landfill gas was about 2% in 1990, this amount reached 13% in the year 2002.

As this study only covers the amount of collected landfill gas from 1990 to 2002, the 2002 data were also used for 2003 to 2005. A study to update the amounts of collected landfill gas will be undertaken and results are expected for next year's submission.

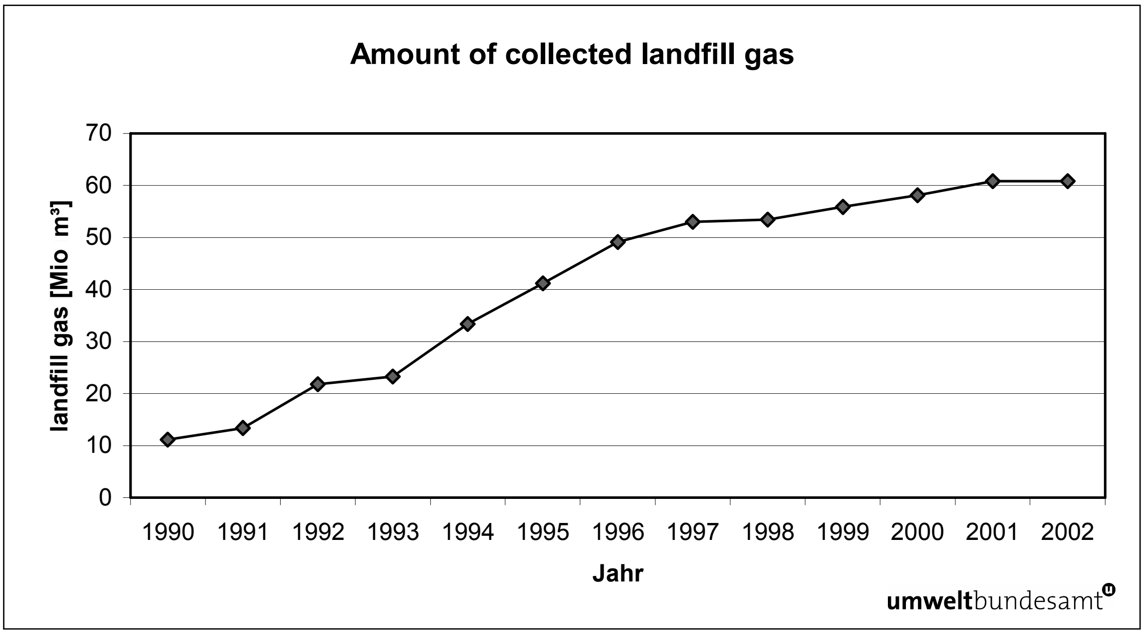

Figure 27: Amount of collected landfill gas 1990 to 2002 (ROLLAND & OLIVA 2004).

Uncertainty Assessment

The uncertainty is based on a national study (WINIWARTER & RYPDAL 2000) and was improved and revised by expert judgement for the submission 2005. These values were confirmed in the latest uncertainty study (WINIWARTER 2008).

The uncertainty decreased due to

- the use of IPCC Tier 2 method,
- activity data which are now taken from the Austrian landfill database reported from landfill operators,
- data on the amount of annual collected landfill gas that were collected and due to the update of DOC according to a study of the Umweltbundesamt,
- emission factors which were determined taking into account IPCC default values and national experts on waste and landfills.

Table 230:Uncertainty assessment for managed waste disposal on land.

	(WINIWARTER & RYPDAL 2000)	Expert judgement 2005 (WINIWARTER 2008)
Activity data	25%	12%
Emission factor	35%	25%

8.2.1.3 Recalculations

The following improvements have been made compared to last year's submission:

- Activity data (1998 to 2005) has been updated. According to the Austrian Landfill Ordinance, the operators of landfill sites have to report their activity data annually. Based on reports received after the due date and updates the amount of deposited waste changed slightly (<10%) compared to the previous submission.
- According to the recommendation of the ERT the double counting of deposited waste due to clean-up of former waste deposits, was corrected and resulted in lower amounts of deposited waste in 2002 and 2003.
- The DOC values for residual waste were updated for the years 2000–2005.

Table 231:Recalculations with respect to previous submission from Category Managed Waste Disposal on Land 1990–2005.

Difference	1998	1999	2000	2001	2002	2003	2004	2005
CH_4 [Gg]	0.00	0.00	0.00	0.49	0.62	0.53	0.94	0.81
%	0.0%	0.0%	0.0%	0.5%	0.6%	0.5%	1.0%	0.9%

8.3 Wastewater Handling (CRF Source Category 6.B)

8.3.1 Source Category Description

Key Source: Yes (N_2O)

Emissions: CH_4, N_2O

In the year 2006, greenhouse gas emissions from Wastewater Handling contributed 0.3% to total greenhouse gas emissions in Austria.

The trend of greenhouse gas emissions during the period is increasing. From 1990 to 2006 greenhouse gas emissions increased by 52% due to increasing amounts of wastewater that is treated in treatment plants and increasing amount of denitrification. Table 232 presents CH_4 and N_2O emissions from category Wastewater Handling for the period from 1990 to 2006.

This source category is separated into the subcategories *6.B.1 Industrial Wastewater Handling* and *6.B.2 Urban Wastewater Handling*.

Table 232: Greenhouse gas emissions from Subcategories Industrial Wastewater Handling 6.B.1 and Urban Wastewater Handling 6.B.2 for the period 1990–2006.

	6 B 1 Industrial Wastewater Handling	**6 B 2 Urban Wastewater Handling**		**Total**
	N_2O emissions [Gg]	**CH_4 emissions [Gg]**	**N_2O emissions [Gg]**	**[Gg CO_2 equivalent]**
1990	0.01	4.85	0.34	210.29
1991	0.01	4.84	0.33	209.46
1992	0.01	4.70	0.32	200.88
1993	0.01	4.56	0.30	192.82
1994	0.03	4.39	0.32	201.51
1995	0.05	4.21	0.35	211.73
1996	0.06	3.87	0.39	220.53
1997	0.07	3.53	0.41	223.29
1998	0.09	3.19	0.44	229.15
1999	0.10	2.93	0.47	238.76
2000	0.12	2.68	0.53	258.12
2001	0.14	2.42	0.59	279.55
2002	0.15	2.18	0.59	275.18
2003	0.15	1.93	0.59	270.53
2004	0.16	1.95	0.63	287.03
2005	0.17	1.96	0.67	303.46
2006	0.18	1.97	0.71	319.71
Trend 1990–2006	*1 348%*	*–59%*	*112%*	*52%*

8.3.2 Methodological Issues

8.3.2.1 CH_4 Emissions

Municipal wastewater treatment

Municipal wastewater treatment in Austria uses mainly aerobic procedures. As a result no or negligible methane emissions are produced since such emissions only occur under anaerobic conditions.

Mainly due to the structure of area of settlement in Austria there is still a small amount of inhabitants not connected to sewage systems and wastewater treatment plants. This wastewater is discharged in septic tanks and cesspools. Due to the tanks anaerobic processes occurring there methane emissions are produced.

CH_4 emissions from cesspools and septic tanks are calculated pursuant to the IPCC method. The following parameters were used:

- Average organic load: .... 60 g BOD_5 per inhabitant and day [IPCC default]
- Methane producing capacity B_o: ..... 0.6 kg CH_4/ kg BoB_5 [IPCC default]
- Methane conversion factor MCF: .... 0.27 (STEINLECHNER et al. 1994)

The MCF defines the portion of methane producing capacity (B_o) that degrades anaerobically and may vary between 0.0 (completely aerobic) to 1.0 (completely anaerobic). When the system is anaerobic only the temperature is the deciding influence. In Austria there are two ranges of temperature: 20°C for 2/3 of the year with a MCF of 35% and 10°C for 1/3 of the year with a MCF of 10% (STEINLECHNER et al. 1994).

Activity data

The amount of inhabitants not connected to sewage systems and wastewater treatment plants was taken from the respective Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHT 1993, 1996, 1999, 2002) and the situation report on the disposal of urban wastewater and sludge (BMLFUW 2006b). Data for the years 1971, 1981, 1991, 1995, 1998, 2001 and 2003 were available. The missing data were interpolated.

For the years 1971 to 1998 statistical data were available for the population not connected to urban waste water treatment plants ≥,50 p.e., but treated in domestic sewage treatment plants, septic tanks and other treatment. But statistical investigations were changed and thus from 2001 to 2006 there are only data available for the categories "municipal wastewater treatment" and "other treatment". As a consequence the amount of inhabitants connected to septic tanks in the years form 2001 to 2006 has to be extrapolated taking into account the trend of earlier years.

Municipal sewage sludge Treatment

In Austria sewage sludge treatment is carried out on the one hand by aerobic stabilisation and on the other hand by anaerobic digestion. As sludge stabilisation is carried out aerobic, the amount of methane emissions produced is negligible. Methane gas produced in the digestion processes is usually used for energy recovery or is flared. Thus a negligible amount of CH_4 emissions is emitted as well.

Industrial Wastewater Treatment

Industrial Wastewater treatment and sewage sludge treatment is carried out under aerobic as well as anaerobic conditions. Due to lack of data the overall amount of industrial wastewater cannot be estimated. But according to national experts the amount of CH_4 emissions from industrial wastewater treatment and sewage sludge treatment is negligible because CH_4 gas is usually used for energy recovery or is flared. In the Energy Sector sewage gas as an energy source is considered.

8.3.2.2 N_2O Emissions

N_2O emissions from Urban Wastewater Handling are calculated by differentiating between wastewater arising from households connected and from households not connected to the public sewage system. This approach was chosen because of a recommendation by the ERT during the in-country review of the initial report of Austria (February 2007).

N_2O emissions resulting from households not connected to the public sewage system were calculated according to the IPCC default method, as described in the Revised 1996 IPCC Guidelines. The data for the daily protein intake per person are taken from FAO statistics. The number of inhabitants is provided by *Austria Statistics.* Emission factor (0.01) and fraction of nitrogen in protein (0.16) are IPCC default values.

N_2O emissions arising in waste water treatment plants are calculated by using a country-specific method based on IPCC. According to a national study (ORTHOFER et al. 1995) the amount of wastewater that is treated in sewage plants and the amount of nitrogen that is denitrificated should be considered additionally. This approach better reflects that in Austria we have advanced centralized wastewater treatment plants with denitrification steps. Denitrification is a treatment requirement in Austria for Urban Waste Water Treatment Plants based on the Waste water emission ordinance for urban waste water for an organic design capacity larger than 5 000 population equivalents[59] in order to fulfill the minimum reduction rate of 70% of total nitrogen. The objective of denitrification is to reduce the risk of eutrophication of surface waters. In 1990, waste water treatment was at its beginning and only 10% of the nitrogen was denitrificated. In 2006 this value increased to 77%.

According to (ORTHOFER et al. 1995) only 1% of the total nitrogen in the denitrification process is emitted as N_2O. The formula for estimating the N_2O emissions from wastewater treatment is:

$$N_2O\ Emissions = WW_{tr} * DF * 0.01 * P * Frac_{NPR} * Inhabitants * F$$

Where:

WWtr	*amount of wastewater that is treated in sewage plants*
DF	*percentage of nitrogen that is denitrificated*
P	*annual protein intake per capita [kg protein/ person/ a]*
$Frac_{NPR}$	*Fraction of nitrogen in protein (IPCC default value – 0.16 kg N/kg protein)*
Inhabitants	*number of inhabitants in Austria*
F	*Factor [1.57 kg N_2O-N/ kg N]*

[59] Abwasseremissionsverordnung für kommunales Abwasser (BGBl 210/1996)

Finally the N_2O emissions arising from waste water treatment plants and other treatment are summed up.

It is assumed that industrial wastewater handling additionally contributes 30% of N_2O emissions from urban wastewater treatment plants (ORTHOFER et al. 1995). As this share represents only the situation in the 1990ies, the ERT recommended a survey to verify this share. In this survey (LENZ & KAMPEL 2007) several methods and different international approaches were compared and a literature review was undertaken. It resulted in the conclusion that the consideration of industrial N_2O with 30% of N_2O emissions from urban wastewater treatment plants, is still justified.

The amount of wastewater that is treated in sewage plants as well as the denitrification rate increased over the time series as presented in Table 233. Data were taken from the Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHTE 1993, 1996, 1999, 2002; BMLFUW 2006b) and an evaluation of data from the Austrian database on sewage treatment plants for 2006; missing data in between were interpolated.

Table 233:Parameters used for the calculation of N_2O emissions for 1990–2006.

	Connection rate to public sewage systems [%]	Denitrification rate [%]	Protein intake (g/day/capita)	Total Inhabitants
1990	59.0%	0.1	102	7 678 000
1991	60.0% [a])	0.1	102	7 754 891
1992	63.4%	0.1	102	7 840 709
1993	66.8%	0.1	103	7 905 632
1994	70.1%	0.18	104	7 936 118
1995	73.5% [a])	0.27	105	7 948 278
1996	76.0%	0.35 [a)]	105	7 959 016
1997	78.4%	0.40	105	7 968 041
1998	80.9% [a])	0.46	107	7 976 789
1999	82.6%	0.51 [a)]	108	7 992 323
2000	84.3%	0.60	110	8 011 566
2001	86.0% [a])	0.68 [a)]	111	8 043 046
2002	87.5%	0.68	111	8 083 797
2003	88.9% [b])	0.68	111	8 117 754
2004	88.9%	0.68 [c)]	118	8 174 733
2005	88.9%	0.73	118	8 233 306
2006	88.9%	0.77 [d)]	118	8 281 948

[a]) *Source: Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHTE 1993, 1996, 1999, 2002);*

[b]) *Source: (UMWELTBUNDESAMT 2004d)*

[c]) *Source: Situation Report on the disposal of urban wastewater and sludge (BMLFUW 2006b)*

[d]) *Source: Evaluation of data from the Austrian database on sewage treatment plants (2007)*

8.3.3 Recalculation

The following improvements have been made compared to last year's submission:

- A new value for the denitrification rate was available for 2006, so the 2005 value was updated (interpolation between 2004 and 2006) accordingly. This led to increased emissions between 2004 and 2006.
- The interpolation of connection rate was corrected and affected N_2O emissions over the whole time series.

Table 234: Recalculations with respect to previous submission from Category Wastewater Handling 1990–2005.

Difference	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
CH_4 [Gg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N_2O [Gg]	-0.01	-0.03	-0.03	0.00	-0.01	-0.01	0.00	0.00
CO_2 eq [%]	-1.9%	-4.0%	-5.1%	0.0%	-1.0%	-1.7%	0.0%	-0.4%
Difference	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**		
CH_4 [Gg]	0.00	0.00	0.00	0.00	0.00	0.00		
N_2O [Gg]	0.00	0.00	0.00	0.00	0.00	0.05		
CO_2 eq [%]	-0.5%	0.0%	-0.1%	0.0%	0.0%	5.0%		

8.4 Waste Incineration (CRF Source Category 6.C)

8.4.1 Source Category Description

Key source: No

In this category emissions from incineration of waste oil are included as well as emissions from municipal waste incineration without energy recovery. All CO_2 emissions from Category *6 Waste* are caused by waste incineration. The share in total emissions from sector 6 is 0.7% for the year 1990 and 0.6% for the year 2006.

In Austria waste oil is incinerated in especially designed so called "USK-facilities". The emissions of waste oil combustion for energy recovery (e.g. in cement industry) are reported under *CRF sector 1 A Fuel Combustion*.

In general, municipal, industrial and hazardous waste are combusted for energy recovery in district heating plants or in industrial sites and therefore the emissions are reported in *CRF sector 1 A Fuel Combustion*. There is only one waste incineration plant without energy recovery which has been operated until 1991 with a capacity of 22 000 tons of municipal waste per year. This plant has been rebuilt as a district heating plant starting operation in 1996. Therefore the emissions since the re-opening of this plant are reported under *CRF sector 1 A Fuel Combustion* from 1996 onwards.

Table 235:Greenhouse gas emissions from Category 6.C.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	27	0.003	0.0004	27
1991	23	0.003	0.0004	24
1992	11	0.001	0.0001	11
1993	11	0.000	0.0001	11
1994	11	0.000	0.0001	11
1995	11	0.000	0.0001	11
1996	11	0.000	0.0001	11
1997	12	0.000	0.0001	12
1998	12	0.000	0.0001	12
1999	12	0.000	0.0001	12
2000	12	0.000	0.0001	12
2001	12	0.000	0.0001	12
2002	12	0.000	0.0001	12
2003	12	0.000	0.0001	12
2004	12	0.000	0.0001	12
2005	12	0.000	0.0001	12
2006	12	0.000	0.0001	12
Trend 1990–2006	*-54.4%*	*-90.1%*	*-74.4%*	*-54.6%*

8.4.2 Methodological Issues

CORINAIR methodology is applied: the quantity of waste is multiplied by an emission factor for CO_2, CH_4 and N_2O.

Emission factors

National emission factors for CH_4 are derived from residual fuel oil VOC emission factors (BMWA-EB 1990, BMWA-EB 1996, UMWELTBUNDESAMT 2001). N_2O emission factors are taken from a national study (ORTHOFER et al. 1995).

For waste oil, the same CO_2 emission factor as for *1 A 1 a* heavy oil (CO_2: 80 [t/TJ]) is used and a heating value of 40.3 GJ/Mg Waste Oil (source: Energy balance-residual fuel oil) is used to convert the emission factors from [kg/TJ] to [kg/Mg].

For municipal solid waste and clinical waste the CO_2 emission factor is calculated by means of default assumptions from (IPCC-GPG 2000) as presented in Table 236.

Table 236:Emission factors and parameters of IPCC Category 6.C Waste Incineration.

Waste Type	Carbon content	Share in fossil carbon	Combustion efficiency	CO_2 [kg/ Mg]	CH_4 [g/Mg]	N_2O [g/Mg]
Municipal Waste	40%	40%	95%	557.70	104.40	12.18
Clinical Waste	60%	40%	95%	836.00	100.00	12.00
Waste Oil	–	–	–	3 224.00	NA	24.18

Activity data

For municipal solid waste the known capacity of 22 000 tons of waste per year of one waste incineration plant was taken.

Waste oil activity data 1990 to 1999 were taken from (BOOS et al. 1995). For 2000 to 2004 the activity data of 1999 was used. (PERZ 2001) quotes that in 2001 total waste oil accumulation was about 37 500 t. Nevertheless, waste oil is mainly used for energy recovery in cement kilns or public power plants and it is consequently accounted for in the energy balance as *Industrial Waste*.

Activity data of clinical waste is determined by data interpretation of the waste flow database at the *Umweltbundesamt* considering the waste key number "971" for the years 1990 and 1994 and extrapolated for the remaining time series.

Generally, few amounts of clinical waste and waste oil are nowadays incinerated without energy recovery in Austria. Thus, it is assumed that activity data since the last surveys are overestimated but no explicit survey to update these data has been made yet. It is planned for the future to update activity data for clinical waste and waste oil incineration.

Table 237:Activity data for IPCC Category 6 C Waste Incineration.

Year	Municipal Waste [Mg]	Clinical Waste [Mg]	Waste Oil [Mg]
1990	22 000	9 000	2 200
1991	22 000	7 525	1 500
1992	0	6 050	1 800
1993	0	4 575	2 100
1994	0	3 100	2 500
1995	0	3 100	2 600
1996	0	3 100	2 700
1997	0	3 100	2 800
1998	0	3 100	2 900
1999 to 2006	0	3 100	3 000

The following table shows activity data of waste incineration with energy recovery.

Table 238:Activity data for waste incineration with energy recovery.

Year	1.A.1.a Public Electricity and Heat[1)]			1.A.2.f Cement Industry[2)]		1.A.2 Manuf. Industries[3)]
	MSW [Mg]	hazardous waste [Mg] [4)]	sewage sludge [Mg]	Industrial waste [Mg]	of which waste oil [Mg]	Ind. Waste [TJ]
1990	299 256	80 000	55 000	59 422	11 716	3 220
1991	341 001	80 000	55 000	66 552	22 069	4 556
1992	403 307	80 000	55 000	78 803	24 141	5 271
1993	421 907	72 500	64 500	78 568	21 273	4 179
1994	442 479	75 000	61 600	82 658	25 047	4 726
1995	441 502	71 337	60 672	86 998	28 675	5 270
1996	438 549	75 812	61 372	100 036	25 719	6 349
1997	446 471	95 334	64 778	101 063	22 781	5 692

Year	1.A.1.a Public Electricity and Heat[1]			1.A.2.f Cement Industry[2]		1.A.2 Manuf. Industries[3]
	MSW [Mg]	hazardous waste [Mg] [4]	sewage sludge [Mg]	Industrial waste [Mg]	of which waste oil [Mg]	Ind. Waste [TJ]
1998	608 505	86 098	68 316	121 719	28 279	5 891
1999	526 928	70 513	80 406	135 065	26 607	5 298
2000	528 365	70 513	80 406	169 888	27 794	6 157
2001	535 641	70 513	75 117	218 048	26 437	8 140
2002	561 801	70 513	64 225	238 959	30 017	8 902
2003	645 807	70 513	62 970	253 874	30 057	9 846
2004	845 500	90 771	59 460	257 360	28 370	11 950
2005	773 160	103 024	58 979	262 059	26 701	11 096
2006	1 147 980	113 695	60 216	301 374	21 596	12 199

[1] *Umweltbundesamt, Statistik Austria 2007.*

[2] *(HACKL & MAUSCHITZ 1995, 1997, 2001, 2003, 2007, MAUSCHITZ 2004)*

[3] *1.A.2.f other fuels – activity data*

[4] *including waste oil and clinical waste*

Recalculations

No recalculations have been carried out.

8.5 Other Waste (CRF Source Category 6 D)

In this category compost production is addressed.

8.5.1 Compost Production

Key Source: No

Emission: CH_4, N_2O

This category includes CH_4 and N_2O emissions from biological waste treatment production, which are presented in Table 239 for the period from 1990 to 2006.

CH_4 and N_2O emissions, that arise from the sub-category compost production increased over the time period as a result of the increasing amount of composted waste.

Table 239:Greenhouse gas emissions from Category Compost Production 1990–2006.

	CH_4 emissions [Gg]	N_2O emissions [Gg]	Total [Gg CO_2 eq.]
1990	0.52	0.08	34.36
1991	0.54	0.08	36.00
1992	0.65	0.09	42.69
1993	0.82	0.12	53.20
1994	0.98	0.14	63.12
1995	1.04	0.14	66.70
1996	1.09	0.15	69.87
1997	1.08	0.15	68.84
1998	1.12	0.15	71.28
1999	1.18	0.16	74.93
2000	1.21	0.17	77.03
2001	1.25	0.17	79.17
2002	1.29	0.18	81.51
2003	1.32	0.18	83.28
2004	1.53	0.21	98.25
2005	1.63	0.23	105.23
2006	1.63	0.23	105.47
Trend 1990–2006	*216%*	*203%*	*207%*

8.5.1.1 Methodological Issues

Emissions were estimated using a country specific methodology.

To estimate the amount of composted waste it was split up into two fractions of composted waste:

- mechanical biological treated residual waste
- composted waste: bio-waste collected separately, loppings. home composting

Emissions were calculated by multiplying the quantity of waste by the corresponding emission factor.

Activity data

The activity data were taken from several national studies. For years where no data were available inter- or extrapolation was done.

Table 240:Activity Data and sources for IPCC Category 6 D Other Waste (Compost Production).

	Total waste	Mechanical biological treated waste		Bio waste collected separately*	Loppings; gardening waste		Home composting	
	[Gg]	[Mg]	source	[Mg]	[Mg]	source	[Mg]	source
1990	758.2	345 000	(BAUMELER et al. 1998)	5 790	37 370	Sum of data reported by the Austrian federal provinces, (AMLINGER 2003)	370 000	(AMLINGER 2003)
1991	793.3	345 000		22 342	50 995		375 000	
1992	936.3	345 000		82 853	48 464		460 000	
1993	1 161.2	345 000		156 775	149 470		510 000	
1994	1 373.5	345 000		246 385	197 130		584 985	
1995	1 446.6	295 000	(ANGERER 1997)	302 383	249 264		600 000	
1996	1 513.5	280 000	(Rolland) expert judgement	334 371	283 127		616 000	
1997	1 489.1	245 000	(LAHL 1998)	351 862	229 643		662 571	
1998	1 540.9	240 000	(LAHL 2000)	362 572	241 835		696 487	
1999	1 620.7	265 000	(GRECH & ROLLAND 2001)	378 796	244 587		732 273	
2000	1 664.7	250 673	Same as 1999	374 550	267 670	Interpolated	771 773	
2001	1 709.5	236 346		410 630	290 752		771 773	
2002	1 758.5	222 020		450 835	313 835		771 773	
2003	1 795.3	207 693	(NEUBAUER, et al. 2006);	478 919	336 917		771 773	Same as 2002
2004	2 134.6	488 426		514 357	360 000	BAWP 2006	771 773	
2005	2 292.3	612 500	BAWP 2006	548 010	360 000	Same as 2005	771 773	
2006	2 297.3	612 500	Same as 2005	552 999	360 000		771 773	

* *source of data for 1990–2006: Sum of data reported by the Austrian federal provinces, partly interpolated*

Emission factors

Due to different emission factors in different national references an average value was used for each of the two fractions of composted waste.

Table 241:Emission factors for IPCC Category 6 D Other Waste (Compost Production).

	CH_4 [kg/t FS]	N_2O [kg/t FS]	References
mechanical biological treated residual waste	0.6	0.1	(UBA BERLIN 1999) (AMLINGER et al. 2003) (ANGERER & FRÖHLICH 2002) (DOEDENS et al. 1999)
bio-waste, loppings, home composting	0.75	0.1	(AMLINGER et al. 2003)

8.5.1.2 Recalculations

The following improvement has been made compared to last year's submission:

- Sewage sludge is no longer considered as separate waste fraction for composting as it can be assumed that it is already accounted for in the waste fraction undergoing a mechanical-biological treatment. Emissions from mechanical-biological treatment are considered in this source category.
- Activity Data for mechanical-biological treatment are updated for the years 2003–2005, as new data were available.
- Activity Data for separately collected bio-waste were updated from 2001–2005, because new data from the waste Management Concepts and Plans of the nine Federal Provinces (Bundesländer) were available.

Table 242:Recalculations with respect to previous submission from Category Other Waste (Compost) 1999–2005.

Difference	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
CH_4 [Mg]	-0.3	-0.3	-0.4	-0.6	-0.8	-1.0	-1.0	-1.0	-1.0	-1.5
N_2O [Mg]	-1.4	-1.4	-2.2	-3.1	-4.0	-4.8	-4.8	-4.8	-4.8	-7.7
CO_2 eq. [%]	-1.2	-1.2	-1.6	-1.8	-1.9	-2.2	-2.1	-2.1	-2.1	-3.1
Difference	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**				
CH_4 [Mg]	-10.7	-4.3	6.0	-85.3	184.4	92.1				
N_2O [Mg]	-12.1	-10.6	-8.5	-23.5	21.8	5.7				
CO_2 eq. [%]	-4.9	-4.1	-3.0	-9.8	12.2	3.6				

9 RECALCULATIONS AND IMPROVEMENTS

This chapter quantifies the changes in emissions for all six greenhouse gases compared to the previous submission – UNFCCC 2007. Recalculations are quantified for total GHG gas emissions for all years and gas specific emissions for 1990 and 2005. The Implication of recalculation for emission levels by category for CO_2, CH_4, N_2O and FCs are presented in Annex 5.

Recalculations of previously submitted inventory data are performed following the IPCC Good Practice Guidance, Chapter 7 "Methodological Choice and Recalculation" with the unique purpose to improve the GHG inventory.

9.1 Explanations and Justifications for Recalculations

Compiling an emission inventory includes data collecting, data transfer and data processing. Data has to be collected from different sources, for instance national statistics, plant operators, studies, personal information or other publications. The provided data must be transferred from different data formats and units into a unique electronic format to be processed further. The calculation of emissions by applying methodologies on the collected data and the final computing of time series into a predefined format (CRF) are further steps in the preparation of the final submission. Finally the submission must be delivered in due time. Even though a QA/QC system gives assistance so that potential error sources are minimized it is sometimes necessary to make some revisions (called recalculations) under the following circumstances:

- An emission source was not considered in the previous inventory.
- A source/data supplier has delivered new data. The causes might be: Previous data were preliminary data only (by estimation, extrapolation), improvements in methodology.
- Occurrence of errors in data transfer or processing: wrong data, unit-conversion, software errors, etc.
- Methodological changes: a new methodology must be applied to fulfil the reporting obligations because one of the following reasons:
  - to decrease uncertainties.
  - an emission source becomes a key source.
  - consistent input data needed for applying the methodology is no longer accessible.
  - input data for more detailed methodology is now available.
  - the methodology is no longer appropriate.

For detailed information on recalculations and their justifications see the corresponding subchapters of Chapters *3 Energy – 8 Waste*.

The last UNFCCC review of the Austrian inventory took place in February 2007 together with the review of the initial report. Changes to the inventory made as response to this review are described in the NIR 2007. The UNFCCC review process of the last submission (NIR 2007) is just about to start. This is why no particular improvements in this submission can be identified in response to issues raised in the UNFCCC review of the last submission.

The following list describes all methodological changes and activity data update that led to recalculations of emissions with respect to the previous submission to the UNFCCC (April 2007).

Energy (IPCC Category 1)

Combustion Activities (1 A)

Update of activity data

Updates of activity data and NCVs follow the updates of the IEA compliant energy balance compiled by the federal office for national statistics Statistik Austria.

Energy balance update and corrections:

- Correction of residual fuel oil NCVs from 1995 to 2005 (e.g. +2% in 1999, +1% in 2005).
- Correction of hard coal NCVs from 1999 to 2001 and from 2004 to 2005 (e.g -4.5% in 2000; -0.2% in 2005).
- Correction of brown coal NCVs from 1999 to 2001 and for 2005 (e.g +0.2% in 1999; +3.9% in 2001).
- Correction of petrol coke and 'other oil products' NCVs 1994 to 1996 (+0.2%).

Correction of NCVs affects fuel consumption calculation (conversion of tonnes or cubic metres to TJ) and therefore leads to changes in GHG emission calculations for the respective fuels and periods as mentioned above.

Update of activity data (in 'tonnes' or 'cubic metres' per category) mainly affects the period 1999 to 2004. Transformation input has been revised to improve the compliance between transformation input and electricity and heat production (more reliable efficiencies). National fossil fuel consumption and total CO_2 emissions are not affected by this update but consumption and emissions have been shifted between categories 1.A.1 (public energy plants) and 1.A.2 (auto producer plants) and/or between final energy consumption and transformation input.

Improvement of Reference Approach

Naphtha, anthracite and sub-bituminous coal are now considered separate fuels/flows.

Improved methodology of ETS data input

Improved allocation of ETS reported fuels to IEA fuel definition. Fuel classification is more compliant with energy statistics definitions (e.g. coal reported as 'lignite' with an NCV > 20 GJ/t has been shifted to bituminous coal).

Changes in Allocation

Sinter magnesite plants 2002 to 2005 have been shifted from category 1.A.2.b Non Ferrous Metals to category 1.A.2.f. Other Industry.

1.A.3.b Transport – Road: Update of statistical energy data, particularly the biodiesel consumption.

1.A.3.e Pipeline compressors: Update of 2004 natural gas consumption according to the updated national energy balance.

1.A.3.c: Update of statistical energy data for railways (coal, diesel, electricity) up to 2000.

Improvements of methodologies and emission factors

1.A.1.c Other Energy Industries – natural gas:

New information from E-Control clarified that 'natural gas distribution losses' in the Energy Balance also includes the natural gas suppliers' 'own usage' of natural gas. Previously it was assumed that 'distribution losses' included statistical differences and therefore no emissions had been calculated from this quantity. The energy balance has been revised from 1990 on and 'own usage' has been shifted to the oil/gas extraction sector. The remaining quantity of distribution losses is now much lower and represents a more reliable quantity of real fugitive losses.

The sectoral approach considers now combustion related GHG emissions from the gas suppliers 'own usage'. This leads to higher consumption (1990: 2 382 TJ) and GHG emissions (1990: +132 Gg CO_2) of category 1.A.1.c/natural gas.

1.A.2.a Iron and Steel:

Updated natural gas activity data from 2004 to 2005 has been submitted by the integrated steel plants operator. The plant operator affirms that updated activity data is more consistent with reported CO_2 emissions. This leads to up to -105 Gg less CO_2 emissions for the respective years due to the avoidance of fuel consumption 'double counting'.

1.A.2.f Cement Production:

Update of 2003 to 2004 activity data and emissions according to a 'bottom up' approach (unpublished national study).

1.A.3.b Road Transport:

All emission factors for passenger cars, light goods vehicles and motorcycles have been updated. The source of the new emission factors is the EU project ARTEMIS. In ARTEMIS a new set of real world driving cycles was developed (CADC, Common ARTEMIS Driving Cycle; http://www.trl.co.uk/artemis/introduction.htm). This CADC results for most exhaust gas components in emission factors that are clearly different compared to the former ones (HBEFA; 2004, www.hbefa.net).

1.A.4.b Residential:

Update of heating type split from 2001 onwards by means of 2004 household census data. This affects calculation of CH_4 emissions from residential heating.

Fuel consumption of new biomass heating has been revised from the year 2000 onwards by means of new boiler sales statistics. This affects calculation of CH_4 emissions from residential biomass heating.

Fugitive Emissions (1 B)

Update of activity data

1.B.1.a Coal Mining: Activity data for 2005 was updated according to information from the Association of Mining and Steel.

1.B.2.a Refining/Storage: Activity data for 2005 was updated according to data from the national energy balance

1.B.2.b Distribution: Length of Distribution Network for 2005 was updated according to updated data from E-Control.

Industrial Processes (IPCC Category 2)

Update of activity data

2.A.7.a Bricks: Activity data for 2005 was updated.

2.B.1. Ammonia: Natural gas consumption was updated according to data from the national energy balance.

2.C.2. Ferroalloys: Activity data for 2005 was updated.

2.F.3. Fire Extinguishers: the stocks of C_4F_{10} and HFC 23 were updated.

2.F.4. Aerosols and 2.F.5 Solvents:
Potential emissions have been updated for the years 2003–2005 according to recalculations of the Austrian GDP in these years.

2.F.7. Semiconductor Manufacture: Potential emissions were updated for 2003 to 2005.

2.F.8. Electrical equipment: Potential emissions were updated for 2005.

Improvements of methodologies and emission factors

2.F.2. Foam Blowing: HFC 245fa and HFC 365mfc emissions, previously reported as unspecified mix of HFC, were excluded from the GHG Inventory totals, because they are not fluorinated gases as defined in the CRF. They are now reported in CRF Table 9(b) as additional GHG.

Solvent and other Product Use (IPCC Category 3)

Update of activity data

3.A, 3.B, 3.C and 3.D.5.: NMVOC emissions from solvent use have been updated using short-term economic data provided by Statistik Austria.

Agriculture (IPCC Category 4)

Improvements of methodologies and emission factors

The revision of the share of dairy cattle held in loose (32%) and tied housing systems (68%) within the NH_3 inventory resulted in slightly lower direct N_2O emissions from animal manure applied to soils and slightly higher indirect N_2O emissions.

The new data on housing system distribution is based on the following study:

AMON, B., FRÖHLICH, M., WEIßENSTEINER, R, ZABLATNIK, B., AMON. T. (2007): Tierhaltung und Wirtschaftsdüngermanagement in Österreich. Endbericht Projekt Nr. 1 441 Auftraggeber: Bundesministerium für Land- und Forstwirtschaft, Umwelt- und Wasserwirtschaft, Wien.

4.D.1. Direct Soil Emissions – Crop Residue: N contents of crops were revised, resulting in higher N_2O emissions from 1990 onwards.

LULUCF (IPCC Category 5)

General improvements:

For all LUC categories the areas undergoing conversion are followed up and reported for 20 years. After these 20 years they are accounted for in the remaining categories. Consequently, the whole time series on activity data (consistent area table for land use and land use changes) has been revised.

Update of activity data

5.B. Cropland:

For the area of perennial cropland national data sources from Statistik Austria since 1960 are used.

For annual cropland a national emission factor for C-stock in biomass was calculated which replaces the IPCC default value.

5.C. Grassland:

For grassland national emission factors for C-stock in biomass (ΔC growth) and below ground biomass were calculated which replace the IPCC default values.

Waste (IPCC Category 6)

Update of activity data

6.A.1. Managed waste disposal on land:

Activity data (1998 to 2005) has been updated. According to the Austrian Landfill Ordinance, the operators of landfill sites have to report their activity data annually. Based on reports received after the due date and updates, the amount of deposited waste changed slightly (<10%) compared to the previous submission.

According to the recommendation of the ERT, the double counting of deposited waste due to the clean-up of former waste deposits was corrected and resulted in lower amounts of deposited waste in 2002 and 2003.

6.B. Waste Water Handling: The interpolation of the connection rate was corrected and affected N_2O emissions over the whole time series.

6.D. Other:

Sewage sludge is no longer considered a separate waste fraction for composting as it can be assumed that it is already accounted for in the waste fraction undergoing mechanical-biological treatment. Emissions from mechanical-biological treatment are considered in this source category.

Activity Data for mechanical-biological treatment have been updated for the years 2003–2005, as new data were available.

Activity Data for separately collected bio-waste were updated from 2001–2005, because new data from the waste Management Concepts and Plans of the nine Federal Provinces (Bundesländer) were available.

Improvements of methodologies and emission factors:

6.A.1. Managed waste disposal on land: The DOC values for residual waste were updated for the years 2000–2005.

6.B. Waste Water Handling: A new value for the denitrification rate was available so the 2005 value was updated (interpolation between 2004 and 2006) accordingly.

9.2 Implication for Emission Levels

As a result of the continuous improvement of Austria's GHG inventory, emissions of some sources have been recalculated on the basis of updated data or revised methodologies, thus emission data for 1990 to 2004 which are submitted this year differ from data reported previously.

The following table presents the recalculation difference with respect to last year's submission for each gas (positive values indicate that this year's estimate is higher).

Table 243: Recalculation difference of Austria's greenhouse gas emissions compared to the previous submission.

	1990 (Base year)	2005
	Recalculation Difference [%]	
TOTAL	0.15%	-0.02%
CO_2	0.25%	-0.17%
CH_4	0.04%	0.20%
N_2O	-0.62%	1.86%
HFC, PFC, SF6	0.00%	0.24%

Emissions without LULUCF

CO_2 emissions in all years were recalculated by including combustion related GHG emissions from the gas suppliers 'own usage' in the sectoral approach (1.A.1.c/natural gas). This is the main reason for the increase of reported CO_2 emissions in 1990.

The main reason for the decrease of reported CO_2 emissions in 2005 is correction of fuel consumption double counting in the sector 1.A.2.a Iron and Steel.

The main reason for the increase of reported methane emissions in 2005 is the update of activity data in the sector *6.A.1. Managed Waste Disposal on Land*.

The main reason for the changes of reported N_2O emissions is the update of N_2O emission factors in *1.A.3.b Road Transport*. In 2005 the revision of N-content of crops in sector *4.D.1. Direct Soil Emissions* leads to an additional increase of N_2O emissions.

The main reason for the increase of reported emissions of fluorinated compounds is the update of potential emissions in several 2 F subcategories.

Table 244 presents the recalculation differences of national total GHG emissions for all years. The implication of recalculation for emission levels by category for CO_2, CH_4, N_2O and FCs and the recalculation differences of national total emissions by gas are presented in Annex 5.

Table 244:Recalculation Difference of National Total GHG Emissions.

Year	National Total GHG emissions without LUCF		
	Submission 2007 [Gg CO_2e]	Submission 2008 [Gg CO_2e]	Recalculation Difference [%]
1990*	79 053	79 172	0.15%
1991	83 101	83 243	0.17%
1992	76 394	76 525	0.17%
1993	76 357	76 425	0.09%
1994	77 195	77 340	0.19%
1995	80 294	80 624	0.41%
1996	83 624	83 695	0.08%
1997	83 201	83 259	0.07%
1998	82 627	82 614	-0.02%
1999	80 749	81 018	0.33%
2000	81 116	81 136	0.02%
2001	85 056	85 279	0.26%
2002	86 680	87 166	0.56%
2003	92 953	93 300	0.37%
2004	91 177	91 663	0.53%
2005	93 280	93 260	-0.02%

**Base year is 1990 for all gases*

9.3 Implications for Emission Trends

As can be seen in Table 244 and Figure 28, Austria's greenhouse gas emissions as reported in the UNFCCC submission 2008 are slightly different than the values reported last year due to recalculations: for the base year they are 0.15% higher and for the year 2005 0.02% lower. This results in a less strong increasing trend: last year the trend from the base year to 2005 was plus 18.0% whereas now it is plus 17.8% (for explanations please refer to Chapters 9.1 and 9.2).

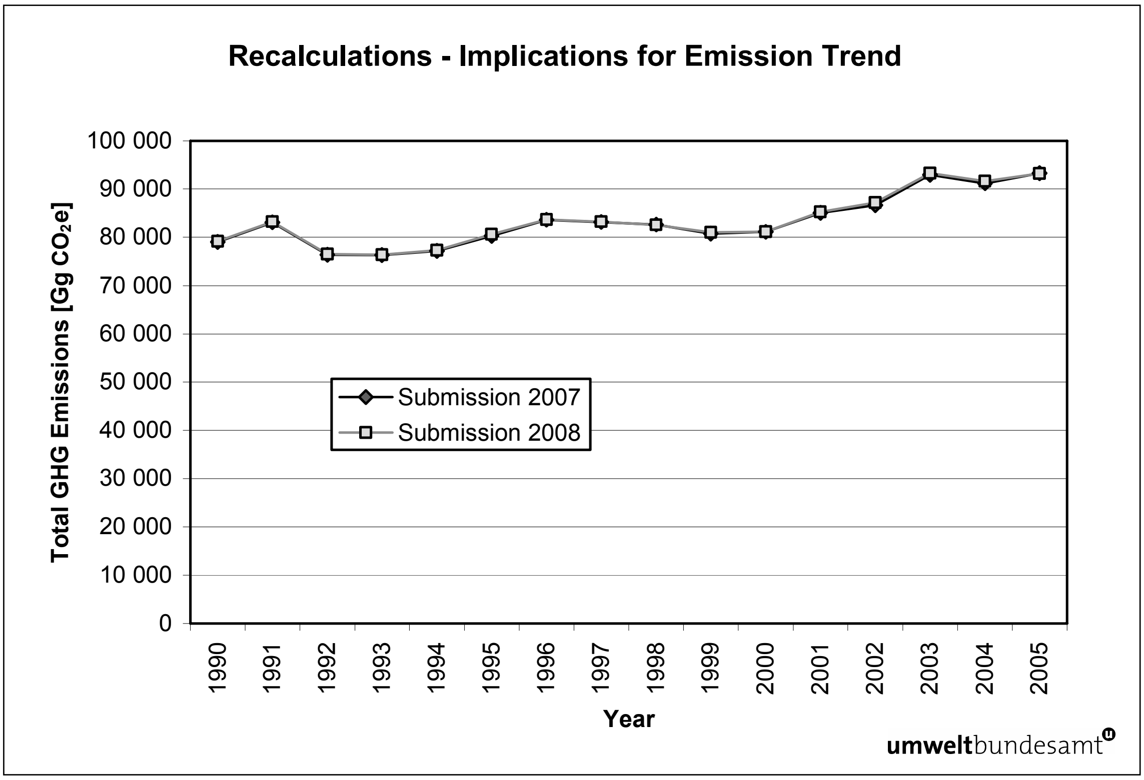

Figure 28: Emission estimates of the submission 2007 and recalculated values of the submission 2008.

9.4 Planned Improvements

Source specific planned improvements are presented in the respective subchapters of Chapters 3–8.

Goals

The overall goal is to produce emission inventories which are fully consistent with the UNFCCC reporting guidelines and the IPCC Guidelines.

An improvement programme has been established to help meet this goal including implementation of the Good Practice Guidance to avoid any adjustments under the Kyoto Protocol.

Linkages

The improvement programme is driven by the results of the various review processes, as e.g. the internal Austrian review, review under the European Union Monitoring Mechanism, and review under the UNFCCC and/or under the Kyoto Protocol. Improvement is triggered by the improvement programme that plans improvements sector by sector and also identifies actions outside the Umweltbundesamt.

The improvement programme is supported by the QA/QC programme based on the international standard ISO 17020.

Updating

The improvement programme is updated every year in January.

Responsibilities

The Umweltbundesamt is responsible for the management of the improvement programme.

ABBREVIATIONS

General

AMA .... Agrarmarkt Austria

BAWP .... Bundes-Abfallwirtschaftsplan
Federal Waste Management Plan

BFW .... Bundesamt und Forschungszentrum für Wald
Austrian Federal Office and Research Centre for Forest

BMLFUW .... Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft
Federal Ministry for Agriculture, Forestry, Environment and Water Management

BMUJF .... Bundesministerium für Umwelt, Jugend und Familie
Federal Ministry for Environment, Youth and Family
(before 2000, now domain of Environment: BMLFUW)

BMWA................... Bundesministerium für Wirtschaft und Arbeit
Federal Ministry for Economic Affairs and Labour

BUWAL .... Bundesamt für Umwelt, Wald und Landschaft, Bern
The Swiss Agency for the Environment, Forests and Landscape (SAEFL), Bern

COP .... Conference of the Parties

CORINAIR .... Core Inventory Air

CORINE .... Coordination d´information Environmentale

CRF .... Common Reporting Format

DKDB .... Dampfkesseldatenbank
Austrian annual steam boiler inventory

DOC .... Degradable Organic Carbon

EC .... European Community

EEA....................... European Environment Agency

EFTA..................... European Free Trade Association

EIONET .... European Environment Information and Observation NETwork

EMEP.................... Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

EN .... European Norm

EPER .... European Pollutant Emission Register

ETC/AE .... European Topic Centre on Air Emissions

EU .... European Union

ERT....................... Expert Review Team (in context of the UNFCCC review process)

FAO .... Food and Agricultural Organisation of the United Nations

GHG...................... Greenhouse Gas

GLOBEMI .... Globale Modellbildung für Emissions- und Verbrauchsszenarien im Verkehrssektor (Global Modelling for Emission- and Fuel consumption Scenarios of the Transport Sector) see (HAUSBERGER 1998)

GPG .... Good Practice Guidance [IPCC GPG, 2000]

GWP .... Global Warming Potential

IPCC .... Intergovernmental Panel on Climate Change

IEA .... International Energy Agency

ISO .... International Standards Organisation

LTO .... Landing/Take-Off cycle

LULUCF .... Land Use, Land-Use Change and Forestry – IPCC-CRF Category 5

NACE .... Nomenclature des activites economiques de la Communaute Europeenne

NAPFUE .... Nomenclature for Air Pollution Fuels

NFI .... National Forest Inventory

NFR .... Nomenclature for Reporting (Format of Reporting under the UNECE/CLRTAP Convention)

NISA .... National Inventory System Austria

OECD .... Organisation for Economic Co-operation and Development

OLI .... Österreichische Luftschadstoff Inventur
Austrian Air Emission Inventory

OMV .... Österreichische Mineralölverwaltung
Austrian Mineraloil Company

PHARE .... Phare is the acronym of the Programme's original name:
'**P**oland and **H**ungary: **A**ction for the **R**estructuring of the **E**conomy'.
It covers now 14 partner countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, the Former Yugoslav Republic of Macedonia (FYROM), Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. (However, Croatia was suspended from the Phare Programme in July 1995.)

QA/QC .... Quality Assurance/Quality Control

QMS .... Quality Management System

RWA .... Raiffeisen Ware Austria (see www.rwa.at)

SNAP .... Selected Nomenclature on Air Pollutants

UNECE/CLRTAP .. United Nations Economic Commission for Europe,
Convention on Long-range Transboundary Air Pollution

UNFCCC .... United Nations Framework Convention on Climate Change

Notation Keys

according to UNFCCC guidelines on reporting and review (FCCC/CP/2002/8)

"NO" (not occurring)	for activities or processes in a particular source or sink category that do not occur within a country;
"NE" (not estimated)	for existing emissions by sources and removals by sinks of greenhouse gases which have not been estimated. Where "NE" is used in an inventory for emissions or removals of CO_2 , CH_4 , N_2O, HFCs, PFCs, or SF_6 , the Party should indicate in both the NIR and the CRF completeness table why emissions or removals have not been estimated
"NA" (not applicable)	for activities in a given source/sink category that do not result in emissions or removals of a specific gas. If categories in the CRF for which "NA" is applicable are shaded, they do not need to be filled in
"IE" (included elsewhere)	for emissions by sources and removals by sinks of greenhouse gases estimated but included elsewhere in the inventory instead of the expected source/sink category. Where "IE" is used in an inventory, the Annex I Party should indicate, using the CRF completeness table, where in the inventory the emissions or removals from the displaced source/sink category have been included and the Annex I Party should explain such a deviation from the expected category
"C" (confidential)	for emissions by sources and removals by sinks of greenhouse gases which could lead to the disclosure of confidential information, given the provisions of paragraph 27 of above

Chemical Symbols

Symbol .... Name

Greenhouse gases

CH_4 .... Methane

CO_2 .... Carbon Dioxide

N_2O .... Nitrous Oxide

HFCs..................... Hydroflurocarbons

PFCs..................... Perfluorocarbons

SF_6........................ Sulphur hexafluoride

Further chemical compounds

CO .... Carbon Monoxide

Cd .... Cadmium

NH_3 .... Ammonia

Hg .... Mercury

NO_X....................... Nitrogen Oxides (NO plus NO_2)

NO_2 .... Nitrogen Dioxide

NMVOC .... Non-Methane Volatile Organic Compounds

PAH .... Polycyclic Aromatic Hydrocarbons

Pb .... Lead

POP .... Persistent Organic Pollutants

SO_2 .... Sulfur Dioxide

SO_X....................... Sulfur Oxides

Units and Metric Symbols

UNIT	Name	Unit for
g	gram	mass
t	ton	mass
W	watt	power
J	joule	calorific value
m	meter	length

Mass Unit Conversion		
1g		
1kg	= 1 000 g	
1t	= 1 000 kg	= 1 Mg
1kt	= 1 000 t	= 1 Gg
1Mt	= 1 Mio t	= 1 Tg

Metric Symbol	Prefix	Factor
P	peta	10^{15}
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
h	hecto	10^{2}
da	deca	10^{1}
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}

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ANNEX

ANNEX 1: KEY CATEGORY ANALYSIS

The following tables present results from the key source analysis, the methodology of the analysis is presented in Chapter 1.5 of the NIR 2008.

Table A1.1 presents results from the Level Assessment of the key category analysis excluding LULUCF.

Table A1.2 presents results from the Trend Assessment of the key category analysis excluding LULUCF.

Table A1.3 presents results from the Level Assessment of the key category analysis including LULUCF.

Table A1.4 presents results from the Trend Assessment of the key category analysis including LULUCF.

Table A1.5 presents emission sources and removal sinks in the level of aggregation as used for the key category analysis. Emissions/removals from 1990 to 2006 for these categories are also included.

Table A1.6 summarizes the key categories identified including their ranking in the level and trend assessments.

Rank		IPCC Source Categories	GHG	Unit	BY	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	11 300.5	14.27%	14.27%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 930.3	10.02%	24.29%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 319.1	9.24%	33.53%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	7.89%	41.43%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 016.3	6.34%	47.76%
6	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	5.07%	52.83%
7	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	4.50%	57.33%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4.48%	61.81%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	3 376.6	4.26%	66.07%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 883.6	3.64%	69.71%
11	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	3.35%	73.07%
12	2 A 1	Cement Production	CO2	Gg	2 033.4	2.57%	75.63%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 957.7	2.47%	78.11%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 804.9	2.28%	80.39%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 311.6	1.66%	82.04%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.7	1.65%	83.70%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1.55%	85.25%
18	2C3	Aluminium production	PFCs	GgCO2e	1 050.2	1.33%	86.58%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 016.0	1.28%	87.86%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	1.15%	89.01%
21	4 B 1	Cattle	N2O	Gg CO2e	908.1	1.15%	90.16%
22	4 B 1	Cattle	CH4	Gg CO2e	587.1	0.74%	90.90%
23	2 B 1	Ammonia Production	CO2	Gg	516.6	0.65%	91.55%
24	2 A 7 b	Sinter Production	CO2	Gg	481.2	0.61%	92.16%
25	4 B 8	Swine	CH4	Gg CO2e	447.7	0.57%	92.73%
26	2 A 2	Lime Production	CO2	Gg	396.2	0.50%	93.23%
27	1 A 4 other	Other Sectors	CO2	Gg	349.6	0.44%	93.67%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	314.7	0.40%	94.07%
29	3	Solvent and other Product Use	CO2	Gg	282.7	0.36%	94.42%
30	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	0.34%	94.77%
31	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	264.1	0.33%	95.10%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1991	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	11 940.3	14.34%	14.34%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 698.5	10.45%	24.79%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 694.4	9.24%	34.04%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 817.0	8.19%	42.23%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 830.0	5.80%	48.03%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 760.6	5.72%	53.75%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 509.5	4.22%	57.96%
8	4 A 1	Cattle	CH4	Gg CO2e	3 503.5	4.21%	62.17%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	3 370.0	4.05%	66.22%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 270.6	3.93%	70.15%
11	1 A 4 solid	Other Sectors	CO2	Gg	2 934.3	3.52%	73.67%
12	2 A 1	Cement Production	CO2	Gg	2 005.0	2.41%	76.08%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 978.2	2.38%	78.46%
14	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 908.5	2.29%	80.75%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 498.0	1.80%	82.55%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 394.3	1.67%	84.23%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 175.5	1.41%	85.64%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 056.9	1.27%	86.91%
19	2C3	Aluminium production	PFCs	GgCO2e	1 050.2	1.26%	88.17%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	927.3	1.11%	89.28%
21	4 B 1	Cattle	N2O	Gg CO2e	896.1	1.08%	90.36%
22	4 B 1	Cattle	CH4	Gg CO2e	576.9	0.69%	91.05%
23	2 B 1	Ammonia Production	CO2	Gg	545.7	0.66%	91.71%
24	4 B 8	Swine	CH4	Gg CO2e	441.7	0.53%	92.24%
25	2 A 7 b	Sinter Production	CO2	Gg	391.6	0.47%	92.71%
26	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	390.0	0.47%	93.18%
27	2 A 2	Lime Production	CO2	Gg	361.3	0.43%	93.61%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	341.8	0.41%	94.02%
29	1 B 2 b	Natural gas	CH4	Gg CO2e	288.1	0.35%	94.37%
30	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	277.2	0.33%	94.70%
31	1 A 4 other	Other Sectors	CO2	Gg	273.3	0.33%	95.03%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1992	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	12 000.1	15.68%	15.68%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 316.4	10.87%	26.55%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 183.5	9.39%	35.94%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 156.8	6.74%	42.67%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 139.6	5.41%	48.08%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 009.5	5.24%	53.32%
7	4 A 1	Cattle	CH4	Gg CO2e	3 340.8	4.37%	57.69%
8	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	3 281.7	4.29%	61.98%
9	2 C 1	Iron and Steel Production	CO2	Gg	3 074.9	4.02%	66.00%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 525.9	3.30%	69.30%
11	1 A 4 solid	Other Sectors	CO2	Gg	2 510.7	3.28%	72.58%
12	2 A 1	Cement Production	CO2	Gg	2 105.0	2.75%	75.33%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 916.8	2.50%	77.83%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 832.4	2.39%	80.23%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 481.6	1.94%	82.16%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 276.6	1.67%	83.83%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 217.2	1.59%	85.42%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 068.1	1.40%	86.82%
19	4 B 1	Cattle	N2O	Gg CO2e	858.5	1.12%	87.94%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	837.5	1.09%	89.03%
21	2 B 1	Ammonia Production	CO2	Gg	552.8	0.72%	89.76%
22	4 B 1	Cattle	CH4	Gg CO2e	552.0	0.72%	90.48%
23	4 B 8	Swine	CH4	Gg CO2e	451.6	0.59%	91.07%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	447.1	0.58%	91.65%
25	2C3	Aluminium production	PFCs	GgCO2e	417.6	0.55%	92.20%
26	2 A 2	Lime Production	CO2	Gg	355.1	0.46%	92.66%
27	1 A 4 other	Other Sectors	CO2	Gg	338.9	0.44%	93.11%
28	2 A 7 b	Sinter Production	CO2	Gg	336.1	0.44%	93.54%
29	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	316.5	0.41%	93.96%
30	1 B 2 b	Natural gas	CH4	Gg CO2e	307.1	0.40%	94.36%
31	2F7	Semiconductor Manufacture	FCs	GgCO2e	287.8	0.38%	94.74%
32	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	0.33%	95.07%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1993	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	12 453.3	16.29%	16.29%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 975.7	10.44%	26.73%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 118.8	9.31%	36.05%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 677.5	7.43%	43.47%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 320.1	5.65%	49.13%
6	4 A 1	Cattle	CH4	Gg CO2e	3 330.5	4.36%	53.48%
7	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	3 235.8	4.23%	57.72%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 144.7	4.11%	61.83%
9	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 088.9	4.04%	65.87%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 996.3	3.92%	69.80%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 184.3	2.86%	72.65%
12	1 A 4 solid	Other Sectors	CO2	Gg	2 080.0	2.72%	75.38%
13	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 052.0	2.68%	78.06%
14	2 A 1	Cement Production	CO2	Gg	2 031.9	2.66%	80.72%
15	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 672.4	2.19%	82.91%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 228.3	1.61%	84.51%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 180.0	1.54%	86.06%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 034.1	1.35%	87.41%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	878.7	1.15%	88.56%
20	4 B 1	Cattle	N2O	Gg CO2e	857.4	1.12%	89.68%
21	4 B 1	Cattle	CH4	Gg CO2e	546.3	0.71%	90.40%
22	2 B 1	Ammonia Production	CO2	Gg	538.8	0.71%	91.10%
23	4 B 8	Swine	CH4	Gg CO2e	463.7	0.61%	91.71%
24	2 A 2	Lime Production	CO2	Gg	365.2	0.48%	92.19%
25	2F7	Semiconductor Manufacture	FCs	GgCO2e	360.4	0.47%	92.66%
26	1 B 2 b	Natural gas	CH4	Gg CO2e	326.7	0.43%	93.09%
27	2 A 7 b	Sinter Production	CO2	Gg	324.6	0.42%	93.51%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	316.2	0.41%	93.92%
29	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	299.6	0.39%	94.32%
30	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	277.2	0.36%	94.68%
31	3	Solvent and other Product Use	N2O	Gg CO2e	232.5	0.30%	94.98%
32	4 D 2	Pasture, Range and Paddock Manure	N2O	Gg CO2e	228.3	0.30%	95.28%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1994	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	13 111.3	16.95%	16.95%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 688.4	9.94%	26.89%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 528.7	8.44%	35.34%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 914.7	7.65%	42.98%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 238.9	5.48%	48.46%
6	2 C 1	Iron and Steel Production	CO2	Gg	3 411.1	4.41%	52.87%
7	4 A 1	Cattle	CH4	Gg CO2e	3 350.1	4.33%	57.21%
8	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 279.1	4.24%	61.45%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	3 061.1	3.96%	65.40%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 886.8	3.73%	69.14%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 325.4	3.01%	72.14%
12	2 A 1	Cement Production	CO2	Gg	2 102.3	2.72%	74.86%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	2 004.7	2.59%	77.45%
14	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 901.8	2.46%	79.91%
15	1 A 4 solid	Other Sectors	CO2	Gg	1 855.6	2.40%	82.31%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 339.4	1.73%	84.04%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 309.0	1.69%	85.74%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 061.3	1.37%	87.11%
19	4 B 1	Cattle	N2O	Gg CO2e	858.1	1.11%	88.22%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	825.2	1.07%	89.29%
21	4 B 1	Cattle	CH4	Gg CO2e	542.2	0.70%	89.99%
22	2 B 1	Ammonia Production	CO2	Gg	507.0	0.66%	90.64%
23	4 B 8	Swine	CH4	Gg CO2e	457.1	0.59%	91.23%
24	2F7	Semiconductor Manufacture	FCs	GgCO2e	430.9	0.56%	91.79%
25	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	427.0	0.55%	92.34%
26	2 A 2	Lime Production	CO2	Gg	390.5	0.50%	92.85%
27	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	372.8	0.48%	93.33%
28	1 B 2 b	Natural gas	CH4	Gg CO2e	342.7	0.44%	93.77%
29	2 A 7 b	Sinter Production	CO2	Gg	322.9	0.42%	94.19%
30	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	286.6	0.37%	94.56%
31	3	Solvent and other Product Use	N2O	Gg CO2e	232.5	0.30%	94.86%
32	4 D 2	Pasture, Range and Paddock Manure	N2O	Gg CO2e	230.9	0.30%	95.16%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1995	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	14 339.2	17.79%	17.79%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 427.5	9.21%	27.00%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 194.0	8.92%	35.92%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	6 546.3	8.12%	44.04%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 529.8	5.62%	49.66%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 459.2	5.53%	55.19%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 921.0	4.86%	60.05%
8	4 A 1	Cattle	CH4	Gg CO2e	3 372.6	4.18%	64.24%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 893.6	3.59%	67.82%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 688.6	3.33%	71.16%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 169.1	2.69%	73.85%
12	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	2 034.4	2.52%	76.37%
13	1 A 4 solid	Other Sectors	CO2	Gg	1 746.4	2.17%	78.54%
14	2 A 1	Cement Production	CO2	Gg	1 631.3	2.02%	80.56%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 557.5	1.93%	82.49%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 364.1	1.69%	84.19%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 217.3	1.51%	85.70%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 036.3	1.29%	86.98%
19	4 B 1	Cattle	N2O	Gg CO2e	879.2	1.09%	88.07%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	857.2	1.06%	89.14%
21	2 B 1	Ammonia Production	CO2	Gg	537.1	0.67%	89.80%
22	4 B 1	Cattle	CH4	Gg CO2e	532.8	0.66%	90.46%
23	2F7	Semiconductor Manufacture	FCs	GgCO2e	505.7	0.63%	91.09%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	466.8	0.58%	91.67%
25	4 B 8	Swine	CH4	Gg CO2e	458.5	0.57%	92.24%
26	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	443.1	0.55%	92.79%
27	2 A 7 b	Sinter Production	CO2	Gg	409.9	0.51%	93.30%
28	2 A 2	Lime Production	CO2	Gg	394.6	0.49%	93.79%
29	1 B 2 b	Natural gas	CH4	Gg CO2e	368.0	0.46%	94.24%
30	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	302.5	0.38%	94.62%
31	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	259.1	0.32%	94.94%
32	2 A 3	Limestone and Dolomite Use	CO2	Gg	251.2	0.31%	95.25%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1996	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	15 287.3	18.27%	18.27%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	8 679.9	10.37%	28.64%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 322.2	9.94%	38.58%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 870.2	8.21%	46.79%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 695.9	5.61%	52.40%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 400.3	5.26%	57.66%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 702.9	4.42%	62.08%
8	4 A 1	Cattle	CH4	Gg CO2e	3 320.4	3.97%	66.05%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 737.5	3.27%	69.32%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 504.5	2.99%	72.31%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 182.2	2.61%	74.92%
12	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 765.2	2.11%	77.03%
13	1 A 4 solid	Other Sectors	CO2	Gg	1 657.7	1.98%	79.01%
14	2 A 1	Cement Production	CO2	Gg	1 634.2	1.95%	80.96%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 550.5	1.85%	82.81%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 335.9	1.60%	84.41%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 252.3	1.50%	85.91%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 008.0	1.20%	87.11%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	874.2	1.04%	88.16%
20	4 B 1	Cattle	N2O	Gg CO2e	865.0	1.03%	89.19%
21	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	610.6	0.73%	89.92%
22	2 B 1	Ammonia Production	CO2	Gg	538.7	0.64%	90.56%
23	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	538.5	0.64%	91.21%
24	4 B 1	Cattle	CH4	Gg CO2e	525.7	0.63%	91.83%
25	4 B 8	Swine	CH4	Gg CO2e	447.6	0.53%	92.37%
26	2F7	Semiconductor Manufacture	FCs	GgCO2e	403.9	0.48%	92.85%
27	1 B 2 b	Natural gas	CH4	Gg CO2e	393.9	0.47%	93.32%
28	2 A 2	Lime Production	CO2	Gg	382.7	0.46%	93.78%
29	2 A 7 b	Sinter Production	CO2	Gg	355.4	0.42%	94.20%
30	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	337.4	0.40%	94.61%
31	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	324.5	0.39%	94.99%
32	1 A 4 other	Other Sectors	CO2	Gg	301.8	0.36%	95.35%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1997	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	14 720.1	17.68%	17.68%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	7 968.6	9.57%	27.25%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 407.4	8.90%	36.15%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 504.4	7.81%	43.96%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 018.5	6.03%	49.99%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 002.2	6.01%	56.00%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 099.9	4.92%	60.92%
8	4 A 1	Cattle	CH4	Gg CO2e	3 253.7	3.91%	64.83%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 220.7	3.87%	68.70%
10	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 607.5	3.13%	71.83%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 155.8	2.59%	74.42%
12	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 936.5	2.33%	76.74%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 809.0	2.17%	78.92%
14	2 A 1	Cement Production	CO2	Gg	1 760.9	2.11%	81.03%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 430.2	1.72%	82.75%
16	1 A 4 solid	Other Sectors	CO2	Gg	1 294.5	1.55%	84.30%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 256.7	1.51%	85.81%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 024.9	1.23%	87.04%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	862.6	1.04%	88.08%
20	4 B 1	Cattle	N2O	Gg CO2e	851.4	1.02%	89.10%
21	2F7	Semiconductor Manufacture	FCs	GgCO2e	593.8	0.71%	89.82%
22	2 B 1	Ammonia Production	CO2	Gg	532.1	0.64%	90.45%
23	4 B 1	Cattle	CH4	Gg CO2e	520.5	0.63%	91.08%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	513.4	0.62%	91.70%
25	4 B 8	Swine	CH4	Gg CO2e	448.3	0.54%	92.23%
26	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	418.3	0.50%	92.74%
27	2 A 2	Lime Production	CO2	Gg	412.5	0.50%	93.23%
28	1 B 2 b	Natural gas	CH4	Gg CO2e	410.3	0.49%	93.73%
29	2 A 7 b	Sinter Production	CO2	Gg	384.3	0.46%	94.19%
30	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	349.2	0.42%	94.61%
31	1 A 4 other	Other Sectors	CO2	Gg	264.1	0.32%	94.92%
32	2F9	Other Sources of SF6	SF6	GgCO2e	256.1	0.31%	95.23%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1998	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	15 135.5	18.32%	18.32%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 734.1	11.78%	30.10%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 457.1	9.03%	39.13%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 805.5	8.24%	47.37%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 276.4	5.18%	52.54%
6	2 C 1	Iron and Steel Production	CO2	Gg	3 900.4	4.72%	57.26%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 498.0	4.23%	61.50%
8	4 A 1	Cattle	CH4	Gg CO2e	3 226.6	3.91%	65.40%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 961.2	3.58%	68.99%
10	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 511.8	3.04%	72.03%
11	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 212.4	2.68%	74.71%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 172.2	2.63%	77.34%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 834.4	2.22%	79.56%
14	2 A 1	Cement Production	CO2	Gg	1 598.7	1.94%	81.49%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 376.8	1.67%	83.16%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 259.8	1.52%	84.68%
17	1 A 4 solid	Other Sectors	CO2	Gg	1 127.3	1.36%	86.05%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 040.1	1.26%	87.31%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	896.7	1.09%	88.39%
20	4 B 1	Cattle	N2O	Gg CO2e	848.1	1.03%	89.42%
21	2 B 1	Ammonia Production	CO2	Gg	525.3	0.64%	90.06%
22	4 B 1	Cattle	CH4	Gg CO2e	517.0	0.63%	90.68%
23	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	492.2	0.60%	91.28%
24	2F7	Semiconductor Manufacture	FCs	GgCO2e	477.8	0.58%	91.86%
25	4 B 8	Swine	CH4	Gg CO2e	462.4	0.56%	92.41%
26	2 A 2	Lime Production	CO2	Gg	453.8	0.55%	92.96%
27	1 B 2 b	Natural gas	CH4	Gg CO2e	424.9	0.51%	93.48%
28	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	416.6	0.50%	93.98%
29	2 A 7 b	Sinter Production	CO2	Gg	345.4	0.42%	94.40%
30	2F9	Other Sources of SF6	SF6	GgCO2e	286.1	0.35%	94.75%
31	2 A 3	Limestone and Dolomite Use	CO2	Gg	264.1	0.32%	95.07%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1999	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	15 406.0	19.02%	19.02%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 523.1	11.75%	30.77%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 839.8	9.68%	40.45%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 324.0	7.81%	48.25%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 336.4	5.35%	53.60%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 789.2	4.68%	58.28%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 759.3	4.64%	62.92%
8	4 A 1	Cattle	CH4	Gg CO2e	3 204.8	3.96%	66.88%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 406.7	2.97%	69.85%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 113.3	2.61%	72.46%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 056.5	2.54%	74.99%
12	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 806.9	2.23%	77.23%
13	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 763.6	2.18%	79.40%
14	2 A 1	Cement Production	CO2	Gg	1 607.4	1.98%	81.39%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 400.1	1.73%	83.11%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 222.8	1.51%	84.62%
17	1 A 4 solid	Other Sectors	CO2	Gg	1 066.2	1.32%	85.94%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 046.9	1.29%	87.23%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	923.5	1.14%	88.37%
20	4 B 1	Cattle	N2O	Gg CO2e	843.6	1.04%	89.41%
21	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	539.2	0.67%	90.08%
22	2 B 1	Ammonia Production	CO2	Gg	530.4	0.65%	90.73%
23	4 B 1	Cattle	CH4	Gg CO2e	510.4	0.63%	91.36%
24	2F7	Semiconductor Manufacture	FCs	GgCO2e	453.9	0.56%	91.92%
25	2 A 2	Lime Production	CO2	Gg	453.1	0.56%	92.48%
26	1 B 2 b	Natural gas	CH4	Gg CO2e	451.7	0.56%	93.04%
27	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	435.3	0.54%	93.58%
28	4 B 8	Swine	CH4	Gg CO2e	416.6	0.51%	94.09%
29	2 A 7 b	Sinter Production	CO2	Gg	350.0	0.43%	94.52%
30	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	251.0	0.31%	94.83%
31	2 A 3	Limestone and Dolomite Use	CO2	Gg	247.4	0.31%	95.14%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	2000	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	14 683.6	18.10%	18.10%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	10 765.3	13.27%	31.37%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 766.4	8.34%	39.71%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 110.7	7.53%	47.24%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 824.4	5.95%	53.18%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 665.3	5.75%	58.93%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 201.8	5.18%	64.11%
8	4 A 1	Cattle	CH4	Gg CO2e	3 190.5	3.93%	68.04%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 303.3	2.84%	70.88%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 059.5	2.54%	73.42%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 991.6	2.45%	75.88%
12	2 A 1	Cement Production	CO2	Gg	1 711.6	2.11%	77.99%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 699.5	2.09%	80.08%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 314.5	1.62%	81.70%
15	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 196.1	1.47%	83.17%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 185.4	1.46%	84.64%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 060.6	1.31%	85.94%
18	2 B 2	Nitric Acid Production	N2O	Gg CO2e	951.6	1.17%	87.12%
19	1 A 4 solid	Other Sectors	CO2	Gg	951.2	1.17%	88.29%
20	4 B 1	Cattle	N2O	Gg CO2e	836.6	1.03%	89.32%
21	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	592.7	0.73%	90.05%
22	2 B 1	Ammonia Production	CO2	Gg	518.0	0.64%	90.69%
23	4 B 1	Cattle	CH4	Gg CO2e	501.3	0.62%	91.31%
24	2 A 2	Lime Production	CO2	Gg	497.5	0.61%	91.92%
25	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	487.7	0.60%	92.52%
26	1 B 2 b	Natural gas	CH4	Gg CO2e	469.7	0.58%	93.10%
27	2F7	Semiconductor Manufacture	FCs	GgCO2e	407.1	0.50%	93.60%
28	4 B 8	Swine	CH4	Gg CO2e	404.3	0.50%	94.10%
29	2 A 7 b	Sinter Production	CO2	Gg	339.2	0.42%	94.52%
30	2 A 3	Limestone and Dolomite Use	CO2	Gg	275.6	0.34%	94.86%
31	2F9	Other Sources of SF6	SF6	GgCO2e	265.2	0.33%	95.18%

Rank	IPCC Source Categories		GHG	Unit	2001	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	15 628.8	18.33%	18.33%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	11 964.2	14.03%	32.36%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 459.6	8.75%	41.10%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 154.7	7.22%	48.32%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 873.0	6.89%	55.21%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 448.4	5.22%	60.42%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 159.4	4.88%	65.30%
8	4 A 1	Cattle	CH4	Gg CO2e	3 140.0	3.68%	68.98%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 218.1	2.60%	71.58%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 128.9	2.50%	74.08%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 014.2	2.36%	76.44%
12	2 A 1	Cement Production	CO2	Gg	1 719.9	2.02%	78.46%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 711.5	2.01%	80.47%
14	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 476.8	1.73%	82.20%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 382.7	1.62%	83.82%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 187.0	1.39%	85.21%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 075.6	1.26%	86.47%
18	1 A 4 solid	Other Sectors	CO2	Gg	925.4	1.09%	87.56%
19	4 B 1	Cattle	N2O	Gg CO2e	824.5	0.97%	88.52%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	786.5	0.92%	89.45%
21	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	690.9	0.81%	90.26%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	615.9	0.72%	90.98%
23	2 A 2	Lime Production	CO2	Gg	506.6	0.59%	91.57%
24	4 B 1	Cattle	CH4	Gg CO2e	486.6	0.57%	92.14%
25	1 B 2 b	Natural gas	CH4	Gg CO2e	476.5	0.56%	92.70%
26	2 B 1	Ammonia Production	CO2	Gg	472.5	0.55%	93.26%
27	4 B 8	Swine	CH4	Gg CO2e	422.5	0.50%	93.75%
28	2F7	Semiconductor Manufacture	FCs	GgCO2e	416.9	0.49%	94.24%
29	2 A 7 b	Sinter Production	CO2	Gg	334.0	0.39%	94.63%
30	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	328.1	0.38%	95.02%

Table A1.1: Level assessment excluding LULUCF

Rank	**IPCC Source Categories**		**GHG**	Unit	**2002**	**Level Assessment**	**Cumulative Total**
1	1 A gaseous	Fuel combustion activities	CO2	Gg	15 792.4	18.12%	18.12%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	13 529.4	15.52%	33.64%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 340.7	8.42%	42.06%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 626.8	7.60%	49.66%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 510.1	6.32%	55.98%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 857.6	5.57%	61.56%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 606.8	5.29%	66.84%
8	4 A 1	Cattle	CH4	Gg CO2e	3 086.5	3.54%	70.38%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 181.2	2.50%	72.89%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 157.5	2.48%	75.36%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 775.7	2.04%	77.40%
12	2 A 1	Cement Production	CO2	Gg	1 735.7	1.99%	79.39%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 710.6	1.96%	81.35%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 421.0	1.63%	82.98%
15	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 181.7	1.36%	84.34%
16	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 081.0	1.24%	85.58%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	831.4	0.95%	86.53%
18	4 B 1	Cattle	N2O	Gg CO2e	809.0	0.93%	87.46%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	807.2	0.93%	88.39%
20	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	777.1	0.89%	89.28%
21	1 A 4 solid	Other Sectors	CO2	Gg	763.3	0.88%	90.15%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	708.8	0.81%	90.97%
23	2 A 2	Lime Production	CO2	Gg	546.6	0.63%	91.59%
24	1 B 2 b	Natural gas	CH4	Gg CO2e	496.6	0.57%	92.16%
25	2 B 1	Ammonia Production	CO2	Gg	486.1	0.56%	92.72%
26	4 B 1	Cattle	CH4	Gg CO2e	476.4	0.55%	93.27%
27	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	432.3	0.50%	93.76%
28	2F7	Semiconductor Manufacture	FCs	GgCO2e	425.8	0.49%	94.25%
29	4 B 8	Swine	CH4	Gg CO2e	403.3	0.46%	94.71%
30	2 A 7 b	Sinter Production	CO2	Gg	373.5	0.43%	95.14%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	2003	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	17 069.8	18.30%	18.30%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 142.3	16.23%	34.53%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 175.3	8.76%	43.29%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 916.2	7.41%	50.70%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 777.1	7.26%	57.96%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 994.3	5.35%	63.32%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 523.1	4.85%	68.17%
8	4 A 1	Cattle	CH4	Gg CO2e	3 047.2	3.27%	71.43%
9	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 303.6	2.47%	73.90%
10	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 205.9	2.36%	76.26%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 843.9	1.98%	78.24%
12	2 A 1	Cement Production	CO2	Gg	1 754.5	1.88%	80.12%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 603.5	1.72%	81.84%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 415.5	1.52%	83.36%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 139.3	1.22%	84.58%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 138.5	1.22%	85.80%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 086.0	1.16%	86.96%
18	2 B 2	Nitric Acid Production	N2O	Gg CO2e	883.4	0.95%	87.91%
19	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	859.1	0.92%	88.83%
20	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	816.6	0.88%	89.71%
21	4 B 1	Cattle	N2O	Gg CO2e	799.8	0.86%	90.56%
22	1 A 4 solid	Other Sectors	CO2	Gg	694.6	0.74%	91.31%
23	2 A 2	Lime Production	CO2	Gg	576.9	0.62%	91.93%
24	2 B 1	Ammonia Production	CO2	Gg	526.4	0.56%	92.49%
25	1 B 2 b	Natural gas	CH4	Gg CO2e	515.3	0.55%	93.04%
26	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	488.0	0.52%	93.57%
27	2F7	Semiconductor Manufacture	FCs	GgCO2e	483.0	0.52%	94.08%
28	4 B 1	Cattle	CH4	Gg CO2e	470.4	0.50%	94.59%
29	4 B 8	Swine	CH4	Gg CO2e	410.3	0.44%	95.03%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	2004	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	16 914.9	18.45%	18.45%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 837.1	17.28%	35.73%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 798.7	7.42%	43.15%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 674.2	7.28%	50.43%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 591.7	7.19%	57.62%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 987.3	5.44%	63.06%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 446.2	4.85%	67.91%
8	4 A 1	Cattle	CH4	Gg CO2e	3 044.3	3.32%	71.23%
9	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 515.1	2.74%	73.98%
10	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	2 049.3	2.24%	76.21%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 992.7	2.17%	78.39%
12	2 A 1	Cement Production	CO2	Gg	1 790.0	1.95%	80.34%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 552.5	1.69%	82.03%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 459.7	1.59%	83.63%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 173.0	1.28%	84.91%
16	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 143.5	1.25%	86.15%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 082.7	1.18%	87.33%
18	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	946.4	1.03%	88.37%
19	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	892.7	0.97%	89.34%
20	4 B 1	Cattle	N2O	Gg CO2e	800.7	0.87%	90.21%
21	2 A 2	Lime Production	CO2	Gg	601.1	0.66%	90.87%
22	1 A 4 solid	Other Sectors	CO2	Gg	561.3	0.61%	91.48%
23	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	558.5	0.61%	92.09%
24	1 B 2 b	Natural gas	CH4	Gg CO2e	539.1	0.59%	92.68%
25	2F7	Semiconductor Manufacture	FCs	GgCO2e	508.9	0.56%	93.24%
26	2 B 1	Ammonia Production	CO2	Gg	469.9	0.51%	93.75%
27	4 B 1	Cattle	CH4	Gg CO2e	467.5	0.51%	94.26%
28	4 B 8	Swine	CH4	Gg CO2e	385.3	0.42%	94.68%
29	2 A 7 b	Sinter Production	CO2	Gg	328.5	0.36%	95.04%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	2005	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	18 508.0	19.85%	19.85%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	16 658.0	17.86%	37.71%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 092.0	7.60%	45.31%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 392.8	6.85%	52.17%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 844.0	6.27%	58.43%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 478.5	5.87%	64.31%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 995.0	5.36%	69.66%
8	4 A 1	Cattle	CH4	Gg CO2e	3 016.5	3.23%	72.90%
9	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 148.7	2.30%	75.20%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 964.6	2.11%	77.31%
11	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	1 896.6	2.03%	79.34%
12	2 A 1	Cement Production	CO2	Gg	1 797.5	1.93%	81.27%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 562.0	1.67%	82.95%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 391.0	1.49%	84.44%
15	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 145.7	1.23%	85.67%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 090.6	1.17%	86.83%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 086.7	1.17%	88.00%
18	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	903.9	0.97%	88.97%
19	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	848.8	0.91%	89.88%
20	4 B 1	Cattle	N2O	Gg CO2e	789.1	0.85%	90.73%
21	2 A 2	Lime Production	CO2	Gg	578.7	0.62%	91.35%
22	1 A 4 solid	Other Sectors	CO2	Gg	571.9	0.61%	91.96%
23	1 B 2 b	Natural gas	CH4	Gg CO2e	555.8	0.60%	92.56%
24	2 B 1	Ammonia Production	CO2	Gg	503.1	0.54%	93.09%
25	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	490.0	0.53%	93.62%
26	4 B 1	Cattle	CH4	Gg CO2e	458.2	0.49%	94.11%
27	4 B 8	Swine	CH4	Gg CO2e	396.9	0.43%	94.54%
28	2 A 7 b	Sinter Production	CO2	Gg	309.5	0.33%	94.87%
29	2F7	Semiconductor Manufacture	FCs	GgCO2e	297.6	0.32%	95.19%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	2006	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	16 792.1	18.43%	18.43%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 788.4	17.33%	35.77%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 188.6	7.89%	43.66%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 144.1	6.75%	50.40%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 666.2	6.22%	56.62%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 642.5	6.19%	62.82%
7	2 C 1	Iron and Steel Production	CO2	Gg	5 089.5	5.59%	68.41%
8	4 A 1	Cattle	CH4	Gg CO2e	3 009.5	3.30%	71.71%
9	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 153.4	2.36%	74.07%
10	2 A 1	Cement Production	CO2	Gg	1 954.1	2.15%	76.22%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 880.7	2.06%	78.28%
12	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	1 759.6	1.93%	80.22%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 610.3	1.77%	81.98%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 348.7	1.48%	83.46%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 170.6	1.29%	84.75%
16	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 119.0	1.23%	85.98%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 091.9	1.20%	87.18%
18	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	861.7	0.95%	88.12%
19	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	852.9	0.94%	89.06%
20	4 B 1	Cattle	N2O	Gg CO2e	787.8	0.86%	89.92%
21	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	695.5	0.76%	90.69%
22	2 A 2	Lime Production	CO2	Gg	585.7	0.64%	91.33%
23	1 B 2 b	Natural gas	CH4	Gg CO2e	577.6	0.63%	91.96%
24	1 A 4 solid	Other Sectors	CO2	Gg	560.7	0.62%	92.58%
25	2 B 1	Ammonia Production	CO2	Gg	541.8	0.59%	93.17%
26	4 B 1	Cattle	CH4	Gg CO2e	454.9	0.50%	93.67%
27	4 B 8	Swine	CH4	Gg CO2e	395.0	0.43%	94.11%
28	2 A 7 b	Sinter Production	CO2	Gg	312.4	0.34%	94.45%
29	2F7	Semiconductor Manufacture	FCs	GgCO2e	308.7	0.34%	94.79%
30	2 A 3	Limestone and Dolomite Use	CO2	Gg	296.2	0.33%	95.11%

Rank	IPCC Source Categories		GHG	Unit	BY	2006	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	15 788.4	17.33%	0.107	28.69%	28.69%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	11 300.5	16 792.1	18.43%	0.036	9.74%	38.43%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 930.3	6 144.1	6.75%	0.028	7.65%	46.08%
4	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	560.7	0.62%	0.024	6.40%	52.49%
5	6 A	Solid Waste Disposal on Land	CH4	Gg CO2e	3 376.6	1 759.6	1.93%	0.020	5.46%	57.95%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	5 642.5	6.19%	0.015	3.97%	61.91%
7	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 883.6	1 880.7	2.06%	0.014	3.69%	65.61%
8	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 319.1	7 188.6	7.89%	0.012	3.17%	68.77%
9	2C3	Aluminium production	PFCs	GgCO2e	1 050.2	0.0	0.00%	0.012	3.10%	71.87%
10	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 009.5	3.30%	0.010	2.79%	74.67%
11	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	5 089.5	5.59%	0.010	2.59%	77.26%
12	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	852.9	0.94%	0.008	2.13%	79.39%
13	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	280.1	0.31%	0.007	1.98%	81.37%
14	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	695.5	0.76%	0.005	1.44%	82.80%
15	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	264.1	861.7	0.95%	0.005	1.43%	84.24%
16	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 804.9	1 610.3	1.77%	0.004	1.20%	85.43%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.7	1 091.9	1.20%	0.004	1.07%	86.50%
18	2 A 1	Cement Production	CO2	Gg	2 033.4	1 954.1	2.15%	0.004	0.99%	87.49%
19	1 A 4 other	Other Sectors	CO2	Gg	349.6	75.9	0.08%	0.003	0.84%	88.33%
20	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	0.0	0.00%	0.003	0.75%	89.08%
21	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	577.6	0.63%	0.003	0.68%	89.75%
22	4 B 1	Cattle	N2O	Gg CO2e	908.1	787.8	0.86%	0.002	0.66%	90.42%
23	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 170.6	1.29%	0.002	0.62%	91.04%
24	2 A 7 b	Sinter Production	CO2	Gg	481.2	312.4	0.34%	0.002	0.62%	91.66%
25	4 B 1	Cattle	CH4	Gg CO2e	587.1	454.9	0.50%	0.002	0.57%	92.23%
26	1 A 3 a jet kerosene	Civil Aviation	CO2	Gg	24.2	218.2	0.24%	0.002	0.49%	92.71%
27	2 C 3	Aluminium production	CO2	Gg	158.4	0.0	0.00%	0.002	0.47%	93.18%
28	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 311.6	1 348.7	1.48%	0.002	0.41%	93.59%
29	2F7	Semiconductor Manufacture	FCs	GgCO2e	133.1	308.7	0.34%	0.001	0.40%	93.99%
30	6 B	Wastewater Handling	N2O	Gg CO2e	108.4	278.3	0.31%	0.001	0.39%	94.39%
31	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	314.7	228.2	0.25%	0.001	0.34%	94.73%
32	2 A 2	Lime Production	CO2	Gg	396.2	585.7	0.64%	0.001	0.33%	95.07%

Table A1.2: Trend assessment excluding LULUCF

Rank		IPCC Source Categories	GHG	Unit	BY	BY ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-11 511.2	11 511.2	11.58%	11.58%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	11 300.5	11 300.5	11.37%	22.96%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 930.3	7 930.3	7.98%	30.94%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 319.1	7 319.1	7.37%	38.30%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	6 247.0	6.29%	44.59%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 016.3	5 016.3	5.05%	49.64%
7	5 A 2	Land converted to forest land	CO2	Gg	-4 642.8	4 642.8	4.67%	54.31%
8	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	4 012.9	4.04%	58.35%
9	4 A 1	Cattle	CH4	Gg CO	3 560.9	3 560.9	3.58%	61.93%
10	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	3 545.7	3.57%	65.50%
11	6 A	Solid Waste Disposal on Land	CH4	Gg CO	3 376.6	3 376.6	3.40%	68.90%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 883.6	2 883.6	2.90%	71.80%
13	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	2 654.1	2.67%	74.47%
14	2 A 1	Cement Production	CO2	Gg	2 033.4	2 033.4	2.05%	76.52%
15	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 957.7	1 957.7	1.97%	78.49%
16	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 804.9	1 804.9	1.82%	80.30%
17	5 B 2	Land converted to cropland	CO2	Gg	1 547.9	1 547.9	1.56%	81.86%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 311.6	1 311.6	1.32%	83.18%
19	4 D 3	Indirect Emissions	N2O	Gg CO	1 309.7	1 309.7	1.32%	84.50%
20	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 228.7	1.24%	85.74%
21	2C3	Aluminium production	PFCs	GgCO	1 050.2	1 050.2	1.06%	86.79%
22	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 016.0	1 016.0	1.02%	87.82%
23	2 B 2	Nitric Acid Production	N2O	Gg CO	912.0	912.0	0.92%	88.73%
24	4 B 1	Cattle	N2O	Gg CO	908.1	908.1	0.91%	89.65%
25	5 C 2	Land converted to grassland	CO2	Gg	-880.8	880.8	0.89%	90.53%
26	5 F 2	Land converted to Other land	CO2	Gg	809.9	809.9	0.82%	91.35%
27	4 B 1	Cattle	CH4	Gg CO	587.1	587.1	0.59%	91.94%
28	2 B 1	Ammonia Production	CO2	Gg	516.6	516.6	0.52%	92.46%
29	2 A 7 b	Sinter Production	CO2	Gg	481.2	481.2	0.48%	92.94%
30	4 B 8	Swine	CH4	Gg CO	447.7	447.7	0.45%	93.39%
31	2 A 2	Lime Production	CO2	Gg	396.2	396.2	0.40%	93.79%
32	1 A 4 other	Other Sectors	CO2	Gg	349.6	349.6	0.35%	94.14%
33	1 A 4 biomass	Other Sectors	CH4	Gg CO	314.7	314.7	0.32%	94.46%
34	3	Solvent and other Product Use	CO2	Gg	282.7	282.7	0.28%	94.75%
35	1 B 2 b	Natural gas	CH4	Gg CO	272.7	272.7	0.27%	95.02%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	1991	1991 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-17 415.7	17 415.7	15.91%	15.91%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	11 940.3	11 940.3	10.91%	26.82%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 698.5	8 698.5	7.95%	34.77%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 694.4	7 694.4	7.03%	41.80%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 817.0	6 817.0	6.23%	48.03%
6	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 830.0	4 830.0	4.41%	52.45%
7	5 A 2	Land converted to forest land	CO2	Gg	-4 779.8	4 779.8	4.37%	56.81%
8	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 760.6	4 760.6	4.35%	61.16%
9	2 C 1	Iron and Steel Production	CO2	Gg	3 509.5	3 509.5	3.21%	64.37%
10	4 A 1	Cattle	CH4	Gg CO	3 503.5	3 503.5	3.20%	67.57%
11	6 A	Solid Waste Disposal on Land	CH4	Gg CO	3 370.0	3 370.0	3.08%	70.65%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 270.6	3 270.6	2.99%	73.64%
13	1 A 4 solid	Other Sectors	CO2	Gg	2 934.3	2 934.3	2.68%	76.32%
14	2 A 1	Cement Production	CO2	Gg	2 005.0	2 005.0	1.83%	78.15%
15	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 978.2	1 978.2	1.81%	79.96%
16	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 908.5	1 908.5	1.74%	81.70%
17	5 B 2	Land converted to cropland	CO2	Gg	1 551.5	1 551.5	1.42%	83.12%
18	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 498.0	1 498.0	1.37%	84.49%
19	4 D 3	Indirect Emissions	N2O	Gg CO	1 394.3	1 394.3	1.27%	85.77%
20	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 175.5	1 175.5	1.07%	86.84%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 056.9	1 056.9	0.97%	87.81%
22	2C3	Aluminium production	PFCs	GgCO	1 050.2	1 050.2	0.96%	88.76%
23	2 B 2	Nitric Acid Production	N2O	Gg CO	927.3	927.3	0.85%	89.61%
24	4 B 1	Cattle	N2O	Gg CO	896.1	896.1	0.82%	90.43%
25	5 C 2	Land converted to grassland	CO2	Gg	-869.4	869.4	0.79%	91.23%
26	5 F 2	Land converted to Other land	CO2	Gg	829.2	829.2	0.76%	91.98%
27	4 B 1	Cattle	CH4	Gg CO	576.9	576.9	0.53%	92.51%
28	2 B 1	Ammonia Production	CO2	Gg	545.7	545.7	0.50%	93.01%
29	4 B 8	Swine	CH4	Gg CO	441.7	441.7	0.40%	93.41%
30	2 A 7 b	Sinter Production	CO2	Gg	391.6	391.6	0.36%	93.77%
31	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	390.0	390.0	0.36%	94.13%
32	2 A 2	Lime Production	CO2	Gg	361.3	361.3	0.33%	94.46%
33	1 A 4 biomass	Other Sectors	CH4	Gg CO	341.8	341.8	0.31%	94.77%
34	1 B 2 b	Natural gas	CH4	Gg CO	288.1	288.1	0.26%	95.03%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	1992	1992 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-12 214.7	12 214.7	12.49%	12.49%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	12 000.1	12 000.1	12.27%	24.76%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 316.4	8 316.4	8.50%	33.27%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 183.5	7 183.5	7.35%	40.61%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 156.8	5 156.8	5.27%	45.89%
6	5 A 2	Land converted to forest land	CO2	Gg	-4 916.7	4 916.7	5.03%	50.92%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 139.6	4 139.6	4.23%	55.15%
8	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 009.5	4 009.5	4.10%	59.25%
9	4 A 1	Cattle	CH4	Gg CO	3 340.8	3 340.8	3.42%	62.67%
10	6 A	Solid Waste Disposal on Land	CH4	Gg CO	3 281.7	3 281.7	3.36%	66.02%
11	2 C 1	Iron and Steel Production	CO2	Gg	3 074.9	3 074.9	3.14%	69.17%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 525.9	2 525.9	2.58%	71.75%
13	1 A 4 solid	Other Sectors	CO2	Gg	2 510.7	2 510.7	2.57%	74.32%
14	2 A 1	Cement Production	CO2	Gg	2 105.0	2 105.0	2.15%	76.47%
15	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 916.8	1 916.8	1.96%	78.43%
16	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 832.4	1 832.4	1.87%	80.30%
17	5 B 2	Land converted to cropland	CO2	Gg	1 559.4	1 559.4	1.59%	81.90%
18	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 481.6	1 481.6	1.52%	83.41%
19	4 D 3	Indirect Emissions	N2O	Gg CO	1 276.6	1 276.6	1.31%	84.72%
20	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 217.2	1 217.2	1.24%	85.96%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 068.1	1 068.1	1.09%	87.06%
22	5 C 2	Land converted to grassland	CO2	Gg	-861.2	861.2	0.88%	87.94%
23	4 B 1	Cattle	N2O	Gg CO	858.5	858.5	0.88%	88.81%
24	5 F 2	Land converted to Other land	CO2	Gg	848.5	848.5	0.87%	89.68%
25	2 B 2	Nitric Acid Production	N2O	Gg CO	837.5	837.5	0.86%	90.54%
26	2 B 1	Ammonia Production	CO2	Gg	552.8	552.8	0.57%	91.10%
27	4 B 1	Cattle	CH4	Gg CO	552.0	552.0	0.56%	91.67%
28	4 B 8	Swine	CH4	Gg CO	451.6	451.6	0.46%	92.13%
29	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	447.1	447.1	0.46%	92.59%
30	2C3	Aluminium production	PFCs	GgCO	417.6	417.6	0.43%	93.01%
31	2 A 2	Lime Production	CO2	Gg	355.1	355.1	0.36%	93.38%
32	1 A 4 other	Other Sectors	CO2	Gg	338.9	338.9	0.35%	93.72%
33	2 A 7 b	Sinter Production	CO2	Gg	336.1	336.1	0.34%	94.07%
34	1 A 4 biomass	Other Sectors	CH4	Gg CO	316.5	316.5	0.32%	94.39%
35	1 B 2 b	Natural gas	CH4	Gg CO	307.1	307.1	0.31%	94.71%
36	2F7	Semiconductor Manufacture	FCs	GgCO	287.8	287.8	0.29%	95.00%

Rank	IPCC Source Categories		GHG	Unit	1993	1993 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-16 051.3	16 051.3	15.79%	15.79%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	12 453.3	12 453.3	12.25%	28.04%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 975.7	7 975.7	7.84%	35.88%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 118.8	7 118.8	7.00%	42.88%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 677.5	5 677.5	5.58%	48.47%
6	5 A 2	Land converted to forest land	CO2	Gg	-5 053.7	5 053.7	4.97%	53.44%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 320.1	4 320.1	4.25%	57.69%
8	4 A 1	Cattle	CH4	Gg CO	3 330.5	3 330.5	3.28%	60.96%
9	6 A	Solid Waste Disposal on Land	CH4	Gg CO	3 235.8	3 235.8	3.18%	64.15%
10	2 C 1	Iron and Steel Production	CO2	Gg	3 144.7	3 144.7	3.09%	67.24%
11	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 088.9	3 088.9	3.04%	70.28%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 996.3	2 996.3	2.95%	73.22%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 184.3	2 184.3	2.15%	75.37%
14	1 A 4 solid	Other Sectors	CO2	Gg	2 080.0	2 080.0	2.05%	77.42%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 052.0	2 052.0	2.02%	79.44%
16	2 A 1	Cement Production	CO2	Gg	2 031.9	2 031.9	2.00%	81.43%
17	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 672.4	1 672.4	1.64%	83.08%
18	5 B 2	Land converted to cropland	CO2	Gg	1 571.1	1 571.1	1.55%	84.63%
19	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 228.3	1 228.3	1.21%	85.83%
20	4 D 3	Indirect Emissions	N2O	Gg CO	1 180.0	1 180.0	1.16%	86.99%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 034.1	1 034.1	1.02%	88.01%
22	2 B 2	Nitric Acid Production	N2O	Gg CO	878.7	878.7	0.86%	88.88%
23	5 F 2	Land converted to Other land	CO2	Gg	867.8	867.8	0.85%	89.73%
24	4 B 1	Cattle	N2O	Gg CO	857.4	857.4	0.84%	90.57%
25	5 C 2	Land converted to grassland	CO2	Gg	-855.8	855.8	0.84%	91.41%
26	4 B 1	Cattle	CH4	Gg CO	546.3	546.3	0.54%	91.95%
27	2 B 1	Ammonia Production	CO2	Gg	538.8	538.8	0.53%	92.48%
28	4 B 8	Swine	CH4	Gg CO	463.7	463.7	0.46%	92.94%
29	2 A 2	Lime Production	CO2	Gg	365.2	365.2	0.36%	93.30%
30	2F7	Semiconductor Manufacture	FCs	GgCC	360.4	360.4	0.35%	93.65%
31	1 B 2 b	Natural gas	CH4	Gg CO	326.7	326.7	0.32%	93.97%
32	2 A 7 b	Sinter Production	CO2	Gg	324.6	324.6	0.32%	94.29%
33	1 A 4 biomass	Other Sectors	CH4	Gg CO	316.2	316.2	0.31%	94.60%
34	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	299.6	299.6	0.29%	94.90%
35	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCC	277.2	277.2	0.27%	95.17%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	1994	1994 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-14 991.7	14 991.7	14.82%	14.82%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	13 111.3	13 111.3	12.96%	27.78%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 688.4	7 688.4	7.60%	35.38%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 528.7	6 528.7	6.45%	41.84%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 914.7	5 914.7	5.85%	47.68%
6	5 A 2	Land converted to forest land	CO2	Gg	-4 793.9	4 793.9	4.74%	52.42%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 238.9	4 238.9	4.19%	56.61%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 411.1	3 411.1	3.37%	59.98%
9	4 A 1	Cattle	CH4	Gg C(	3 350.1	3 350.1	3.31%	63.30%
10	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 279.1	3 279.1	3.24%	66.54%
11	6 A	Solid Waste Disposal on Land	CH4	Gg C(	3 061.1	3 061.1	3.03%	69.56%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 886.8	2 886.8	2.85%	72.42%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 325.4	2 325.4	2.30%	74.72%
14	2 A 1	Cement Production	CO2	Gg	2 102.3	2 102.3	2.08%	76.79%
15	4 D 1	Direct Soil Emissions	N2O	Gg C(	2 004.7	2 004.7	1.98%	78.78%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 901.8	1 901.8	1.88%	80.66%
17	1 A 4 solid	Other Sectors	CO2	Gg	1 855.6	1 855.6	1.83%	82.49%
18	5 B 2	Land converted to cropland	CO2	Gg	1 573.3	1 573.3	1.56%	84.05%
19	4 D 3	Indirect Emissions	N2O	Gg C(	1 339.4	1 339.4	1.32%	85.37%
20	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 309.0	1 309.0	1.29%	86.66%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 061.3	1 061.3	1.05%	87.71%
22	5 C 2	Land converted to grassland	CO2	Gg	-872.8	872.8	0.86%	88.58%
23	4 B 1	Cattle	N2O	Gg C(	858.1	858.1	0.85%	89.42%
24	5 F 2	Land converted to Other land	CO2	Gg	833.0	833.0	0.82%	90.25%
25	2 B 2	Nitric Acid Production	N2O	Gg C(	825.2	825.2	0.82%	91.06%
26	4 B 1	Cattle	CH4	Gg C(	542.2	542.2	0.54%	91.60%
27	2 B 1	Ammonia Production	CO2	Gg	507.0	507.0	0.50%	92.10%
28	4 B 8	Swine	CH4	Gg C(	457.1	457.1	0.45%	92.55%
29	2F7	Semiconductor Manufacture	FCs	GgCC	430.9	430.9	0.43%	92.98%
30	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	427.0	427.0	0.42%	93.40%
31	2 A 2	Lime Production	CO2	Gg	390.5	390.5	0.39%	93.79%
32	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCC	372.8	372.8	0.37%	94.15%
33	1 B 2 b	Natural gas	CH4	Gg C(	342.7	342.7	0.34%	94.49%
34	2 A 7 b	Sinter Production	CO2	Gg	322.9	322.9	0.32%	94.81%
35	1 A 4 biomass	Other Sectors	CH4	Gg C(	286.6	286.6	0.28%	95.10%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	1995	1995 ABS	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	14 339.2	14 339.2	13.84%	13.84%
2	5 A 1	Forest land remaining forest land	CO2	Gg	-14 288.1	14 288.1	13.79%	27.63%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 427.5	7 427.5	7.17%	34.79%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 194.0	7 194.0	6.94%	41.74%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	6 546.3	6 546.3	6.32%	48.05%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 529.8	4 529.8	4.37%	52.42%
7	5 A 2	Land converted to forest land	CO2	Gg	-4 476.8	4 476.8	4.32%	56.74%
8	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 459.2	4 459.2	4.30%	61.05%
9	2 C 1	Iron and Steel Production	CO2	Gg	3 921.0	3 921.0	3.78%	64.83%
10	4 A 1	Cattle	CH4	Gg CO	3 372.6	3 372.6	3.25%	68.09%
11	6 A	Solid Waste Disposal on Land	CH4	Gg CO	2 893.6	2 893.6	2.79%	70.88%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 688.6	2 688.6	2.59%	73.47%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 169.1	2 169.1	2.09%	75.57%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO	2 034.4	2 034.4	1.96%	77.53%
15	1 A 4 solid	Other Sectors	CO2	Gg	1 746.4	1 746.4	1.69%	79.21%
16	2 A 1	Cement Production	CO2	Gg	1 631.3	1 631.3	1.57%	80.79%
17	5 B 2	Land converted to cropland	CO2	Gg	1 568.8	1 568.8	1.51%	82.30%
18	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 557.5	1 557.5	1.50%	83.81%
19	4 D 3	Indirect Emissions	N2O	Gg CO	1 364.1	1 364.1	1.32%	85.12%
20	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 217.3	1 217.3	1.17%	86.30%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 036.3	1 036.3	1.00%	87.30%
22	5 C 2	Land converted to grassland	CO2	Gg	-997.5	997.5	0.96%	88.26%
23	4 B 1	Cattle	N2O	Gg CO	879.2	879.2	0.85%	89.11%
24	2 B 2	Nitric Acid Production	N2O	Gg CO	857.2	857.2	0.83%	89.94%
25	5 F 2	Land converted to Other land	CO2	Gg	743.9	743.9	0.72%	90.65%
26	2 B 1	Ammonia Production	CO2	Gg	537.1	537.1	0.52%	91.17%
27	4 B 1	Cattle	CH4	Gg CO	532.8	532.8	0.51%	91.69%
28	2F7	Semiconductor Manufacture	FCs	GgCC	505.7	505.7	0.49%	92.17%
29	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	466.8	466.8	0.45%	92.62%
30	4 B 8	Swine	CH4	Gg CO	458.5	458.5	0.44%	93.07%
31	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCC	443.1	443.1	0.43%	93.49%
32	2 A 7 b	Sinter Production	CO2	Gg	409.9	409.9	0.40%	93.89%
33	2 A 2	Lime Production	CO2	Gg	394.6	394.6	0.38%	94.27%
34	1 B 2 b	Natural gas	CH4	Gg CO	368.0	368.0	0.36%	94.63%
35	1 A 4 biomass	Other Sectors	CH4	Gg CO	302.5	302.5	0.29%	94.92%
36	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCC	259.1	259.1	0.25%	95.17%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	1996	1996 ABS	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	15 287.3	15 287.3	15.02%	15.02%
2	5 A 1	Forest land remaining forest land	CO2	Gg	-9 638.0	9 638.0	9.47%	24.49%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	8 679.9	8 679.9	8.53%	33.02%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 322.2	8 322.2	8.18%	41.20%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 870.2	6 870.2	6.75%	47.95%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 695.9	4 695.9	4.61%	52.57%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 400.3	4 400.3	4.32%	56.89%
8	5 A 2	Land converted to forest land	CO2	Gg	-4 158.0	4 158.0	4.09%	60.98%
9	2 C 1	Iron and Steel Production	CO2	Gg	3 702.9	3 702.9	3.64%	64.62%
10	4 A 1	Cattle	CH4	Gg CO	3 320.4	3 320.4	3.26%	67.88%
11	6 A	Solid Waste Disposal on Land	CH4	Gg CO	2 737.5	2 737.5	2.69%	70.57%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 504.5	2 504.5	2.46%	73.03%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 182.2	2 182.2	2.14%	75.18%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 765.2	1 765.2	1.73%	76.91%
15	1 A 4 solid	Other Sectors	CO2	Gg	1 657.7	1 657.7	1.63%	78.54%
16	2 A 1	Cement Production	CO2	Gg	1 634.2	1 634.2	1.61%	80.15%
17	5 B 2	Land converted to cropland	CO2	Gg	1 571.4	1 571.4	1.54%	81.69%
18	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 550.5	1 550.5	1.52%	83.22%
19	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 335.9	1 335.9	1.31%	84.53%
20	4 D 3	Indirect Emissions	N2O	Gg CO	1 252.3	1 252.3	1.23%	85.76%
21	5 C 2	Land converted to grassland	CO2	Gg	-1 019.4	1 019.4	1.00%	86.76%
22	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 008.0	1 008.0	0.99%	87.75%
23	2 B 2	Nitric Acid Production	N2O	Gg CO	874.2	874.2	0.86%	88.61%
24	4 B 1	Cattle	N2O	Gg CO	865.0	865.0	0.85%	89.46%
25	5 F 2	Land converted to Other land	CO2	Gg	700.5	700.5	0.69%	90.15%
26	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	610.6	610.6	0.60%	90.75%
27	2 B 1	Ammonia Production	CO2	Gg	538.7	538.7	0.53%	91.28%
28	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	538.5	538.5	0.53%	91.81%
29	4 B 1	Cattle	CH4	Gg CO	525.7	525.7	0.52%	92.32%
30	4 B 8	Swine	CH4	Gg CO	447.6	447.6	0.44%	92.76%
31	2F7	Semiconductor Manufacture	FCs	GgCO	403.9	403.9	0.40%	93.16%
32	1 B 2 b	Natural gas	CH4	Gg CO	393.9	393.9	0.39%	93.55%
33	2 A 2	Lime Production	CO2	Gg	382.7	382.7	0.38%	93.92%
34	2 A 7 b	Sinter Production	CO2	Gg	355.4	355.4	0.35%	94.27%
35	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	337.4	337.4	0.33%	94.61%
36	1 A 4 biomass	Other Sectors	CH4	Gg CO	324.5	324.5	0.32%	94.92%
37	1 A 4 other	Other Sectors	CO2	Gg	301.8	301.8	0.30%	95.22%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	1997	1997 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-18 809.3	18 809.3	17.09%	17.09%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	14 720.1	14 720.1	13.38%	30.47%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	7 968.6	7 968.6	7.24%	37.71%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 407.4	7 407.4	6.73%	44.45%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 504.4	6 504.4	5.91%	50.36%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 018.5	5 018.5	4.56%	54.92%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 002.2	5 002.2	4.55%	59.46%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 099.9	4 099.9	3.73%	63.19%
9	5 A 2	Land converted to forest land	CO2	Gg	-3 839.2	3 839.2	3.49%	66.68%
10	4 A 1	Cattle	CH4	Gg CC	3 253.7	3 253.7	2.96%	69.64%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 220.7	3 220.7	2.93%	72.56%
12	6 A	Solid Waste Disposal on Land	CH4	Gg CC	2 607.5	2 607.5	2.37%	74.93%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 155.8	2 155.8	1.96%	76.89%
14	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 936.5	1 936.5	1.76%	78.65%
15	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 809.0	1 809.0	1.64%	80.30%
16	2 A 1	Cement Production	CO2	Gg	1 760.9	1 760.9	1.60%	81.90%
17	5 B 2	Land converted to cropland	CO2	Gg	1 573.9	1 573.9	1.43%	83.33%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 430.2	1 430.2	1.30%	84.63%
19	1 A 4 solid	Other Sectors	CO2	Gg	1 294.5	1 294.5	1.18%	85.80%
20	4 D 3	Indirect Emissions	N2O	Gg CC	1 256.7	1 256.7	1.14%	86.95%
21	5 C 2	Land converted to grassland	CO2	Gg	-1 041.3	1 041.3	0.95%	87.89%
22	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 024.9	1 024.9	0.93%	88.82%
23	2 B 2	Nitric Acid Production	N2O	Gg CC	862.6	862.6	0.78%	89.61%
24	4 B 1	Cattle	N2O	Gg CC	851.4	851.4	0.77%	90.38%
25	5 F 2	Land converted to Other land	CO2	Gg	657.1	657.1	0.60%	90.98%
26	2F7	Semiconductor Manufacture	FCs	GgCC	593.8	593.8	0.54%	91.52%
27	2 B 1	Ammonia Production	CO2	Gg	532.1	532.1	0.48%	92.00%
28	4 B 1	Cattle	CH4	Gg CC	520.5	520.5	0.47%	92.47%
29	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	513.4	513.4	0.47%	92.94%
30	4 B 8	Swine	CH4	Gg CC	448.3	448.3	0.41%	93.35%
31	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCC	418.3	418.3	0.38%	93.73%
32	2 A 2	Lime Production	CO2	Gg	412.5	412.5	0.37%	94.10%
33	1 B 2 b	Natural gas	CH4	Gg CC	410.3	410.3	0.37%	94.48%
34	2 A 7 b	Sinter Production	CO2	Gg	384.3	384.3	0.35%	94.83%
35	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCC	349.2	349.2	0.32%	95.14%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	1998	1998 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-17 028.0	17 028.0	15.84%	15.84%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	15 135.5	15 135.5	14.08%	29.92%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 734.1	9 734.1	9.06%	38.98%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 457.1	7 457.1	6.94%	45.92%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 805.5	6 805.5	6.33%	52.25%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 276.4	4 276.4	3.98%	56.23%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 900.4	3 900.4	3.63%	59.86%
8	5 A 2	Land converted to forest land	CO2	Gg	-3 520.5	3 520.5	3.28%	63.13%
9	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 498.0	3 498.0	3.25%	66.39%
10	4 A 1	Cattle	CH4	Gg CO	3 226.6	3 226.6	3.00%	69.39%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 961.2	2 961.2	2.76%	72.15%
12	6 A	Solid Waste Disposal on Land	CH4	Gg CO	2 511.8	2 511.8	2.34%	74.48%
13	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 212.4	2 212.4	2.06%	76.54%
14	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 172.2	2 172.2	2.02%	78.56%
15	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 834.4	1 834.4	1.71%	80.27%
16	2 A 1	Cement Production	CO2	Gg	1 598.7	1 598.7	1.49%	81.76%
17	5 B 2	Land converted to cropland	CO2	Gg	1 576.8	1 576.8	1.47%	83.22%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 376.8	1 376.8	1.28%	84.50%
19	4 D 3	Indirect Emissions	N2O	Gg CO	1 259.8	1 259.8	1.17%	85.68%
20	1 A 4 solid	Other Sectors	CO2	Gg	1 127.3	1 127.3	1.05%	86.73%
21	5 C 2	Land converted to grassland	CO2	Gg	-1 063.5	1 063.5	0.99%	87.72%
22	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 040.1	1 040.1	0.97%	88.68%
23	2 B 2	Nitric Acid Production	N2O	Gg CO	896.7	896.7	0.83%	89.52%
24	4 B 1	Cattle	N2O	Gg CO	848.1	848.1	0.79%	90.31%
25	5 F 2	Land converted to Other land	CO2	Gg	613.7	613.7	0.57%	90.88%
26	2 B 1	Ammonia Production	CO2	Gg	525.3	525.3	0.49%	91.37%
27	4 B 1	Cattle	CH4	Gg CO	517.0	517.0	0.48%	91.85%
28	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	492.2	492.2	0.46%	92.31%
29	2F7	Semiconductor Manufacture	FCs	GgCO	477.8	477.8	0.44%	92.75%
30	4 B 8	Swine	CH4	Gg CO	462.4	462.4	0.43%	93.18%
31	2 A 2	Lime Production	CO2	Gg	453.8	453.8	0.42%	93.60%
32	1 B 2 b	Natural gas	CH4	Gg CO	424.9	424.9	0.40%	94.00%
33	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	416.6	416.6	0.39%	94.39%
34	5 E 2	Land converted to Settlements	CO2	Gg	-357.2	357.2	0.33%	94.72%
35	2 A 7 b	Sinter Production	CO2	Gg	345.4	345.4	0.32%	95.04%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	1999	1999 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-21 549.9	21 549.9	19.54%	19.54%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	15 406.0	15 406.0	13.97%	33.51%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 523.1	9 523.1	8.64%	42.15%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 839.8	7 839.8	7.11%	49.26%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 324.0	6 324.0	5.74%	54.99%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 336.4	4 336.4	3.93%	58.93%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 789.2	3 789.2	3.44%	62.36%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 759.3	3 759.3	3.41%	65.77%
9	5 A 2	Land converted to forest land	CO2	Gg	-3 390.5	3 390.5	3.07%	68.85%
10	4 A 1	Cattle	CH4	Gg CO	3 204.8	3 204.8	2.91%	71.75%
11	6 A	Solid Waste Disposal on Land	CH4	Gg CO	2 406.7	2 406.7	2.18%	73.94%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 113.3	2 113.3	1.92%	75.85%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 056.5	2 056.5	1.86%	77.72%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 806.9	1 806.9	1.64%	79.36%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 763.6	1 763.6	1.60%	80.96%
16	2 A 1	Cement Production	CO2	Gg	1 607.4	1 607.4	1.46%	82.41%
17	5 B 2	Land converted to cropland	CO2	Gg	1 583.0	1 583.0	1.44%	83.85%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 400.1	1 400.1	1.27%	85.12%
19	4 D 3	Indirect Emissions	N2O	Gg CO	1 222.8	1 222.8	1.11%	86.23%
20	5 C 2	Land converted to grassland	CO2	Gg	-1 074.0	1 074.0	0.97%	87.20%
21	1 A 4 solid	Other Sectors	CO2	Gg	1 066.2	1 066.2	0.97%	88.17%
22	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 046.9	1 046.9	0.95%	89.12%
23	2 B 2	Nitric Acid Production	N2O	Gg CO	923.5	923.5	0.84%	89.96%
24	4 B 1	Cattle	N2O	Gg CO	843.6	843.6	0.77%	90.72%
25	5 F 2	Land converted to Other land	CO2	Gg	596.0	596.0	0.54%	91.26%
26	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	539.2	539.2	0.49%	91.75%
27	2 B 1	Ammonia Production	CO2	Gg	530.4	530.4	0.48%	92.23%
28	4 B 1	Cattle	CH4	Gg CO	510.4	510.4	0.46%	92.69%
29	2F7	Semiconductor Manufacture	FCs	GgCO	453.9	453.9	0.41%	93.11%
30	2 A 2	Lime Production	CO2	Gg	453.1	453.1	0.41%	93.52%
31	1 B 2 b	Natural gas	CH4	Gg CO	451.7	451.7	0.41%	93.93%
32	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	435.3	435.3	0.39%	94.32%
33	4 B 8	Swine	CH4	Gg CO	416.6	416.6	0.38%	94.70%
34	2 A 7 b	Sinter Production	CO2	Gg	350.0	350.0	0.32%	95.02%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	2000	2000 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-16 239.2	16 239.2	15.46%	15.46%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	14 683.6	14 683.6	13.98%	29.44%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	10 765.3	10 765.3	10.25%	39.69%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 766.4	6 766.4	6.44%	46.14%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 110.7	6 110.7	5.82%	51.96%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 824.4	4 824.4	4.59%	56.55%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 665.3	4 665.3	4.44%	60.99%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 201.8	4 201.8	4.00%	64.99%
9	5 A 2	Land converted to forest land	CO2	Gg	-3 260.6	3 260.6	3.10%	68.10%
10	4 A 1	Cattle	CH4	Gg CO	3 190.5	3 190.5	3.04%	71.14%
11	6 A	Solid Waste Disposal on Land	CH4	Gg CO	2 303.3	2 303.3	2.19%	73.33%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 059.5	2 059.5	1.96%	75.29%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 991.6	1 991.6	1.90%	77.19%
14	2 A 1	Cement Production	CO2	Gg	1 711.6	1 711.6	1.63%	78.82%
15	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 699.5	1 699.5	1.62%	80.43%
16	5 B 2	Land converted to cropland	CO2	Gg	1 590.6	1 590.6	1.51%	81.95%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 314.5	1 314.5	1.25%	83.20%
18	4 D 3	Indirect Emissions	N2O	Gg CO	1 196.1	1 196.1	1.14%	84.34%
19	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 185.4	1 185.4	1.13%	85.47%
20	5 C 2	Land converted to grassland	CO2	Gg	-1 085.6	1 085.6	1.03%	86.50%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 060.6	1 060.6	1.01%	87.51%
22	2 B 2	Nitric Acid Production	N2O	Gg CO	951.6	951.6	0.91%	88.42%
23	1 A 4 solid	Other Sectors	CO2	Gg	951.2	951.2	0.91%	89.32%
24	4 B 1	Cattle	N2O	Gg CO	836.6	836.6	0.80%	90.12%
25	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	592.7	592.7	0.56%	90.68%
26	5 F 2	Land converted to Other land	CO2	Gg	578.3	578.3	0.55%	91.23%
27	2 B 1	Ammonia Production	CO2	Gg	518.0	518.0	0.49%	91.73%
28	4 B 1	Cattle	CH4	Gg CO	501.3	501.3	0.48%	92.21%
29	2 A 2	Lime Production	CO2	Gg	497.5	497.5	0.47%	92.68%
30	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	487.7	487.7	0.46%	93.14%
31	1 B 2 b	Natural gas	CH4	Gg CO	469.7	469.7	0.45%	93.59%
32	2F7	Semiconductor Manufacture	FCs	GgCO	407.1	407.1	0.39%	93.98%
33	4 B 8	Swine	CH4	Gg CO	404.3	404.3	0.38%	94.36%
34	5 E 2	Land converted to Settlements	CO2	Gg	-370.2	370.2	0.35%	94.72%
35	2 A 7 b	Sinter Production	CO2	Gg	339.2	339.2	0.32%	95.04%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	2001	2001 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-19 043.4	19 043.4	17.03%	17.03%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	15 628.8	15 628.8	13.98%	31.01%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	11 964.2	11 964.2	10.70%	41.71%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 459.6	7 459.6	6.67%	48.38%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 154.7	6 154.7	5.50%	53.88%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 873.0	5 873.0	5.25%	59.13%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 448.4	4 448.4	3.98%	63.11%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 159.4	4 159.4	3.72%	66.83%
9	4 A 1	Cattle	CH4	Gg CO	3 140.0	3 140.0	2.81%	69.64%
10	5 A 2	Land converted to forest land	CO2	Gg	-3 130.7	3 130.7	2.80%	72.44%
11	6 A	Solid Waste Disposal on Land	CH4	Gg CO	2 218.1	2 218.1	1.98%	74.42%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 128.9	2 128.9	1.90%	76.33%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 014.2	2 014.2	1.80%	78.13%
14	2 A 1	Cement Production	CO2	Gg	1 719.9	1 719.9	1.54%	79.67%
15	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 711.5	1 711.5	1.53%	81.20%
16	5 B 2	Land converted to cropland	CO2	Gg	1 536.7	1 536.7	1.37%	82.57%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 476.8	1 476.8	1.32%	83.89%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 382.7	1 382.7	1.24%	85.13%
19	4 D 3	Indirect Emissions	N2O	Gg CO	1 187.0	1 187.0	1.06%	86.19%
20	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 075.6	1 075.6	0.96%	87.15%
21	5 C 2	Land converted to grassland	CO2	Gg	-1 048.6	1 048.6	0.94%	88.09%
22	1 A 4 solid	Other Sectors	CO2	Gg	925.4	925.4	0.83%	88.92%
23	4 B 1	Cattle	N2O	Gg CO	824.5	824.5	0.74%	89.65%
24	2 B 2	Nitric Acid Production	N2O	Gg CO	786.5	786.5	0.70%	90.36%
25	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	690.9	690.9	0.62%	90.98%
26	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	615.9	615.9	0.55%	91.53%
27	5 F 2	Land converted to Other land	CO2	Gg	560.6	560.6	0.50%	92.03%
28	2 A 2	Lime Production	CO2	Gg	506.6	506.6	0.45%	92.48%
29	4 B 1	Cattle	CH4	Gg CO	486.6	486.6	0.44%	92.92%
30	1 B 2 b	Natural gas	CH4	Gg CO	476.5	476.5	0.43%	93.34%
31	2 B 1	Ammonia Production	CO2	Gg	472.5	472.5	0.42%	93.77%
32	4 B 8	Swine	CH4	Gg CO	422.5	422.5	0.38%	94.14%
33	5 E 2	Land converted to Settlements	CO2	Gg	-420.9	420.9	0.38%	94.52%
34	2F7	Semiconductor Manufacture	FCs	GgCO	416.9	416.9	0.37%	94.89%
35	2 A 7 b	Sinter Production	CO2	Gg	334.0	334.0	0.30%	95.19%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	2002	2002 ABS	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	15 792.4	15 792.4	14.35%	14.35%
2	5 A 1	Forest land remaining forest land	CO2	Gg	-15 354.6	15 354.6	13.95%	28.29%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	13 529.4	13 529.4	12.29%	40.59%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 340.7	7 340.7	6.67%	47.25%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 626.8	6 626.8	6.02%	53.27%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 510.1	5 510.1	5.01%	58.28%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 857.6	4 857.6	4.41%	62.69%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 606.8	4 606.8	4.18%	66.88%
9	4 A 1	Cattle	CH4	Gg CO	3 086.5	3 086.5	2.80%	69.68%
10	5 A 2	Land converted to forest land	CO2	Gg	-3 000.8	3 000.8	2.73%	72.41%
11	6 A	Solid Waste Disposal on Land	CH4	Gg CO	2 181.2	2 181.2	1.98%	74.39%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 157.5	2 157.5	1.96%	76.35%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 775.7	1 775.7	1.61%	77.96%
14	2 A 1	Cement Production	CO2	Gg	1 735.7	1 735.7	1.58%	79.54%
15	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 710.6	1 710.6	1.55%	81.09%
16	5 B 2	Land converted to cropland	CO2	Gg	1 634.7	1 634.7	1.48%	82.58%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 421.0	1 421.0	1.29%	83.87%
18	4 D 3	Indirect Emissions	N2O	Gg CO	1 181.7	1 181.7	1.07%	84.94%
19	5 C 2	Land converted to grassland	CO2	Gg	-1 154.6	1 154.6	1.05%	85.99%
20	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 081.0	1 081.0	0.98%	86.97%
21	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	831.4	831.4	0.76%	87.73%
22	4 B 1	Cattle	N2O	Gg CO	809.0	809.0	0.73%	88.46%
23	2 B 2	Nitric Acid Production	N2O	Gg CO	807.2	807.2	0.73%	89.20%
24	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	777.1	777.1	0.71%	89.90%
25	1 A 4 solid	Other Sectors	CO2	Gg	763.3	763.3	0.69%	90.60%
26	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	708.8	708.8	0.64%	91.24%
27	2 A 2	Lime Production	CO2	Gg	546.6	546.6	0.50%	91.74%
28	5 F 2	Land converted to Other land	CO2	Gg	542.9	542.9	0.49%	92.23%
29	1 B 2 b	Natural gas	CH4	Gg CO	496.6	496.6	0.45%	92.68%
30	2 B 1	Ammonia Production	CO2	Gg	486.1	486.1	0.44%	93.12%
31	4 B 1	Cattle	CH4	Gg CO	476.4	476.4	0.43%	93.55%
32	5 E 2	Land converted to Settlements	CO2	Gg	-433.0	433.0	0.39%	93.95%
33	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	432.3	432.3	0.39%	94.34%
34	2F7	Semiconductor Manufacture	FCs	GgCO	425.8	425.8	0.39%	94.73%
35	4 B 8	Swine	CH4	Gg CO	403.3	403.3	0.37%	95.09%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	2003	2003 ABS	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	17 069.8	17 069.8	14.50%	14.50%
2	5 A 1	Forest land remaining forest land	CO2	Gg	-16 936.7	16 936.7	14.39%	28.89%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 142.3	15 142.3	12.87%	41.76%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 175.3	8 175.3	6.95%	48.71%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 916.2	6 916.2	5.88%	54.58%
6	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 777.1	6 777.1	5.76%	60.34%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 994.3	4 994.3	4.24%	64.58%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 523.1	4 523.1	3.84%	68.43%
9	4 A 1	Cattle	CH4	Gg CO	3 047.2	3 047.2	2.59%	71.02%
10	5 A 2	Land converted to forest land	CO2	Gg	-2 870.9	2 870.9	2.44%	73.46%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 303.6	2 303.6	1.96%	75.41%
12	6 A	Solid Waste Disposal on Land	CH4	Gg CO	2 205.9	2 205.9	1.87%	77.29%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 843.9	1 843.9	1.57%	78.85%
14	2 A 1	Cement Production	CO2	Gg	1 754.5	1 754.5	1.49%	80.34%
15	5 B 2	Land converted to cropland	CO2	Gg	1 681.5	1 681.5	1.43%	81.77%
16	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 603.5	1 603.5	1.36%	83.14%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 415.5	1 415.5	1.20%	84.34%
18	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 139.3	1 139.3	0.97%	85.31%
19	4 D 3	Indirect Emissions	N2O	Gg CO	1 138.5	1 138.5	0.97%	86.27%
20	5 C 2	Land converted to grassland	CO2	Gg	-1 135.7	1 135.7	0.96%	87.24%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 086.0	1 086.0	0.92%	88.16%
22	2 B 2	Nitric Acid Production	N2O	Gg CO	883.4	883.4	0.75%	88.91%
23	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	859.1	859.1	0.73%	89.64%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	816.6	816.6	0.69%	90.34%
25	4 B 1	Cattle	N2O	Gg CO	799.8	799.8	0.68%	91.02%
26	1 A 4 solid	Other Sectors	CO2	Gg	694.6	694.6	0.59%	91.61%
27	2 A 2	Lime Production	CO2	Gg	576.9	576.9	0.49%	92.10%
28	2 B 1	Ammonia Production	CO2	Gg	526.4	526.4	0.45%	92.54%
29	5 F 2	Land converted to Other land	CO2	Gg	525.3	525.3	0.45%	92.99%
30	1 B 2 b	Natural gas	CH4	Gg CO	515.3	515.3	0.44%	93.43%
31	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	488.0	488.0	0.41%	93.84%
32	2F7	Semiconductor Manufacture	FCs	GgCO	483.0	483.0	0.41%	94.25%
33	4 B 1	Cattle	CH4	Gg CO	470.4	470.4	0.40%	94.65%
34	5 E 2	Land converted to Settlements	CO2	Gg	-418.3	418.3	0.36%	95.01%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	2004	2004 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-16 944.2	16 944.2	14.61%	14.61%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	16 914.9	16 914.9	14.58%	29.19%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 837.1	15 837.1	13.65%	42.84%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 798.7	6 798.7	5.86%	48.70%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 674.2	6 674.2	5.75%	54.45%
6	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 591.7	6 591.7	5.68%	60.14%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 987.3	4 987.3	4.30%	64.44%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 446.2	4 446.2	3.83%	68.27%
9	4 A 1	Cattle	CH4	Gg CC	3 044.3	3 044.3	2.62%	70.89%
10	5 A 2	Land converted to forest land	CO2	Gg	-2 836.3	2 836.3	2.44%	73.34%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 515.1	2 515.1	2.17%	75.51%
12	6 A	Solid Waste Disposal on Land	CH4	Gg CC	2 049.3	2 049.3	1.77%	77.27%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 992.7	1 992.7	1.72%	78.99%
14	2 A 1	Cement Production	CO2	Gg	1 790.0	1 790.0	1.54%	80.53%
15	5 B 2	Land converted to cropland	CO2	Gg	1 611.6	1 611.6	1.39%	81.92%
16	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 552.5	1 552.5	1.34%	83.26%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 459.7	1 459.7	1.26%	84.52%
18	5 C 2	Land converted to grassland	CO2	Gg	-1 219.2	1 219.2	1.05%	85.57%
19	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 173.0	1 173.0	1.01%	86.58%
20	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 143.5	1 143.5	0.99%	87.57%
21	4 D 3	Indirect Emissions	N2O	Gg CC	1 082.7	1 082.7	0.93%	88.50%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	946.4	946.4	0.82%	89.32%
23	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCC	892.7	892.7	0.77%	90.09%
24	4 B 1	Cattle	N2O	Gg CC	800.7	800.7	0.69%	90.78%
25	2 A 2	Lime Production	CO2	Gg	601.1	601.1	0.52%	91.29%
26	1 A 4 solid	Other Sectors	CO2	Gg	561.3	561.3	0.48%	91.78%
27	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	558.5	558.5	0.48%	92.26%
28	1 B 2 b	Natural gas	CH4	Gg CC	539.1	539.1	0.46%	92.72%
29	5 F 2	Land converted to Other land	CO2	Gg	511.6	511.6	0.44%	93.16%
30	2F7	Semiconductor Manufacture	FCs	GgCC	508.9	508.9	0.44%	93.60%
31	2 B 1	Ammonia Production	CO2	Gg	469.9	469.9	0.41%	94.01%
32	4 B 1	Cattle	CH4	Gg CC	467.5	467.5	0.40%	94.41%
33	5 E 2	Land converted to Settlements	CO2	Gg	-415.2	415.2	0.36%	94.77%
34	4 B 8	Swine	CH4	Gg CC	385.3	385.3	0.33%	95.10%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	2005	2005 ABS	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel combustion activities	CO2	Gg	18 508.0	18 508.0	15.78%	15.78%
2	5 A 1	Forest land remaining forest land	CO2	Gg	-16 951.7	16 951.7	14.45%	30.22%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	16 658.0	16 658.0	14.20%	44.42%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 092.0	7 092.0	6.04%	50.47%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 392.8	6 392.8	5.45%	55.92%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 844.0	5 844.0	4.98%	60.90%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 478.5	5 478.5	4.67%	65.57%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 995.0	4 995.0	4.26%	69.82%
9	4 A 1	Cattle	CH4	Gg C(	3 016.5	3 016.5	2.57%	72.40%
10	5 A 2	Land converted to forest land	CO2	Gg	-2 801.7	2 801.7	2.39%	74.78%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 148.7	2 148.7	1.83%	76.61%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 964.6	1 964.6	1.67%	78.29%
13	6 A	Solid Waste Disposal on Land	CH4	Gg C(	1 896.6	1 896.6	1.62%	79.91%
14	2 A 1	Cement Production	CO2	Gg	1 797.5	1 797.5	1.53%	81.44%
15	5 B 2	Land converted to cropland	CO2	Gg	1 671.5	1 671.5	1.42%	82.86%
16	4 D 1	Direct Soil Emissions	N2O	Gg C(	1 562.0	1 562.0	1.33%	84.19%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 391.0	1 391.0	1.19%	85.38%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 145.7	1 145.7	0.98%	86.36%
19	5 C 2	Land converted to grassland	CO2	Gg	-1 128.3	1 128.3	0.96%	87.32%
20	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 090.6	1 090.6	0.93%	88.25%
21	4 D 3	Indirect Emissions	N2O	Gg C(	1 086.7	1 086.7	0.93%	89.17%
22	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCC	903.9	903.9	0.77%	89.94%
23	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	848.8	848.8	0.72%	90.67%
24	4 B 1	Cattle	N2O	Gg C(	789.1	789.1	0.67%	91.34%
25	2 A 2	Lime Production	CO2	Gg	578.7	578.7	0.49%	91.83%
26	1 A 4 solid	Other Sectors	CO2	Gg	571.9	571.9	0.49%	92.32%
27	1 B 2 b	Natural gas	CH4	Gg C(	555.8	555.8	0.47%	92.79%
28	2 B 1	Ammonia Production	CO2	Gg	503.1	503.1	0.43%	93.22%
29	5 F 2	Land converted to Other land	CO2	Gg	497.9	497.9	0.42%	93.65%
30	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	490.0	490.0	0.42%	94.07%
31	4 B 1	Cattle	CH4	Gg C(	458.2	458.2	0.39%	94.46%
32	4 B 8	Swine	CH4	Gg C(	396.9	396.9	0.34%	94.79%
33	2 A 7 b	Sinter Production	CO2	Gg	309.5	309.5	0.26%	95.06%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	2006	2006 ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-16 959.3	16 959.3	14.71%	14.71%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	16 792.1	16 792.1	14.57%	29.28%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 788.4	15 788.4	13.70%	42.98%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 188.6	7 188.6	6.24%	49.22%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 144.1	6 144.1	5.33%	54.55%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 666.2	5 666.2	4.92%	59.47%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 642.5	5 642.5	4.90%	64.36%
8	2 C 1	Iron and Steel Production	CO2	Gg	5 089.5	5 089.5	4.42%	68.78%
9	4 A 1	Cattle	CH4	Gg CC	3 009.5	3 009.5	2.61%	71.39%
10	5 A 2	Land converted to forest land	CO2	Gg	-2 770.0	2 770.0	2.40%	73.79%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 153.4	2 153.4	1.87%	75.66%
12	2 A 1	Cement Production	CO2	Gg	1 954.1	1 954.1	1.70%	77.36%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 880.7	1 880.7	1.63%	78.99%
14	6 A	Solid Waste Disposal on Land	CH4	Gg CC	1 759.6	1 759.6	1.53%	80.51%
15	5 B 2	Land converted to cropland	CO2	Gg	1 715.9	1 715.9	1.49%	82.00%
16	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 610.3	1 610.3	1.40%	83.40%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 348.7	1 348.7	1.17%	84.57%
18	5 C 2	Land converted to grassland	CO2	Gg	-1 197.0	1 197.0	1.04%	85.61%
19	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 170.6	1 170.6	1.02%	86.62%
20	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 119.0	1 119.0	0.97%	87.60%
21	4 D 3	Indirect Emissions	N2O	Gg CC	1 091.9	1 091.9	0.95%	88.54%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	861.7	861.7	0.75%	89.29%
23	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCC	852.9	852.9	0.74%	90.03%
24	4 B 1	Cattle	N2O	Gg CC	787.8	787.8	0.68%	90.71%
25	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	695.5	695.5	0.60%	91.32%
26	2 A 2	Lime Production	CO2	Gg	585.7	585.7	0.51%	91.83%
27	1 B 2 b	Natural gas	CH4	Gg CC	577.6	577.6	0.50%	92.33%
28	1 A 4 solid	Other Sectors	CO2	Gg	560.7	560.7	0.49%	92.81%
29	2 B 1	Ammonia Production	CO2	Gg	541.8	541.8	0.47%	93.28%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	BY	2006	2006 ABS	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	15 788.4	15 788.4	21.65%	0.137	24.77%	24.77%
2	1 A gaseous	Fuel combustion activities	CO2	Gg	11 300.5	16 792.1	16 792.1	23.02%	0.050	8.96%	33.73%
3	5 A 1	Forest land remaining forest land	CO2	Gg	-11 511.2	-16 959.3	16 959.3	23.25%	0.049	8.81%	42.54%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 930.3	6 144.1	6 144.1	8.42%	0.034	6.10%	48.65%
5	5 A 2	Land converted to forest land	CO2	Gg	-4 642.8	-2 770.0	2 770.0	3.80%	0.030	5.39%	54.04%
6	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	560.7	560.7	0.77%	0.030	5.33%	59.37%
7	6 A	Solid Waste Disposal on Land	CH4	Gg CC	3 376.6	1 759.6	1 759.6	2.41%	0.025	4.48%	63.85%
8	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	5 642.5	5 642.5	7.74%	0.017	3.04%	66.89%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 883.6	1 880.7	1 880.7	2.58%	0.017	3.00%	69.89%
10	2C3	Aluminium production	PFCs	GgCO	1 050.2	0.0	0.0	0.00%	0.014	2.60%	72.48%
11	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	5 089.5	5 089.5	6.98%	0.013	2.42%	74.90%
12	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 319.1	7 188.6	7 188.6	9.86%	0.013	2.30%	77.20%
13	4 A 1	Cattle	CH4	Gg CC	3 560.9	3 009.5	3 009.5	4.13%	0.012	2.19%	79.39%
14	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	21.1	852.9	852.9	1.17%	0.010	1.82%	81.21%
15	2 B 2	Nitric Acid Production	N2O	Gg CC	912.0	280.1	280.1	0.38%	0.009	1.64%	82.85%
16	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	264.1	861.7	861.7	1.18%	0.007	1.24%	84.09%
17	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	695.5	695.5	0.95%	0.007	1.24%	85.32%
18	5 F 2	Land converted to Other land	CO2	Gg	809.9	484.1	484.1	0.66%	0.005	0.94%	86.26%
19	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 804.9	1 610.3	1 610.3	2.21%	0.005	0.92%	87.19%
20	4 D 3	Indirect Emissions	N2O	Gg CC	1 309.7	1 091.9	1 091.9	1.50%	0.005	0.84%	88.02%
21	2 A 1	Cement Production	CO2	Gg	2 033.4	1 954.1	1 954.1	2.68%	0.004	0.73%	88.76%
22	1 A 4 other	Other Sectors	CO2	Gg	349.6	75.9	75.9	0.10%	0.004	0.70%	89.45%
23	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	253.3	0.0	0.0	0.00%	0.003	0.63%	90.08%
24	1 B 2 b	Natural gas	CH4	Gg CC	272.7	577.6	577.6	0.79%	0.003	0.60%	90.68%
25	4 B 1	Cattle	N2O	Gg CC	908.1	787.8	787.8	1.08%	0.003	0.51%	91.19%
26	2 A 7 b	Sinter Production	CO2	Gg	481.2	312.4	312.4	0.43%	0.003	0.50%	91.69%
27	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 170.6	1 170.6	1.60%	0.003	0.47%	92.16%
28	5 C 2	Land converted to grassland	CO2	Gg	-880.8	-1 197.0	1 197.0	1.64%	0.003	0.45%	92.61%
29	4 B 1	Cattle	CH4	Gg CC	587.1	454.9	454.9	0.62%	0.003	0.45%	93.06%
30	1 A 3 a jet kerosei	Civil Aviation	CO2	Gg	24.2	218.2	218.2	0.30%	0.002	0.42%	93.48%
31	2 C 3	Aluminium production	CO2	Gg	158.4	0.0	0.0	0.00%	0.002	0.39%	93.87%
32	2F7	Semiconductor Manufacture	FCs	GgCO	133.1	308.7	308.7	0.42%	0.002	0.35%	94.22%
33	6 B	Wastewater Handling	N2O	Gg CC	108.4	278.3	278.3	0.38%	0.002	0.34%	94.57%
34	5 B 1	Cropland remaining cropland	CO2	Gg	-74.1	70.8	70.8	0.10%	0.002	0.34%	94.91%
35	2 A 2	Lime Production	CO2	Gg	396.2	585.7	585.7	0.80%	0.002	0.31%	95.21%

Table A1.4: Trend assessment including LULUCF

IPCC 96	Bezeichnung	Gas	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1 A 1 a liquid	Public Electricity and Heat Production	CH4	Gg C(	0.3	0.4	0.4	0.6	0.5	0.4	0.5	0.5	0.6	0.4	0.3	0.4	0.2	0.2	0.3	0.3	0.4
1 A 1 a solid	Public Electricity and Heat Production	CH4	Gg C(	1.5	1.7	0.9	0.7	0.6	0.5	0.4	0.4	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.1	0.1
1 A 1 a gaseou	Public Electricity and Heat Production	CH4	Gg C(	0.5	0.5	0.5	0.6	0.6	0.7	1.1	1.2	1.2	1.2	1.0	1.0	1.1	1.4	1.5	0.9	0.9
1 A 1 a biomas	Public Electricity and Heat Production	CH4	Gg C(	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.6	0.5	0.6	1.0	0.8	0.9	1.0	1.1	1.4
1 A 1 a other	Public Electricity and Heat Production	CH4	Gg C(	0.6	0.7	0.9	0.9	1.0	1.0	1.2	1.2	1.2	1.2	1.2	1.4	1.7	2.0	2.4	2.1	3.2
1 A 1 c liquid	Manufacture of Solid fuels and Other Ene	CH4	Gg C(	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 1 c gaseou	Manufacture of Solid fuels and Other Ene	CH4	Gg C(	0.3	0.3	0.3	0.2	0.3	0.3	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3
1 A 2 mobile-li	Manufacturing Industries and Constructic	CH4	Gg C(	1.6	1.6	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0
1 A 2 stat-liqui	Manufacturing Industries and Constructic	CH4	Gg C(	1.0	1.1	0.8	0.9	0.9	0.8	0.7	0.9	0.8	0.6	0.6	0.5	0.5	0.6	0.7	0.7	0.7
1 A 2 solid	Manufacturing Industries and Constructic	CH4	Gg C(	1.6	1.7	1.7	1.6	1.4	1.4	1.5	1.7	1.7	1.5	1.7	1.6	1.5	2.0	2.1	2.3	2.7
1 A 2 gaseous	Manufacturing Industries and Constructic	CH4	Gg C(	2.2	2.3	2.3	2.2	2.8	2.9	3.0	3.1	3.0	3.1	3.3	3.2	3.3	3.6	3.4	3.6	3.5
1 A 2 biomass	Manufacturing Industries and Constructic	CH4	Gg C(	1.2	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.3	1.9	1.7	1.7	1.7	1.6	1.7	1.8	2.1
1 A 2 other	Manufacturing Industries and Constructic	CH4	Gg C(	0.8	1.1	1.3	1.1	1.2	1.3	1.6	1.4	1.5	1.3	1.6	2.1	2.2	2.5	3.0	2.8	3.1
1 A 3 a jet kerc	Civil Aviation	CH4	Gg C(	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3
1 A 3 b gasolin	Road Transportation	CH4	Gg C(	62.1	68.1	68.1	68.0	64.5	59.9	53.4	48.1	46.0	40.3	36.3	33.4	31.8	29.2	25.8	22.7	19.5
1 A 3 b diesel (	Road Transportation	CH4	Gg C(	1.8	2.0	2.1	2.2	2.1	2.2	2.8	2.3	2.7	2.4	2.5	2.6	2.8	3.0	3.0	3.1	2.9
1 A 3 c liquid	Railways	CH4	Gg C(	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1 A 3 c solid	Railways	CH4	Gg C(	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 3 d gas/die	Navigation	CH4	Gg C(	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 3 d gasolin	Navigation	CH4	Gg C(	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1 A 3 e gaseou	Other	CH4	Gg C(	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3	0.3
1 A 4 mobile-di	Other Sectors	CH4	Gg C(	2.8	2.5	2.6	2.6	2.7	2.5	2.7	2.8	2.6	2.5	2.3	2.3	2.2	2.1	2.1	1.9	1.8
1 A 4 mobile-g	Other Sectors	CH4	Gg C(	1.2	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.0	0.9	0.9
1 A 4 mobile-li	Other Sectors	CH4	Gg C(	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.0	1.8	1.7	1.5	1.3	1.1	0.9	0.8
1 A 4 stat-liqui	Other Sectors	CH4	Gg C(	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.8	0.7	0.6	0.6
1 A 4 solid	Other Sectors	CH4	Gg C(	61.8	66.7	54.9	49.1	44.8	43.4	42.3	27.6	24.0	22.7	20.2	19.6	16.2	14.7	11.9	12.1	11.8
1 A 4 gaseous	Other Sectors	CH4	Gg C(	4.0	4.0	3.5	3.0	1.9	1.3	1.2	1.2	1.2	1.2	1.2	1.4	1.3	1.5	1.5	1.5	1.3
1 A 4 biomass	Other Sectors	CH4	Gg C(	314.7	341.8	316.5	316.2	286.6	302.5	324.5	249.6	242.4	251.0	237.1	252.7	240.3	245.0	233.7	240.6	228.2
1 A 4 other	Other Sectors	CH4	Gg C(	0.8	0.7	0.8	0.5	0.5	0.4	0.7	0.6	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2
1 A 5 liquid	Other	CH4	Gg C(	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
1 B 1 a	Coal Mining	CH4	Gg C(	11.0	9.4	7.8	7.6	6.2	5.8	5.0	5.1	5.1	5.1	5.6	5.4	6.3	5.2	1.1	0.0	0.0
1 B 2 a	Oil	CH4	Gg C(	101.0	101.3	101.6	101.0	100.3	98.3	99.7	101.7	98.2	92.8	90.2	91.9	93.8	88.2	112.9	115.3	121.3
1 B 2 b	Natural gas	CH4	Gg C(	272.7	288.1	307.1	326.7	342.7	368.0	393.9	410.3	424.9	451.7	469.7	476.5	496.6	515.3	539.1	555.8	577.6
2 B	Chemical Industry	CH4	Gg C(	14.8	14.6	13.9	14.6	14.9	14.3	14.6	14.8	15.4	14.5	14.6	14.0	14.8	14.6	14.7	15.7	19.2
2 C	Metal Production	CH4	Gg C(	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4 A 1	Cattle	CH4	Gg C(	3 560.9	3 503.5	3 340.8	3 330.5	3 350.1	3 372.6	3 320.4	3 253.7	3 226.6	3 204.8	3 190.5	3 140.0	3 086.5	3 047.2	3 044.3	3 016.5	3 009.5
4 A 3	Sheep	CH4	Gg C(	52.1	54.8	52.4	56.1	57.5	61.4	64.0	64.5	60.6	59.2	57.0	53.8	51.1	54.7	55.0	54.7	52.5
4 A 4	Goats	CH4	Gg C(	3.9	4.3	4.1	5.0	5.2	5.7	5.7	6.1	5.7	6.1	5.9	6.2	6.1	5.7	5.8	5.8	5.6
4 A 6	Horses	CH4	Gg C(	18.6	21.8	23.2	24.5	25.2	27.4	27.7	28.0	28.5	30.8	30.8	30.8	30.8	32.9	32.9	32.9	32.9
4 A 8	Swine	CH4	Gg C(	116.2	114.6	117.2	120.3	117.5	116.7	115.4	115.9	120.0	108.1	105.5	108.4	104.1	102.2	98.4	99.8	98.9
4 A 9	Poultry	CH4	Gg C(	3.7	3.9	3.7	3.9	3.8	3.8	3.5	4.0	3.9	3.9	3.2	3.4	3.4	3.5	3.5	3.5	3.5
4 A-10	Other	CH4	Gg C(	6.2	6.2	6.2	6.2	6.3	6.8	7.0	9.4	8.5	6.6	6.5	6.5	6.5	6.9	6.9	6.9	6.9
4 B 1	Cattle	CH4	Gg C(	587.1	576.9	552.0	546.3	542.2	532.8	525.7	520.5	517.0	510.4	501.3	486.6	476.4	470.4	467.5	458.2	454.9
4 B 3	Sheep	CH4	Gg C(	1.2	1.3	1.2	1.3	1.4	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.2	1.3	1.3	1.3	1.2
4 B 4	Goats	CH4	Gg C(	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4 B 6	Horses	CH4	Gg C(	1.4	1.7	1.8	1.9	1.9	2.1	2.1	2.2	2.2	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5
4 B 8	Swine	CH4	Gg C(	447.7	441.7	451.6	463.7	457.1	458.5	447.6	448.3	462.4	416.6	404.3	422.5	403.3	410.3	385.3	396.9	395.0
4 B 9	Poultry	CH4	Gg C(	22.6	23.6	22.4	23.8	23.2	22.9	21.3	24.2	23.4	23.7	19.3	20.6	20.6	21.3	21.3	21.3	21.3
4 B-10	Other	CH4	Gg C(	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4 D	Agricultural Soils	CH4	Gg C(	6.9	6.9	6.6	9.8	8.4	9.3	9.4	9.4	9.4	9.4	9.4	9.1	7.9	8.6	7.7	7.8	8.6
4 F	Field Burning of Agricultural Residues	CH4	Gg C(	1.4	1.4	1.3	1.3	1.4	1.4	1.3	1.4	1.4	1.4	1.3	1.4	1.4	1.3	1.9	1.3	1.2

IPCC 96	Bezeichnung	Gas	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
6 A	Solid Waste Disposal on Land	CH4	Gg C(	3 376.6	3 370.0	3 281.7	3 235.8	3 061.1	2 893.6	2 737.5	2 607.5	2 511.8	2 406.7	2 303.3	2 218.1	2 181.2	2 205.9	2 049.3	1 896.6	1 759.6
6 B	Wastewater Handling	CH4	Gg C(	101.9	101.6	98.8	95.7	92.1	88.3	81.2	74.1	66.9	61.6	56.2	50.9	45.8	40.6	40.9	41.2	41.4
6 C	Waste Incineration	CH4	Gg C(	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 D	Other Waste	CH4	Gg C(	10.9	11.4	13.7	17.2	20.5	21.9	23.0	22.7	23.5	24.7	25.4	26.2	27.0	27.6	32.1	34.2	34.3
1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 498.0	1 481.6	2 052.0	1 901.8	1 557.5	1 550.5	1 936.5	2 212.4	1 763.6	1 185.4	1 476.8	831.4	1 139.3	1 173.0	1 090.6	1 170.6
1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	6 817.0	4 009.5	3 088.9	3 279.1	4 529.8	4 695.9	5 002.2	3 498.0	3 789.2	4 824.4	5 873.0	5 510.1	6 916.2	6 674.2	5 844.0	5 642.5
1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	141.7	170.3	183.8	186.9	191.2	233.1	239.3	233.8	232.1	234.4	328.1	432.3	488.0	558.5	490.0	695.5
1 A 1 b liquid	Petroleum refining	CO2	Gg	1 957.7	1 908.5	1 916.8	2 184.3	2 325.4	2 169.1	2 182.2	2 155.8	2 172.2	2 056.5	1 991.6	2 014.2	2 157.5	2 303.6	2 515.1	2 148.7	2 153.4
1 A 1 c liquid	Manufacture of Solid fuels and Other Ene	CO2	Gg	3.9	2.6	0.0	0.1	0.1	0.5	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1 A 2 mobile-li(	Manufacturing Industries and Constructic	CO2	Gg	1 016.0	1 056.9	1 068.1	1 034.1	1 061.3	1 036.3	1 008.0	1 024.9	1 040.1	1 046.9	1 060.6	1 075.6	1 081.0	1 086.0	1 143.5	1 145.7	1 119.0
1 A 2 stat-liqui(	Manufacturing Industries and Constructic	CO2	Gg	2 883.6	3 270.6	2 525.9	2 996.3	2 886.8	2 688.6	2 504.5	3 220.7	2 961.2	2 113.3	2 059.5	2 128.9	1 775.7	1 843.9	1 992.7	1 964.6	1 880.7
1 A 2 solid	Manufacturing Industries and Constructic	CO2	Gg	5 016.3	4 760.6	4 139.6	4 320.1	4 238.9	4 459.2	4 400.3	5 018.5	4 276.4	4 336.4	4 665.3	4 448.4	4 857.6	4 994.3	4 987.3	5 478.5	5 666.2
1 A 2 other	Manufacturing Industries and Constructic	CO2	Gg	264.1	390.0	447.1	299.6	427.0	466.8	538.5	513.4	416.6	435.3	487.7	615.9	708.8	816.6	946.4	848.8	861.7
1 A 3 a aviatior	Civil Aviation	CO2	Gg	7.8	8.1	8.3	8.6	8.8	7.1	6.8	7.6	8.2	8.7	6.4	5.9	7.5	8.2	7.6	8.8	9.0
1 A 3 a jet kerc	Civil Aviation	CO2	Gg	24.2	29.4	34.7	40.0	45.3	50.5	56.7	62.9	69.1	72.4	75.7	72.4	70.4	154.1	184.6	208.6	218.2
1 A 3 b gasolin	Road Transportation	CO2	Gg	7 930.3	8 698.5	8 316.4	7 975.7	7 688.4	7 427.5	6 870.2	6 504.4	6 805.5	6 324.0	6 110.7	6 154.7	6 626.8	6 777.1	6 591.7	6 392.8	6 144.1
1 A 3 b diesel (	Road Transportation	CO2	Gg	4 012.9	4 830.0	5 156.8	5 677.5	5 914.7	6 546.3	8 679.9	7 968.6	9 734.1	9 523.1	10 765.3	11 964.2	13 529.4	15 142.3	15 837.1	16 658.0	15 788.4
1 A 3 c liquid	Railways	CO2	Gg	167.3	174.2	173.5	169.6	171.2	159.2	143.5	145.0	143.1	177.1	176.9	174.3	170.8	166.9	172.5	146.4	142.0
1 A 3 c solid	Railways	CO2	Gg	6.6	6.0	6.3	5.7	5.6	5.8	5.8	3.3	2.9	2.8	2.5	2.4	2.3	2.2	2.2	2.1	2.1
1 A 3 d gas/die	Navigation	CO2	Gg	42.8	38.0	37.0	37.3	46.3	51.8	53.0	52.6	57.2	55.9	61.0	63.7	70.6	56.7	43.8	43.2	43.6
1 A 3 d gasolin	Navigation	CO2	Gg	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.2	9.2	9.1	9.1	9.0	9.0	8.9	8.9	8.8	8.7
1 A 4 mobile-di	Other Sectors	CO2	Gg	1 311.6	1 175.5	1 217.2	1 228.3	1 309.0	1 217.3	1 335.9	1 430.2	1 376.8	1 400.1	1 314.5	1 382.7	1 421.0	1 415.5	1 459.7	1 391.0	1 348.7
1 A 4 mobile-g	Other Sectors	CO2	Gg	45.6	41.3	42.2	42.3	44.5	43.9	45.1	44.8	44.1	44.1	43.0	43.1	44.3	46.3	45.7	43.5	43.3
1 A 4 mobile-li(	Other Sectors	CO2	Gg	142.0	142.4	143.8	144.7	143.6	144.4	143.5	142.4	141.5	140.7	140.5	140.5	140.5	140.3	140.1	139.1	137.0
1 A 4 stat-liqui(	Other Sectors	CO2	Gg	7 319.1	7 694.4	7 183.5	7 118.8	6 528.7	7 194.0	8 322.2	7 407.4	7 457.1	7 839.8	6 766.4	7 459.6	7 340.7	8 175.3	6 798.7	7 092.0	7 188.6
1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	2 934.3	2 510.7	2 080.0	1 855.6	1 746.4	1 657.7	1 294.5	1 127.3	1 066.2	951.2	925.4	763.3	694.6	561.3	571.9	560.7
1 A 4 other	Other Sectors	CO2	Gg	349.6	273.3	338.9	191.4	206.0	180.7	301.8	264.1	167.9	152.1	143.7	65.3	64.3	67.6	70.9	71.6	75.9
1 A 5 liquid	Other	CO2	Gg	35.0	37.1	33.7	39.4	41.6	32.6	38.9	37.1	42.4	41.6	45.0	43.1	41.9	89.3	106.6	120.1	125.5
1 A gaseous	Fuel combustion activities	CO2	Gg	11 300.5	11 940.3	12 000.1	12 453.3	13 111.3	14 339.2	15 287.3	14 720.1	15 135.5	15 406.0	14 683.6	15 628.8	15 792.4	17 069.8	16 914.9	18 508.0	16 792.1
1 B 2 a	Oil	CO2	Gg	43.0	43.0	40.0	37.0	47.5	38.0	41.0	31.1	61.0	90.0	72.0	88.0	84.0	133.0	122.0	122.0	140.0
1 B 2 b	Natural gas	CO2	Gg	59.0	68.0	80.0	75.0	80.0	89.0	30.0	89.4	80.8	80.5	92.5	94.7	83.0	100.0	88.0	83.0	92.0
2 A 1	Cement Production	CO2	Gg	2 033.4	2 005.0	2 105.0	2 031.9	2 102.3	1 631.3	1 634.2	1 760.9	1 598.7	1 607.4	1 711.6	1 719.9	1 735.7	1 754.5	1 790.0	1 797.5	1 954.1
2 A 2	Lime Production	CO2	Gg	396.2	361.3	355.1	365.2	390.5	394.6	382.7	412.5	453.8	453.1	497.5	506.6	546.6	576.9	601.1	578.7	585.7
2 A 3	Limestone and Dolomite Use	CO2	Gg	222.4	225.2	205.2	205.0	220.0	251.2	227.1	254.2	264.1	247.4	275.6	271.1	290.4	295.6	297.5	290.8	296.2
2 A 4	Soda Ash Production and use	CO2	Gg	19.4	22.3	19.7	19.8	21.1	21.2	21.2	19.7	19.7	21.6	18.2	21.4	18.9	18.8	11.9	15.3	16.0
2 A 7 a	Bricks and Tiles (decarbonizing)	CO2	Gg	116.5	121.9	126.0	135.4	139.7	148.8	148.8	137.1	133.6	121.5	115.9	123.7	120.3	115.8	133.7	128.0	129.9
2 A 7 b	Sinter Production	CO2	Gg	481.2	391.6	336.1	324.6	322.9	409.9	355.4	384.3	345.4	350.0	339.2	334.0	373.5	311.5	328.5	309.5	312.4
2 B 1	Ammonia Production	CO2	Gg	516.6	545.7	552.8	538.8	507.0	537.1	538.7	532.1	525.3	530.4	518.0	472.5	486.1	526.4	469.9	503.1	541.8
2 B 2	Nitric Acid Production	CO2	Gg	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
2 B 4	Carbide Production	CO2	Gg	37.5	35.2	41.3	32.9	25.1	26.2	32.8	32.8	35.0	32.5	48.1	46.7	40.8	41.5	35.8	35.9	30.5
2 B 5	Other	CO2	Gg	30.5	28.0	38.0	33.8	22.6	20.0	18.4	17.6	19.0	19.9	20.8	20.0	24.0	24.2	24.2	18.0	26.5
2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	3 509.5	3 074.9	3 144.7	3 411.1	3 921.0	3 702.9	4 099.9	3 900.4	3 759.3	4 201.8	4 159.4	4 606.8	4 523.1	4 446.2	4 995.0	5 089.5
2 C 2	Ferroalloys Production	CO2	Gg	20.8	20.8	20.8	20.8	20.8	20.8	18.8	19.3	19.2	18.9	18.9	18.1	17.1	16.7	16.9	18.7	16.9
2 C 3	Aluminium production	CO2	Gg	158.4	158.4	63.0	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	Solvent and other Product Use	CO2	Gg	282.7	236.8	187.7	187.4	171.5	189.9	172.8	190.1	172.2	158.4	181.0	215.1	225.6	217.8	213.7	190.1	221.0
6 C	Waste Incineration	CO2	Gg	26.9	23.4	10.9	10.6	10.7	11.0	11.3	11.6	11.9	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3
1 A 1 a liquid	Public Electricity and Heat Production	N2O	Gg C(	6.7	7.8	7.0	9.9	9.5	7.5	7.7	10.1	11.5	9.9	5.9	6.9	4.1	6.0	6.1	5.9	6.2
1 A 1 a solid	Public Electricity and Heat Production	N2O	Gg C(	23.0	27.3	17.4	15.0	14.9	19.6	15.4	14.2	14.9	16.6	21.2	23.7	22.9	27.4	29.2	9.6	9.3
1 A 1 a gaseou	Public Electricity and Heat Production	N2O	Gg C(	10.2	10.0	9.2	9.2	10.6	11.2	12.0	8.6	11.2	11.0	9.2	10.4	10.3	11.7	11.6	17.0	14.1
1 A 1 a biomas	Public Electricity and Heat Production	N2O	Gg C(	2.0	3.2	3.7	3.7	4.0	4.8	6.9	7.0	8.0	7.6	9.7	11.8	16.0	16.9	21.8	25.0	34.8
1 A 1 a other	Public Electricity and Heat Production	N2O	Gg C(	1.0	1.3	1.5	1.6	1.7	1.7	2.1	2.1	2.1	2.1	2.0	2.4	2.9	3.4	4.1	3.7	5.4

IPCC 96	Bezeichnung	Gas	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1 A 1 b liquid	Petroleum refining	N2O	Gg C(	4.4	4.7	4.7	5.4	5.3	5.2	5.1	5.1	5.2	5.0	4.7	5.0	5.6	5.1	5.7	5.2	4.9
1 A 1 b gaseou	Petroleum refining	N2O	Gg C(	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4
1 A 1 c liquid	Manufacture of Solid fuels and Other Ene	N2O	Gg C(	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 1 c gaseou	Manufacture of Solid fuels and Other Ene	N2O	Gg C(	0.3	0.3	0.3	0.2	0.3	0.3	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3
1 A 2 mobile-li	Manufacturing Industries and Constructic	N2O	Gg C(	109.9	114.3	115.4	111.7	118.4	115.6	113.5	118.2	121.8	114.9	112.1	109.8	107.3	96.9	89.3	85.5	80.8
1 A 2 stat-liqui	Manufacturing Industries and Constructic	N2O	Gg C(	10.8	12.3	9.5	10.8	10.4	9.6	8.8	11.2	10.7	8.3	8.1	8.2	7.9	8.0	9.0	8.4	7.7
1 A 2 solid	Manufacturing Industries and Constructic	N2O	Gg C(	16.6	17.0	15.2	15.2	14.9	16.5	16.1	18.4	17.8	17.2	19.2	17.5	17.9	18.2	17.9	19.1	21.8
1 A 2 gaseous	Manufacturing Industries and Constructic	N2O	Gg C(	2.4	2.4	2.4	2.4	3.0	3.1	3.3	3.4	3.3	3.3	3.5	3.4	3.6	3.6	3.5	3.6	3.5
1 A 2 biomass	Manufacturing Industries and Constructic	N2O	Gg C(	20.4	20.8	21.4	24.7	25.2	24.4	23.0	24.3	20.7	37.3	30.8	30.4	30.3	29.8	29.3	31.9	39.2
1 A 2 other	Manufacturing Industries and Constructic	N2O	Gg C(	1.4	2.0	2.3	1.8	2.1	2.3	2.8	2.5	2.6	2.3	2.7	3.5	3.9	4.3	5.2	4.8	5.3
1 A 3 a jet kerc	Civil Aviation	N2O	Gg C(	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.9	0.9	1.0	0.9	0.9	2.0	2.4	2.6	2.6
1 A 3 b gasolin	Road Transportation	N2O	Gg C(	136.4	170.1	175.1	180.1	187.1	187.8	180.5	176.9	195.8	185.8	181.1	180.7	191.4	189.2	174.8	158.7	139.9
1 A 3 b diesel (	Road Transportation	N2O	Gg C(	31.7	38.1	40.5	44.3	46.3	50.6	65.5	63.4	77.5	78.7	88.9	99.0	113.8	127.5	134.5	140.2	137.3
1 A 3 c liquid	Railways	N2O	Gg C(	6.6	6.9	6.7	6.5	6.4	5.9	5.2	5.2	5.1	6.2	6.1	5.9	5.7	5.5	5.6	4.7	4.7
1 A 3 c solid	Railways	N2O	Gg C(	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
1 A 3 d gas/die	Navigation	N2O	Gg C(	3.8	3.4	3.2	3.2	3.9	4.3	4.4	4.3	4.6	4.4	4.7	4.8	5.3	4.2	3.2	3.1	3.2
1 A 3 d gasolin	Navigation	N2O	Gg C(	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1 A 3 e gaseou	Other	N2O	Gg C(	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.3	0.3
1 A 4 mobile-di	Other Sectors	N2O	Gg C(	137.7	123.5	127.8	129.0	138.4	130.2	144.7	156.8	151.2	151.2	139.2	142.9	142.6	137.5	136.2	126.6	122.6
1 A 4 mobile-g	Other Sectors	N2O	Gg C(	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1 A 4 mobile-li	Other Sectors	N2O	Gg C(	7.4	7.4	7.5	7.6	7.8	8.0	7.9	7.9	7.9	7.0	6.9	6.8	6.7	5.8	5.6	5.4	5.1
1 A 4 stat-liqui	Other Sectors	N2O	Gg C(	25.8	28.3	26.5	27.2	25.3	27.5	31.6	29.0	29.2	30.0	26.0	28.7	28.3	31.6	26.7	28.0	28.6
1 A 4 solid	Other Sectors	N2O	Gg C(	20.6	22.8	19.6	16.1	14.3	13.4	12.7	10.0	8.6	8.3	7.5	7.4	5.9	5.4	4.4	4.4	4.4
1 A 4 gaseous	Other Sectors	N2O	Gg C(	14.4	17.3	19.7	22.2	19.5	23.1	22.9	21.7	22.7	22.5	21.3	25.7	24.8	27.9	27.1	27.8	24.0
1 A 4 biomass	Other Sectors	N2O	Gg C(	85.8	94.6	89.0	90.5	83.0	89.6	97.4	91.5	88.4	91.2	86.2	95.1	93.4	97.9	96.9	102.6	99.4
1 A 4 other	Other Sectors	N2O	Gg C(	1.5	1.1	1.4	0.8	0.9	0.8	1.3	1.1	0.7	0.6	0.6	0.3	0.3	0.3	0.3	0.3	0.3
1 A 5 liquid	Other	N2O	Gg C(	0.9	0.9	0.9	1.0	1.0	0.8	1.0	0.9	1.0	0.9	1.1	1.0	1.0	2.1	2.3	2.3	2.3
2 B 2	Nitric Acid Production	N2O	Gg C(	912.0	927.3	837.5	878.7	825.2	857.2	874.2	862.6	896.7	923.5	951.6	786.5	807.2	883.4	280.9	274.2	280.1
3	Solvent and other Product Use	N2O	Gg C(	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	220.7	208.9	197.2	185.4	173.6	164.3
4 B 1	Cattle	N2O	Gg C(	908.1	896.1	858.5	857.4	858.1	879.2	865.0	851.4	848.1	843.6	836.6	824.5	809.0	799.8	800.7	789.1	787.8
4 B 3	Sheep	N2O	Gg C(	1.9	2.0	1.9	2.0	2.1	2.2	2.3	2.3	2.2	2.1	2.1	1.9	1.8	2.0	2.0	2.0	1.9
4 B 4	Goats	N2O	Gg C(	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4 B 6	Horses	N2O	Gg C(	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
4 B 8	Swine	N2O	Gg C(	77.9	76.9	78.6	80.7	79.6	79.9	78.0	78.1	80.4	72.4	70.3	73.5	70.2	71.3	67.0	68.9	68.6
4 B 9	Poultry	N2O	Gg C(	16.7	17.7	16.7	17.8	17.4	17.0	15.9	18.0	17.4	17.5	14.4	15.3	15.3	15.8	15.8	15.8	15.8
4 B-10	Other	N2O	Gg C(	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
4 D 1	Direct Soil Emissions	N2O	Gg C(	1 804.9	1 978.2	1 832.4	1 672.4	2 004.7	2 034.4	1 765.2	1 809.0	1 834.4	1 806.9	1 699.5	1 711.5	1 710.6	1 603.5	1 552.5	1 562.0	1 610.3
4 D 2	Pasture, Range and Paddock Manure	N2O	Gg C(	218.5	222.9	216.1	228.3	230.9	239.4	237.5	237.3	232.1	231.6	226.0	222.1	218.1	220.1	220.0	219.3	217.3
4 D 3	Indirect Emissions	N2O	Gg C(	1 309.7	1 394.3	1 276.6	1 180.0	1 339.4	1 364.1	1 252.3	1 256.7	1 259.8	1 222.8	1 196.1	1 187.0	1 181.7	1 138.5	1 082.7	1 086.7	1 091.9
4 F	Field Burning of Agricultural Residues	N2O	Gg C(	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.4	0.4	0.3	0.5	0.3	0.3
6 B	Wastewater Handling	N2O	Gg C(	108.4	107.9	102.1	97.1	109.4	123.4	139.3	149.2	162.2	177.2	201.9	228.6	229.4	229.9	246.1	262.3	278.3
6 C	Waste Incineration	N2O	Gg C(	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 D	Other Waste	N2O	Gg C(	23.5	24.6	29.0	36.0	42.6	44.8	46.9	46.2	47.8	50.2	51.6	53.0	54.5	55.7	66.2	71.1	71.2
2C3	Aluminium production	PFCs	GgCC	1 050.2	1 050.2	417.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2C4	SF6 Used in Al and Mg Foundries	SF6	GgCC	253.3	277.2	253.3	277.2	372.8	443.1	610.6	349.2	164.2	22.2	7.6	7.6	7.6	0.0	0.0	0.0	0.0
2F8	Electrical Equipment	SF6	GgCC	20.6	21.7	22.8	23.9	25.0	26.1	26.9	27.1	27.2	28.9	29.1	29.4	30.0	31.5	33.7	36.3	38.1
2F7	Semiconductor Manufacture	FCs	GgCC	133.1	215.2	287.8	360.4	430.9	505.7	403.9	593.8	477.8	453.9	407.1	416.9	425.8	483.0	508.9	297.6	308.7
2F1/2/3/4/5	ODS Substitutes	HFCs	GgCC	21.1	42.1	44.6	151.9	200.0	259.1	337.4	418.3	492.2	539.2	592.7	690.9	777.1	859.1	892.7	903.9	852.9
2F9	Other Sources of SF6	SF6	GgCC	126.6	179.2	183.1	190.6	222.5	241.2	252.2	256.1	286.1	246.4	265.2	268.3	268.0	185.1	100.1	81.7	274.0
5 A 1	Forest land remaining forest land	CO2	Gg	-11 511.2	-17 415.7	-12 214.7	-16 051.3	-14 991.7	-14 288.1	-9 638.0	-18 809.3	-17 028.0	-21 549.9	-16 239.2	-19 043.4	-15 354.6	-16 936.7	-16 944.2	-16 951.7	-16 959.3
5 A 2	Land converted to forest land	CO2	Gg	-4 642.8	-4 779.8	-4 916.7	-5 053.7	-4 793.9	-4 476.8	-4 158.0	-3 839.2	-3 520.5	-3 390.5	-3 260.6	-3 130.7	-3 000.8	-2 870.9	-2 836.3	-2 801.7	-2 770.0

Table A1.5: Source/sink categories and emissions/removals for key category analysis

IPCC 96	Bezeichnung	Gas	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
5 B 1	Cropland remaining cropland	CO2	Gg	-74.1	-78.6	-78.1	-58.7	-51.3	-44.8	24.1	42.4	56.9	82.5	89.8	114.4	97.8	120.7	87.2	89.5	70.8
5 B 2	Land converted to cropland	CO2	Gg	1 547.9	1 551.5	1 559.4	1 571.1	1 573.3	1 568.8	1 571.4	1 573.9	1 576.8	1 583.0	1 590.6	1 536.7	1 634.7	1 681.5	1 611.6	1 671.5	1 715.9
5 B	Cropland-LimeApp	CO2	Gg	90.3	91.1	90.7	90.7	90.7	92.0	92.0	92.1	91.6	91.6	90.3	90.3	90.2	90.3	90.2	90.3	90.1
5 C 1	Grassland remaining grassland	CO2	Gg	39.1	39.5	39.9	40.3	40.1	39.9	39.4	39.0	39.0	39.4	39.7	41.3	42.6	44.1	45.2	47.0	48.3
5 C 2	Land converted to grassland	CO2	Gg	-880.8	-869.4	-861.2	-855.8	-872.8	-997.5	-1 019.4	-1 041.3	-1 063.5	-1 074.0	-1 085.6	-1 048.6	-1 154.6	-1 135.7	-1 219.2	-1 128.3	-1 197.0
5 D 2	Land converted to Wetlands	CO2	Gg	188.7	204.8	221.0	237.1	243.1	243.7	281.8	287.6	260.6	271.0	281.3	289.5	297.8	306.0	314.6	307.3	328.8
5 E 2	Land converted to Settlements	CO2	Gg	-160.0	-82.2	-177.6	-163.6	-73.9	-250.6	-281.4	-134.5	-357.2	-315.0	-370.2	-420.9	-433.0	-418.3	-415.2	-209.8	-233.8
5 F 2	Land converted to Other land	CO2	Gg	809.9	829.2	848.5	867.8	833.0	743.9	700.5	657.1	613.7	596.0	578.3	560.6	542.9	525.3	511.6	497.9	484.1
5	Total land use categories	CH4	Gg C(	0.3	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.3	0.1	0.1	0.1	0.1
5	Total land use categories	N2O	Gg C(	252.1	252.8	253.4	254.2	255.0	255.7	256.6	257.5	258.3	259.4	260.3	264.4	264.7	264.4	267.4	268.5	267.6

IPCC Category Description		Gas	LA90	LA91	LA92	LA93	LA94	LA95	LA96	LA97	LA98	LA99	LA00	LA01	LA02	LA03	LA04	LA05	LA06	TA06
1 A gaseous	Fuel combustion activities	CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
1 A 3 b diesel oil	Road Transportation	CO2	6	5	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	1
1 A 4 stat-liquid	Other Sectors	CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	8
1 A 3 b gasoline	Road Transportation	CO2	2	2	2	2	2	2	4	4	4	4	4	4	4	5	5	4	4	3
1 A 2 solid	Manufacturing Industries and Construction	CO2	5	6	5	5	5	6	6	5	5	5	6	6	6	6	6	6	5	
1 A 1 a solid	Public Electricity and Heat Production	CO2	4	4	6	9	8	5	5	6	7	6	5	5	5	4	4	5	6	6
2 C 1	Iron and Steel Production	CO2	8	7	9	8	6	7	7	7	6	7	7	7	7	7	7	7	7	11
4 A 1	Cattle	CH4	7	8	7	6	7	8	8	8	8	8	8	8	8	8	8	8	8	10
1 A 1 b liquid	Petroleum refining	CO2	13	14	13	11	11	11	11	11	12	11	11	11	10	9	9	9	9	
2 A 1	Cement Production	CO2	12	12	12	14	12	14	14	14	14	14	12	12	12	12	12	12	10	18
1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	10	10	10	10	10	10	10	9	9	10	10	10	11	11	11	10	11	7
6 A	Solid Waste Disposal on Land	CH4	9	9	8	7	9	9	9	10	10	9	9	9	9	10	10	11	12	5
4 D 1	Direct Soil Emissions	N2O	14	13	14	15	13	12	12	13	13	12	13	13	13	13	13	13	13	16
1 A 4 mobile-diesel	Other Sectors	CO2	15	17	17	16	17	17	16	15	15	15	14	15	14	14	14	14	14	28
1 A 1 a liquid	Public Electricity and Heat Production	CO2	17	15	15	13	14	15	15	12	11	13	16	14	17	15	15	16	15	23
1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	19	18	18	18	18	18	18	18	18	18	17	17	16	17	16	15	16	
4 D 3	Indirect Emissions	N2O	16	16	16	17	16	16	17	17	16	16	15	16	15	16	17	17	17	17
1 A 2 other	Manufacturing Industries and Construction	CO2	31	26	24	29	25	24	23	24	28	27	25	22	22	20	18	19	18	15
2F1/2/3/4/5	ODS Substitutes	HFCs						31	30	26	23	21	21	21	20	19	19	18	19	12
4 B 1	Cattle	N2O	21	21	19	20	19	19	20	20	20	20	20	19	18	21	20	20	20	22
1 A 1 a other	Public Electricity and Heat Production	CO2												30	27	26	23	25	21	14
2 A 2	Lime Production	CO2	26	27	26	24	26	28	28	27	26	25	24	23	23	23	21	21	22	32
1 B 2 b	Natural gas	CH4	30	29	30	26	28	29	27	28	27	26	26	25	24	25	24	23	23	21
1 A 4 solid	Other Sectors	CO2	11	11	11	12	15	13	13	16	17	17	19	18	21	22	22	22	24	4
2 B 1	Ammonia Production	CO2	23	23	21	22	22	21	22	22	21	22	22	26	25	24	26	24	25	
4 B 1	Cattle	CH4	22	22	22	21	21	22	24	23	22	23	23	24	26	28	27	26	26	25
4 B 8	Swine	CH4	25	24	23	23	23	25	25	25	25	28	28	27	29	29	28	27	27	
2 A 7 b	Sinter Production	CO2	24	25	28	27	29	27	29	29	29	29	29	29	30		29	28	28	24
2 F 7	Semiconductor Manufacture	FCs			31	25	24	23	26	21	24	24	27	28	28	27	25	29	29	29
2 A 3	Limestone and Dolomite Use	CO2						32			31	31	30						30	
1 A 3 a jet kerosene	Civil Aviation	CO2																		26
1 A 4 biomass	Other Sectors	CH4	28	28	29	28	30	30	31			30								31
1 A 4 other	Other Sectors	CO2	27	31	27				32	31										19
2 B 2	Nitric Acid Production	N2O	20	20	20	19	20	20	19	19	19	19	18	20	19	18				13
2 C 3	Aluminium production	PFCs	18	19	25															9
2 C 3	Aluminium production	CO2																		27
2 C 4	SF6 Used in Al and Mg Foundries	SF6		30	32	30	27	26	21	30										20
2 F 9	Other Sources of SF6	SF6								32	30		31							
3	Solvent and other Product Use	CO2	29			31	31													
4 D 2	Pasture, Range and Paddock Manure	N2O				32	32													
6 B	Wastewater Handling	N2O																		30

Table A1.6: Ranking of Key Categories excluding LULUCF

IPCC Category Description		Gas	LA90	LA91	LA92	LA93	LA94	LA95	LA96	LA97	LA98	LA99	LA00	LA01	LA02	LA03	LA04	LA05	LA06	TA06
5 A 1	Forest land remaining forest land	CO2	1	1	1	1	1	2	2	1	1	1	1	1	2	2	1	2	1	3
1 A gaseous	Fuel combustion activities	CO2	2	2	2	2	2	1	1	2	2	2	2	2	1	1	2	1	2	2
1 A 3 b diesel oil	Road Transportation	CO2	8	6	5	5	5	5	3	3	3	3	3	3	3	3	3	3	3	1
1 A 4 stat-liquid	Other Sectors	CO2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	12
1 A 3 b gasoline	Road Transportation	CO2	3	3	3	3	3	3	5	5	5	5	5	5	5	6	6	5	5	4
1 A 2 solid	Manufacturing Industries and Construction	CO2	6	8	7	7	7	8	7	6	6	6	7	7	7	7	7	7	6	
1 A 1 a solid	Public Electricity and Heat Production	CO2	5	5	8	11	10	6	6	7	9	7	6	6	6	5	5	6	7	8
2 C 1	Iron and Steel Production	CO2	10	9	11	10	8	9	9	8	7	8	8	8	8	8	8	8	8	11
4 A 1	Cattle	CH4	9	10	9	8	9	10	10	10	10	10	10	9	9	9	9	9	9	13
5 A 2	Land converted to forest land	CO2	7	7	6	6	6	7	8	9	8	9	9	10	10	10	10	10	10	5
1 A 1 b liquid	Petroleum refining	CO2	15	16	15	13	13	13	13	13	14	13	13	13	12	11	11	11	11	
2 A 1	Cement Production	CO2	14	14	14	16	14	16	16	16	16	16	14	14	14	14	14	14	12	21
1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	12	12	12	12	12	12	12	11	11	12	12	12	13	13	13	12	13	9
6 A	Solid Waste Disposal on Land	CH4	11	11	10	9	11	11	11	12	12	11	11	11	11	12	12	13	14	7
5 B 2	Land converted to cropland	CO2	17	17	17	18	18	17	17	17	17	17	16	16	16	15	15	15	15	
4 D 1	Direct Soil Emissions	N2O	16	15	16	17	15	14	14	15	15	14	15	15	15	16	16	16	16	19
1 A 4 mobile-diesel	Other Sectors	CO2	18	20	20	19	20	20	19	18	18	18	17	18	17	17	17	17	17	
5 C 2	Land converted to grassland	CO2	25	25	22	25	22	22	21	21	21	20	20	21	19	20	18	19	18	28
1 A 1 a liquid	Public Electricity and Heat Production	CO2	20	18	18	15	16	18	18	14	13	15	19	17	21	18	19	20	19	27
1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	22	21	21	21	21	21	22	22	22	22	21	20	20	21	20	18	20	
4 D 3	Indirect Emissions	N2O	19	19	19	20	19	19	20	20	19	19	18	19	18	19	21	21	21	20
1 A 2 other	Manufacturing Industries and Construction	CO2		31	29	34	30	29	28	29	33	32	30	26	26	24	22	23	22	16
2F1/2/3/4/5	ODS Substitutes	HFCs						36	35	31	28	26	25	25	24	23	23	22	23	14
4 B 1	Cattle	N2O	24	24	23	24	23	23	24	24	24	24	24	23	22	25	24	24	24	25
1 A 1 a other	Public Electricity and Heat Production	CO2													33	31	27	30	25	17
2 A 2	Lime Production	CO2	31	32	31	29	31	33	33	32	31	30	29	28	27	27	25	25	26	35
1 B 2 b	Natural gas	CH4	35	34	35	31	33	34	32	33	32	31	31	30	29	30	28	27	27	24
1 A 4 solid	Other Sectors	CO2	13	13	13	14	17	15	15	19	20	21	23	22	25	26	26	26	28	6
2 B 1	Ammonia Production	CO2	28	28	26	27	27	26	27	27	26	27	27	31	30	28	31	28	29	
5 F 2	Land converted to Other land	CO2	26	26	24	23	24	25	25	25	25	25	26	27	28	29	29	29	30	18
4 B 1	Cattle	CH4	27	27	27	26	26	27	29	28	27	28	28	29	31	33	32	31	31	29
4 B 8	Swine	CH4	30	29	28	28	28	30	30	30	30	33	33	32	35		34	32	32	
5 D 2	Land converted to Wetlands	CO2																	33	
2 A 7 b	Sinter Production	CO2	29	30	33	32	34	32	34	34	35	34	35	35				33	34	26
2F7	Semiconductor Manufacture	FCs			36	30	29	28	31	26	29	29	32	34	34	32	30		35	32
1 A 3 a jet kerosene	Civil Aviation	CO2																		30
1 A 4 biomass	Other Sectors	CH4	33	33	34	33	35	35	36											
1 A 4 other	Other Sectors	CO2	32		32				37											22
2 B 2	Nitric Acid Production	N2O	23	23	25	22	25	24	23	23	23	23	22	24	23	22				15
2 C 3	Aluminium production	CO2																		31
2C3	Aluminium production	PFCs	21	22	30															10

Table A1.6: Ranking of Key Categories including LULUCF

IPCC Category Description		Gas	**LA90**	LA91	LA92	LA93	LA94	LA95	LA96	LA97	LA98	LA99	LA00	LA01	LA02	LA03	LA04	LA05	**LA06**	**TA06**
2C4	SF6 Used in Al and Mg Foundries	SF6				35	32	31	26	35										**23**
3	Solvent and other Product Use	CO2	***34***																	
5 B 1	Cropland remaining cropland	CO2																		**34**
5 E 2	Land converted to Settlements	CO2									34		34	33	32	34	33			
6 B	Wastewater Handling	N2O																		**33**

ANNEX 2: SECTOR 1.A FUEL COMBUSTION

This annex includes detailed information about category *1.A* (trend information by sub-category), a description of the national energy balance (including fuel and fuel categories) and a description of the methodology applied to extract activity data from the energy balance for the calculation of emissions for *Sector 1.A Fuel Combustion* (e.g. correspondence of categories of the energy balance to IPCC categories). Activity data used for estimating emissions in the sectoral approach as taken from the energy balance is also presented.

Furthermore, the revision of the national energy balance as well as the implication of this revision on activity data is described.

Trend information by sub category

1.A.1.a Public Electricity and Heat Production

The following table shows the emission trends of category *1.A.1.a Public Electricity and Heat Production* by gas.*Table 1: Greenhouse gas emissions from Category 1.A.1.a*

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	10 888	0.15	0.14	10 934
1991	11 645	0.17	0.16	11 698
1992	8 570	0.14	0.13	8 612
1993	8 310	0.15	0.13	8 353
1994	8 600	0.14	0.13	8 643
1995	9 717	0.14	0.14	9 765
1996	10 897	0.17	0.14	10 945
1997	10 968	0.18	0.14	11 014
1998	10 018	0.18	0.15	10 069
1999	9 983	0.16	0.15	10 033
2000	9 679	0.15	0.15	9 730
2001	11 365	0.19	0.18	11 424
2002	10 586	0.19	0.18	10 647
2003	13 001	0.23	0.21	13 071
2004	12 934	0.26	0.23	13 012
2005	12 744	0.22	0.20	12 810
2006	12 049	0.28	0.23	12 125
Trend 1990-2006	10.7%	90.1%	62.6%	10.9%

During the last three years solid fossil fuels and natural gas were dominant compared to other fuel types. Since 2000 liquid fossil fuels became less important. The share in CO_2 emissions from waste incineration in district heating plants which are reported as 'other fuels' increased from 1% in 1990 to 6% in 2006. See Table 2.

Table 2: Share of fuel types on total CO_2 emissions from Category 1.A.1.a

	Liquid	Solid	Gaseous	Other
1990	11%	57%	30%	1%
1991	13%	59%	27%	1%
1992	17%	47%	34%	2%
1993	25%	37%	36%	2%
1994	22%	38%	38%	2%
1995	16%	47%	35%	2%
1996	14%	43%	41%	2%
1997	18%	46%	35%	2%
1998	22%	35%	41%	2%
1999	18%	38%	42%	2%
2000	12%	50%	35%	2%
2001	13%	52%	32%	3%
2002	8%	52%	36%	4%
2003	9%	53%	34%	4%
2004	9%	52%	35%	4%
2005	9%	46%	42%	4%
2006	10%	47%	38%	6%

1.A.1.b Petroleum Refining

Table 3 present the emission trends of category *1.A.1.b Petroleum Refining Production* by gas.

Table 3: Greenhouse gas emissions from Category 1.A.1.b

	CO_2 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	2 394	0.015	2 399
1991	2 428	0.016	2 433
1992	2 389	0.016	2 394
1993	2 732	0.018	2 737
1994	2 709	0.018	2 715
1995	2 590	0.017	2 596
1996	2 647	0.017	2 652
1997	2 640	0.017	2 645
1998	2 633	0.017	2 638
1999	2 463	0.017	2 468
2000	2 344	0.016	2 349
2001	2 423	0.017	2 428
2002	2 565	0.019	2 571
2003	2 687	0.017	2 692
2004	2 844	0.019	2 849
2005	2 827	0.018	2 832

	CO_2 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
2006	2 830	0.017	2 835
Trend 1990-2006	18.1%	20.6%	18.1%

Table 4 present the share of CO_2 emissions on the different fuel types. From 2003 on gaseous fuels include emissions from bitumen blowing and hydrogen production.

Table 4: Share of fuel types on total CO_2 emissions from Category 1.A.1.b

	Liquid	Gaseous
1990	82%	18%
1991	79%	21%
1992	80%	20%
1993	80%	20%
1994	86%	14%
1995	84%	16%
1996	82%	18%
1997	82%	18%
1998	82%	18%
1999	83%	17%
2000	85%	15%
2001	83%	17%
2002	84%	16%
2003	86%	14%
2004	88%	12%
2005	76%	24%
2006	76%	24%

1 A 1 c Manufacture of Solid Fuels and Other Energy Industries

Table 5 present the emission trends of category *1.A.1.c Manufacture of Solid Fuels and Other Energy Industries.*

Table 5: Greenhouse gas emissions from Category 1.A.1.c

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	510	0.014	0.0010	511
1991	549	0.015	0.0010	550
1992	522	0.014	0.0009	523
1993	424	0.011	0.0008	425
1994	453	0.012	0.0008	453
1995	611	0.017	0.0011	612
1996	261	0.007	0.0005	261

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1997	277	0.008	0.0005	278
1998	343	0.009	0.0006	343
1999	396	0.011	0.0007	396
2000	330	0.009	0.0006	331
2001	340	0.009	0.0006	340
2002	519	0.014	0.0009	520
2003	429	0.012	0.0008	429
2004	574	0.016	0.0010	575
2005	525	0.014	0.0009	526
2006	547	0.015	0.0010	548
Trend 1990-2006	7.3%	8.1%	1.3%	7.3%

Almost all emissions of category *1.A.1.c* originated from natural gas combustion. See Table 6:

Table 6: Share of fuel types on total CO_2 emissions from Category 1.A.1.c

	Liquid	Gaseous
1990	1%	99%
1991	0%	100%
1992	0%	100%
1993	0%	100%
1994	0%	100%
1995	0%	100%
1996	NO	100%
1997	NO	100%
1998	NO	100%
1999	NO	100%
2000	NO	100%
2001	NO	100%
2002	NO	100%
2003	NO	100%
2004	NO	100%
2005	NO	100%
2006	NO	100%

1.A.2.a Iron and Steel

Table 7 present the emission trends of category *1.A.2.a Iron and Steel.*

Table 7: Greenhouse gas emissions from Category 1.A.2.a

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	4 944	0.025	0.043	4 958
1991	4 615	0.023	0.043	4 629
1992	3 933	0.020	0.037	3 945
1993	4 191	0.022	0.038	4 203
1994	4 441	0.026	0.041	4 455
1995	4 774	0.026	0.047	4 789
1996	4 666	0.030	0.043	4 680
1997	5 287	0.034	0.049	5 303
1998	4 715	0.033	0.049	4 731
1999	4 837	0.030	0.049	4 853
2000	5 217	0.038	0.056	5 235
2001	5 191	0.035	0.053	5 208
2002	5 499	0.038	0.053	5 517
2003	5 624	0.077	0.054	5 643
2004	5 718	0.085	0.054	5 737
2005	6 447	0.100	0.059	6 468
2006	6 450	0.108	0.065	6 472
Trend 1990-2006	30.4%	325.1%	50.4%	30.5%

CO_2 emissions from category *1.A.2.a* mainly arise from solid fossil fuels (coke oven coke for blast furnaces). See Table 8.

Table 8: Share of fuel types in total CO_2 emissions from Category 1.A.2.a

	Liquid	Solid	Gaseous
1990	9.1%	77.8%	13.1%
1991	9.7%	75.7%	14.5%
1992	11.1%	72.7%	16.2%
1993	10.9%	74.5%	14.6%
1994	10.9%	73.8%	15.3%
1995	11.7%	72.5%	15.9%
1996	9.9%	70.1%	20.0%
1997	9.8%	69.7%	20.5%
1998	14.1%	63.3%	22.6%
1999	13.5%	65.7%	20.8%
2000	15.8%	65.5%	18.7%

	Liquid	Solid	Gaseous
2001	16.9%	64.7%	18.5%
2002	12.0%	69.5%	18.5%
2003	9.9%	72.1%	18.0%
2004	12.3%	70.5%	17.3%
2005	12.3%	69.7%	18.0%
2006	11.9%	70.1%	18.0%

1.A.2.b Non-Ferrous Metals

Table 9 present the emission trends of category *1.A.2.b Non-Ferrous Metals.*

Table 9: Greenhouse gas emissions from Category 1.A.2.b

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	132	0.003	0.0009	132
1991	119	0.003	0.0008	119
1992	127	0.003	0.0007	127
1993	158	0.004	0.0008	158
1994	261	0.007	0.0011	262
1995	255	0.006	0.0010	255
1996	177	0.004	0.0009	177
1997	221	0.005	0.0012	222
1998	205	0.004	0.0011	206
1999	190	0.004	0.0011	191
2000	194	0.004	0.0010	195
2001	200	0.005	0.0009	201
2002	207	0.005	0.0010	207
2003	218	0.005	0.0010	219
2004	216	0.005	0.0009	217
2005	219	0.005	0.0008	219
2006	228	0.006	0.0009	229
Trend 1990-2006	73.0%	80.7%	4.3%	72.9%

CO_2 emissions arise from combustion of natural gas and residual fuel oil. See Table 10.

Table 10: Share of fuel types in total CO_2 emissions from Category 1.A.2.b

	Liquid	Solid	Gaseous
1990	27%	17%	57%
1991	29%	15%	56%
1992	25%	6%	69%
1993	21%	12%	67%

	Liquid	Solid	Gaseous
1994	15%	6%	79%
1995	16%	4%	80%
1996	28%	9%	63%
1997	32%	9%	59%
1998	30%	8%	62%
1999	25%	12%	63%
2000	24%	10%	66%
2001	24%	5%	71%
2002	21%	8%	71%
2003	19%	7%	74%
2004	17%	8%	75%
2005	14%	6%	79%
2006	15%	6%	79%

1.A.2.c Chemicals

Table 11 present the emission trends of category *1.A.2.c Chemicals.*

Table 11: Greenhouse gas emissions from Category 1.A.2.c

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	883	0.045	0.017	889
1991	905	0.051	0.018	912
1992	986	0.059	0.021	994
1993	1 034	0.049	0.015	1 040
1994	984	0.048	0.014	989
1995	1 033	0.053	0.014	1 039
1996	1 125	0.062	0.019	1 132
1997	1 200	0.060	0.020	1 207
1998	1 117	0.053	0.017	1 123
1999	1 350	0.065	0.028	1 360
2000	1 412	0.071	0.024	1 421
2001	1 496	0.073	0.017	1 502
2002	1 531	0.079	0.016	1 538
2003	1 616	0.086	0.017	1 624
2004	1 743	0.103	0.019	1 751
2005	1 588	0.092	0.018	1 596
2006	1 432	0.088	0.017	1 439
Trend 1990-2006	62.3%	95.5%	0.1%	61.9%

In 2006 natural gas was still the main source of CO_2 emissions from category *1.A.2.c*. CO_2 emissions from solid and liquid fossil fuel combustion got less important while CO_2 emissions from industrial waste (reported as "other fuels") strongly increased since 2000. See Table 12.

Table 12: Share of fuel types in total CO_2 emissions from Category 1.A.2.c

	Liquid	**Solid**	**Gaseous**	**Other**
1990	9%	12%	59%	20%
1991	10%	15%	51%	24%
1992	6%	19%	50%	26%
1993	7%	18%	58%	16%
1994	9%	15%	56%	19%
1995	9%	15%	55%	22%
1996	8%	17%	51%	24%
1997	11%	21%	50%	18%
1998	10%	22%	52%	16%
1999	5%	23%	60%	12%
2000	4%	18%	62%	17%
2001	5%	17%	60%	19%
2002	4%	16%	58%	22%
2003	4%	16%	56%	24%
2004	3%	14%	52%	32%
2005	3%	9%	58%	29%
2006	3%	7%	58%	32%

1.A.2.d Pulp, Paper and Print

Table 13 present the emission trends of category *1.A.2.d Pulp, Paper and Print.*

Table 13: Greenhouse gas emissions from Category 1.A.2.d

	CO_2 [Gg]	**CH_4 [Gg]**	**N_2O [Gg]**	**CO_2 equiv. [Gg]**
1990	2 213	0.12	0.06	2 234
1991	2 676	0.13	0.06	2 698
1992	2 167	0.12	0.06	2 188
1993	2 024	0.12	0.08	2 050
1994	2 555	0.14	0.08	2 582
1995	2 315	0.14	0.08	2 342
1996	2 417	0.14	0.07	2 440
1997	2 821	0.15	0.08	2 849
1998	2 635	0.14	0.07	2 658
1999	2 320	0.14	0.08	2 347
2000	2 347	0.13	0.06	2 369
2001	2 212	0.13	0.07	2 235
2002	2 201	0.13	0.07	2 225

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
2003	2 365	0.13	0.07	2 388
2004	2 223	0.13	0.07	2 246
2005	2 283	0.14	0.07	2 309
2006	2 183	0.14	0.08	2 210
Trend 1990-2006	-1.3%	21.0%	31.6%	-1.1%

Natural gas combustion is the main source of CO_2 emissions from category *1.A.2.d* Liquid fuel consumption decreased since 1990 whereas the share of solid fuels in total CO_2 emissions is quite constant. See Table 14.

Table 14: Share of fuel types in total CO_2 emissions from Category 1.A.2.d

	Liquid	Solid	Gaseous	Other
1990	39%	18%	43%	1%
1991	41%	20%	38%	1%
1992	31%	21%	47%	1%
1993	34%	21%	44%	1%
1994	26%	14%	59%	1%
1995	23%	16%	59%	2%
1996	17%	15%	65%	3%
1997	18%	16%	66%	0%
1998	17%	17%	66%	0%
1999	10%	15%	75%	1%
2000	7%	18%	75%	NO
2001	8%	16%	76%	1%
2002	7%	19%	74%	1%
2003	7%	16%	77%	1%
2004	6%	18%	75%	1%
2005	6%	19%	74%	1%
2006	6%	21%	73%	0%

1.A.2.e Food Processing, Beverages and Tobacco

Table 15 present the emission trends of category *1.A.2.e Food Processing, Beverages and Tobacco.*

Table 15: Greenhouse gas emissions from Category 1.A.2.e

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	870	0.018	0.005	872
1991	933	0.020	0.006	935
1992	854	0.018	0.005	856
1993	886	0.016	0.005	888

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1994	916	0.019	0.005	918
1995	931	0.019	0.005	933
1996	888	0.019	0.004	889
1997	1 042	0.022	0.004	1 043
1998	943	0.021	0.004	944
1999	959	0.023	0.004	960
2000	1 114	0.028	0.005	1 116
2001	1 057	0.026	0.005	1 059
2002	1 250	0.032	0.005	1 253
2003	1 066	0.026	0.005	1 068
2004	987	0.024	0.004	989
2005	831	0.021	0.004	833
2006	842	0.021	0.004	844
Trend 1990-2006	-3.2%	14.6%	-16.0%	-3.2%

The share of natural gas consumption is increasing and is the main source of CO_2 emissions from category *1.A.2.e*. The share of liquid fossil fuel combustion in total CO_2 emissions decreased since 1990. See Table 16.

Table 16: Share of fuel types in total CO_2 emissions from Category 1.A.2.e

	Liquid	Solid	Gaseous	Other
1990	40%	2%	58%	NO
1991	42%	2%	55%	NO
1992	40%	1%	59%	NO
1993	44%	2%	54%	NO
1994	38%	2%	59%	NO
1995	37%	1%	63%	NO
1996	29%	1%	70%	0%
1997	30%	1%	69%	0%
1998	26%	1%	72%	0%
1999	17%	1%	82%	NO
2000	15%	4%	81%	NO
2001	19%	2%	79%	NO
2002	14%	3%	83%	NO
2003	16%	3%	81%	NO
2004	16%	3%	81%	NO
2005	17%	2%	82%	NO
2006	17%	1%	82%	NO

1.A.2.f Manufacturing Industries and Construction – Other

Table 17 present the emission trends of category *1.A.2.f Manufacturing Industries and Construction – Other.*

Table 17: Greenhouse gas emissions from Category 1.A.2.f

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	4 404	0.188	0.395	4 531
1991	4 595	0.203	0.412	4 727
1992	4 478	0.208	0.413	4 610
1993	4 667	0.202	0.402	4 795
1994	4 804	0.204	0.420	4 938
1995	4 858	0.206	0.409	4 989
1996	4 994	0.212	0.408	5 124
1997	5 264	0.213	0.419	5 399
1998	4 923	0.217	0.433	5 062
1999	4 225	0.202	0.435	4 364
2000	4 207	0.206	0.422	4 342
2001	4 257	0.219	0.415	4 391
2002	4 087	0.213	0.407	4 218
2003	4 300	0.214	0.374	4 421
2004	4 389	0.218	0.352	4 502
2005	4 539	0.226	0.339	4 649
2006	4 677	0.256	0.346	4 790
Trend 1990-2006	6.2%	36.2%	-12.5%	5.7%

Natural gas and liquid fossil fuel combustion is the main source of CO_2 emissions from category *1.A.2.f*. The share of fossil fuel types on total CO_2 emissions is quite constant over the years. See Table 18.

Table 18: Share of fuel types in total CO_2 emissions from category 1.A.2.f

	Liquid	Solid	Gaseous	Other
1990	49%	14%	36%	2%
1991	49%	12%	35%	3%
1992	46%	14%	36%	4%
1993	51%	12%	35%	2%
1994	48%	8%	39%	4%
1995	45%	9%	42%	4%
1996	45%	11%	40%	4%
1997	51%	11%	32%	6%
1998	50%	12%	33%	5%
1999	47%	11%	35%	6%

	Liquid	Solid	Gaseous	Other
2000	44%	12%	37%	6%
2001	43%	10%	39%	8%
2002	43%	8%	40%	9%
2003	45%	6%	39%	9%
2004	47%	6%	38%	9%
2005	43%	8%	40%	8%
2006	40%	12%	39%	9%

1.A.2.f Manufacturing Industries and Construction - Other - stationary sources

Table 19 present the emission trends of category *1.A.2.f Manufacturing Industries and Construction – Other - stationary sources.*

Table 19: Greenhouse gas emissions from Category 1.A.2.f stationary sources.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	3 388	0.11	0.04	3 403
1991	3 538	0.12	0.04	3 554
1992	3 410	0.13	0.04	3 425
1993	3 632	0.13	0.04	3 648
1994	3 742	0.13	0.04	3 757
1995	3 822	0.13	0.04	3 836
1996	3 986	0.14	0.04	4 001
1997	4 239	0.14	0.04	4 254
1998	3 883	0.15	0.04	3 898
1999	3 178	0.14	0.06	3 201
2000	3 146	0.15	0.06	3 168
2001	3 182	0.16	0.06	3 204
2002	3 006	0.16	0.06	3 028
2003	3 214	0.16	0.06	3 237
2004	3 245	0.17	0.06	3 268
2005	3 394	0.18	0.06	3 417
2006	3 558	0.21	0.09	3 589
Trend 1990-2006	5.0%	84.4%	108.1%	5.5%

Natural gas and liquid fossil fuel combustion is the main stationary source of CO_2 emissions from category *1.A.2.f*. Solid and liquid fuels got less important but CO_2 emissions from combustion of natural gas and industrial waste are increasing. See Table 20,

Table 20: Share of fuel types on total CO_2 emissions from Category 1.A.2.f stationary sources.

	Liquid	Solid	Gaseous	Other
1990	33%	18%	46%	2%
1991	34%	16%	46%	4%
1992	29%	18%	48%	5%
1993	37%	15%	45%	3%
1994	34%	11%	50%	6%
1995	30%	12%	53%	5%
1996	31%	14%	50%	5%
1997	39%	14%	39%	7%
1998	37%	15%	42%	6%
1999	30%	15%	47%	8%
2000	26%	16%	50%	8%
2001	24%	14%	52%	10%
2002	23%	11%	54%	12%
2003	26%	8%	52%	13%
2004	28%	8%	52%	12%
2005	24%	11%	54%	11%
2006	21%	15%	52%	11%

1.A.2.f Manufacturing Industries and Construction - Cement Clinker Production (NACE 26.51)

Table 21 present greenhouse gas emissions from fuel combustion for cement clinker production.

Table 21: Greenhouse gas emissions from Category 1.A.2.f - cement clinker production.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	1 055	0.06	0.02	1 061
1991	1 038	0.06	0.02	1 044
1992	1 107	0.06	0.02	1 114
1993	1 038	0.06	0.02	1 045
1994	1 089	0.06	0.02	1 095
1995	867	0.05	0.01	872
1996	848	0.06	0.01	853
1997	932	0.06	0.01	938
1998	853	0.07	0.02	859
1999	826	0.06	0.01	832
2000	866	0.07	0.02	872
2001	807	0.08	0.02	813
2002	830	0.08	0.02	837
2003	821	0.08	0.02	828
2004	839	0.09	0.02	847

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
2005	884	0.09	0.02	892
2006	1 012	0.11	0.02	1 021
Trend 1990-2006	-4.0%	89.6%	27.6%	-3.8%

1.A.2.f Manufacturing Industries and Construction - Other - mobile sources

Table 22 present greenhouse gas emissions mobile machinery of industry. All emissions arise from liquid fuels.

Table 22: Greenhouse gas emissions from Category 1.A.2.f mobile sources.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO2-equ [Gg]
1990	1 018	0.07	0.35	1 130
1991	1 059	0.08	0.37	1 175
1992	1 071	0.08	0.37	1 188
1993	1 036	0.08	0.36	1 150
1994	1 063	0.08	0.38	1 183
1995	1 039	0.07	0.37	1 156
1996	1 010	0.07	0.37	1 125
1997	1 026	0.07	0.38	1 146
1998	1 041	0.07	0.39	1 164
1999	1 048	0.06	0.37	1 164
2000	1 062	0.06	0.36	1 175
2001	1 077	0.06	0.35	1 188
2002	1 082	0.06	0.35	1 190
2003	1 087	0.05	0.31	1 185
2004	1 144	0.05	0.29	1 235
2005	1 161	0.05	0.28	1 248
2006	1 161	0.05	0.28	1 248
Trend 1990 - 2006	14.0%	-32.8%	-18.8%	9.3%

1.A.3.e Other Transportation – Pipeline Compressors

The following table present greenhouse gas emissions from *1.A.3.e Other Transportation-Pipeline Compressors*.

Table 23: Greenhouse gas emissions from Category 1.A.3.e.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	224	0.006	0.0004	225
1991	225	0.006	0.0004	226
1992	220	0.006	0.0004	220
1993	214	0.006	0.0004	214
1994	209	0.006	0.0004	210
1995	227	0.006	0.0004	227
1996	234	0.006	0.0004	234
1997	233	0.006	0.0004	233
1998	351	0.010	0.0006	352
1999	434	0.012	0.0008	435
2000	538	0.015	0.0010	538
2001	456	0.012	0.0008	457
2002	275	0.007	0.0005	275
2003	367	0.010	0.0007	368
2004	441	0.012	0.0008	442
2005	545	0.015	0.0010	546
2006	452	0.012	0.0008	452
Trend 1990-2006	101.4%	101.4%	101.4%	101.4%

Combustion of natural gas is the only source of CO_2 emissions from category *1.A.3.e*.

1.A.4 Other sectors

The following table present greenhouse gas emissions from *1.A.4 Other sectors*.

Table 24: Greenhouse gas emissions from Category 1.A.4

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	14 396	18.50	0.95	15 078
1991	15 358	19.99	0.95	16 073
1992	14 951	18.21	0.94	15 625
1993	14 778	17.88	0.95	15 447
1994	13 575	16.22	0.93	14 205
1995	14 652	16.87	0.94	15 299
1996	15 902	17.89	1.03	16 596
1997	14 462	13.61	1.03	15 066
1998	14 378	13.08	1.00	14 962

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1999	14 664	13.42	1.00	15 257
2000	13 170	12.60	0.93	13 723
2001	14 609	13.31	0.99	15 195
2002	14 200	12.54	0.97	14 765
2003	15 523	12.70	0.99	16 097
2004	13 915	12.00	0.96	14 464
2005	14 279	12.32	0.95	14 833
2006	13 646	11.70	0.92	14 176
Trend 1990-2006	-5.2%	-36.8%	-3.0%	-6.0%

As can be seen from Table 25, liquid fossil fuels are the main source of CO_2 emissions from category *1.A.4* with a quite constant share over the time series. Since 1990 solid fossil fuels became less important whereas the share of CO_2 emissions from natural gas combustion almost doubled.

Table 25: Share of fuel types on total CO_2 emissions from Category 1.A.4

	Liquid	Solid	Gaseous	Other
1990	61%	18%	18%	2%
1991	59%	19%	20%	2%
1992	57%	17%	24%	2%
1993	58%	14%	27%	1%
1994	59%	14%	26%	2%
1995	59%	12%	28%	1%
1996	62%	10%	26%	2%
1997	62%	9%	27%	2%
1998	63%	8%	28%	1%
1999	64%	7%	27%	1%
2000	63%	7%	29%	1%
2001	62%	6%	31%	0%
2002	63%	5%	31%	0%
2003	63%	4%	32%	0%
2004	61%	4%	35%	1%
2005	61%	4%	35%	1%
2006	64%	4%	31%	1%

1.A.4 Other sectors - stationary sources

The following table present greenhouse gas emissions from *1.A.4 Other sectors –stationary sources* and yearly changes on heating degree days.

Table 26: Greenhouse gas emissions from Category 1.A.4 stationary sources

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]	Heating degree days(1)
1990	12 897	18.20	0.48	13 427	3 237
1991	13 998	19.71	0.53	14 577	3 612
1992	13 548	17.93	0.50	14 080	3 356
1993	13 363	17.60	0.51	13 889	3 414
1994	12 078	15.93	0.46	12 555	3 138
1995	13 246	16.59	0.50	13 749	3 415
1996	14 377	17.60	0.54	14 913	3 820
1997	12 844	13.32	0.49	13 277	3 485
1998	12 816	12.80	0.48	13 234	3 309
1999	13 079	13.14	0.49	13 508	3 253
2000	11 672	12.35	0.46	12 073	2 958
2001	13 042	13.07	0.51	13 474	3 294
2002	13 042	13.07	0.51	13 474	3 191
2003	13 921	12.48	0.53	14 347	3 463
2004	12 269	11.81	0.50	12 672	3 322
2005	12 706	12.15	0.53	13 124	3 527
2006	12 117	11.53	0.51	12 515	3 315
Trend 1990-2006	-6.0%	-36.7%	5.8%	-6.8%	2.4%

(1) Source: STATISTIK AUSTRIA

As can be seen in Table 27, liquid fossil fuels are the main stationary source of CO_2 emissions from category *1.A.4* with a quite constant share over time. Since 1990 solid fossil fuels became less important whereas the share of CO_2 emissions from natural gas combustion almost doubled.

Table 27: Share of fuel types in total CO_2 emissions from Category 1.A.4 stationary sources

	Liquid	Solid	Gaseous	Other
1990	57%	21%	20%	2.7%
1991	55%	21%	22%	2.0%
1992	53%	19%	26%	2.5%
1993	53%	16%	30%	1.4%
1994	54%	15%	29%	1.7%
1995	54%	13%	31%	1.4%
1996	58%	12%	28%	2.1%
1997	58%	10%	30%	2.1%
1998	58%	9%	32%	1.3%

	Liquid	Solid	Gaseous	Other
1999	60%	8%	31%	1.2%
2000	58%	8%	33%	1.2%
2001	57%	7%	35%	0.5%
2002	57%	6%	34%	0.5%
2003	59%	5%	36%	0.5%
2004	55%	5%	39%	0.6%
2005	56%	5%	39%	0.6%
2006	59%	5%	35%	0.6%

Activity Data Recalculations

Recalculations of activity data are due to the revised energy balance (IEA JQ 2007).

Table 28: Activity data recalculations by sub categories with respect to previous submission [[PJ absolut values]

	Fuel Consumption [PJ]								
	1990			2004			2005		
IPCC Category / Fuel Group	**Subm. 2007**	**Subm. 2008**	**Differe nce**	**Subm. 2007**	**Subm. 2008**	**Differe nce**	**Subm. 2007**	**Subm. 2008**	**Differe nce**
1 A FUEL COMBUSTION ACTIVITIES	821.84	824.43	2.59	1 095.05	1 097.58	2.54	1 146.82	1 145.86	-0.96
1 A liquid	377.04	377.04	0.00	513.57	513.38	-0.19	524.95	526.01	1.05
1 A solid	139.83	139.85	0.02	126.03	124.64	-1.39	123.58	122.40	-1.18
1 A gaseous	201.60	203.98	2.38	297.35	305.32	7.97	334.19	334.17	-0.02
1 A biomass	94.38	94.56	0.18	136.08	132.23	-3.86	143.81	142.98	-0.82
1 A other	8.99	8.99	0.00	22.02	22.02	0.00	20.29	20.29	0.00
1 A 1 Energy Industries	186.40	188.78	2.38	237.56	243.21	5.64	244.62	253.92	9.30
1 A 1 liquid	46.45	46.45	0.00	48.40	48.37	-0.03	43.43	45.08	1.64
1 A 1 solid	61.40	61.40	0.00	69.07	69.07	0.00	61.63	61.63	0.00
1 A 1 gaseous	74.10	76.48	2.38	92.70	98.02	5.32	113.11	117.74	4.63
1 A 1 biomass	2.04	2.04	0.00	18.21	18.36	0.15	17.94	20.97	3.03
1 A 1 other	2.41	2.41	0.00	9.18	9.38	0.21	8.51	8.51	0.00
1 A 1 a Public Electricity and Heat Production	140.95	140.95	0.00	193.22	193.30	0.08	197.79	200.93	3.14
1 A 1 a liquid	15.63	15.63	0.00	14.77	14.75	-0.02	13.71	13.81	0.10
1 A 1 a solid	61.40	61.40	0.00	69.07	69.07	0.00	61.63	61.63	0.00

IPCC Category / Fuel Group	Fuel Consumption [PJ] 1990 Subm. 2007	1990 Subm. 2008	1990 Difference	2004 Subm. 2007	2004 Subm. 2008	2004 Difference	2005 Subm. 2007	2005 Subm. 2008	2005 Difference
1 A 1 a gaseous	59.46	59.46	0.00	81.99	81.73	-0.25	96.01	96.02	0.01
1 A 1 a biomass	2.04	2.04	0.00	18.21	18.36	0.15	17.94	20.97	3.03
1 A 1 a other	2.41	2.41	0.00	9.18	9.38	0.21	8.51	8.51	0.00
1 A 1 b Petroleum refining	39.89	38.63	-1.26	39.69	39.55	-0.14	41.92	43.51	1.59
1 A 1 b liquid	30.75	30.75	0.00	33.63	33.62	-0.01	29.72	31.27	1.54
1 A 1 b solid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 1 b gaseous	9.14	7.88	-1.26	6.06	5.93	-0.13	12.20	12.24	0.04
1 A 1 b biomass	NO	NO	-	NO	NO	-	NO	NO	-
1 A 1 b other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 1 c Manufacture of Solid fuels and Other Energy Industries	5.55	9.20	3.64	4.65	10.36	5.71	4.90	9.48	4.57
1 A 1 c liquid	0.06	0.06	0.00	NO	NO	-	NO	NO	-
1 A 1 c solid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 1 c gaseous	5.49	9.13	3.64	4.65	10.36	5.71	4.90	9.48	4.57
1 A 1 c biomass	NO	NO	-	NO	NO	-	NO	NO	-
1 A 1 c other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 Manufacturing Industries and Construction	210.78	209.52	-1.26	253.98	253.88	-0.09	263.91	267.33	3.42
1 A 2 liquid	50.95	50.95	0.00	40.57	40.57	0.00	40.55	40.91	0.37
1 A 2 solid	50.23	50.25	0.02	50.94	49.54	-1.39	55.89	54.62	-1.27
1 A 2 gaseous	77.40	76.99	-0.41	107.54	112.01	4.47	108.49	116.89	8.40
1 A 2 biomass	27.93	28.11	0.18	42.98	39.81	-3.17	47.88	43.81	-4.07
1 A 2 other	4.28	3.22	-1.06	11.95	11.95	0.00	11.10	11.10	0.00
1 A 2 a Iron and Steel	55.57	55.59	0.02	67.72	66.31	-1.41	73.48	75.41	1.93
1 A 2 a liquid	5.78	5.79	0.00	9.00	9.00	0.00	10.16	10.17	0.01
1 A 2 a solid	38.05	38.07	0.02	40.91	39.50	-1.41	45.42	44.15	-1.27
1 A 2 a gaseous	11.73	11.73	0.00	17.82	17.82	0.00	17.90	21.09	3.19
1 A 2 a biomass	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 a other	NO	NO	-	NO	NO	-	NO	NO	-

IPCC Category / Fuel Group	Fuel Consumption [PJ] 1990 Subm. 2007	1990 Subm. 2008	1990 Difference	2004 Subm. 2007	2004 Subm. 2008	2004 Difference	2005 Subm. 2007	2005 Subm. 2008	2005 Difference
1 A 2 b Non-ferrous Metals	2.08	2.08	0.00	3.61	3.61	0.00	6.73	3.70	-3.04
1 A 2 b liquid	0.51	0.51	0.00	0.51	0.51	0.00	0.99	0.44	-0.56
1 A 2 b solid	0.21	0.21	0.00	0.16	0.16	0.00	0.13	0.13	0.00
1 A 2 b gaseous	1.35	1.35	0.00	2.93	2.93	0.00	5.58	3.13	-2.44
1 A 2 b biomass	NO	NO	-	NO	NO	-	0.03	NO	-
1 A 2 b other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 c Chemicals	16.94	16.09	-0.85	26.96	26.44	-0.51	22.32	25.75	3.43
1 A 2 c liquid	1.06	1.06	0.00	0.67	0.67	0.00	0.54	0.65	0.11
1 A 2 c solid	1.14	1.10	-0.04	2.49	2.50	0.01	1.57	1.57	0.00
1 A 2 c gaseous	9.57	9.36	-0.21	16.27	16.27	0.00	12.74	16.69	3.95
1 A 2 c biomass	2.90	2.90	0.00	2.23	1.71	-0.52	2.89	2.26	-0.63
1 A 2 c other	2.27	1.67	-0.60	5.30	5.30	0.00	4.57	4.57	0.00
1 A 2 d Pulp, Paper and Print	54.76	54.15	-0.62	63.15	66.16	3.01	71.50	70.13	-1.37
1 A 2 d liquid	10.93	10.94	0.00	1.68	1.68	0.00	1.76	1.76	0.00
1 A 2 d solid	4.08	4.12	0.04	4.27	4.28	0.01	4.72	4.72	0.00
1 A 2 d gaseous	17.22	17.01	-0.20	25.67	30.07	4.40	30.58	30.58	0.00
1 A 2 d biomass	21.88	21.88	0.00	31.33	29.92	-1.40	34.26	32.89	-1.37
1 A 2 d other	0.65	0.19	-0.46	0.20	0.20	0.00	0.18	0.18	0.00
1 A 2 e Food Processing, Beverages and Tobacco	13.90	13.91	0.00	16.97	16.97	0.00	13.58	14.68	1.10
1 A 2 e liquid	4.45	4.45	0.00	2.13	2.13	0.00	1.69	1.81	0.13
1 A 2 e solid	0.18	0.18	0.00	0.25	0.25	0.00	0.13	0.13	0.00
1 A 2 e gaseous	9.15	9.15	0.00	14.43	14.43	0.00	11.31	12.28	0.98
1 A 2 e biomass	0.13	0.13	0.00	0.17	0.17	0.00	0.46	0.46	0.00
1 A 2 e other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 f Other	67.53	67.71	0.18	75.56	74.39	-1.18	76.29	77.66	1.37
1 A 2 f liquid	28.20	28.20	0.00	26.59	26.59	0.00	25.41	26.09	0.68
1 A 2 f solid	6.56	6.56	0.00	2.86	2.87	0.01	3.92	3.92	0.00
1 A 2 f gaseous	28.39	28.38	0.00	30.42	30.48	0.06	30.38	33.10	2.73
1 A 2 f biomass	3.02	3.21	0.18	9.25	8.00	-1.25	10.24	8.21	-2.03

IPCC Category / Fuel Group	Fuel Consumption [PJ] 1990 Subm. 2007	1990 Subm. 2008	1990 Difference	2004 Subm. 2007	2004 Subm. 2008	2004 Difference	2005 Subm. 2007	2005 Subm. 2008	2005 Difference
1 A 2 f other	1.36	1.36	0.00	6.45	6.45	0.00	6.34	6.34	0.00
1 A 3 Transport	166.12	166.12	0.00	317.63	317.45	-0.18	331.60	331.37	-0.22
1 A 3 liquid	162.00	162.00	0.00	309.64	309.46	-0.18	321.75	321.51	-0.23
1 A 3 solid	0.07	0.07	0.00	0.02	0.02	0.00	0.02	0.02	0.00
1 A 3 gaseous	4.05	4.05	0.00	7.96	7.96	0.00	9.83	9.84	0.01
1 A 3 biomass	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 a Civil Aviation	0.44	0.44	0.00	2.64	2.64	0.00	2.99	2.99	0.00
1 A 3 a aviation gasoline	0.11	0.11	0.00	0.10	0.10	0.00	0.12	0.12	0.00
1 A 3 a jet kerosene	0.33	0.33	0.00	2.54	2.54	0.00	2.87	2.87	0.00
1 A 3 b Road Transportation	158.60	158.60	0.00	303.49	303.77	0.28	315.60	315.79	0.20
1 A 3 b gasoline	104.38	104.38	0.00	88.79	88.79	0.00	86.14	86.14	0.00
1 A 3 b diesel oil	54.22	54.22	0.00	214.70	214.98	0.28	229.46	229.65	0.20
1 A 3 b LPG	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 b other liquid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 b gaseous	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 b biomass	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 b other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 c Railways	2.33	2.33	0.00	2.50	2.37	-0.13	2.07	2.04	-0.03
1 A 3 c solid	2.26	2.26	0.00	2.47	2.34	-0.13	2.05	2.02	-0.03
1 A 3 c liquid	0.07	0.07	0.00	0.02	0.02	0.00	0.02	0.02	0.00
1 A 3 c gaseous	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 c other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 d Navigation	0.70	0.70	0.00	1.04	0.71	-0.33	1.12	0.71	-0.40
1 A 3 d residual oil	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 d gas/diesel oil	0.58	0.58	0.00	0.92	0.59	-0.33	1.00	0.60	-0.40
1 A 3 d gasoline	0.12	0.12	0.00	0.12	0.12	0.00	0.12	0.12	0.00
1 A 3 d other liquid	NO	NO	-	NO	NO	-	NO	NO	-

IPCC Category / Fuel Group	Fuel Consumption [PJ]								
	1990			2004			2005		
	Subm. 2007	Subm. 2008	Difference	Subm. 2007	Subm. 2008	Difference	Subm. 2007	Subm. 2008	Difference
1 A 3 d solid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 d gaseous	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 d other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 e Other	4.05	4.05	0.00	7.96	7.96	0.00	9.83	9.84	0.01
1 A 3 e liquid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 e solid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 e gaseous	4.05	4.05	0.00	7.96	7.96	0.00	9.83	9.84	0.01
1 A 3 e biomass	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 e other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 4 Other Sectors	258.05	259.52	1.46	284.41	281.58	-2.84	305.05	291.58	-13.46
1 A 4 liquid	117.16	117.16	0.00	113.49	113.51	0.02	117.58	116.85	-0.72
1 A 4 solid	28.14	28.14	0.00	6.00	6.00	0.01	6.03	6.12	0.09
1 A 4 gaseous	46.05	46.46	0.41	89.15	87.33	-1.82	102.76	89.71	-13.05
1 A 4 biomass	64.40	64.40	0.00	74.89	74.06	-0.83	77.99	78.20	0.22
1 A 4 other	2.29	3.36	1.06	0.89	0.68	-0.21	0.69	0.69	0.00
1 A 4 a Commecial/Institutional	37.88	39.35	1.46	60.99	59.31	-1.68	70.07	57.00	-13.07
1 A 4 a liquid	19.10	19.10	0.00	21.65	21.94	0.29	22.64	22.17	-0.47
1 A 4 a solid	0.95	0.95	0.00	0.68	0.70	0.02	0.46	0.53	0.06
1 A 4 a gaseous	13.36	13.77	0.41	32.40	30.70	-1.70	41.15	28.04	-13.10
1 A 4 a biomass	2.18	2.17	0.00	5.37	5.28	-0.09	5.13	5.58	0.45
1 A 4 a other	2.29	3.36	1.06	0.89	0.68	-0.21	0.69	0.69	0.00
1 A 4 b Residential	191.41	191.41	0.00	193.23	192.11	-1.12	205.45	204.78	-0.66
1 A 4 b liquid	74.40	74.40	0.00	69.13	68.86	-0.27	72.93	72.93	0.00
1 A 4 b solid	26.64	26.64	0.00	5.22	5.21	-0.02	5.46	5.49	0.03
1 A 4 b gaseous	32.33	32.33	0.00	56.11	55.99	-0.12	60.93	60.98	0.05
1 A 4 b biomass	58.05	58.05	0.00	62.77	62.05	-0.72	66.13	65.39	-0.75
1 A 4 b other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 4 c Agriculture/Forestry/Fisheries	28.76	28.76	0.00	30.20	30.16	-0.03	29.53	29.80	0.27
1 A 4 c liquid	23.67	23.67	0.00	22.71	22.70	-0.01	22.01	21.76	-0.25

IPCC Category / Fuel Group	Fuel Consumption [PJ]								
	1990			2004			2005		
	Subm. 2007	Subm. 2008	Difference	Subm. 2007	Subm. 2008	Difference	Subm. 2007	Subm. 2008	Difference
1 A 4 c solid	0.55	0.55	0.00	0.10	0.10	0.00	0.11	0.11	0.00
1 A 4 c gaseous	0.37	0.37	0.00	0.63	0.63	0.00	0.69	0.69	0.00
1 A 4 c biomass	4.18	4.18	0.00	6.75	6.73	-0.02	6.73	7.24	0.51
1 A 4 c other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 5 Other	0.48	0.48	0.00	1.46	1.46	0.00	1.65	1.65	0.00
1 A 5 liquid	0.48	0.48	0.00	1.46	1.46	0.00	1.65	1.65	0.00
1 A 5 solid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 5 gaseous	NO	NO	-	NO	NO	-	NO	NO	-
1 A 5 biomass	NO	NO	-	NO	NO	-	NO	NO	-
1 A 5 other	NO	NO	-	NO	NO	-	NO	NO	-
International Bunkers	12.26	12.26	0.00	21.06	21.06	0.00	23.79	23.79	0.00

A "-" indicates that no recalculations were carried out or recalculations are lower than ± 0.001 PJ (mostly due to rounding) .

Methodology

For calculations of emissions from category *1.A Fuel Combustion* CORINAIR methodology was applied. The fuel consumption based on the energy balance is multiplied with source specific emission factors for CO_2, CH_4 and N_2O. Sector specific considerations and emission factors are described in the related sub chapters of Chapter *3 Energy* of the NIR 2008.

Activity data is taken from the national energy balance as described in the following sub chapters. Data of the national energy balance is presented in Annex 4.

The National Energy Balance

The new time series is consistent to the *IEA/EUROSTAT Joint Questionnaire* format. new energy balance for 2006 has been submitted to IEA and EUROSTAT in November 2007 by STATISTIK AUSTRIA.

There are five different IEA questionnaires for each of: oil; natural gas; coal; renewable fuels; electricity and heat. Table 29 shows the unified categories of the IEA questionnaires with ISIC codes and the corresponding SNAP and IPCC categories to which the fuel consumption is assigned to.

Data of the national energy balance is presented in Annex 4.

Table 29: Categories of the national energy balance (IEA-JQ, 2007) and their correspondence to IPCC categories.

IEA-Category and ISIC Codes[(2)]	Comments	SNAP	IPCC-Category
Production			Reference Approach: Production
Imports			Reference Approach: Import
Exports			Reference Approach: Export
Bunkers	No consumption [(1)]		
Stock Changes			Reference Approach: Stock Change
Refinery Fuel		0103	1 A 1 b Petroleum Refining
Transformation Sector, of which:			
Public Electricity plants Public CHP plants Public Heat plants	In the inventory plant specific data are considered.	0101 0102	1 A 1 a Public Electricity and Heat Production
Auto Producer Electricity plants Auto Producer CHP plants Auto Producer Heat plants	For autoproducers by sectors see table below.		
Coke Ovens	Transformation from *Coking Coal* to *Coke Oven Coke* .		
Blast furnaces	Coke Oven Coke.	030326	1 A 2 a Iron and Steel
Gas Works	Transformation of *Other Oil Products* to *Gas Works Gas* .		
Petrochemical Industry	No consumption [(1)]		
Patent Fuel Plants	No consumption [(1)]		
Not Elsewhere Specified	No consumption [(1)]		
Energy Sector, of which (ISIC 10, 11, 12, 23, 40):			
Coal Mines	No consumption [(1)]		
Oil and Gas Extraction		0105	1 A 1 c Manufacture of Solid fuels and Other Energy Industries
Inputs to oil refineries		0103	1 A 1 b Petroleum Refining
Coke Ovens	*Coke Oven Gas* and *Blast Furnace Gas*.	0301	1 A 2 a Iron and Steel
Blast furnaces	*Coke Oven Coke*.	030326	1 A 2 a Iron and Steel
Gas Works	*Natural Gas*.	0201	1 A 4 a Commercial/ Institutional
Electricity, CHP and Heat Plants		0101	1 A 1 a Public Electricity and Heat Production
Liquefaction Plants	No consumption [(1)]		
Not Elsewhere Specified	No consumption [(1)]		
Distribution Losses	Includes statistical differences and therefore it may be less than zero.		
Final Energy Consumption			
Total Transport, of which (ISIC 60, 61, 62):			
Domestic Air Transport Road	Division to SNAP categories is performed	07 08	1 A 2 f Manuf. Ind. and Constr. - Other

IEA-Category and ISIC Codes(2)	Comments	SNAP	IPCC-Category
Rail Inland Waterways	by means of studies.	0201	1 A 3 Transport 1 A 4 b Residential 1 A 4 c Agriculture/ Forestry/ Fisheries
Pipeline Transport	*Natural Gas*.	010506	1 A 3 e Transport-Other
Non Specified	*Other biofuels* and *Lubricants*.	0201	1 A 4 a Commercial/ Institutional
Total Industry, of which:			
Iron and Steel (ISIC 271, 2731)		0301 030301 030326	1 A 2 a Iron and Steel
Chemical incl.Petro-Chemical (ISIC 24)		0301	1 A 2 c Chemicals
Non ferrous Metals (ISIC 272, 2732)		0301	1 A 2 b Non-ferrous Metals
Non metallic Mineral Products (ISIC 26)		0301 030311 030317 030319	1 A 2 f Manuf. Ind. and Constr. - Other
Transportation Equipment (ISIC 34, 35)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Machinery (ISIC 28, 29, 30, 31, 32)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Mining and Quarrying (ISIC 13, 14)		0105	1 A 1 c Manufacture of Solid fuels and Other Energy Industries
Food, Beverages and Tobacco (ISIC 15, 16)		0301	1 A 2 e Food Processing, Beverages and Tobacco
Pulp, Paper and Printing (ISIC 21, 22)		0301	1 A 2 d Pulp, Paper and Print
Wood and Wood Products (ISIC 20)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Construction (ISIC 45)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Textiles and Leather (ISIC 17, 18, 19)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Non Specified (ISIC 25, 33, 36, 37)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Total Other sectors, of which:			
Commercial and Public Services (ISIC 41, 50, 51, 52, 55, 63, 64, 65, 66, 67, 70, 71, 72, 73, 74, 75, 80, 85, 90, 91, 92, 93, 99)		0201	1 A 4 a Commercial/ Institutional
Residential (ISIC 95)		0202	1 A 4 b Residential
Agriculture (ISIC 01, 02, 05)		0203	1 A 4 c Agriculture/Forestry/ Fisheries
Non Specified	No consumption (1)		

(1) Indicates that no fuel consumption is reported in the energy balance for the specific category. In some cases this may be interpreted as "included elsewhere" if the energy statistic has lack of detailed sectoral data.

(2) Sector names may differ to original IEA questionnaire naming convention. Note that the ISIC codes cited in this table are consistent with the NACE nomenclature.

Table 30: Categories of the national energy balance (IEA-JQ, 2007) and their correspondence to IPCC categories: Autoproducers by sector

Auto Producers (Electricity + CHP + Heat), of which:			
Energy Sector, of which			
Coal Mines	No consumption (1)		
Oil and Gas Extraction		0105	1 A 1 c Manufacture of Solid fuels and Other Energy Industries
Inputs to oil refineries		0103	1 A 1 b Petroleum Refining
Coke Ovens	No consumption (1)		
Gas Works	No consumption (1)		
Liquefaction Plants	No consumption (1)		
Not Elsewhere Specified	No consumption (1)		
Industrie, of which:			
Iron and Steel		030326	1 A 2 a Iron and Steel
Chemical (incl.Petro-Chemical)		0301	1 A 2 c Chemicals
Non ferrous Metals		0301	1 A 2 b Non-ferrous Metals
Non metallic Mineral Products		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Transportation Equipment		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Machinery		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Mining and Quarrying		0301	1 A 1 c Manufacture of Solid fuels and Other Energy Industries
Food, Beverages and Tobacco		0301	1 A 2 e Food Processing, Beverages and Tobacco
Pulp, Paper and Printing		0301	1 A 2 d Pulp, Paper and Print
Wood and Wood Products		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Construction		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Textiles and Leather		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Non Specified (Industry)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Total Transport, of which			
Pipeline Transport	No consumption (1)		
Non Specified	No consumption (1)		
Other Sectors, of which			
Commercial and Public Services		0201	1 A 4 a Commercial/ Institutional
Residential	No consumption (1)		

Auto Producers (Electricity + CHP + Heat), of which:	
Agriculture	No consumption (1)
Non Specified	No consumption (1)

(1) Indicates that no fuel consumption is reported in the energy balance for the specific category. In some cases this may be interpreted as "included elsewhere" if the energy statistic has lack of detailed sectoral data.

Fuels and Fuel Categories

The units used in the national fuel statistics are: *ton* for solid or liquid fuels and *cubic meter* for gaseous fuels. To convert these units into the caloric unit *Joule* the calorific value of each fuel category has to be quantified. These calorific values are specified in the unit *Joule per Mass or Volume Unit,* e.g. MJ/kg, MJ/m³ gas.

Each fuel has chemical and physical characteristics which influence its burning performance e.g. calorific value or carbon and sulphur content. Fuel categories are formed to pool fuels of the same characteristics in fuel groups. Limitations are given by the fuel categories of the energy balance. A list of the inventory fuel categories and their correspondence to IPCC-fuel categories is shown in Table 31.

Table 31: Fuel categories used for the inventory and correspondence to IPCC fuel categories

Inventory Fuel Category		**IEA Fuel Category**		
Code (1)	**Category**	**Category**	**Average Net Calorific Value(2)**	**IPCC Fuel Category (3)**
102 A	Hard Coal	Bituminous Coal and Anthracite	28.07	Solid (coal)
104 A	Hard Coal Briquettes	Patent Fuel	31.00	Solid (coal)
105 A	Brown Coal	Lignite/Brown Coal	10.95	Solid (coal)
106 A	Brown Coal Briquettes	BKB/PB	19.30	Solid (coal)
107 A	Coke	Coke Oven Coke	29.00	Solid (coal)
113 A	Peat	Peat	8.80	Solid
304 A	Coke Oven Gas	Coke Oven Gas	17.90	Solid
305 A	Blast Furnace Gas	Blast Furnace Gas	35.72	Solid
110 A	Petrol Coke	Petrol Coke	30.89	Liquid
203 B	Light Fuel Oil Sulphur Content < 0,2 %	Residual Fuel Oil	41.29	Liquid (residual oil)
203 C	Medium Fuel Oil Sulphur Content < 0,4%			
203 D	Heavy Fuel Oil Sulphur Content >= 1%			
204 A	Gasoil	Heating and other Gasoil	42.80	Liquid (gas/diesel oil)
205 0	Diesel	Transport Diesel	42.80	Liquid (diesel oil; gas/diesel oil)
206 A	Petroleum	Other Kerosene	43.30	Liquid
206 B	Kerosene	Kerosene Type Jet Fuel	43.30	Liquid (jet kerosene)
207 A	Aviation Gasoline	Gasoline Type Jet Fuel	43.20	Liquid (aviation gasoline)

Inventory Fuel Category		**IEA Fuel Category**		
Code (1)	**Category**	**Category**	**Average Net Calorific Value(2)**	**IPCC Fuel Category (3)**
208 0	Motor Gasoline	Motor Gasoline	43.20	Liquid (gasoline)
224 A	Other Petroleum Products	Other Products	44.10	Liquid
303 A	Liquified Petroleum Gas (LPG)	LPG	46.00	Liquid
308 A	Refinery Gas	Refinery Gas	30.68	Liquid
301 A	Natural Gas	Natural Gas	36.36	Gaseous (natural gas)
114 B	Municipal Waste	Municipal Solid Waste Renewable	9.60	Other Fuels
		Municipal Solid Waste Non Renewable	9.67	Other Fuels
115 A	Industrial Waste	Industrial Wastes	15.76	Other Fuels
111 A	Fuel Wood	*Wood/Wood wastes/Other Solid Wastes, of which:* Wood	14.35	Biomass
116 A	Wood Wastes, Wood Chips, Pellets, Straw.	*Wood/Wood wastes/Other Solid Wastes, of which:* Other vegetal materials and waste (including straw, sawdust, wood chips)	10.93	Biomass
118 A	Sewage Sludge (dry substance)	*Wood/Wood wastes/Other Solid Wastes, of which:* Other vegetal materials and waste (including straw, sawdust, wood chips)	12.00	Biomass
215 A	Black Liquor	*Wood/Wood wastes/Other Solid Wastes, of which:* Black Liquor	8.17	Biomass
309 A	Biogas	Biogas	20.86	Biomass
309 B	Sewage Sludge Gas	Sewage Sludge Gas	16.80	Biomass
310 A	Landfill Gas	Landfill Gas	19.39	Biomass

(1) First three digits are based on CORINAIR / NAPFUE 94–Code

(2) Units: [MJ / kg] or [MJ / m3 Gas] respectively, for the Year 2006 Note that for some fuels sector specific calorific values are taken. The energy balance reports some fuels (e.g. renewables) in [TJ] so that unit conversion by means of calorific values is not necessary.

(3) Fuel subcategories are shown in parenthesis

Specific remark to natural gas NCV

Natural gas NCV is calculated by GCV / 1.1 (=GCV*0.909) whereas the IEA calculates it by GCV*0.9. This follows the methodology used by the Austrian energy statistics agency and leads to different apparent consumption (1%) between the national and IEA reference approach.

Energy Consumption and CO_2 Emissions by Sectors and Fuel Types

Table 32 to Table 48 show detailed data on fuel consumption and CO_2 emissions for each fuel type according to Table 31 and each sector of *1.A Fuel Combustion* are provided for the period from 1990 to 2006 For information on completeness, in particular on CO_2 emissions included elsewhere, please refer to the documentation boxes of the CRF and to Chapter 3.2.1 subchapter *Completeness* of the NIR.

Table 32: 2006 energy consumption and CO_2 emissions from category 1.A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	**1 A 2**	**1 A 3 + 1 A 5**	**1 A 4**	**1 A**	**1 A 1**	**1 A 2**	**1 A 3 + 1 A 5**	**1 A 4**	**1 A**
		Energy Ind.	**Industry**	**Transport**	**Other Sectors**	**Total**	**Energy Ind.**	**Industry**	**Transport**	**Other Sectors**	**Total**
	Total Solid	**60.20**	**56.31**	**0.02**	**5.99**	**122.52**	**5.64**	**5.67**	**0.00**	**0.56**	**11.87**
102A	Hard Coal	53.98	10.26	0.02	1.20	65.46	5.01	0.94	0.00	0.11	6.06
104A	Hard Coal Briquettes				0.02	0.02				0.00	0.00
105A	Brown Coal	6.22	1.81		0.17	8.20	0.63	0.18		0.02	0.83
106A	Brown Coal Briquettes		0.00		1.09	1.09		0.00		0.11	0.11
107A	Coke		38.26		3.50	41.76		3.98		0.32	4.30
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		5.98			5.98		0.57			0.57
	Total Liquid	**49.46**	**40.24**	**318.21**	**118.38**	**526.29**	**3.32**	**3.00**	**22.35**	**8.72**	**37.52**
110A	Petrol Coke	2.02	1.33			3.35	0.20	0.13			0.33
203B	Light Fuel Oil	0.25	5.41		10.74	16.40	0.02	0.42		0.83	1.27
203 C	Medium Fuel Oil	2.30				2.30	0.18				0.18
203 D	Heavy Fuel Oil	12.37	13.15			25.52	0.98	1.03			2.00
204A	Gasoil	0.19	2.70		79.01	81.90	0.01	0.20		5.93	6.14
2050	Diesel	0.01	15.95	229.08	20.19	265.23	0.00	1.11	15.97	1.41	18.50
206A	Other Kerosene		0.01		0.15	0.16		0.00		0.01	0.01
206B	Jet Kerosene			4.70		4.70			0.22		0.34
207A	Aviation Gasoline			0.12		0.12			0.01		0.01
2080	Motor Gasoline		0.09	84.31	1.66	86.06		0.01	6.15	0.12	6.28
224A	Other Petroleum Products	12.45				12.45	0.97				0.97
303A	Liquified Petroleum Gas (LPG)	0.16	1.60		6.63	8.39	0.01	0.10		0.42	0.54
308A	Refinery Gas	19.71				19.71	0.95				0.95
301 A	**Total Gaseous** (Natural Gas)	**104.05**	**113.53**	**8.16**	**77.46**	**303.20**	**5.76**	**6.28**	**0.45**	**4.29**	**16.79**
	Total Other Fuel	**12.55**	**12.20**		**0.73**	**25.48**	**0.70**	**0.86**		**0.08**	**1.63**
114B	Municipal Waste	11.07				11.07	0.54				0.54
115A	Industrial Waste	1.48	12.20		0.73	14.41	0.15	0.86		0.08	1.09
	Total Biomass(1)	**29.08**	**50.22**		**76.12**	**155.42**	**(3.2)**	**(5.51)**		**(7.77)**	**(16.48)**
111A	Fuel Wood	0.05	1.54		60.29	61.87	0.00	0.15		6.03	6.19
116A	Wood Wastes	27.62	20.25		15.47	63.34	3.04	2.23		1.70	6.97
118A	Sewage Sludge	0.77	0.06			0.83	0.08	0.01			0.09
215A	Black Liquor		27.41			27.41		3.01			3.01
309A	Biogas	0.57	0.34		0.02	0.94	0.06	0.04		0.00	0.10
309B	Sewage Sludge Gas	0.04	0.62			0.66	0.00	0.07			0.07
310A	Landfill Gas	0.04			0.34	0.38	0.00			0.04	0.04
	Total(1)	**255.35**	**272.49**	**326.39**	**278.68**	**1 132.91**	**15.43**	**15.81**	**22.81**	**13.65**	**67.82**

(1) CO_2 emissions of Biomass are not included in Total.

Table 33: 2005 energy consumption and CO_2 emissions from category 1.A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					**CO_2 emissions (Tg)**				
		1 A 1	**1 A 2**	**1 A 3 + 1 A 5**	**1 A 4**	**1 A**	**1 A 1**	**1 A 2**	**1 A 3 + 1 A 5**	**1 A 4**	**1 A**
		Energy Ind.	**Industry**	**Transport**	**Other Sectors**	**Total**	**Energy Ind.**	**Industry**	**Transport**	**Other Sectors**	**Total**
	Total Solid	**61.63**	**54.62**	**0.02**	**6.12**	**122.40**	**5.84**	**5.48**	**0.00**	**0.57**	**11.90**
102A	Hard Coal	51.51	7.65	0.02	1.27	60.45	4.81	0.71	0.00	0.12	5.64
104A	Hard Coal Briquettes				0.03	0.03				0.00	0.00
105A	Brown Coal	10.12	2.24		0.14	12.50	1.04	0.22		0.01	1.27
106A	Brown Coal Briquettes		0.00		0.98	0.98		0.00		0.09	0.09
107A	Coke		34.01		3.70	37.71		3.54		0.34	3.88
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		10.72			10.72		1.01			1.01
	Total Liquid	**45.08**	**40.91**	**323.17**	**116.85**	**526.01**	**3.24**	**3.11**	**23.47**	**8.67**	**38.60**
110A	Petrol Coke	2.07	2.05			4.12	0.21	0.19			0.40
203B	Light Fuel Oil	0.17	5.35		11.90	17.41	0.01	0.42		0.92	1.35
203 C	Medium Fuel Oil	2.29	0.00			2.29	0.18	0.00			0.18
203 D	Heavy Fuel Oil	12.23	13.43			25.66	0.97	1.05			2.02
204A	Gasoil	0.19	2.92		76.63	79.74	0.01	0.22		5.75	5.98
2050	Diesel	0.02	15.70	232.29	20.02	268.04	0.00	1.14	16.85	1.45	19.44
206A	Other Kerosene		0.02		0.13	0.15		0.00		0.01	0.01
206B	Jet Kerosene			4.49		4.49			0.21		0.33
207A	Aviation Gasoline			0.12		0.12			0.01		0.01
2080	Motor Gasoline		0.09	86.26	1.64	87.99		0.01	6.40	0.12	6.53
224A	Other Petroleum Products	10.08				10.08	0.79				0.79
303A	Liquified Petroleum Gas (LPG)	2.29	1.35		6.54	10.17	0.15	0.09		0.42	0.65
308A	Refinery Gas	15.75				15.75	0.92				0.92
301 A	**Total Gaseous** (Natural Gas)	**117.74**	**116.89**	**9.84**	**89.71**	**334.17**	**6.52**	**6.47**	**0.54**	**4.97**	**18.51**
	Total Other Fuel	**8.51**	**11.10**		**0.69**	**20.29**	**0.49**	**0.85**		**0.07**	**1.41**
114B	Municipal Waste	7.17				7.17	0.35				0.35
115A	Industrial Waste	1.34	11.10		0.69	13.12	0.14	0.85		0.07	1.06
	Total Biomass[(1)]	**20.97**	**43.81**		**78.20**	**142.98**	**(2.31)**	**(4.81)**		**(7.97)**	**(15.08)**
111A	Fuel Wood	0.05	0.94		63.73	64.73	0.01	0.09		6.37	6.47
116A	Wood Wastes	19.74	15.18		14.11	49.03	2.17	1.67		1.55	5.39
118A	Sewage Sludge	0.75	0.04			0.79	0.08	0.00			0.09
215A	Black Liquor		26.72			26.72		2.94			2.94
309A	Biogas	0.33	0.35			0.68	0.04	0.04			0.08
309B	Sewage Sludge Gas	0.05	0.59		0.06	0.70	0.01	0.07		0.01	0.08
310A	Landfill Gas	0.04			0.30	0.35	0.00			0.03	0.04
	Total[(1)]	**253.92**	**267.33**	**333.03**	**291.58**	**1 145.86**	**16.10**	**15.91**	**24.01**	**14.28**	**70.42**

(2) CO_2 emissions of Biomass are not included in Total.

Table 34: 2004 energy consumption and CO_2 emissions from category 1.A Fuel Combustion by fuel type and Sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	**Industry**	**Transport**	**Other Sectors**	**Total**	**Energy Ind.**	**Industry**	**Transport**	**Other Sectors**	**Total**
	Total Solid	**69.07**	**49.54**	**0.02**	**6.00**	**124.64**	**6.67**	**4.99**	**0.00**	**0.56**	**12.23**
102A	Hard Coal	59.70	7.50	0.02	1.69	68.92	5.64	0.71	0.00	0.16	6.51
104A	Hard Coal Briquettes				0.04	0.04				0.00	0.00
105A	Brown Coal	9.37	1.71		0.11	11.19	1.03	0.17		0.01	1.21
106A	Brown Coal Briquettes		0.00		1.13	1.13		0.00		0.11	0.11
107A	Coke		32.02		3.03	35.05		3.33		0.28	3.61
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		8.31			8.31		0.79			0.79
	Total Liquid	**48.37**	**40.57**	**310.93**	**113.51**	**513.38**	**3.69**	**3.14**	**22.85**	**8.44**	**38.22**
110A	Petrol Coke	1.99	3.11			5.09	0.20	0.31			0.51
203B	Light Fuel Oil	1.39	5.93		12.64	19.97	0.11	0.46		0.97	1.54
203 C	Medium Fuel Oil				2.29	2.29				0.18	0.18
203 D	Heavy Fuel Oil	13.59	11.79			25.37	1.08	0.92			2.00
204A	Gasoil	0.06	2.79		69.50	72.36	0.00	0.21		5.21	5.43
2050	Diesel	0.03	15.43	217.94	20.66	254.06	0.00	1.14	16.05	1.52	18.72
206A	Other Kerosene		0.01		0.15	0.17		0.00		0.01	0.01
206B	Jet Kerosene			3.98		3.98			0.18		0.29
207A	Aviation Gasoline			0.10		0.10			0.01		0.01
2080	Motor Gasoline		0.09	88.91	1.67	90.67		0.01	6.60	0.12	6.73
224A	Other Petroleum Products	17.72				17.72	1.38				1.38
303A	Liquified Petroleum Gas (LPG)	0.15	1.41		6.59	8.15	0.01	0.09		0.42	0.52
308A	Refinery Gas	13.46				13.46	0.90				0.90
301 A	**Total Gaseous** (Natural Gas)	**98.02**	**112.01**	**7.96**	**87.33**	**305.32**	**5.43**	**6.21**	**0.44**	**4.84**	**16.91**
	Total Other Fuel	**9.38**	**11.95**		**0.68**	**22.02**	**0.56**	**0.95**		**0.07**	**1.58**
114B	Municipal Waste	7.58				7.58	0.37				0.37
115A	Industrial Waste	1.80	11.95		0.68	14.43	0.19	0.95		0.07	1.21
	Total Biomass[(1)]	**18.36**	**39.81**		**74.06**	**132.23**	**(2.02)**	**(4.37)**		**(7.55)**	**(13.94)**
111A	Fuel Wood	0.05	0.89		60.23	61.17	0.00	0.09		6.02	6.12
116A	Wood Wastes	17.23	14.14		13.38	44.75	1.90	1.56		1.47	4.92
118A	Sewage Sludge	0.81				0.81	0.09				0.09
215A	Black Liquor		24.31			24.31		2.67			2.67
309A	Biogas	0.16	0.32			0.48	0.02	0.04			0.05
309B	Sewage Sludge Gas	0.06	0.15		0.03	0.25	0.01	0.02		0.00	0.03
310A	Landfill Gas	0.05			0.41	0.46	0.01			0.05	0.05
	Total[(1)]	**243.21**	**253.88**	**318.92**	**281.58**	**1 097.58**	**16.35**	**15.28**	**23.29**	**13.91**	**68.94**

(3) CO_2 emissions of Biomass are not included in Total.

Table 35: 2003 energy consumption and CO_2 emissions from category 1.A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**70.89**	**49.51**	**0.02**	**7.44**	**127.86**	**6.92**	**4.99**	**0.00**	**0.69**	**12.61**
102A	Hard Coal	57.19	7.13	0.02	1.75	66.10	5.41	0.67	0.00	0.16	6.24
104A	Hard Coal Briquettes				0.06	0.06				0.01	0.01
105A	Brown Coal	13.70	1.70		0.10	15.50	1.51	0.17		0.01	1.68
106A	Brown Coal Briquettes		0.00		1.38	1.38		0.00		0.13	0.13
107A	Coke		33.05		4.14	37.19		3.44		0.38	3.82
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		7.63			7.63		0.72			0.72
	Total Liquid	**44.77**	**38.24**	**303.41**	**131.08**	**517.50**	**3.44**	**2.93**	**22.31**	**9.78**	**38.55**
110A	Petrol Coke	1.85	2.13			3.98	0.19	0.21			0.40
203B	Light Fuel Oil	0.76	5.19		18.11	24.06	0.06	0.40		1.39	1.86
203C	Medium Fuel Oil				2.25	2.25				0.18	0.18
203D	Heavy Fuel Oil	14.40	11.45			25.85	1.15	0.89			2.04
204A	Gasoil	0.15	2.92		82.49	85.56	0.01	0.22		6.19	6.42
2050	Diesel	0.19	14.65	208.61	20.06	243.50	0.01	1.08	15.37	1.48	17.94
206A	Other Kerosene		0.01		0.19	0.21		0.00		0.02	0.02
206B	Jet Kerosene			3.32		3.32			0.15		0.24
207A	Aviation Gasoline			0.11		0.11			0.01		0.01
2080	Motor Gasoline		0.09	91.37	1.68	93.14		0.01	6.79	0.12	6.92
224A	Other Petroleum Products	14.83				14.83	1.16				1.16
303A	Liquified Petroleum Gas (LPG)	0.06	1.81		6.29	8.15	0.00	0.12		0.40	0.52
308A	Refinery Gas	12.53				12.53	0.86				0.86
301 A	**Total Gaseous** (Natural Gas)	**95.11**	**116.41**	**6.63**	**89.96**	**308.12**	**5.27**	**6.45**	**0.37**	**4.98**	**17.07**
	Total Other Fuel	**7.75**	**9.85**		**0.65**	**18.24**	**0.49**	**0.82**		**0.07**	**1.37**
114B	Municipal Waste	5.77				5.77	0.28				0.28
115A	Industrial Waste	1.98	9.85		0.65	12.47	0.21	0.82		0.07	1.09
	Total Biomass(1)	**14.73**	**39.40**		**75.50**	**129.64**	**(1.62)**	**(4.32)**		**(7.68)**	**(13.63)**
111A	Fuel Wood		1.07		62.53	63.60		0.11		6.25	6.36
116A	Wood Wastes	13.14	14.85		12.70	40.69	1.44	1.63		1.40	4.48
118A	Sewage Sludge	1.32				1.32	0.15				0.15
215A	Black Liquor		22.97			22.97		2.53			2.53
309A	Biogas		0.33			0.33		0.04			0.04
309B	Sewage Sludge Gas	0.05	0.19			0.24	0.01	0.02			0.03
310A	Landfill Gas	0.23			0.27	0.49	0.03			0.03	0.05
	Total(1)	**233.25**	**253.42**	**310.07**	**304.63**	**1 101.36**	**16.12**	**15.19**	**22.68**	**15.52**	**69.60**

(1) CO_2 emissions of Biomass are not included in Total.

Table 36: 2002 energy consumption and CO_2 emissions from category 1.A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**56.13**	**48.25**	**0.02**	**8.15**	**112.55**	**5.51**	**4.86**	**0.00**	**0.76**	**11.13**
102A	Hard Coal	42.89	8.36	0.02	1.89	53.16	4.05	0.79	0.00	0.18	5.02
104A	Hard Coal Briquettes				0.02	0.02				0.00	0.00
105A	Brown Coal	13.24	1.60		0.33	15.17	1.46	0.16		0.04	1.65
106A	Brown Coal Briquettes		0.00		1.26	1.26		0.00		0.12	0.12
107A	Coke		31.31		4.64	35.95		3.26		0.43	3.68
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		6.98			6.98		0.66			0.66
	Total Liquid	**42.36**	**37.32**	**277.93**	**119.98**	**477.59**	**2.99**	**2.86**	**20.48**	**8.95**	**35.32**
110A	Petrol Coke	2.54	2.05			4.59	0.26	0.20			0.46
203B	Light Fuel Oil	1.01	3.16		16.75	20.92	0.08	0.25		1.29	1.61
203 C	Medium Fuel Oil				1.91	1.91				0.15	0.15
203 D	Heavy Fuel Oil	9.63	12.77			22.40	0.77	1.00			1.76
204A	Gasoil	0.10	2.75		73.55	76.40	0.01	0.21		5.52	5.73
2050	Diesel	0.03	14.58	186.96	20.14	221.71	0.00	1.07	13.77	1.48	16.33
206A	Other Kerosene		0.01		0.18	0.19		0.00		0.01	0.02
206B	Jet Kerosene			1.52		1.52			0.07		0.11
207A	Aviation Gasoline			0.10		0.10			0.01		0.01
2080	Motor Gasoline		0.09	89.35	1.65	91.09		0.01	6.64	0.12	6.76
224A	Other Petroleum Products	14.78				14.78	1.15				1.15
303A	Liquified Petroleum Gas (LPG)	0.13	1.90		5.80	7.84	0.01	0.12		0.37	0.50
308A	Refinery Gas	14.13				14.13	0.72				0.72
301 A	**Total Gaseous** (Natural Gas)	**85.54**	**114.68**	**4.96**	**79.88**	**285.06**	**4.74**	**6.35**	**0.27**	**4.43**	**15.79**
	Total Other Fuel	**6.76**	**8.90**		**0.62**	**16.28**	**0.43**	**0.71**		**0.06**	**1.21**
114B	Municipal Waste	4.91				4.91	0.24				0.24
115A	Industrial Waste	1.84	8.90		0.62	11.36	0.19	0.71		0.06	0.97
	Total Biomass(1)	**13.71**	**41.22**		**72.88**	**127.80**	**(1.51)**	**(4.53)**		**(7.4)**	**(13.43)**
111A	Fuel Wood		1.42		61.87	63.29		0.14		6.19	6.33
116A	Wood Wastes	12.47	14.46		10.71	37.64	1.37	1.59		1.18	4.14
118A	Sewage Sludge	1.12				1.12	0.12				0.12
215A	Black Liquor		22.78			22.78		2.51			2.51
309A	Biogas		2.56			2.56		0.29			0.29
309B	Sewage Sludge Gas	0.06				0.06	0.01				0.01
310A	Landfill Gas	0.06			0.30	0.36	0.01			0.03	0.04
	Total(1)	**204.49**	**250.38**	**282.91**	**281.51**	**1 019.29**	**13.67**	**14.78**	**20.76**	**14.20**	**63.45**

(1) CO_2 emissions of Biomass are not included in Total.

Table 37: 2001 energy consumption and CO_2 emissions from category 1.A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**59.77**	**44.10**	**0.03**	**9.86**	**113.75**	**5.87**	**4.45**	**0.00**	**0.93**	**11.25**
102A	Hard Coal	45.15	9.36	0.03	2.07	56.61	4.27	0.88	0.00	0.19	5.34
104A	Hard Coal Briquettes				0.02	0.02				0.00	0.00
105A	Brown Coal	14.62	1.38		0.38	16.39	1.60	0.13		0.04	1.78
106A	Brown Coal Briquettes		0.00		2.09	2.09		0.00		0.20	0.20
107A	Coke		29.66		5.29	34.95		3.08		0.49	3.57
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		3.70			3.70		0.35			0.35
	Total Liquid	**49.01**	**42.21**	**250.35**	**120.84**	**462.41**	**3.49**	**3.20**	**18.44**	**9.03**	**34.21**
110A	Petrol Coke	2.27	0.67			2.94	0.23	0.07			0.30
203B	Light Fuel Oil	3.05	5.89		17.12	26.06	0.24	0.46		1.32	2.02
203 C	Medium Fuel Oil				1.40	1.40				0.11	0.11
203 D	Heavy Fuel Oil	15.14	15.68		0.00	30.82	1.20	1.22		0.00	2.43
204A	Gasoil	0.80	3.18		76.65	80.63	0.06	0.24		5.75	6.05
2050	Diesel	0.02	14.51	165.66	19.62	199.82	0.00	1.07	12.20	1.45	14.72
206A	Other Kerosene		0.01		0.04	0.04		0.00		0.00	0.00
206B	Jet Kerosene			1.56		1.56			0.07		0.11
207A	Aviation Gasoline			0.08		0.08			0.01		0.01
2080	Motor Gasoline		0.09	83.04	1.63	84.76		0.01	6.16	0.12	6.29
224A	Other Petroleum Products	12.72				12.72	0.99				0.99
303A	Liquified Petroleum Gas (LPG)		2.19		4.38	6.58		0.14		0.28	0.42
308A	Refinery Gas	15.01				15.01	0.77				0.77
301 A	**Total Gaseous** (Natural Gas)	**80.07**	**110.91**	**8.24**	**82.89**	**282.11**	**4.44**	**6.14**	**0.46**	**4.59**	**15.63**
	Total Other Fuel	**5.62**	**8.14**		**0.63**	**14.38**	**0.33**	**0.62**		**0.07**	**1.01**
114B	Municipal Waste	4.65				4.65	0.23				0.23
115A	Industrial Waste	0.97	8.14		0.63	9.74	0.10	0.62		0.07	0.78
	Total Biomass(1)	**11.11**	**40.10**		**75.17**	**126.39**	**(1.22)**	**(4.4)**		**(7.63)**	**(13.25)**
111A	Fuel Wood		1.15		64.10	65.25		0.11		6.41	6.52
116A	Wood Wastes	8.69	15.10		10.63	34.42	0.96	1.66		1.17	3.79
118A	Sewage Sludge	2.35				2.35	0.26				0.26
215A	Black Liquor		23.30			23.30		2.56			2.56
309A	Biogas	0.00	0.26		0.01	0.27	0.00	0.03		0.00	0.03
309B	Sewage Sludge Gas		0.30		0.03	0.33		0.03		0.00	0.04
310A	Landfill Gas	0.07			0.41	0.47	0.01			0.05	0.05
	Total(1)	**205.58**	**245.47**	**258.61**	**289.38**	**999.04**	**14.13**	**14.41**	**18.90**	**14.61**	**62.10**

(1) CO_2 emissions of Biomass are not included in Total.

Table 38: 2000 energy consumption and CO2 emissions from category 1.A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**49.16**	**46.11**	**0.03**	**10.12**	**105.42**	**4.82**	**4.67**	**0.00**	**0.95**	**10.44**
102A	Hard Coal	37.36	10.31	0.03	2.18	49.87	3.53	0.97	0.00	0.20	4.70
104A	Hard Coal Briquettes				0.11	0.11				0.01	0.01
105A	Brown Coal	11.80	1.35		0.46	13.61	1.29	0.13		0.05	1.48
106A	Brown Coal Briquettes		0.00		2.06	2.06		0.00		0.20	0.20
107A	Coke		32.60		5.31	37.91		3.39		0.49	3.88
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		1.85			1.85		0.18			0.18
	Total Liquid	**45.09**	**41.08**	**233.52**	**110.69**	**430.38**	**3.18**	**3.12**	**17.21**	**8.26**	**31.81**
110A	Petrol Coke	1.61	0.81			2.42	0.16	0.08			0.24
203B	Light Fuel Oil	1.83	5.53		15.66	23.02	0.14	0.43		1.21	1.78
203 C	Medium Fuel Oil				1.47	1.47				0.11	0.11
203 D	Heavy Fuel Oil	14.60	16.17		0.14	30.90	1.16	1.26		0.01	2.44
204A	Gasoil	0.01	1.61		68.48	70.09	0.00	0.12		5.14	5.26
2050	Diesel	0.03	14.32	149.39	18.69	182.43	0.00	1.05	11.00	1.38	13.44
206A	Other Kerosene		0.01		0.24	0.26		0.00		0.02	0.02
206B	Jet Kerosene			1.63		1.63			0.08		0.12
207A	Aviation Gasoline			0.09		0.09			0.01		0.01
2080	Motor Gasoline		0.09	82.41	1.63	84.13		0.01	6.12	0.12	6.25
224A	Other Petroleum Products	11.81				11.81	0.92				0.92
303A	Liquified Petroleum Gas (LPG)	0.94	2.54		4.37	7.85	0.06	0.16		0.28	0.50
308A	Refinery Gas	14.26				14.26	0.72				0.72
301 A	**Total Gaseous** (Natural Gas)	**74.31**	**112.24**	**9.70**	**68.79**	**265.05**	**4.12**	**6.22**	**0.54**	**3.81**	**14.68**
	Total Other Fuel	**4.64**	**6.16**		**1.38**	**12.18**	**0.23**	**0.49**		**0.14**	**0.87**
114B	Municipal Waste	4.51				4.51	0.22				0.22
115A	Industrial Waste	0.13	6.16		1.38	7.67	0.01	0.49		0.14	0.65
	Total Biomass(1)	**8.52**	**41.04**		**69.33**	**118.89**	**(0.94)**	**(4.51)**		**(7.04)**	**(12.48)**
111A	Fuel Wood		0.96		59.22	60.18		0.10		5.92	6.02
116A	Wood Wastes	7.46	15.28		9.60	32.34	0.82	1.68		1.06	3.56
118A	Sewage Sludge	0.96				0.96	0.11				0.11
215A	Black Liquor		24.12			24.12		2.65			2.65
309A	Biogas	0.00	0.31		0.05	0.36	0.00	0.03		0.01	0.04
309B	Sewage Sludge Gas	0.08	0.36		0.03	0.47	0.01	0.04		0.00	0.05
310A	Landfill Gas	0.01			0.43	0.44	0.00			0.05	0.05
	Total(1)	**181.73**	**246.62**	**243.25**	**260.31**	**931.92**	**12.35**	**14.49**	**17.75**	**13.17**	**57.80**

(1) CO_2 emissions of Biomass are not included in Total.

Table 39: 1999 energy consumption and CO2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**37.89**	**42.93**	**0.03**	**11.35**	**92.19**	**3.79**	**4.34**	**0.00**	**1.07**	**9.19**
102A	Hard Coal	24.21	9.01	0.03	2.72	35.97	2.28	0.85	0.00	0.25	3.39
104A	Hard Coal Briquettes				0.12	0.12				0.01	0.01
105A	Brown Coal	13.68	1.12		0.56	15.36	1.50	0.11		0.06	1.67
106A	Brown Coal Briquettes		0.00		2.05	2.05		0.00		0.20	0.20
107A	Coke		29.59		5.89	35.49		3.08		0.54	3.62
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		3.20			3.20		0.30			0.30
	Total Liquid	**52.08**	**41.40**	**219.40**	**126.06**	**438.95**	**3.82**	**3.16**	**16.17**	**9.42**	**32.62**
110A	Petrol Coke	2.14	1.19			3.32	0.22	0.12			0.34
203B	Light Fuel Oil	1.17	7.24		18.81	27.22	0.09	0.56		1.45	2.10
203 C	Medium Fuel Oil	0.09	0.00		2.18	2.26	0.01	0.00		0.17	0.18
203 D	Heavy Fuel Oil	21.69	15.37		0.17	37.24	1.73	1.20		0.01	2.94
204A	Gasoil	0.31	1.04		78.27	79.62	0.02	0.08		5.87	5.97
2050	Diesel	0.03	14.16	132.46	19.86	166.52	0.00	1.04	9.76	1.46	12.27
206A	Other Kerosene		0.04		0.66	0.70		0.00		0.05	0.05
206B	Jet Kerosene			1.54		1.54			0.07		0.11
207A	Aviation Gasoline			0.12		0.12			0.01		0.01
2080	Motor Gasoline		0.09	85.28	1.64	87.02		0.01	6.33	0.12	6.46
224A	Other Petroleum Products	12.17				12.17	0.95				0.95
303A	Liquified Petroleum Gas (LPG)	0.20	2.27		4.47	6.94	0.01	0.15		0.29	0.44
308A	Refinery Gas	14.29				14.29	0.79				0.79
301 A	**Total Gaseous** (Natural Gas)	**90.26**	**107.41**	**7.84**	**72.59**	**278.09**	**5.00**	**5.95**	**0.43**	**4.02**	**15.41**
	Total Other Fuel	**4.74**	**5.30**		**1.46**	**11.50**	**0.23**	**0.44**		**0.15**	**0.82**
114B	Municipal Waste	4.74				4.74	0.23				0.23
115A	Industrial Waste	0.01	5.30		1.46	6.76	0.00	0.44		0.15	0.59
	Total Biomass(1)	**6.78**	**45.91**		**73.29**	**125.97**	**(0.75)**	**(5.03)**		**(7.42)**	**(13.2)**
111A	Fuel Wood		1.88		64.10	65.98		0.19		6.41	6.60
116A	Wood Wastes	5.79	19.83		8.67	34.29	0.64	2.18		0.95	3.77
118A	Sewage Sludge	0.96				0.96	0.11				0.11
215A	Black Liquor		23.65			23.65		2.60			2.60
309A	Biogas		0.20		0.03	0.22		0.02		0.00	0.03
309B	Sewage Sludge Gas		0.35		0.02	0.37		0.04		0.00	0.04
310A	Landfill Gas	0.02			0.48	0.50	0.00			0.05	0.06
	Total(1)	**191.74**	**242.94**	**227.27**	**284.75**	**946.71**	**12.84**	**13.88**	**16.61**	**14.66**	**58.04**

(1) CO_2 emissions of Biomass are not included in Total.

Table 40: 1998 energy consumption and CO_2 emissions from category 1.A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**35.81**	**42.45**	**0.03**	**12.01**	**90.30**	**3.50**	**4.28**	**0.00**	**1.13**	**8.90**
102A	Hard Coal	28.48	11.94	0.03	3.06	43.51	2.69	1.12	0.00	0.28	4.10
104A	Hard Coal Briquettes				0.12	0.12				0.01	0.01
105A	Brown Coal	7.33	0.66		0.57	8.57	0.81	0.06		0.06	0.93
106A	Brown Coal Briquettes		0.00		1.99	1.99		0.00		0.19	0.19
107A	Coke		28.33		6.26	34.60		2.95		0.58	3.52
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		1.50			1.50		0.14			0.14
	Total Liquid	**60.96**	**52.44**	**227.95**	**120.63**	**461.98**	**4.38**	**4.00**	**16.83**	**9.02**	**34.27**
110A	Petrol Coke	2.20	0.67			2.87	0.22	0.07			0.29
203B	Light Fuel Oil	2.12	12.96		12.83	27.90	0.16	1.01		0.99	2.16
203 C	Medium Fuel Oil	0.14	0.00		2.13	2.28	0.01	0.00		0.17	0.18
203 D	Heavy Fuel Oil	28.01	20.63		0.26	48.90	2.23	1.61		0.02	3.86
204A	Gasoil	0.20	1.04		79.97	81.21	0.02	0.08		6.00	6.09
2050	Diesel	0.07	14.00	134.57	19.51	168.15	0.01	1.03	9.93	1.44	12.42
206A	Other Kerosene		0.01		0.73	0.73		0.00		0.06	0.06
206B	Jet Kerosene			1.51		1.51			0.07		0.11
207A	Aviation Gasoline			0.11		0.11			0.01		0.01
2080	Motor Gasoline		0.09	91.76	1.64	93.49		0.01	6.81	0.12	6.94
224A	Other Petroleum Products	11.05				11.05	0.86				0.86
303A	Liquified Petroleum Gas (LPG)	0.13	3.04		3.57	6.74	0.01	0.19		0.23	0.43
308A	Refinery Gas	17.04				17.04	0.87				0.87
301 A	**Total Gaseous** (Natural Gas)	**88.04**	**105.48**	**6.34**	**73.35**	**273.20**	**4.88**	**5.84**	**0.35**	**4.06**	**15.14**
	Total Other Fuel	**4.78**	**5.89**		**1.61**	**12.29**	**0.23**	**0.42**		**0.17**	**0.82**
114B	Municipal Waste	4.78				4.78	0.23				0.23
115A	Industrial Waste		5.89		1.61	7.50		0.42		0.17	0.58
	Total Biomass(1)	**7.10**	**32.05**		**70.45**	**109.60**	**(0.78)**	**(3.52)**		**(7.11)**	**(11.41)**
111A	Fuel Wood	0.21	0.15		64.52	64.88	0.02	0.02		6.45	6.49
116A	Wood Wastes	5.99	8.46		5.26	19.71	0.66	0.93		0.58	2.17
118A	Sewage Sludge	0.82				0.82	0.09				0.09
215A	Black Liquor		22.92			22.92		2.52			2.52
309A	Biogas		0.03			0.03		0.00			0.00
309B	Sewage Sludge Gas	0.05			0.66	0.71	0.01			0.07	0.08
310A	Landfill Gas	0.03	0.49		0.01	0.53	0.00	0.05		0.00	0.06
	Total(1)	**196.70**	**238.30**	**234.32**	**278.05**	**947.37**	**12.99**	**14.54**	**17.18**	**14.38**	**59.13**

(1) CO_2 emissions of Biomass are not included in Total.

Table 41: 1997 energy consumption and CO_2 emissions from category 1.A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**50.96**	**50.17**	**0.03**	**13.78**	**114.94**	**5.00**	**5.02**	**0.00**	**1.29**	**11.32**
102A	Hard Coal	39.25	12.17	0.03	3.36	54.82	3.71	1.14	0.00	0.31	5.17
104A	Hard Coal Briquettes				0.22	0.22				0.02	0.02
105A	Brown Coal	11.70	0.69		0.64	13.03	1.29	0.07		0.07	1.42
106A	Brown Coal Briquettes		0.00		2.55	2.56		0.00		0.25	0.25
107A	Coke		29.63		7.01	36.63		3.08		0.64	3.73
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		7.67			7.67		0.73			0.73
	Total Liquid	**57.44**	**55.57**	**199.77**	**120.69**	**433.48**	**4.09**	**4.25**	**14.75**	**9.02**	**32.15**
110A	Petrol Coke	2.15	0.49			2.64	0.22	0.05			0.27
203B	Light Fuel Oil	2.54	16.26		12.59	31.40	0.20	1.27		0.97	2.44
203 C	Medium Fuel Oil	0.09	0.01		2.06	2.16	0.01	0.00		0.16	0.17
203 D	Heavy Fuel Oil	23.37	20.95		0.17	44.49	1.86	1.63		0.01	3.50
204A	Gasoil	0.11	1.19		80.30	81.60	0.01	0.09		6.02	6.12
2050	Diesel	0.31	13.80	110.62	20.24	144.96	0.02	1.02	8.17	1.49	10.70
206A	Other Kerosene		0.00		0.42	0.43		0.00		0.03	0.03
206B	Jet Kerosene			1.35		1.35			0.06		0.10
207A	Aviation Gasoline			0.10		0.10			0.01		0.01
2080	Motor Gasoline		0.09	87.70	1.66	89.44		0.01	6.51	0.12	6.64
224A	Other Petroleum Products	11.60				11.60	0.90				0.90
303A	Liquified Petroleum Gas (LPG)	0.09	2.78		3.25	6.12	0.01	0.18		0.21	0.39
308A	Refinery Gas	17.18				17.18	0.87				0.87
301 A	**Total Gaseous** (Natural Gas)	**82.16**	**109.34**	**4.20**	**70.01**	**265.71**	**4.55**	**6.06**	**0.23**	**3.88**	**14.72**
	Total Other Fuel	**4.89**	**5.69**		**2.54**	**13.12**	**0.24**	**0.51**		**0.26**	**1.02**
114B	Municipal Waste	4.89				4.89	0.24				0.24
115A	Industrial Waste		5.69		2.54	8.23		0.51		0.26	0.78
	Total Biomass[(1)]	**6.22**	**34.11**		**72.24**	**112.57**	**(0.68)**	**(3.75)**		**(7.28)**	**(11.71)**
111A	Fuel Wood		0.27		66.93	67.21		0.03		6.69	6.72
116A	Wood Wastes	5.36	11.63		4.67	21.65	0.59	1.28		0.51	2.38
118A	Sewage Sludge	0.78				0.78	0.09				0.09
215A	Black Liquor		21.67			21.67		2.38			2.38
309A	Biogas		0.05			0.05		0.01			0.01
309B	Sewage Sludge Gas	0.06			0.63	0.69	0.01			0.07	0.08
310A	Landfill Gas	0.03	0.49		0.01	0.52	0.00	0.06		0.00	0.06
	Total[(1)]	**201.67**	**254.89**	**204.00**	**279.26**	**939.82**	**13.89**	**15.84**	**14.99**	**14.46**	**59.21**

(1) CO_2 emissions of Biomass are not included in Total.

Table 42: 1996 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1 Energy Ind.	1 A 2 Industry	1 A 3 + 1 A 5 Transport	1 A 4 Other Sectors	1 A Total	1 A 1 Energy Ind.	1 A 2 Industry	1 A 3 + 1 A 5 Transport	1 A 4 Other Sectors	1 A Total
	Total Solid	**47.52**	**43.95**	**0.06**	**17.65**	**109.19**	**4.70**	**4.40**	**0.01**	**1.66**	**10.76**
102A	Hard Coal	33.51	9.72	0.06	4.30	47.60	3.17	0.91	0.01	0.40	4.49
104A	Hard Coal Briquettes										
105A	Brown Coal	14.01	1.12		0.92	16.05	1.52	0.11		0.10	1.73
106A	Brown Coal Briquettes		0.26		2.96	3.22		0.02		0.29	0.31
107A	Coke		26.03		9.46	35.49		2.71		0.87	3.58
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		6.82			6.82		0.65			0.65
	Total Liquid	**52.93**	**46.24**	**214.15**	**131.49**	**444.82**	**3.73**	**3.51**	**15.82**	**9.85**	**32.95**
110A	Petrol Coke	2.13	0.32			2.45	0.21	0.03			0.25
203B	Light Fuel Oil	1.88	12.45		21.41	35.74	0.15	0.97		1.65	2.77
203 C	Medium Fuel Oil	0.34	0.00		1.66	2.00	0.03	0.00		0.13	0.16
203 D	Heavy Fuel Oil	19.39	16.19		0.25	35.83	1.54	1.26		0.02	2.82
204A	Gasoil	0.07	0.49		83.18	83.74	0.00	0.04		6.24	6.28
2050	Diesel	0.16	13.60	120.24	18.98	152.97	0.01	1.00	8.88	1.40	11.30
206A	Other Kerosene		0.01		0.51	0.51		0.00		0.04	0.04
206B	Jet Kerosene			1.29		1.29			0.06		0.09
207A	Aviation Gasoline			0.09		0.09			0.01		0.01
2080	Motor Gasoline		0.09	92.53	1.66	94.29		0.01	6.88	0.12	7.01
224A	Other Petroleum Products	11.02				11.02	0.86				0.86
303A	Liquified Petroleum Gas (LPG)	0.38	3.10		3.83	7.31	0.02	0.20		0.25	0.47
308A	Refinery Gas	17.57				17.57	0.91				0.91
301 A	**Total Gaseous** (Natural Gas)	**92.83**	**104.97**	**4.22**	**73.93**	**275.94**	**5.14**	**5.82**	**0.23**	**4.10**	**15.29**
	Total Other Fuel	**4.77**	**6.35**		**2.90**	**14.02**	**0.23**	**0.54**		**0.30**	**1.07**
114B	Municipal Waste	4.77				4.77	0.23				0.23
115A	Industrial Waste		6.35		2.90	9.25		0.54		0.30	0.84
	Total Biomass[(1)]	**6.12**	**32.54**		**76.31**	**114.97**	**(0.67)**	**(3.57)**		**(7.67)**	**(11.92)**
111A	Fuel Wood		0.78		72.50	73.29		0.08		7.25	7.33
116A	Wood Wastes	5.32	10.31		3.13	18.76	0.59	1.13		0.34	2.06
118A	Sewage Sludge	0.74				0.74	0.08				0.08
215A	Black Liquor		21.17			21.17		2.33			2.33
309A	Biogas		0.04			0.04		0.00			0.00
309B	Sewage Sludge Gas	0.03			0.64	0.67	0.00			0.07	0.07
310A	Landfill Gas	0.03	0.24		0.04	0.31	0.00	0.03		0.00	0.03
	Total[(1)]	**204.17**	**234.05**	**218.43**	**302.28**	**958.93**	**13.80**	**14.27**	**16.06**	**15.90**	**60.07**

(1) CO_2 emissions of Biomass are not included in Total.

Table 43: 1995 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	**Industry**	**Transport**	**Other Sectors**	**Total**	**Energy Ind.**	**Industry**	**Transport**	**Other Sectors**	**Total**
	Total Solid	**45.49**	**44.34**	**0.06**	**18.57**	**108.47**	**4.53**	**4.46**	**0.01**	**1.75**	**10.74**
102A	Hard Coal	29.91	7.44	0.06	4.09	41.50	2.82	0.70	0.01	0.38	3.91
104A	Hard Coal Briquettes										
105A	Brown Coal	15.58	2.29		1.14	19.00	1.71	0.22		0.12	2.05
106A	Brown Coal Briquettes		0.28		3.05	3.32		0.03		0.30	0.32
107A	Coke		27.96		10.30	38.25		2.91		0.95	3.85
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		6.38			6.38		0.60			0.60
	Total Liquid	**51.95**	**48.92**	**192.77**	**115.04**	**408.68**	**3.73**	**3.72**	**14.25**	**8.60**	**30.34**
110A	Petrol Coke	1.87	0.36			2.23	0.19	0.04			0.23
203B	Light Fuel Oil	1.39	11.55		17.79	30.73	0.11	0.90		1.37	2.38
203 C	Medium Fuel Oil	0.11	0.00		2.32	2.43	0.01	0.00		0.18	0.19
203 D	Heavy Fuel Oil	23.32	19.84		0.46	43.61	1.85	1.55		0.04	3.44
204A	Gasoil	0.09	0.20		70.50	70.80	0.01	0.02		5.29	5.31
2050	Diesel	0.28	14.01	91.54	17.39	123.22	0.02	1.03	6.76	1.28	9.10
206A	Other Kerosene				0.25	0.25				0.02	0.02
206B	Jet Kerosene			1.11		1.11			0.05		0.08
207A	Aviation Gasoline			0.10		0.10			0.01		0.01
2080	Motor Gasoline		0.09	100.02	1.65	101.77		0.01	7.44	0.12	7.57
224A	Other Petroleum Products	8.88			0.01	8.89	0.69			0.00	0.69
303A	Liquified Petroleum Gas (LPG)	1.06	2.87		4.67	8.61	0.07	0.18		0.30	0.55
308A	Refinery Gas	14.94				14.94	0.78				0.78
301 A	**Total Gaseous** (Natural Gas)	**80.70**	**99.58**	**4.09**	**74.46**	**258.83**	**4.47**	**5.52**	**0.23**	**4.13**	**14.34**
	Total Other Fuel	**3.91**	**5.27**		**1.74**	**10.92**	**0.19**	**0.47**		**0.18**	**0.84**
114B	Municipal Waste	3.91				3.91	0.19				0.19
115A	Industrial Waste		5.27		1.74	7.00		0.47		0.18	0.65
	Total Biomass(1)	**4.37**	**33.86**		**69.86**	**108.10**	**(0.48)**	**(3.71)**		**(7.02)**	**(11.22)**
111A	Fuel Wood		1.08		66.28	67.35		0.11		6.63	6.74
116A	Wood Wastes	3.60	11.01		2.93	17.54	0.40	1.21		0.32	1.93
118A	Sewage Sludge	0.73				0.73	0.08				0.08
215A	Black Liquor		21.63			21.63		2.38			2.38
309A	Biogas		0.04			0.04		0.00			0.00
309B	Sewage Sludge Gas	0.01	0.00		0.61	0.62	0.00	0.00		0.07	0.07
310A	Landfill Gas	0.03	0.12		0.05	0.20	0.00	0.01		0.01	0.02
	Total(1)	**186.41**	**231.97**	**196.93**	**279.67**	**894.99**	**12.92**	**14.17**	**14.48**	**14.65**	**56.25**

(1) CO_2 emissions of Biomass are not included in Total.

Table 44: 1994 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**32.97**	**42.27**	**0.06**	**19.73**	**95.03**	**3.28**	**4.24**	**0.01**	**1.86**	**9.38**
102A	Hard Coal	22.73	6.39	0.06	4.04	33.22	2.17	0.60	0.01	0.38	3.15
104A	Hard Coal Briquettes										
105A	Brown Coal	10.05	2.20		1.28	13.53	1.09	0.21		0.14	1.44
106A	Brown Coal Briquettes	0.19	0.47		3.20	3.86	0.02	0.05		0.31	0.38
107A	Coke		25.23		11.20	36.43		2.62		1.03	3.65
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		7.99			7.99		0.76			0.76
	Total Liquid	**59.12**	**51.79**	**187.73**	**107.49**	**406.12**	**4.23**	**3.95**	**13.88**	**8.03**	**30.13**
110A	Petrol Coke	1.80	0.36			2.16	0.18	0.04			0.22
203B	Light Fuel Oil	1.88	11.31		14.23	27.43	0.15	0.88		1.10	2.13
203 C	Medium Fuel Oil	0.09	0.00		2.86	2.95	0.01	0.00		0.22	0.23
203 D	Heavy Fuel Oil	27.62	22.57		0.37	50.56	2.20	1.76		0.03	3.99
204A	Gasoil	0.08	0.20		64.72	65.00	0.01	0.01		4.85	4.88
2050	Diesel	0.21	14.27	82.88	18.57	115.92	0.02	1.06	6.13	1.37	8.58
206A	Other Kerosene				0.10	0.10				0.01	0.01
206B	Jet Kerosene			1.17		1.17			0.05		0.08
207A	Aviation Gasoline			0.12		0.12			0.01		0.01
2080	Motor Gasoline		0.09	103.55	1.66	105.31		0.01	7.70	0.12	7.83
224A	Other Petroleum Products	10.60			0.02	10.62	0.83			0.00	0.83
303A	Liquified Petroleum Gas (LPG)	0.13	2.98		4.95	8.06	0.01	0.19		0.32	0.52
308A	Refinery Gas	16.71				16.71	0.84				0.84
301 A	**Total Gaseous** (Natural Gas)	**73.43**	**96.51**	**3.78**	**62.95**	**236.67**	**4.07**	**5.35**	**0.21**	**3.49**	**13.11**
	Total Other Fuel	**3.82**	**4.73**		**1.98**	**10.53**	**0.19**	**0.43**		**0.21**	**0.82**
114B	Municipal Waste	3.82				3.82	0.19				0.19
115A	Industrial Waste		4.73		1.98	6.70		0.43		0.21	0.63
	Total Biomass(1)	**3.71**	**33.14**		**64.60**	**101.45**	**(0.41)**	**(3.64)**		**(6.49)**	**(10.54)**
111A	Fuel Wood		0.91		61.49	62.39		0.09		6.15	6.24
116A	Wood Wastes	2.97	12.55		2.39	17.91	0.33	1.38		0.26	1.97
118A	Sewage Sludge	0.74				0.74	0.08				0.08
215A	Black Liquor		19.68			19.68		2.16			2.16
309A	Biogas										
309B	Sewage Sludge Gas		0.00		0.64	0.64		0.00		0.07	0.07
310A	Landfill Gas				0.09	0.09				0.01	0.01
	Total(1)	**173.06**	**228.43**	**191.57**	**256.74**	**849.79**	**11.76**	**13.96**	**14.10**	**13.57**	**53.44**

(1) CO_2 emissions of Biomass are not included in Total.

Table 45: 1993 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**30.81**	**43.29**	**0.06**	**22.10**	**96.25**	**3.09**	**4.32**	**0.01**	**2.08**	**9.49**
102A	Hard Coal	19.93	8.35	0.06	4.23	32.58	1.92	0.79	0.01	0.39	3.10
104A	Hard Coal Briquettes										
105A	Brown Coal	10.64	2.48		1.54	14.66	1.15	0.24		0.17	1.55
106A	Brown Coal Briquettes	0.23	0.34		3.61	4.18	0.02	0.03		0.35	0.41
107A	Coke		23.75		12.71	36.46		2.47		1.17	3.64
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		8.36			8.36		0.79			0.79
	Total Liquid	**59.10**	**52.62**	**188.12**	**114.14**	**413.98**	**4.24**	**4.03**	**13.92**	**8.53**	**30.76**
110A	Petrol Coke	2.22	0.78			3.01	0.22	0.08			0.30
203B	Light Fuel Oil	2.22	13.32		17.41	32.95	0.17	1.04		1.34	2.55
203 C	Medium Fuel Oil	0.39	0.04		3.50	3.92	0.03	0.00		0.27	0.31
203 D	Heavy Fuel Oil	28.19	21.66		0.42	50.27	2.23	1.69		0.03	3.96
204A	Gasoil	0.11	0.26		67.95	68.32	0.01	0.02		5.10	5.12
2050	Diesel	0.24	13.92	79.53	17.49	111.19	0.02	1.03	5.88	1.29	8.23
206A	Other Kerosene				0.62	0.62				0.05	0.05
206B	Jet Kerosene			1.07		1.07			0.04		0.08
207A	Aviation Gasoline			0.12		0.12			0.01		0.01
2080	Motor Gasoline		0.09	107.40	1.63	109.13		0.01	7.98	0.12	8.11
224A	Other Petroleum Products	9.86			0.03	9.90	0.77			0.00	0.77
303A	Liquified Petroleum Gas (LPG)	0.22	2.54		5.08	7.84	0.01	0.16		0.32	0.50
308A	Refinery Gas	15.65				15.65	0.77				0.77
301 A	**Total Gaseous** (Natural Gas)	**71.43**	**77.79**	**3.87**	**71.70**	**224.79**	**3.96**	**4.31**	**0.21**	**3.97**	**12.45**
	Total Other Fuel	**3.76**	**4.18**		**1.84**	**9.78**	**0.18**	**0.30**		**0.19**	**0.67**
114B	Municipal Waste	3.76				3.76	0.18				0.18
115A	Industrial Waste		4.18		1.84	6.02		0.30		0.19	0.49
	Total Biomass(1)	**3.52**	**32.12**		**69.73**	**105.37**	**(0.39)**	**(3.52)**		**(7.01)**	**(10.92)**
111A	Fuel Wood		0.80		66.38	67.18		0.08		6.64	6.72
116A	Wood Wastes	2.74	12.57		2.65	17.96	0.30	1.38		0.29	1.98
118A	Sewage Sludge	0.77				0.77	0.09				0.09
215A	Black Liquor		18.75			18.75		2.06			2.06
309A	Biogas										
309B	Sewage Sludge Gas		0.00		0.63	0.63		0.00		0.07	0.07
310A	Landfill Gas				0.08	0.08				0.01	0.01
	Total(1)	**168.61**	**210.00**	**192.05**	**279.51**	**850.16**	**11.47**	**12.96**	**14.14**	**14.78**	**53.38**

(1) CO_2 emissions of Biomass are not included in Total.

Table 46: 1992 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					**CO_2 emissions (Tg)**				
		1 A 1	**1 A 2**	**1 A 3 + 1 A 5**	**1 A 4**	**1 A**	**1 A 1**	**1 A 2**	**1 A 3 + 1 A 5**	**1 A 4**	**1 A**
		Energy Ind.	**Industry**	**Transport**	**Other Sectors**	**Total**	**Energy Ind.**	**Industry**	**Transport**	**Other Sectors**	**Total**
	Total Solid	**39.96**	**41.56**	**0.07**	**26.69**	**108.29**	**4.01**	**4.14**	**0.01**	**2.51**	**10.67**
102A	Hard Coal	27.97	10.19	0.07	3.35	41.58	2.73	0.96	0.01	0.31	4.01
104A	Hard Coal Briquettes										
105A	Brown Coal	11.74	2.27		1.89	15.91	1.25	0.22		0.20	1.67
106A	Brown Coal Briquettes	0.26	0.39		4.23	4.87	0.03	0.04		0.41	0.47
107A	Coke		22.07		17.22	39.29		2.30		1.58	3.88
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		6.64			6.64		0.63			0.63
	Total Liquid	**48.41**	**46.95**	**183.17**	**114.56**	**393.09**	**3.40**	**3.59**	**13.74**	**8.59**	**29.35**
110A	Petrol Coke	2.30	0.93			3.23	0.23	0.09			0.33
203B	Light Fuel Oil	1.88	9.15		24.10	35.13	0.15	0.71		1.86	2.72
203 C	Medium Fuel Oil	0.12	0.07		3.68	3.87	0.01	0.01		0.29	0.30
203 D	Heavy Fuel Oil	19.86	19.92		1.12	40.91	1.57	1.55		0.09	3.21
204A	Gasoil	0.04	0.18		60.38	60.61	0.00	0.01		4.53	4.55
2050	Diesel	0.00	14.34	72.55	17.32	104.20	0.00	1.06	5.37	1.28	7.71
206A	Other Kerosene		0.05		1.26	1.31		0.00		0.10	0.10
206B	Jet Kerosene			0.92		0.92			0.03		0.07
207A	Aviation Gasoline			0.12		0.12			0.01		0.01
2080	Motor Gasoline		0.09	109.59	1.60	111.28		0.01	8.33	0.12	8.45
224A	Other Petroleum Products	7.38			0.00	7.38	0.58			0.00	0.58
303A	Liquified Petroleum Gas (LPG)	0.22	2.23		5.09	7.54	0.01	0.14		0.33	0.48
308A	Refinery Gas	16.60				16.60	0.84				0.84
301 A	**Total Gaseous** (Natural Gas)	**70.45**	**78.76**	**3.97**	**63.44**	**216.61**	**3.90**	**4.36**	**0.22**	**3.51**	**12.00**
	Total Other Fuel	**3.48**	**5.27**		**3.25**	**12.01**	**0.17**	**0.45**		**0.34**	**0.96**
114B	Municipal Waste	3.48				3.48	0.17				0.17
115A	Industrial Waste		5.27		3.25	8.52		0.45		0.34	0.79
	Total Biomass(1)	**3.40**	**29.18**		**67.68**	**100.26**	**(0.37)**	**(3.2)**		**(6.79)**	**(10.37)**
111A	Fuel Wood		0.71		65.28	65.98		0.07		6.53	6.60
116A	Wood Wastes	2.74	10.19		2.40	15.34	0.30	1.12		0.26	1.69
118A	Sewage Sludge	0.66				0.66	0.07				0.07
215A	Black Liquor		18.28			18.28		2.01			2.01
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**165.71**	**201.71**	**187.21**	**275.62**	**830.25**	**11.48**	**12.54**	**13.96**	**14.95**	**52.97**

(1) CO_2 emissions of Biomass are not included in Total.

Table 47: 1991 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1 Energy Ind.	1 A 2 Industry	1 A 3 + 1 A 5 Transport	1 A 4 Other Sectors	1 A Total	1 A 1 Energy Ind.	1 A 2 Industry	1 A 3 + 1 A 5 Transport	1 A 4 Other Sectors	1 A Total
	Total Solid	**67.34**	**47.56**	**0.06**	**31.15**	**146.12**	**6.82**	**4.76**	**0.01**	**2.93**	**14.52**
102A	Hard Coal	41.79	8.24	0.06	5.51	55.60	4.13	0.77	0.01	0.51	5.42
104A	Hard Coal Briquettes										
105A	Brown Coal	24.92	2.89		2.38	30.19	2.62	0.28		0.26	3.16
106A	Brown Coal Briquettes	0.63	0.62		4.90	6.15	0.06	0.06		0.47	0.60
107A	Coke		27.40		18.36	45.76		2.85		1.69	4.54
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		8.42			8.42		0.80			0.80
	Total Liquid	**48.53**	**56.55**	**183.78**	**120.54**	**409.40**	**3.41**	**4.33**	**13.79**	**9.05**	**30.61**
110A	Petrol Coke	2.20	1.02			3.22	0.22	0.10			0.32
203B	Light Fuel Oil	2.08	11.75		26.29	40.12	0.16	0.92		2.02	3.10
203 C	Medium Fuel Oil	0.06	0.02		4.81	4.88	0.00	0.00		0.37	0.38
203 D	Heavy Fuel Oil	19.88	25.76		0.79	46.43	1.57	2.01		0.06	3.64
204A	Gasoil	0.01	0.19		64.86	65.07	0.00	0.01		4.86	4.88
2050	Diesel	0.00	14.19	68.15	16.74	99.09	0.00	1.05	5.04	1.24	7.33
206A	Other Kerosene				1.36	1.36				0.11	0.11
206B	Jet Kerosene			0.89		0.89			0.03		0.06
207A	Aviation Gasoline			0.11		0.11			0.01		0.01
2080	Motor Gasoline		0.09	114.63	1.58	116.30		0.01	8.71	0.12	8.83
224A	Other Petroleum Products	7.72	0.02		0.53	8.27	0.60	0.00		0.03	0.64
303A	Liquified Petroleum Gas (LPG)	0.58	3.50		3.58	7.67	0.04	0.22		0.23	0.49
308A	Refinery Gas	16.00				16.00	0.81				0.81
301 A	**Total Gaseous** (Natural Gas)	**76.80**	**78.77**	**4.07**	**55.89**	**215.53**	**4.25**	**4.36**	**0.23**	**3.10**	**11.94**
	Total Other Fuel	**2.90**	**4.56**		**2.62**	**10.08**	**0.14**	**0.39**		**0.27**	**0.81**
114B	Municipal Waste	2.90				2.90	0.14				0.14
115A	Industrial Waste		4.56		2.62	7.18		0.39		0.27	0.66
	Total Biomass(1)	**3.02**	**28.46**		**71.56**	**103.04**	**(0.33)**	**(3.12)**		**(7.18)**	**(10.63)**
111A	Fuel Wood		0.74		69.23	69.96		0.07		6.92	7.00
116A	Wood Wastes	2.36	9.78		2.34	14.48	0.26	1.08		0.26	1.59
118A	Sewage Sludge	0.66				0.66	0.07				0.07
215A	Black Liquor		17.94			17.94		1.97			1.97
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**198.59**	**215.90**	**187.91**	**281.77**	**884.17**	**14.62**	**13.84**	**14.02**	**15.36**	**57.88**

(1) CO_2 emissions of Biomass are not included in Total.

Table 48: 1990 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					**CO_2 emissions (Tg)**				
		1 A 1	**1 A 2**	**1 A 3 + 1 A 5**	**1 A 4**	**1 A**	**1 A 1**	**1 A 2**	**1 A 3 + 1 A 5**	**1 A 4**	**1 A**
		Energy Ind.	**Industry**	**Transport**	**Other Sectors**	**Total**	**Energy Ind.**	**Industry**	**Transport**	**Other Sectors**	**Total**
	Total Solid	**61.40**	**50.25**	**0.07**	**28.14**	**139.85**	**6.25**	**5.02**	**0.01**	**2.65**	**13.92**
102A	Hard Coal	38.44	7.17	0.07	5.29	50.97	3.85	0.67	0.01	0.49	5.03
104A	Hard Coal Briquettes										
105A	Brown Coal	22.73	2.19		2.36	27.28	2.37	0.21		0.26	2.84
106A	Brown Coal Briquettes	0.23	1.24		4.45	5.91	0.02	0.12		0.43	0.57
107A	Coke		27.57		16.04	43.60		2.87		1.48	4.34
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		12.09			12.09		1.14			1.14
	Total Liquid	**46.45**	**50.95**	**162.48**	**117.16**	**377.04**	**3.19**	**3.90**	**12.19**	**8.82**	**28.14**
110A	Petrol Coke	1.95	0.98			2.92	0.20	0.10			0.29
203B	Light Fuel Oil	1.61	10.99		33.54	46.14	0.13	0.86		2.58	3.57
203 C	Medium Fuel Oil	0.29	0.01		4.47	4.77	0.02	0.00		0.35	0.37
203 D	Heavy Fuel Oil	16.97	22.17		1.63	40.78	1.34	1.73		0.13	3.19
204A	Gasoil	0.00	0.06		52.94	53.00	0.00	0.00		3.97	3.97
2050	Diesel	0.01	13.64	57.08	18.58	89.31	0.00	1.01	4.22	1.38	6.61
206A	Other Kerosene				0.77	0.77				0.06	0.06
206B	Jet Kerosene			0.79		0.79			0.02		0.06
207A	Aviation Gasoline			0.11		0.11			0.01		0.01
2080	Motor Gasoline		0.08	104.50	1.63	106.22		0.01	7.94	0.12	8.07
224A	Other Petroleum Products	6.93	0.02		0.87	7.82	0.54	0.00		0.06	0.60
303A	Liquified Petroleum Gas (LPG)	0.41	2.99		2.73	6.14	0.03	0.19		0.18	0.39
308A	Refinery Gas	18.28				18.28	0.94				0.94
301 A	**Total Gaseous** (Natural Gas)	**76.48**	**76.99**	**4.05**	**46.46**	**203.98**	**4.24**	**4.27**	**0.22**	**2.57**	**11.30**
	Total Other Fuel	**2.41**	**3.22**		**3.36**	**8.99**	**0.12**	**0.26**		**0.35**	**0.73**
114B	Municipal Waste	2.41				2.41	0.12				0.12
115A	Industrial Waste		3.22		3.36	6.58		0.26		0.35	0.61
	Total Biomass(1)	**2.04**	**28.11**		**64.40**	**94.56**	**(0.22)**	**(3.09)**		**(6.46)**	**(9.77)**
111A	Fuel Wood		0.66		62.46	63.12		0.07		6.25	6.31
116A	Wood Wastes	1.38	9.47		1.95	12.80	0.15	1.04		0.21	1.41
118A	Sewage Sludge	0.66				0.66	0.07				0.07
215A	Black Liquor		17.98			17.98		1.98			1.98
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**188.78**	**209.52**	**166.60**	**259.52**	**824.43**	**13.79**	**13.45**	**12.43**	**14.40**	**54.09**

(1) CO_2 emissions of Biomass are not included in Total.

ANNEX 3: CO_2 REFERENCE APPROACH

In this annex the results, methodology and detailed data for the CO_2 reference approach are presented.

Methodology

The default methodology according to IPCC Worksheet 1-1 was used.

Emission factors

Carbon emission factors

For estimation of emissions that arise from combustion of fossil fuels the default carbon emission factors described in chapter 1.4.1.1 of the IPCC Reference Manual have been used (IPCC Workbook 1.6 table 1-2). For selected values see Table 5.

Fraction of carbon oxidised

The default values of table 1-6 of the IPCC Reference Manual have been used. For selected values see Table 5.

Activity data

Production, Imports, Exports, Stock Change

Activity data are taken from the national energy balance (IEA JQ 2006) (see Annex 2 and Annex 4). The reference approach requires more detailed fuel categories than provided in the national energy balance. Some fuel categories are aggregations of the detailed fuel categories the reference approach asks for. The following fuel types are included elsewhere:

- Ethane is included in Refinery Feedstocks.
- Liquid Biomass is included in Solid Biomass.

International Bunkers

International bunkers are only relevant for aviation. However, there is "international" navigation on the Danube, but this is included in national navigation.

Fuel consumption of international bunkers is consistent with memo item international bunkers as described in the relevant chapter for Category *1 A 3*.

Carbon Stored (Feedstocks)

Emissions from carbon stored in products are calculated for each fuel by multiplying its non–energy use with the corresponding default IPCC carbon emission factor.

For all fuels except for coke oven coke the IPCC default values for the fraction of carbon stored are used. To estimate carbon stored from coke oven coke carbon remaining in steel is calculated as the following:

Carbon stored in steel [Mg]= raw steel production [Mg] 0.0015 + electric steel [Mg] * 0.01*

which leads to an average fraction of carbon stored of 0.007 of total inland coke consumption.

In the Sectoral Approach the release of stored carbon as emissions is considered as quoted in the NIR, chapter *3.4 Feedstock*.

Recalculations

Activity data

Imports, Exports and Production are updated according to the new version of the energy balance (IEA JQ 2007). Changes of activity data are based on energy balance recalculations as described in Annex 2.

Results of the Reference Approach

Table 1-Table 5 present calculation results, apparent fuel consumption, carbon stored, international bunker fuels, conversion factors, carbon emission factors and the fraction of carbon oxidised for all fuel types of the Reference Approach.

Table 1 present the calculation results for each fuel type of the Reference Approach for selecte years.

Table 1: Actual CO_2 emissions (Gg CO_2) for selected years.

Fuel Type	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Crude Oil	24 681	26 751	27 168	29 101	28 522	26 802	25 573	27 308	27 771	27 371	26 201	27 135	26 294
Orimulsion	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Natural Gas Liquids	116	121	150	122	637	199	302	154	149	261	249	309	353
Gasoline	-240	386	-235	-933	-90	-278	516	227	669	1 217	1 294	855	1 207
Jet Kerosene	-843	-1 206	-1 380	-1 464	-1 536	-1 445	-1 550	-1 458	-1 374	-1 126	-1 101	-1 491	-1 264
Other Kerosene	-44	-8	21	31	47	48	16	-1	10	11	9	8	7
Shale Oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas / Diesel Oil	1 815	3 719	6 143	4 404	6 165	6 599	6 916	8 237	9 471	12 198	13 018	13 337	13 457
Residuel Fuel Oil	995	1 212	1 183	1 222	1 893	922	1 097	1 079	242	865	375	358	511
LPG	252	373	409	259	341	389	405	422	434	376	355	335	391
Ethane	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Naphtha	-1 060	-1 233	-1 441	-1 855	-1 524	-1 549	-1 429	-1 569	-1 551	-1 549	-1 757	-1 388	-2 094
Bitumen	-864	-815	-838	-960	-950	-1 046	-1 100	-1 291	-1 336	-1 276	-1 391	-1 496	-1 257
Lubricants	165	-85	-165	-172	-158	-156	-166	-183	-165	-226	-204	-210	-238
Petroleum Coke	88	39	30	46	61	108	74	61	203	210	307	206	135
Refinery Feedstocks	3 031	1 643	2 366	2 589	1 719	2 543	1 516	1 785	1 278	323	986	1 149	1 507
OtherOil	209	-127	-202	263	-193	-214	-135	-337	-398	-379	-272	-195	-311
Liquid Fossil Totals	**28 302**	**30 771**	**33 210**	**32 653**	**34 935**	**32 921**	**32 035**	**34 435**	**35 402**	**38 276**	**38 069**	**38 912**	**38 698**
Anthracite	40	44	185	7	4	4	7	4	19	8	18	12	244
Coking Coal	5 926	4 766	5 301	5 313	5 500	5 560	4 658	4 720	4 681	4 695	4 718	4 645	4 625
Other Bit. Coal	4 688	3 808	4 236	5 080	4 034	3 341	4 784	5 286	4 933	6 136	6 369	5 569	5 844
Sub- Bit.	0	0	0	0	0	29	79	92	123	150	136	136	163

Fuel Type	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Coal													
Lignite	2 707	1 884	1 592	1 292	850	1 506	1 307	1 538	1 459	1 516	1 110	1 174	733
Oil Shale	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peat	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB & Patent Fuel	548	308	299	250	192	197	197	195	118	132	107	92	103
Coke Oven / Gas Coke	2 008	2 687	1 898	2 376	1 970	1 839	3 118	2 746	3 546	3 331	3 268	4 075	4 090
Solid Fuel Totals	**15 917**	**13 499**	**13 511**	**14 318**	**12 550**	**12 478**	**14 151**	**14 581**	**14 880**	**15 970**	**15 725**	**15 705**	**15 803**
Gaseous Fossil	12 238	15 048	16 017	15 437	15 848	16 125	15 388	16 309	16 494	17 833	17 622	19 307	17 605
TOTAL	**56 457**	**59 318**	**62 738**	**62 408**	**63 333**	**61 524**	**61 574**	**65 325**	**66 776**	**72 079**	**71 416**	**73 924**	**72 106**
Biomass Total	**9 105**	**10 416**	**11 104**	**10 876**	**10 589**	**12 167**	**11 485**	**12 206**	**12 366**	**12 520**	**12 566**	**13 383**	**14 499**
Solid Biomass	9 105	10 324	10 994	10 739	10 451	12 048	11 347	12 090	12 043	12 405	12 436	13 243	14 336
Liquid Biomass	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Gas Biomass	NO	92	110	137	138	119	138	116	323	115	129	140	163

Table 2 present the apparent fuel consumption for each fuel type of the Reference Approach.

Table 2: Apparent Consumption (TJ)

Fuel Type	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Crude Oil	339 954	368 466	374 217	400 837	392 864	369 171	352 242	376 144	382 524	377 005	360 896	373 757	362 178
Orimulsion	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Natural Gas Liquids	1 854	1 944	2 400	1 961	10 206	3 194	4 842	2 473	2 394	4 182	3 987	4 954	5 646
Gasoline	-3 341	5 621	-3 419	-13 593	-1 311	-4 059	7 523	3 310	9 746	17 738	18 863	12 465	17 590
Jet Kerosene	-11 906	-17 043	-19 491	-20 683	-21 700	-20 411	-21 904	-20 601	-19 415	-15 913	-15 553	-21 071	-17 861
Other Kerosene	-623	-106	290	439	666	674	218	-14	137	154	133	113	104
Shale Oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas / Diesel Oil	24 755	50 721	83 771	60 057	84 071	90 000	94 318	112 339	129 157	166 359	177 541	181 887	183 523
Residuel Fuel Oil	12 990	15 825	15 450	15 949	24 720	12 033	14 316	14 090	3 158	11 291	4 892	4 669	6 675
LPG	4 029	5 975	6 545	4 147	5 464	6 224	6 486	6 763	6 956	6 025	5 682	5 373	6 261
Ethane	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Naphtha	90	0	0	0	0	0	0	0	0	0	0	-450	-4 906
Bitumen	10 804	7 475	9 324	9 766	11 092	9 407	9 798	8 685	7 412	8 668	8 554	7 445	11 784
Lubricants	5 804	563	-161	-201	-40	-82	-111	-355	-538	-1 270	-1 308	-1 229	-1 646
Petroleum Coke	2 611	883	1 167	1 190	1 450	2 074	1 890	1 777	3 311	3 609	4 551	3 278	2 358
Refinery Feedstocks	41 754	22 633	32 591	35 661	23 678	35 029	20 888	24 590	17 601	4 455	13 582	15 823	20 761
OtherOil	3 602	-934	-1 892	4 637	-1 757	-1 991	-1 113	-3 878	-4 660	-4 343	-2 806	-1 831	-3 280

Fuel Type	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Liquid Fossil Totals	**432 378**	**462 024**	**500 793**	**500 167**	**529 402**	**501 264**	**489 393**	**525 323**	**537 783**	**577 962**	**579 014**	**585 184**	**589 188**
Anthracite	448	476	1 932	84	56	56	84	56	224	112	196	140	2 548
Coking Coal	65 423	53 427	58 604	59 096	60 811	61 358	52 579	52 969	53 149	53 140	53 337	53 158	52 954
Other Bit. Coal	50 568	41 076	45 696	54 796	43 512	36 043	51 604	57 016	53 214	66 190	68 698	60 073	63 036
Sub- Bit. Coal	0	0	0	0	0	311	844	977	1 310	1 598	1 443	1 443	1 732
Lignite	27 294	18 999	16 048	13 028	8 573	15 183	13 178	15 512	14 710	15 290	11 194	11 840	7 390
Oil Shale	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peat	4	4	4	4	4	4	4	4	4	4	4	4	4
BKB & Patent Fuel	5 912	3 323	3 221	2 694	2 066	2 126	2 127	2 099	1 277	1 422	1 153	997	1 109
Coke Oven / Gas Coke	19 100	25 549	18 090	22 622	18 769	17 540	29 618	26 103	33 668	31 628	31 020	38 694	38 845
Solid Fuel Totals	**168 749**	**142 854**	**143 595**	**152 325**	**133 791**	**132 620**	**150 040**	**154 736**	**157 556**	**169 385**	**167 045**	**166 350**	**167 618**
Gaseous Fossil	219 239	269 583	286 941	276 551	283 920	288 876	275 681	292 169	295 485	319 481	315 695	345 876	315 391
TOTAL	**820 366**	**874 462**	**931 330**	**929 043**	**947 113**	**922 759**	**915 115**	**972 228**	**990 825**	**1 066 828**	**1 061 755**	**1 097 410**	**1 072 196**
Biomass Total	**94 376**	**107 860**	**114 968**	**112 575**	**109 596**	**125 972**	**118 889**	**126 387**	**127 804**	**129 636**	**130 095**	**138 560**	**150 093**
Solid Biomass	94 376	107 011	113 954	111 312	108 327	124 880	117 614	125 319	124 832	128 579	128 906	137 271	148 592
Liquid Biomass	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Gas Biomass	0	849	1 014	1 263	1 269	1 092	1 275	1 069	2 973	1 057	1 189	1 290	1 502

Table 3 present the carbon stored for each fuel type of the Reference Approach.

Table 3: Carbon Stored (Gg C)

Fuel Type	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Crude Oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Orimulsion	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Natural Gas Liquids	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gasoline	2.9	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Jet Kerosene	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other Kerosene	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Shale Oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas / Diesel Oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Residuel Fuel Oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
LPG	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Ethane	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Naphtha	293.7	339.6	397.0	511.1	419.9	426.7	393.6	432.1	427.4	426.7	484.1	373.4	478.7
Bitumen	475.7	389.0	435.9	479.2	505.8	495.1	518.7	546.7	531.0	542.3	571.4	575.9	605.4

Fuel Type	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Lubricants	70.5	34.6	42.2	43.4	42.6	41.4	43.4	43.3	34.7	36.9	30.2	33.3	32.7
Petroleum Coke	47.5	13.5	23.7	20.0	23.2	27.3	31.5	32.1	35.2	41.3	40.6	33.4	27.6
Refinery Feedstocks	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
OtherOil	14.3	16.2	17.8	20.3	17.9	19.2	14.9	15.4	16.4	17.7	18.8	17.1	20.2
Liquid Fossil Totals	**904.7**	**792.9**	**916.6**	**1074.0**	**1009.4**	**1009.7**	**1002.2**	**1069.6**	**1044.7**	**1064.9**	**1145.1**	**1033.0**	**1164.7**
Anthracite	0.8	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.8	0.8	0.4	0.4	0.4
Coking Coal	38.8	52.0	36.8	46.0	38.2	35.7	60.2	53.1	68.5	64.3	63.1	78.7	79.0
Other Bit. Coal	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Sub- Bit. Coal	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Lignite	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Oil Shale	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peat	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
BKB & Patent Fuel	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Coke Oven / Gas Coke	4.8	5.9	5.4	6.2	5.5	5.5	6.0	6.0	6.5	6.2	5.7	7.4	7.6
Solid Fuel Totals	**44.4**	**58.2**	**42.6**	**52.6**	**44.0**	**41.6**	**66.7**	**59.4**	**75.7**	**71.2**	**69.2**	**86.4**	**87.0**
Gaseous Fossil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
TOTAL	**949.0**	**851.1**	**959.2**	**1126.6**	**1053.5**	**1051.2**	**1068.8**	**1129.0**	**1120.4**	**1136.1**	**1214.3**	**1119.4**	**1251.7**
Biomass Total	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Solid Biomass	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Liquid Biomass	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas Biomass	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Table 4 present international bunker fuels for the relevant fuel types of the Reference Approach.

Table 4: International Bunkers [Gg fuel]

Fuel Type	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Jet Kerosene	275.0	409.2	453.1	471.4	487.6	475.4	516.4	502.0	470.5	402.3	472.2	533.6	558.0

Table 5 present conversion factors, carbon emission factors and the fraction of carbon oxidised for all fuel types of the Reference Approach.

Table 5: Conversion factor, carbon emission factor and fraction of carbon oxidised.

Fuel Type	Conversion Factor [TJ/Gg]	Carbon emission factor [t C/TJ]	Fraction of carbon oxidised [t C/t C]
Crude Oil	42.75	20.00	0.99
Orimulsion	-	-	-
Natural Gas Liquids	45.22	17.20	0.99
Gasoline	44.80	18.90	0.99
Jet Kerosene	44.59	19.50	0.99
Other Kerosene	44.75	19.60	0.99
Shale Oil	-	-	-
Gas / Diesel Oil	43.33	20.20	0.99
Residuel Fuel Oil	40.19	21.10	0.99
LPG	47.31	17.20	0.99
Ethane	-	-	-
Naphtha	45.01	20.00	0.99
Bitumen	40.19	22.00	0.99
Lubricants	40.19	20.00	0.99
Petroleum Coke	31.00	27.50	0.99
Refinery Feedstocks	42.50	20.00	0.99
OtherOil	40.19	20.00	0.99
Anthracite	28.00	26.80	0.98
Coking Coal	28.00	25.80	0.98
Other Bit. Coal	Country specific	25.80	0.98
Sub- Bit. Coal	22.20	26.20	0.98
Lignite	Country specific	27.60	0.98
Oil Shale	-	-	-
Peat	8.80	28.90	0.98
BKB & Patent Fuel	19.30	25.80	0.98
Coke Oven / Gas Coke	28.20	29.50	0.98
Natural Gas	-	15.30	1.00
Solid Biomass	-	29.90	0.88
Liquid Biomass	-	-	-
Gas Biomass	-	29.90	0.99

Table 6 present country specific conversion factors.

Table 6: Country specific conversion factors [TJ/Gg]

Fuel Type	**1990**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Other Bit. Coal	28.00	28.00	28.00	28.00	28.00	27.66	27.99	27.99	27.50	27.50	28.41	28.14	28.07
Lignite	10.90	10.90	9.90	9.90	9.90	9.77	9.82	9.79	9.82	9.82	9.91	9.83	10.95

ANNEX 4: NATIONAL ENERGY BALANCE

The following tables present the data of the national energy balance by IEA categories. Calorific values for unit conversion are presented at the end of this Annex. Data was submitted to the Umweltbundesamt by STATISTIK AUSTRIA in November 2007

Please note that for reasons of confidentiality energy consumption of autoproducers by sub sectors as quoted in ANNEX 2 are not published here.

Coal

Table 1: National Energy Balance 1990-2006 Coking Coal [1000 tons].

101A Coking Coal	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	2 376	2 071	1 778	2 013	2 167	2 089	2 146	1 738	1 861	1 864	1 858	1 789	2 063	1 806
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-39	25	130	80	-57	83	45	139	30	34	40	115	-164	86
Gross Inland Deliveries (Obs.)	2 337	2 096	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898	1 898	1 905	1 899	1 891
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 337	2 096	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898	1 898	1 905	1 899	1 891
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	2 337	2 096	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898	1 898	1 905	1 899	1 891
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2: National Energy Balance 1990-2006 Bituminous Coal & Anthracite [1000 tons].

102A Bitominous Coal & Anthra-cite	**1990**	**1991**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Indigenous Production	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	1 233	1 717	1 216	1 724	1 616	1 653	1 211	1 672	1 862	2 167	2 101	2 659	2 262	2 312
Total Exports (Balance)	0	0	1	2	4	0	0	0	0	0	0	21	3	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	589	270	268	-21	348	-97	94	176	177	-225	310	-212	-119	26
Gross Inland Deliveries (Obs.)	1 822	1 988	1 484	1 701	1 959	1 555	1 305	1 848	2 040	1 942	2 411	2 426	2 140	2 338
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1 421	1 561	1 082	1 238	1 437	1 061	907	1 422	1 670	1 618	2 136	2 147	1 885	2 001
Public Electricity	964	957	550	1 069	1 275	890	731	1 203	1 384	1 373	1 908	1 908	1 665	1 770
Public Combined Heat and Power	409	535	518	128	127	127	140	161	242	194	177	193	178	174
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	19	5	4	4	10	13	11	13	4	4	4
Auto Producers for CHP	48	68	14	22	31	40	32	48	31	39	38	42	39	53
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	7	33	2	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	7	33	2	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	400	425	400	462	521	493	390	392	366	323	273	278	254	335
Total Transport	3	0	0	1	1	1	1	1	1	1	1	0	0	0
Rail	3	0	0	1	1	1	1	1	1	1	1	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	208	226	251	306	400	383	290	313	291	254	208	218	208	292
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Chemical (incl.Petro-Chemical)	7	13	45	50	73	70	88	57	70	71	68	62	35	29
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	199	175	164	196	208	199	131	170	151	98	74	72	86	136
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	2	38	43	59	118	113	72	86	70	85	66	83	87	122
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	189	199	148	155	120	109	98	78	74	69	64	60	46	43
Commerce - Public Services	11	17	10	12	10	11	18	9	7	12	13	11	9	9
Residential	177	181	137	142	108	98	80	68	67	57	51	49	36	34
Agriculture	1	1	1	1	1	1	1	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	2	2	1	1	1	1	1	1	1	2	2	1	1	1

Table 3: National Energy Balance 1990-2006. Patent Fuel [1000 tons].

104A Patent Fuel	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	0	0	0	0	7	4	4	4	1	1	2	1	1	1
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	0	7	4	4	4	1	1	2	1	1	1
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	7	4	4	4	1	1	2	1	1	1
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	7	4	4	4	1	1	2	1	1	1
Commerce - Public Services	0	0	0	0	1	1	1	1	0	0	0	0	0	0
Residential	0	0	0	0	6	3	3	3	0	1	2	1	1	1
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4: National Energy Balance 1990-2006. Lignite and Brown Coal [1000 tons].

105A Lignite and brown coal	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	2 448	2 081	1 297	1 108	1 130	1 140	1 137	1 249	1 206	1 412	1 152	235	0	0
Total Imports (Balance)	36	53	29	43	23	13	14	54	73	59	70	88	113	140
Total Exports (Balance)	3	3	0	0	0	0	1	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	23	639	417	470	163	-287	418	78	351	86	407	870	1 157	613
Gross Inland Deliveries (Obs.)	2 503	2 770	1 743	1 621	1 316	866	1 569	1 381	1 630	1 557	1 629	1 194	1 270	754
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 133	2 338	1 524	1 495	1 205	763	1 417	1 230	1 483	1 390	1 477	1 039	1 136	657
Public Electricity	1 182	1 445	1 081	1 358	1 164	737	1 372	1 168	1 391	1 316	1 393	967	1 061	620
Public Combined Heat and Power	881	830	339	48	13	3	9	26	59	43	52	41	54	37
Public Heat Plants	16	8	9	9	4	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	4	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	54	54	95	76	23	22	35	35	33	31	32	31	20	1
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	6	3	0	0	1	0	15	2	0	1	0	0	0	0
Coal Mines	3	1	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	3	2	0	0	1	0	15	2	0	1	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	364	429	219	126	111	103	137	149	146	166	152	155	134	96
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	147	211	115	33	46	45	79	102	107	133	142	144	126	88
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	11	14	4	6	3	3	14	38	44	59	72	68	70	84
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	132	193	111	27	43	42	65	64	64	74	70	76	56	4
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	2	3	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	217	218	104	93	65	58	58	47	39	34	10	11	9	8
Commerce - Public Services	9	14	5	3	3	3	8	11	17	21	3	4	2	2
Residential	208	205	99	90	62	55	50	35	21	12	7	7	7	6
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5: National Energy Balance 1990-2006. Brown Coal Briquettes [1000 tons].

106A BKB-PB	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	295	286	173	167	133	103	106	95	108	65	72	59	53	57
Total Exports (Balance)	0	0	2	1	0	0	0	0	0	0	0	1	2	1
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	12	32	1	0	0	0	0	11	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	306	318	172	167	133	103	106	107	108	65	72	58	51	57
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	12	32	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	7	13	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	5	19	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	295	286	172	167	133	103	106	107	108	65	72	58	51	57
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	64	32	14	13	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	1	2	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	63	30	14	13	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	230	254	158	154	132	103	106	107	108	65	72	58	51	57
Commerce - Public Services	8	14	6	6	20	11	11	31	36	8	22	11	5	14
Residential	214	231	146	142	108	88	91	73	69	55	47	46	43	41
Agriculture	8	9	6	6	5	4	4	3	3	2	2	2	2	2
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6: National Energy Balance 1990-2006. Coke Oven Coke [1000 tons].

107A Coke Oven Coke	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	1 725	1 540	1 448	1 559	1 566	1 598	1 608	1 385	1 394	1 395	1 395	1 400	1 388	1 398
Total Imports (Balance)	815	893	718	652	764	642	654	981	1 091	1 073	1 173	1 266	1 402	1 282
Total Exports (Balance)	1	2	1	0	0	0	2	1	1	2	3	42	4	3
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-136	53	189	-10	39	24	-30	71	-164	124	-48	-124	-26	98
Gross Inland Deliveries (Obs.)	2 402	2 484	2 354	2 200	2 369	2 264	2 230	2 435	2 320	2 589	2 517	2 500	2 760	2 775
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	623	591	711	652	758	830	783	909	899	1 049	1 019	1 059	1 035	1 037
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	623	591	711	652	758	830	783	909	899	1 049	1 019	1 059	1 035	1 037
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	107	116	77	88	73	68	48	53	52	58	55	50	65	68
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	107	116	77	88	73	68	48	53	52	58	55	50	65	68
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	853	924	557	528	469	422	453	436	344	366	385	409	395	365
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	290	280	196	192	220	200	245	251	159	205	241	303	267	244
Iron and Steel	235	229	178	164	179	164	176	201	133	173	206	274	235	222
Chemical (incl.Petro-Chemical)	14	11	6	11	13	11	17	16	12	11	14	10	9	0
Non ferrous Metals	7	6	3	5	7	6	8	7	3	6	5	6	4	4
Non metallic Mineral Products	23	18	4	5	15	13	39	11	2	5	4	5	14	14
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	5	3	2	3	3	2	3	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	5	5	2	4	5	4	3	16	9	11	11	9	4	4
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	1	7	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	563	644	361	335	248	222	207	185	184	161	144	106	128	121
Commerce - Public Services	13	15	9	8	6	5	5	5	5	5	4	5	5	5
Residential	537	615	345	320	237	212	198	176	175	153	137	99	121	114
Agriculture	12	14	8	7	5	5	5	4	4	3	3	2	2	2
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	820	852	1 010	932	1 069	944	946	1 037	1 025	1 115	1 058	982	1 265	1 305

Table 7: National Energy Balance 1990-2006. Peat [1000 tons].

113A Peat	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 8: National Energy Balance 1990-2006. Coke Oven Gas [TJ].

304A Coke Oven Gas	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	13 117	12 276	10 906	11 419	11 604	12 166	12 220	10 466	9 776	9 579	10 722	10 911	9 871	9 871
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	13 117	12 276	10 906	11 419	11 604	12 166	12 220	10 466	9 776	9 579	10 722	10 911	9 871	9 871
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	3 385	2 763	6 228	3 545	3 270	3 087	3 732	3 592	3 816	3 187	1 780	2 436	2 336	2 119
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	2 183	2 002	2 033	2 649	3 256	3 449	2 778	1 255	2 193	2 027	1 915
Auto Producers for CHP	3 385	2 763	6 228	1 362	1 268	1 054	1 083	286	367	409	526	243	309	204
Auto Producer Heat Plants	0	0	0	0	0	0	0	50	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	4 136	3 871	3 439	3 601	3 659	3 836	3 853	3 300	3 083	3 020	4 187	4 326	4 171	4 171
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	1 072	1 004	892	934	949	995	999	856	799	783	708	595	699	699
Blast Furnaces (Energy)	3 064	2 867	2 547	2 667	2 710	2 841	2 854	2 444	2 283	2 237	3 479	3 730	3 472	3 472
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	1 023	1 171	1 204	841	1 058
Final Consumption	5 596	5 642	1 239	4 273	4 675	5 243	4 635	3 574	2 878	2 348	3 584	2 946	2 523	2 523
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	5 596	5 642	1 239	4 273	4 675	5 243	4 635	3 574	2 878	2 348	3 584	2 946	2 523	2 523
Iron and Steel	5 596	5 642	1 239	4 273	4 675	5 243	4 635	3 574	2 878	2 348	3 584	2 946	2 523	2 523
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 9: National Energy Balance 1990-2006. Blast Furnace Gas [TJ].

305A Blast Furnace Gas	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	17 094	16 232	19 503	17 719	20 582	22 528	21 873	25 385	25 098	29 309	28 463	29 577	28 902	28 969
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	17 094	16 232	19 503	17 719	20 582	22 528	21 873	25 385	25 098	29 309	28 463	29 577	28 902	28 969
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	4 822	4 352	6 213	6 259	7 906	7 625	6 802	6 014	7 630	8 226	7 958	11 128	11 936	11 389
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	4 493	5 447	5 320	4 629	5 011	7 034	7 440	6 784	10 437	10 937	10 474
Auto Producers for CHP	4 822	4 352	6 213	1 766	2 459	2 305	2 173	1 003	596	786	1 174	690	998	916
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	9 682	9 164	11 685	10 613	12 332	13 536	13 156	15 254	15 077	17 613	17 325	16 175	16 290	16 732
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	2 391	2 223	2 641	2 508	2 787	3 256	3 231	3 675	3 609	4 251	4 161	4 282	3 647	3 647
Blast Furnaces (Energy)	7 291	6 941	9 044	8 105	9 545	10 280	9 924	11 579	11 468	13 363	13 164	11 894	12 643	13 085
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	1 111	653	967	676	847
Final Consumption	2 590	2 716	1 605	847	344	1 367	1 915	4 117	2 391	2 359	2 527	1 307	0	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	2 590	2 716	1 605	847	344	1 367	1 915	4 117	2 391	2 359	2 527	1 307	0	0
Iron and Steel	2 590	2 716	1 605	847	344	1 367	1 915	4 117	2 391	2 359	2 527	1 307	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Oil

Table 10: National Energy Balance 1990-2006. Crude Oil [1000 tons].

201A Crude Oil	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	1 149	1 280	1 035	992	973	959	1 003	971	957	957	1 113	971	855	863
Refinery Losses	120	128	153	75	82	156	226	122	210	72	28	3	-67	-34
Refinery Intake (Calculated)	7 952	8 273	8 619	8 754	9 376	9 190	8 636	8 240	8 799	8 947	8 781	8 404	8 709	8 433
Refinery Intake (Observed)	7 952	8 273	8 619	8 754	9 376	9 190	8 636	8 240	8 799	8 947	8 781	8 404	8 709	8 433
Refinery Fuel	0	0	0	0	0	0	0	0	0	1	38	38	33	39
Total Imports (Balance)	6 797	7 000	7 590	7 737	8 452	8 269	7 698	7 315	7 940	8 118	7 819	7 562	7 833	7 699
Total Exports (Balance)	0	0	0	51	25	44	51	61	63	0	0	0	0	0
Stock Change (National Territory)	6	-8	-6	75	-23	6	-14	16	-36	-128	-114	-91	55	-90
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11: National Energy Balance 1990-2006. Natural Gas Liquids [1000 tons].

302A Natural Gas Liquids	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	41	41	43	53	55	88	60	101	55	53	92	88	110	125
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	41	41	43	53	43	226	71	107	55	53	92	88	76	86
Refinery Intake (Observed)	41	41	43	53	43	226	71	107	55	53	92	88	76	86
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	33	39
Total Imports (Balance)	0	0	0	0	0	135	0	6	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	-12	2	10	0	0	0	0	0	0	0
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 12: National Energy Balance 1990-2006. Refinery Feedstocks [1000 tons].

217A Refinery Feedstocks	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	1 069	1 225	582	858	853	564	876	541	616	440	152	341	370	523
Refinery Intake (Observed)	1 069	1 225	582	858	853	564	873	540	616	440	152	341	370	523
Refinery Fuel	0	0	0	0	0	0	2	1	14	26	5	42	65	29
Total Imports (Balance)	1 009	1 154	600	916	761	746	740	627	534	593	374	223	265	502
Total Exports (Balance)	0	0	39	62	14	7	64	125	80	32	72	15	68	45
Stock Change (National Territory)	-26	-30	-28	-88	92	-182	148	-10	125	-146	-198	112	175	31

Table 13: National Energy Balance 1990-2006. Residual Fuel Oil [1000 tons].

203X; Residual Fuel Oil	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gross Output	1 913	1 981	1 502	1 441	1 540	1 347	1 308	979	1 047	1 012	978	1 031	992	915
Refinery Fuel	81	77	139	56	49	63	22	37	7	7	25	7	26	6
Total Imports (Balance)	602	480	531	386	449	671	468	262	317	241	328	306	182	199
Total Exports (Balance)	185	149	38	121	53	18	37	152	228	146	55	55	72	58
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-93	-88	-100	119	1	-38	-131	246	262	-17	8	-129	7	25
Gross Inland Deliveries (Obs.)	2 156	2 147	1 757	1 770	1 888	1 899	1 586	1 298	1 391	1 083	1 234	1 146	1 081	1 075
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	608	740	573	537	636	732	559	380	449	265	361	366	350	370
Public Electricity	28	37	88	193	317	348	236	109	89	34	106	94	79	91
Public Combined Heat and Power	253	297	316	178	151	233	241	162	191	168	203	196	182	201
Public Heat Plants	99	124	70	109	128	106	54	88	149	47	32	65	72	66
Auto Producers of Electricity	0	0	0	22	11	10	5	5	3	2	10	1	3	3
Auto Producers for CHP	227	281	97	33	28	33	20	15	16	13	8	10	13	7
Auto Producer Heat Plants	1	1	1	1	1	1	2	1	1	1	2	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	116	117	150	110	143	191	191	231	256	154	159	203	234	227
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	116	117	150	110	143	191	191	231	256	154	159	203	234	227
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1 432	1 290	1 035	1 123	1 109	976	836	687	686	664	714	576	498	478
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	518	539	550	557	749	611	335	277	242	214	222	215	213	218
Iron and Steel	19	18	23	26	11	9	10	21	13	8	6	10	10	16
Chemical (incl.Petro-Chemical)	23	24	27	28	40	33	19	11	10	9	10	13	10	10
Non ferrous Metals	4	4	7	10	18	15	9	9	7	7	7	7	6	6
Non metallic Mineral Products	115	110	135	127	195	159	80	50	37	35	38	40	43	44
Transportation Equipment	13	15	17	6	6	5	4	4	5	3	3	4	4	4
Machinery	29	31	32	42	66	54	31	30	27	25	28	27	26	24
Mining and Quarrying	6	6	7	10	11	9	13	12	12	11	11	8	9	10
Food, Beverages and Tobacco	78	86	89	68	85	69	39	38	36	34	34	34	27	29
Pulp, Paper and Printing	126	133	108	95	140	114	56	41	41	35	38	29	37	34
Wood and Wood Products	15	15	21	26	41	33	19	9	4	12	13	13	12	11
Construction	32	34	22	35	44	36	17	16	11	10	12	10	10	15
Textiles and Leather	27	31	25	35	48	39	17	12	16	12	9	8	8	6
Non Specified (Industry)	30	32	36	49	44	36	22	23	24	13	13	12	10	11
Total Other Sectors	914	750	485	566	359	365	501	410	444	450	491	361	286	260
Commerce - Public Services	316	229	239	288	71	58	172	172	187	209	236	122	83	69
Residential	471	410	194	219	227	241	259	189	204	191	203	190	161	152
Agriculture	127	111	53	59	61	65	70	49	53	50	53	49	42	39
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	116	117	150	110	143	191	191	231	256	154	159	203	234	227

Table 14: National Energy Balance 1990-2006. Heating and Oher Gas Oil [1000 tons].

204A Heating and Other Gas Oil	**1990**	**1991**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Refinery Gross Output	1 239	1 575	1 454	1 598	1 604	1 280	1 245	1 062	1 301	1 062	1 103	928	997	1 004
Refinery Fuel	0	0	0	0	1	2	6	0	0	0	0	0	0	0
Total Imports (Balance)	0	0	165	376	355	577	615	533	626	734	860	805	926	950
Total Exports (Balance)	0	28	0	0	0	0	0	1	3	0	0	17	20	34
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	5	-20	39	-17	-53	41	1	44	-41	-11	37	-25	-40	-7
Gross Inland Deliveries (Obs.)	1 244	1 527	1 658	1 956	1 906	1 895	1 854	1 638	1 883	1 785	1 999	1 691	1 863	1 914
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	2	1	2	3	1	0	19	2	4	2	5	5
Public Electricity	0	0	0	0	0	0	0	0	15	0	0	0	1	1
Public Combined Heat and Power	0	0	2	0	0	0	0	0	4	2	1	0	3	1
Public Heat Plants	0	0	0	1	2	2	0	0	0	0	3	1	1	2
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1 244	1 527	1 656	1 955	1 904	1 893	1 853	1 637	1 864	1 783	1 996	1 689	1 858	1 908
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	1	5	5	11	28	24	24	38	74	64	68	65	68	63
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	1	1	1	2	4	4	2	1	1	1
Non ferrous Metals	0	0	0	0	0	0	2	2	3	3	1	1	1	1
Non metallic Mineral Products	0	1	1	2	5	5	2	2	3	2	3	3	4	5
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Machinery	0	1	1	3	7	6	4	5	11	9	9	7	7	7
Mining and Quarrying	0	0	0	1	1	1	1	1	2	3	2	3	3	3
Food, Beverages and Tobacco	0	0	1	1	3	3	6	10	21	19	17	13	13	11
Pulp, Paper and Printing	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Wood and Wood Products	0	0	0	0	1	1	1	1	2	2	3	3	4	3
Construction	0	1	1	3	6	6	5	10	20	17	23	28	29	26
Textiles and Leather	0	0	0	0	1	1	1	1	2	2	2	2	2	2
Non Specified (Industry)	0	0	0	1	2	2	1	2	4	3	3	3	3	3
Total Other Sectors	1 243	1 523	1 651	1 944	1 876	1 868	1 828	1 600	1 790	1 718	1 927	1 624	1 790	1 845
Commerce - Public Services	26	87	92	222	538	471	417	251	471	456	551	293	341	479
Residential	1 216	1 434	1 558	1 720	1 337	1 396	1 410	1 348	1 318	1 261	1 375	1 329	1 448	1 365
Agriculture	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 15: National Energy Balance 1990-2006. Diesel [1000 tons].

2050 Diesel	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gross Output	1 531	1 634	1 920	2 008	2 311	2 615	2 430	2 662	2 658	2 922	2 746	2 601	2 931	2 780
Refinery Fuel	0	0	1	1	1	1	0	0	0	0	4	0	0	0
Total Imports (Balance)	576	686	937	1 777	1 159	1 898	1 877	2 075	2 433	2 728	3 491	4 078	4 129	4 054
Total Exports (Balance)	3	68	83	97	271	467	459	415	415	520	539	563	889	584
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-7	74	112	-106	195	-108	44	-59	-8	49	-9	-179	91	-145
Gross Inland Deliveries (Obs.)	2 097	2 326	2 885	3 581	3 394	3 937	3 892	4 263	4 668	5 180	5 685	5 936	6 262	6 106
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	8	4	7	1	2	1	0	0	0	0	0	0
Public Electricity	0	0	6	3	6	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	1	0	0	1	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	2 096	2 326	2 877	3 578	3 388	3 936	3 890	4 262	4 668	5 179	5 685	5 935	6 262	6 106
Total Transport	1 533	1 710	2 140	2 692	2 542	2 977	2 879	3 238	3 560	3 971	4 373	4 573	4 833	4 710
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	1 472	1 654	2 088	2 645	2 495	2 931	2 831	3 190	3 512	3 919	4 321	4 520	4 780	4 656
Rail	54	50	45	41	41	41	42	42	41	44	44	44	44	44
Inland Waterways	7	7	6	6	6	6	6	6	7	8	8	9	9	10
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	288	335	440	574	539	640	688	700	776	867	960	1 005	1 066	1 036
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	3	4	5	7	6	7	8	8	9	10	11	12	12	12
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	4	5	7	9	8	10	10	10	12	13	14	15	16	16
Transportation Equipment	20	23	30	40	37	44	48	48	54	60	66	69	74	72
Machinery	1	1	1	2	2	2	2	2	2	3	3	3	3	3
Mining and Quarrying	20	24	31	41	38	45	49	50	55	61	68	71	76	73
Food, Beverages and Tobacco	1	1	2	2	2	3	3	3	3	3	4	4	4	4
Pulp, Paper and Printing	1	1	1	1	1	1	1	2	2	2	2	2	2	2
Wood and Wood Products	4	4	6	8	7	9	9	9	10	12	13	14	14	14
Construction	230	267	351	458	430	511	549	558	619	692	766	802	850	827
Textiles and Leather	3	4	5	6	6	7	8	8	8	9	10	11	12	11
Non Specified (Industry)	0	1	1	1	1	1	1	1	1	1	2	2	2	2
Total Other Sectors	275	281	297	312	307	318	323	324	332	342	352	357	363	359
Commerce - Public Services	34	40	52	68	64	76	81	83	92	103	114	119	126	123
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	241	242	245	244	243	242	242	241	240	240	239	238	237	237
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 16: National Energy Balance 1990-2006. Other Kerosene [1000 tons].

206A Other Kerosene	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gross Output	31	43	8	5	0	2	1	1	1	1	1	1	1	1
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	14	4	4	10	10	16	15	5	0	3	4	3	3	2
Total Exports (Balance)	21	13	6	5	2	2	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-7	-4	0	1	2	1	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	18	31	6	12	10	17	16	6	1	4	5	4	3	4
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	18	31	6	12	10	17	16	6	1	4	5	4	3	4
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	18	31	6	12	10	17	15	6	1	4	4	4	3	3
Commerce - Public Services	18	31	6	12	10	17	15	6	1	4	4	4	3	3
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 17: National Energy Balance 1990-2006. Kerosene Type Jet Fuel [1000 tons].

206B Kerosene Type Jet Fuel	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gross Output	291	334	420	479	508	540	508	544	513	484	446	455	592	526
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	13	8	23	24	12	9	21	35	37	38	47	132	85	190
Total Exports (Balance)	5	5	0	0	0	6	5	5	1	1	5	4	2	1
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	-1	4	-8	-4	-2	2	-4	4	-3	4	-4	-22	-32
Gross Inland Deliveries (Obs.)	299	336	447	495	515	541	525	569	553	519	491	578	653	683
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	299	336	447	495	515	541	525	569	553	519	491	578	653	683
Total Transport	299	336	447	495	515	541	525	569	553	519	491	578	653	683
International Civil Aviation	269	307	425	466	493	511	489	537	447	484	414	486	549	575
Domestic Air Transport	30	29	22	29	22	30	36	32	106	34	77	92	104	108
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 18: National Energy Balance 1990-2001. Gasoline Type Jet Fuel [1000 tons].

207A Gasoline Type Jet Fuel	**1990**	**1991**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Refinery Gross Output	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	3	3	4	2	3	3	3	3	4	4	5	7	6	7
Total Exports (Balance)	0	0	0	1	1	0	1	1	1	2	3	3	3	3
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	1	0	-2	1	0	0	0	0	-1	0	1	-1	0	-1
Gross Inland Deliveries (Obs.)	3	3	2	2	2	3	3	2	2	2	3	2	3	3
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	3	3	2	2	2	3	3	2	2	2	3	2	3	3
Total Transport	3	3	2	2	2	3	3	2	2	2	3	2	3	3
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	3	3	2	2	2	3	3	2	2	2	3	2	3	3
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 19: National Energy Balance 1990-2006. Motor Gasoline [1000 tons].

2080 Motor Gasoline	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gross Output	2 631	2 400	2 271	2 297	2 410	2 232	2 141	1 815	1 922	1 927	1 799	1 715	1 798	1 615
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	257	387	698	612	547	759	762	670	603	706	879	1 043	1 090	959
Total Exports (Balance)	281	127	596	700	831	824	824	472	582	496	474	614	767	562
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-54	136	21	10	-23	33	-31	-33	51	6	-12	-11	-48	-8
Gross Inland Deliveries (Obs.)	2 553	2 796	2 395	2 219	2 104	2 200	2 047	1 980	1 994	2 143	2 192	2 133	2 073	2 005
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	2 553	2 796	2 395	2 219	2 104	2 200	2 047	1 980	1 994	2 143	2 192	2 133	2 073	2 005
Total Transport	2 457	2 695	2 312	2 144	2 033	2 128	1 976	1 911	1 925	2 067	2 115	2 058	2 001	1 934
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	2 457	2 695	2 312	2 144	2 033	2 128	1 976	1 911	1 925	2 067	2 115	2 058	2 001	1 934
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	93	97	79	72	68	68	68	66	67	72	73	71	69	67
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	7	3	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	70	77	64	58	55	55	54	54	54	58	59	57	55	53
Machinery	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	12	13	11	10	10	10	11	9	9	10	11	11	10	10
Textiles and Leather	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	4	4	3	3	3	3	3	3	3	3	3	3	3	3
Commerce - Public Services	4	4	3	3	3	3	3	3	3	3	3	3	3	3
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	7	3	0	0	0	0	0	0	0	0	0	0	0	0

Table 20: National Energy Balance 1990-2006. Lubricants [1000 tons].

219A Lubricants	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gross Output	31	31	73	109	113	107	105	111	117	100	123	108	113	122
Refinery Fuel	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	177	171	51	50	51	53	52	57	51	47	44	43	53	53
Total Exports (Balance)	32	30	41	49	57	53	51	58	65	62	80	70	85	91
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-1	-28	4	-5	1	-1	-3	-1	5	2	4	-6	1	-3
Gross Inland Deliveries (Obs.)	175	144	86	105	108	106	103	108	108	86	92	75	83	81
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	19	16	9	11	12	12	11	12	12	9	10	8	9	9
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	1	1	0	1	1	1	1	1	1	0	1	0	0	0
Coke Ovens (Energy)	6	5	3	3	4	3	3	4	4	3	3	2	3	3
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Non Specified (Energy)	11	9	5	6	7	6	6	6	6	5	6	4	5	5
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	156	128	77	94	96	94	92	96	96	77	82	67	74	73
Total Transport	71	59	35	43	44	43	42	44	44	36	38	31	33	33
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	70	58	34	42	43	42	41	43	43	35	37	30	33	33
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	1	1	1	1	1	1	0	1	1	1	1	0	0	0
Total Industry	82	67	40	49	50	49	48	50	50	40	42	35	39	38
Iron and Steel	15	12	7	9	9	9	9	9	9	7	7	7	7	7
Chemical (incl.Petro-Chemical)	7	6	3	4	4	4	4	4	4	3	4	3	3	3
Non ferrous Metals	2	2	1	1	2	1	1	2	2	1	1	1	1	1
Non metallic Mineral Products	11	9	5	6	7	6	6	7	7	5	6	5	5	5
Transportation Equipment	2	2	1	1	1	1	1	1	1	1	1	1	1	1
Machinery	3	3	2	2	2	2	2	2	4	3	3	3	3	3
Mining and Quarrying	3	3	2	2	2	2	2	2	2	2	2	1	1	1
Food, Beverages and Tobacco	11	9	5	7	7	7	7	7	7	5	6	5	5	5
Pulp, Paper and Printing	9	7	4	5	5	5	5	5	5	4	5	4	4	4
Wood and Wood Products	3	2	1	2	2	2	2	2	2	1	1	1	1	1
Construction	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Textiles and Leather	5	4	2	3	3	3	3	3	3	2	2	2	2	2
Non Specified (Industry)	9	8	4	5	6	6	5	6	4	3	3	2	3	3
Total Other Sectors	3	3	2	2	2	2	2	2	2	2	2	1	2	2
Commerce - Public Services	3	3	2	2	2	2	2	2	2	1	1	1	1	1
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	175	144	86	105	108	106	103	108	108	86	92	75	83	81

Table 21: National Energy Balance 1990-2006. White Spirit [1000 tons].

220A White Spirit	**1990**	**1991**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Refinery Gross Output	0	7	5	5	0	0	0	0	0	0	0	18	12	0
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	11	9	8	8	11	12	12	7	6	9	11	10	11	13
Total Exports (Balance)	0	2	0	1	1	1	0	0	0	1	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	-1	0	1	0	1	1	0	0	0	-18	-12	0
Gross Inland Deliveries (Obs.)	11	14	12	12	11	11	13	7	6	8	10	10	12	12
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	11	14	12	12	11	11	13	7	6	8	10	10	12	12
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	11	14	12	12	11	11	13	7	6	8	10	10	12	12
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	11	14	10	9	8	5	4	4	4	4	5	4	4	3
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	2	3	3	6	9	3	2	4	6	6	8	9
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	11	14	12	12	11	11	13	7	6	8	10	10	12	12

Table 22: National Energy Balance 1990-2006. Bitumen [1000 tons].

222A Bitumen	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gross Output	269	281	254	263	299	300	326	343	402	416	398	433	466	392
Refinery Fuel	0	0	0	2	0	4	0	0	0	0	0	0	0	0
Total Imports (Balance)	292	232	187	250	242	279	231	292	296	248	296	295	335	415
Total Exports (Balance)	1	21	5	11	6	1	1	45	78	62	82	81	147	122
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-22	0	4	-7	7	-2	4	-3	-1	-1	1	-2	-3	1
Gross Inland Deliveries (Obs.)	538	492	440	493	542	572	560	587	618	601	613	646	651	685
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	538	492	440	493	542	572	560	587	618	601	613	646	651	685
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	538	492	440	493	542	572	560	587	618	601	613	646	651	685
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	538	492	440	493	542	572	560	587	618	601	613	646	651	685
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	538	492	440	493	542	572	560	587	618	601	613	646	651	685

Table 23: National Energy Balance 1990-2006. Other Oil Products [1000 tons].

224A Other Oil Products	**1990**	**1991**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Refinery Gross Output	499	649	761	923	953	960	927	859	988	1 030	1 048	1 144	854	1 215
Refinery Fuel	164	184	212	264	277	264	213	223	226	254	278	344	229	282
Total Imports (Balance)	126	44	13	-14	121	77	69	111	47	45	43	95	45	78
Total Exports (Balance)	3	-1	39	54	6	137	131	139	162	168	149	163	92	291
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-42	-31	-3	14	-10	6	0	-7	11	-1	-13	7	-8	11
Gross Inland Deliveries (Obs.)	471	479	518	605	780	641	651	601	659	652	651	738	570	730
Statistical Difference	-56	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	23	14	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	23	14	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	448	465	518	605	780	641	651	601	659	652	651	738	570	730
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	448	465	518	605	780	641	651	601	659	652	651	738	570	730
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	448	465	518	605	780	641	651	601	659	652	651	738	570	730
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	448	465	518	605	780	641	651	601	659	652	651	738	570	730

Table 24: National Energy Balance 1990-2006. LPG [1000 tons].

303A LPG	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gross Output	47	43	60	20	45	30	19	34	0	23	50	57	107	50
Refinery Fuel	8	8	19	6	0	1	4	20	0	2	1	3	49	3
Total Imports (Balance)	97	149	149	184	148	132	152	159	140	155	137	132	133	155
Total Exports (Balance)	14	44	42	42	55	19	20	17	4	7	9	17	20	21
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	2	18	20	-3	-5	3	0	-5	6	-2	-1	5	0	-2
Gross Inland Deliveries (Obs.)	125	158	166	152	132	144	147	150	143	168	176	174	172	179
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1	4	3	3	2	1	1	0	0	1	0	0	0	0
Public Electricity	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Public Heat Plants	1	4	3	3	1	1	1	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	124	153	163	150	130	143	147	150	143	168	176	174	171	179
Total Transport	9	9	11	15	11	13	23	23	23	28	28	28	31	34
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	9	9	11	15	11	13	23	23	23	28	28	28	31	34
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	65	76	62	67	60	66	49	55	48	41	39	31	29	35
Iron and Steel	4	5	3	12	12	13	0	1	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	8	7	6	6	4	5	4	4	4	4	5	4	4	4
Non metallic Mineral Products	12	14	23	21	13	14	15	15	14	10	11	2	2	3
Transportation Equipment	1	2	3	2	10	11	0	1	1	1	1	3	2	2
Machinery	11	13	13	12	10	11	11	14	13	13	11	8	8	9
Mining and Quarrying	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Food, Beverages and Tobacco	3	4	3	2	2	2	5	4	5	3	3	4	3	4
Pulp, Paper and Printing	1	1	1	2	1	1	2	2	1	2	1	1	1	1
Wood and Wood Products	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Construction	23	30	9	8	7	7	9	13	6	5	5	5	5	8
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	1	1	1	0	1	1	0	1	1	0	0	0	1
Total Other Sectors	50	68	90	68	59	64	74	72	72	98	109	115	111	111
Commerce - Public Services	32	47	61	34	19	21	26	19	20	48	54	63	55	58
Residential	16	19	26	31	36	39	43	48	48	47	51	48	51	49
Agriculture	2	2	3	3	4	4	4	5	4	4	4	4	4	4
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 25: National Energy Balance 1990-2006. Refinery Gas [1000 tons].

308A Refinery Gas	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Refinery Gross Output	373	327	305	359	351	348	341	312	328	306	235	255	309	390
Refinery Fuel	373	327	305	359	351	348	338	310	327	308	273	293	343	429
Total Imports (Balance)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Exports (Balance)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	0	0	0	2	2	1	0	0	0	0	0
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	2	2	1	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	2	2	1	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	2	2	1	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	2	2	1	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Natural Gas

Table 26: National Energy Balance 1990-2006. Natural Gas [PJNCV].

	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	46.4	47.7	53.3	53.7	51.4	56.4	62.5	64.8	62.2	67.5	75.1	70.5	59.3	66.1
Total Imports (Balance)	187.9	184.1	229.1	236.6	216.9	224.0	219.5	222.8	225.6	234.8	288.4	301.2	339.6	372.5
Total Exports (Balance)	0.0	0.0	0.6	0.0	0.0	0.7	0.0	0.6	14.7	19.1	36.9	53.7	35.0	95.9
Stock Change (National Territory)	-15.1	-0.1	-12.3	-3.3	8.2	4.2	6.9	-11.3	19.1	12.3	-7.2	-2.3	-18.1	-27.4
Gross Inland Deliveries (Obs.)	219.2	231.8	269.6	286.9	276.6	283.9	288.9	275.7	292.2	295.5	319.5	315.7	345.9	315.4
Statistical Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Transformation Sector	74.7	77.0	95.8	108.7	96.9	100.6	102.7	82.9	86.4	89.4	105.4	102.4	117.8	101.0
Public Electricity	28.1	25.6	21.7	36.9	28.7	35.4	37.7	25.4	29.7	24.8	30.0	23.8	41.0	24.4
Public Combined Heat and Power	23.8	24.8	30.8	33.8	31.1	29.4	30.7	27.7	31.0	34.4	42.7	50.9	47.0	51.3
Public Heat Plants	7.6	7.2	9.6	9.0	8.6	8.8	7.4	8.9	5.8	9.6	7.7	7.1	8.9	6.9
Auto Producers of Electricity	9.6	12.2	21.2	18.2	20.7	19.2	16.8	12.0	13.8	7.1	11.0	7.4	7.2	3.7
Auto Producers for CHP	5.7	7.2	12.5	10.7	7.8	7.9	9.6	8.6	5.9	13.5	12.7	12.9	13.2	14.4
Auto Producer Heat Plants	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.4	0.2	0.0	1.2	0.4	0.5	0.4
Gas Works (Transformation)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coke Ovens (Transformation)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Blast Furnaces (Transformation)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Conversion to Liquids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non Specified (Transformation)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Energy Sector	15.8	16.5	18.4	11.5	12.4	12.8	13.6	11.5	12.9	15.6	12.7	14.7	20.0	20.7
Coal Mines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil and Gas Extraction	6.6	6.6	10.8	4.3	4.5	5.5	6.3	5.2	5.6	9.0	6.9	9.9	9.1	9.5
Inputs to Oil Refineries	6.8	6.8	7.6	7.2	7.9	7.3	7.3	6.4	7.4	6.7	5.7	4.8	10.9	11.2
Coke Ovens (Energy)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gas Works (Energy)	2.4	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Power Plants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non Specified (Energy)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Distribution Losses	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Final Consumption	113.5	122.1	144.6	155.8	156.4	159.8	161.7	170.6	182.7	180.0	190.1	188.2	197.2	182.1
Total Transport	4.1	4.1	4.1	4.2	4.2	6.3	7.8	9.7	8.2	5.0	6.6	8.0	9.8	8.2
Road	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipeline Transport	4.1	4.1	4.1	4.2	4.2	6.3	7.8	9.7	8.2	5.0	6.6	8.0	9.8	8.2
Non Specified (Transport)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Industry	69.0	66.7	73.5	77.8	82.6	80.3	81.5	92.4	91.8	95.2	93.5	92.9	97.6	96.5
Iron and Steel	10.5	9.6	11.2	12.1	14.6	14.2	13.8	13.6	13.3	12.4	13.9	13.4	16.1	16.6
Chemical (incl.Petro-Chemical)	7.7	7.1	8.3	8.3	10.1	9.8	12.6	14.4	14.9	14.5	14.8	13.8	14.0	12.8
Non ferrous Metals	1.4	1.2	2.2	2.0	2.4	2.3	2.2	2.3	2.6	2.6	2.9	2.9	3.1	3.3
Non metallic Mineral Products	10.1	10.3	11.1	11.9	13.2	12.9	11.0	11.7	11.9	13.1	13.1	13.1	13.4	12.9
Transportation Equipment	1.5	1.8	2.6	2.4	1.2	1.1	1.0	1.3	1.5	1.2	1.7	2.2	2.2	2.2
Machinery	4.3	4.4	6.1	6.3	5.5	5.4	4.4	4.8	5.1	5.0	5.1	5.3	6.1	6.6
Mining and Quarrying	2.6	2.5	2.5	2.6	2.5	2.5	1.7	2.4	2.6	2.7	2.6	2.6	2.7	2.8
Food, Beverages and Tobacco	8.9	8.9	9.4	9.2	9.6	9.4	12.1	15.1	14.1	17.5	14.3	13.0	11.1	11.4
Pulp, Paper and	12.9	12.2	9.8	10.9	16.9	16.4	16.1	19.5	17.9	18.9	18.0	20.0	20.7	20.0

	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Printing														
Wood and Wood Products	1.7	1.7	2.0	2.3	1.7	1.6	1.8	1.7	1.9	1.9	2.1	1.8	3.3	2.9
Construction	0.7	0.7	1.5	1.5	0.6	0.5	1.6	1.5	1.8	1.6	1.5	1.2	1.3	1.6
Textiles and Leather	3.5	3.3	3.4	3.7	2.4	2.3	2.2	2.9	3.0	2.6	2.2	1.9	1.9	1.9
Non Specified (Industry)	3.1	3.1	3.4	4.5	2.0	1.9	1.1	1.2	1.3	1.3	1.5	1.6	1.6	1.6
Total Other Sectors	40.4	51.3	67.0	73.8	69.7	73.2	72.3	68.5	82.7	79.9	90.0	87.3	89.7	77.4
Commerce - Public Services	7.7	12.1	23.4	24.6	19.2	18.6	17.5	18.0	26.8	24.7	30.4	30.7	28.0	22.0
Residential	32.3	38.8	43.2	48.6	49.9	54.0	54.3	50.0	55.3	54.5	58.9	56.0	61.0	54.8
Agriculture	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.6
Non Specified (Others)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Non-Energy Use	14.9	16.0	10.5	10.8	10.7	10.6	10.6	10.5	9.9	10.3	11.3	10.3	10.8	11.5

Renewable Fuels

Table 27: National Energy Balance 1990-2006. Fuel Wood [PJ].

111A Fuel Wood	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	61.40	66.50	65.76	70.73	65.36	63.42	64.52	58.56	63.62	61.57	62.00	59.17	62.06	58.45
Total Imports (Balance)	2.30	2.84	1.62	2.42	2.02	1.60	1.49	1.80	1.80	2.10	2.53	3.32	3.51	4.14
Total Exports (Balance)	0.04	0.09	0.22	0.11	0.11	0.14	0.03	0.18	0.18	0.38	0.93	1.32	0.84	0.72
Stock Change (National Territory)	-0.55	0.71	0.19	0.24	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross Inland Deliveries (Obs.)	63.12	69.96	67.35	73.29	67.21	64.88	65.98	60.18	65.25	63.29	63.60	61.17	64.73	61.87
Statistical Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transformation Sector	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05
Public Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public Combined Heat and Power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public Heat Plants	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05
Auto Producers of Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Auto Producers for CHP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Auto Producer Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Energy Sector	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal Mines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patent Fuel Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coke Ovens (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blast Furnaces (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas Works (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BKB (Transformation)	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Petroleum refineries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distribution Losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Final Consumption	63.12	69.96	67.35	73.29	67.21	64.67	65.98	60.18	65.25	63.29	63.60	61.12	64.67	61.82
Total Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inland Waterways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Transport)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Industry	0.66	0.74	1.08	0.78	0.27	0.15	1.88	0.96	1.15	1.42	1.07	0.89	0.94	1.54
Iron and Steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemical (incl.Petro-Chemical)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non ferrous Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non metallic Mineral Products	0.05	0.04	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
Transportation Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machinery	0.05	0.05	0.06	0.01	0.02	0.01	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Mining and Quarrying	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food, Beverages and Tobacco	0.12	0.11	0.09	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Pulp, Paper and Printing	0.01	0.03	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wood and Wood Products	0.23	0.25	0.30	0.32	0.08	0.04	1.63	0.72	0.86	1.15	0.78	0.61	0.69	1.30
Construction	0.00	0.00	0.29	0.14	0.08	0.05	0.12	0.11	0.13	0.13	0.13	0.13	0.11	0.11
Textiles and Leather	0.02	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Industry)	0.19	0.21	0.25	0.22	0.08	0.05	0.08	0.08	0.10	0.09	0.09	0.08	0.08	0.07
Total Other Sectors	62.45	69.22	66.28	72.50	66.93	64.52	64.10	59.22	64.10	61.87	62.53	60.23	63.73	60.29
Commerce - Public Services	1.33	1.29	1.17	1.06	0.87	0.49	0.48	0.34	0.49	0.48	0.48	0.52	0.50	0.49
Residential	57.50	63.90	61.25	67.20	62.14	60.24	59.85	55.38	59.84	57.75	58.37	56.17	59.48	56.25
Agriculture	3.63	4.03	3.86	4.24	3.92	3.80	3.77	3.49	3.77	3.64	3.68	3.54	3.75	3.55
Non Specified (Others)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 28: National Energy Balance 1990-2006. Wood Waste [PJ].

116A Wood waste; Other	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	13.67	14.82	18.74	20.57	24.77	23.22	38.75	37.00	40.65	41.15	48.18	54.07	55.94	59.93
Total Imports (Balance)	1.86	2.44	2.14	1.74	2.84	2.34	2.64	2.82	4.09	4.47	4.24	7.09	8.37	19.11
Total Exports (Balance)	2.07	2.12	2.62	2.82	5.18	5.03	6.14	6.51	7.98	6.86	10.41	16.05	13.14	11.50
Stock Change (National Territory)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.26	0.07	-0.03
Gross Inland Deliveries (Obs.)	13.46	15.14	18.26	19.50	22.43	20.53	35.25	33.31	36.77	38.76	42.01	44.85	51.24	67.52
Statistical Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transformation Sector	2.27	3.68	8.64	9.78	10.19	9.18	12.38	12.97	13.64	17.35	17.93	21.29	24.68	33.67
Public Electricity	0.00	0.00	0.00	0.00	0.00	0.01	0.06	0.01	0.53	0.92	1.17	2.45	3.02	6.45
Public Combined Heat and Power	0.00	0.00	0.00	0.07	0.16	0.10	0.38	0.35	1.01	0.74	1.26	3.24	5.07	9.52
Public Heat Plants	2.04	3.02	4.33	5.99	5.98	6.69	6.32	8.06	9.50	11.93	12.02	11.63	12.37	12.14
Auto Producers of Electricity	0.00	0.00	0.19	2.49	2.86	0.27	2.65	1.51	0.81	2.20	2.35	1.67	1.31	2.01
Auto Producers for CHP	0.22	0.66	4.11	1.23	1.19	2.10	2.87	2.96	1.59	1.43	0.93	2.21	2.81	3.54
Auto Producer Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.08	0.21	0.13	0.18	0.09	0.09	0.00
Total Energy Sector	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.45	3.62
Coal Mines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patent Fuel Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coke Ovens (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blast Furnaces (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas Works (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BKB (Transformation)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.45	3.62
Power Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distribution Losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Final Consumption	11.19	11.45	9.63	9.72	12.24	11.35	22.88	20.34	23.13	21.41	24.08	23.56	25.11	30.23
Total Transport	0.08	0.09	0.23	0.25	0.27	0.29	0.34	0.37	0.40	0.43	0.44	0.54	0.54	0.46
Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inland Waterways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Transport)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Industry	9.24	9.12	6.70	6.59	7.58	6.46	15.29	11.74	12.49	10.71	11.38	10.24	11.23	15.20
Iron and Steel	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemical (incl.Petro-Chemical)	2.90	2.90	1.72	2.06	2.41	1.58	3.60	2.52	1.26	1.12	1.33	1.11	1.35	1.28
Non ferrous Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non metallic Mineral Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.05	0.05	0.20
Transportation Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Machinery	0.00	0.00	0.00	0.02	0.02	0.02	0.04	0.05	0.14	0.15	0.22	0.25	0.24	0.16
Mining and Quarrying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
Food, Beverages and Tobacco	0.01	0.01	0.01	0.01	0.00	0.00	0.19	0.21	0.24	0.23	0.15	0.07	0.07	0.07
Pulp, Paper and Printing	3.66	3.47	3.90	2.50	2.76	3.75	4.73	1.95	4.12	2.87	3.06	2.92	3.79	4.85
Wood and Wood Products	2.57	2.62	0.97	1.81	2.08	0.91	5.93	6.13	5.59	5.30	5.51	4.72	4.69	7.61
Construction	0.04	0.04	0.03	0.05	0.07	0.05	0.31	0.36	0.41	0.40	0.39	0.40	0.43	0.39
Textiles and Leather	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
Non Specified (Industry)	0.07	0.08	0.07	0.11	0.24	0.15	0.49	0.52	0.74	0.62	0.64	0.70	0.59	0.61
Total Other Sectors	1.87	2.25	2.70	2.88	4.40	4.60	7.25	8.22	10.23	10.27	12.27	12.78	13.34	14.57
Commerce - Public Services	0.76	0.85	0.70	0.58	1.42	1.35	1.72	2.13	2.23	2.20	2.64	3.72	3.95	3.71
Residential	0.55	0.74	1.14	1.33	1.80	2.20	3.89	4.29	5.68	5.72	6.87	5.88	5.91	7.61
Agriculture	0.55	0.66	0.86	0.97	1.18	1.05	1.64	1.81	2.32	2.36	2.76	3.19	3.49	3.25
Non Specified (Others)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 29: National Energy Balance 1990-2006. Black Liquor [PJ].

215A Black Liquor	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	17.80	17.74	21.39	21.17	21.67	22.92	23.65	24.12	23.30	22.78	22.97	24.31	24.45	24.74
Total Imports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Exports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stock Change (National Territory)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross Inland Deliveries (Obs.)	17.80	17.74	21.39	21.17	21.67	22.92	23.65	24.12	23.30	22.78	22.97	24.31	24.45	24.74
Statistical Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transformation Sector	5.26	5.67	9.27	9.51	8.58	11.35	10.18	7.62	7.61	9.96	11.04	10.73	11.74	11.40
Public Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public Combined Heat and Power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Auto Producers of Electricity	2.62	2.82	5.27	5.41	5.48	8.87	6.16	2.00	3.12	2.78	6.65	6.19	6.56	6.69
Auto Producers for CHP	2.64	2.85	4.00	4.10	3.10	2.49	4.02	5.62	4.50	7.18	4.39	4.54	5.18	4.70
Auto Producer Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Energy Sector	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal Mines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patent Fuel Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coke Ovens (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blast Furnaces (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas Works (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BKB (Transformation)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distribution Losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Final Consumption	12.54	12.07	12.12	11.67	13.09	11.56	13.47	16.50	15.69	12.82	11.94	13.58	12.71	13.34
Total Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inland Waterways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Transport)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Industry	12.54	12.07	12.12	11.67	13.09	11.56	13.47	16.50	15.69	12.82	11.94	13.58	12.71	13.34
Iron and Steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemical (incl.Petro-Chemical)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non ferrous Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non metallic Mineral Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machinery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining and Quarrying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
Food, Beverages and Tobacco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pulp, Paper and Printing	12.54	12.07	12.12	11.67	13.09	11.56	13.38	16.44	15.63	12.76	11.88	13.51	12.64	13.28
Wood and Wood Products	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.06	0.06	0.06	0.06	0.05	0.05	0.05
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Textiles and Leather	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Industry)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
Total Other Sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commerce - Public Services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Others)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 30: National Energy Balance 1990-2006. Biogas [TJ].

309A Biogas	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	0.00	0.00	0.04	0.04	0.05	0.03	0.22	0.36	0.27	2.56	0.33	0.48	0.68	0.94
Total Imports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Exports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stock Change (National Territory)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross Inland Deliveries (Obs.)	0.00	0.00	0.04	0.04	0.05	0.03	0.22	0.36	0.27	2.56	0.33	0.48	0.68	0.94
Statistical Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transformation Sector	0.00	0.00	0.04	0.04	0.05	0.03	0.12	0.22	0.17	0.20	0.20	0.28	0.47	0.84
Public Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.13	0.12
Public Combined Heat and Power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.20	0.24
Public Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22
Auto Producers of Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.12	0.07	0.11	0.11	0.06	0.05	0.16
Auto Producers for CHP	0.00	0.00	0.04	0.04	0.05	0.03	0.09	0.10	0.10	0.10	0.09	0.06	0.09	0.11
Auto Producer Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Energy Sector	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal Mines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patent Fuel Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coke Ovens (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blast Furnaces (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas Works (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BKB (Transformation)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distribution Losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Final Consumption	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.15	0.10	2.36	0.13	0.20	0.21	0.10
Total Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inland Waterways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Transport)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.15	0.10	2.36	0.13	0.20	0.21	0.10
Iron and Steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemical (incl.Petro-Chemical)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00
Non ferrous Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non metallic Mineral Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machinery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining and Quarrying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food, Beverages and Tobacco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.08	0.09	0.00
Pulp, Paper and Printing	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.12	0.10	2.02	0.11	0.11	0.11	0.10
Wood and Wood Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Textiles and Leather	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Industry)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Other Sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commerce - Public Services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Others)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 31: National Energy Balance 1990-2006. Sewage Sludge Gas [PJ].

309B Sewage sludge gas	**1990**	**1991**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Indigenous Production	0.00	0.00	0.62	0.67	0.69	0.71	0.37	0.47	0.33	0.06	0.24	0.25	0.27	0.19
Total Imports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Exports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stock Change (National Territory)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross Inland Deliveries (Obs.)	0.00	0.00	0.62	0.67	0.69	0.71	0.37	0.47	0.33	0.06	0.24	0.25	0.27	0.19
Statistical Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transformation Sector	0.00	0.00	0.62	0.67	0.69	0.71	0.02	0.11	0.03	0.06	0.05	0.10	0.11	0.04
Public Electricity	0.00	0.00	0.01	0.03	0.05	0.05	0.00	0.08	0.00	0.06	0.05	0.06	0.05	0.00
Public Combined Heat and Power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Public Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Auto Producers of Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.03	0.03	0.00	0.00	0.01	0.02	0.00
Auto Producers for CHP	0.00	0.00	0.61	0.64	0.63	0.66	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.00
Auto Producer Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Energy Sector	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal Mines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patent Fuel Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coke Ovens (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blast Furnaces (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas Works (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BKB (Transformation)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distribution Losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Final Consumption	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.36	0.30	0.00	0.19	0.15	0.15	0.15
Total Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inland Waterways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Transport)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.36	0.30	0.00	0.19	0.15	0.15	0.15
Iron and Steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemical (incl.Petro-Chemical)	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.36	0.30	0.00	0.19	0.15	0.15	0.15
Non ferrous Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non metallic Mineral Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machinery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining and Quarrying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food, Beverages and Tobacco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pulp, Paper and Printing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wood and Wood Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Textiles and Leather	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Industry)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Other Sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commerce - Public Services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Others)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 32: National Energy Balance 1990-2006. Landfill Gas [PJ].

310A Landfill Gas	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	0.00	0.00	0.20	0.31	0.52	0.53	0.50	0.44	0.47	0.36	0.49	0.46	0.35	0.38
Total Imports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Exports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stock Change (National Territory)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross Inland Deliveries (Obs.)	0.00	0.00	0.20	0.31	0.52	0.53	0.50	0.44	0.47	0.36	0.49	0.46	0.35	0.38
Statistical Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transformation Sector	0.00	0.00	0.15	0.27	0.52	0.52	0.50	0.44	0.47	0.36	0.49	0.46	0.35	0.38
Public Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.07	0.06	0.21	0.05	0.04	0.04
Public Combined Heat and Power	0.00	0.00	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Public Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Auto Producers of Electricity	0.00	0.00	0.12	0.24	0.49	0.49	0.48	0.43	0.41	0.30	0.27	0.40	0.23	0.33
Auto Producers for CHP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.01
Auto Producer Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Energy Sector	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal Mines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patent Fuel Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coke Ovens (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blast Furnaces (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas Works (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BKB (Transformation)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distribution Losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Final Consumption	0.00	0.00	0.05	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inland Waterways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Transport)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron and Steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemical (incl.Petro-Chemical)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non ferrous Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non metallic Mineral Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machinery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining and Quarrying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food, Beverages and Tobacco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pulp, Paper and Printing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wood and Wood Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Textiles and Leather	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Industry)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Other Sectors	0.00	0.00	0.05	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commerce - Public Services	0.00	0.00	0.05	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Others)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 33: National Energy Balance 1990-2006. Municipal Solid Waste [PJ].

114B Municipal Solid Waste	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	2.41	2.90	3.91	4.77	4.89	4.78	4.74	4.51	4.65	4.91	5.77	7.58	7.17	11.07
Total Imports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Exports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stock Change (National Territory)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross Inland Deliveries (Obs.)	2.41	2.90	3.91	4.77	4.89	4.78	4.74	4.51	4.65	4.91	5.77	7.58	7.17	11.07
Statistical Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transformation Sector	2.41	2.90	3.91	4.77	4.89	4.78	4.74	4.51	4.65	4.91	5.77	7.58	7.17	11.07
Public Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.58	0.63	0.67	1.55	2.89	2.78	2.31
Public Combined Heat and Power	1.72	2.18	2.32	2.50	2.59	2.58	2.34	2.23	2.24	2.28	2.41	2.60	2.41	2.26
Public Heat Plants	0.69	0.72	1.59	2.27	2.30	2.20	1.67	1.69	1.78	1.96	1.81	1.89	1.97	2.86
Auto Producers of Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	3.35
Auto Producers for CHP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.30
Auto Producer Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Energy Sector	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal Mines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patent Fuel Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coke Ovens (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blast Furnaces (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas Works (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BKB (Transformation)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distribution Losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Final Consumption	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inland Waterways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Transport)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron and Steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemical (incl.Petro-Chemical)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non ferrous Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non metallic Mineral Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machinery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining and Quarrying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food, Beverages and Tobacco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pulp, Paper and Printing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wood and Wood Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Textiles and Leather	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Industry)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Other Sectors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commerce - Public Services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Others)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 34: National Energy Balance 1990-2006. Industrial Waste [PJ].

115A Industrial Waste	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Indigenous Production	6.58	7.18	7.00	9.25	8.23	7.50	6.76	7.67	9.74	11.36	12.47	14.43	13.12	14.41
Total Imports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Exports (Balance)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stock Change (National Territory)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gross Inland Deliveries (Obs.)	6.58	7.18	7.00	9.25	8.23	7.50	6.76	7.67	9.74	11.36	12.47	14.43	13.12	14.41
Statistical Difference	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Transformation Sector	2.54	1.94	1.93	4.74	3.61	2.15	2.32	1.59	1.78	2.72	2.88	3.17	2.51	2.69
Public Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.13	0.03	0.80	1.16	0.99	0.67	0.74
Public Combined Heat and Power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94	1.05	0.81	0.81	0.67	0.74
Public Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Auto Producers of Electricity	0.00	0.00	0.00	1.61	1.27	0.54	1.12	0.44	0.34	0.31	0.28	0.18	0.18	0.16
Auto Producers for CHP	2.54	1.94	1.93	3.12	2.34	1.61	1.20	1.02	0.47	0.57	0.62	1.18	0.99	1.05
Auto Producer Heat Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Energy Sector	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal Mines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Patent Fuel Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coke Ovens (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blast Furnaces (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas Works (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BKB (Transformation)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum refineries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Plants	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Energy)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Distribution Losses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Final Consumption	4.03	5.24	5.08	4.51	4.61	5.35	4.45	6.08	7.95	8.64	9.60	11.27	10.62	11.72
Total Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rail	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inland Waterways	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Transport)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Industry	2.92	4.27	4.56	3.96	4.03	4.74	3.84	5.52	7.33	8.02	8.95	10.59	9.93	10.99
Iron and Steel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chemical (incl.Petro-Chemical)	1.57	2.02	1.91	0.99	1.17	1.10	0.09	1.64	1.92	2.41	2.98	4.11	3.79	4.35
Non ferrous Metals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non metallic Mineral Products	1.31	1.67	1.98	2.17	2.10	2.66	2.88	3.56	4.55	4.96	5.31	5.34	5.01	5.69
Transportation Equipment	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machinery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.01
Mining and Quarrying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food, Beverages and Tobacco	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pulp, Paper and Printing	0.00	0.00	0.00	0.06	0.07	0.07	0.14	0.00	0.11	0.09	0.11	0.13	0.12	0.12
Wood and Wood Products	0.04	0.48	0.55	0.65	0.59	0.79	0.69	0.28	0.69	0.50	0.47	0.94	0.90	0.75
Construction	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03
Textiles and Leather	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
Non Specified (Industry)	0.01	0.08	0.09	0.07	0.08	0.09	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.05
Total Other Sectors	1.11	0.97	0.52	0.55	0.58	0.61	0.61	0.56	0.63	0.62	0.65	0.68	0.69	0.73
Commerce - Public Services	1.11	0.97	0.52	0.55	0.58	0.61	0.61	0.56	0.63	0.62	0.65	0.68	0.69	0.73
Residential	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non Specified (Others)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Net Calorific Values

At the following the selected net calorific values of each fuel are presented.

Table 35 present the net calorific values (IEA JQ 2007) used for unit conversion.

Table 35: Net calorific values for 1990-2006 in [MJ/kg], [MJ/m³] taken from (IEA JQ 2007).

Fuel Code	Fuel Name		1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
101A	Coking Coal	T	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07	29.07
102A	Hard Coal	FC	28.00	28.00	28.00	28.00	28.00	28.00	27.66	27.99	27.99	27.50	27.50	28.41	28.14	28.07
		T	28.00	28.00	28.00	28.00	28.00	28.00	27.56	26.74	27.72	27.37	27.43	28.42	27.92	27.78
104A	Hard Coal Briquettes	A	-	-	-	-	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00
105A	Brown Coal	FC	10.90	10.90	10.90	9.90	9.90	9.90	9.77	9.82	9.79	9.82	9.82	9.91	16.05	21.00
		T	10.90	10.90	10.90	9.90	9.90	9.90	9.79	9.86	10.08	9.74	9.48	9.29	9.09	9.48
106A	Brown Coal Briquettes	T	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30	19.30
107A	Coke Oven Coke	T	28.50	28.50	28.50	28.20	28.20	28.20	29.00	29.00	29.00	29.00	29.00	29.00	29.00	29.00
113A	Peat	FC	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80
304A	Coke Oven Gas	P	17.90	17.90	17.90	17.90	17.90	17.90	17.90	17.90	17.90	17.60	17.90	17.90	17.90	17.93
305A	Blast Furnace Gas	P	3.10	3.10	3.10	3.10	3.10	3.10	4.10	4.10	4.10	4.27	3.70	3.69	3.65	3.57
110A	Petrol Coke	A	34.30	34.30	28.40	32.20	32.80	34.00	33.92	33.92	33.92	31.33	31.33	31.33	31.33	30.89
201A	Crude Oil	A	42.50	42.50	42.50	42.50	42.50	42.50	42.52	42.52	42.50	42.50	42.52	42.52	42.51	42.52
203X	Residual Fuel Oil	A	41.00	41.10	40.50	40.30	40.30	40.30	41.50	41.49	41.69	41.49	41.44	41.30	41.66	41.29
204A	Gasoil	A	42.60	42.60	42.70	42.80	42.80	42.80	42.80	42.80	42.82	42.80	42.80	42.80	42.80	42.80
2050	Diesel	A	42.60	42.60	42.70	42.70	42.70	42.70	42.80	42.80	42.80	42.80	42.80	42.80	42.80	42.80
206A	Petroleum	A	43.60	43.60	43.30	43.40	43.40	43.40	43.31	43.30	43.30	43.30	43.30	43.30	43.30	43.30
206B	Kerosene	A	43.60	43.60	43.30	43.40	43.40	43.40	43.31	43.30	43.30	43.30	43.30	43.30	43.30	43.30
207A	Aviation Gasoline	A	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.51	42.49	42.49	42.50	42.49	43.20
2080	Motor Gasoline	A	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.51	42.49	42.49	42.50	42.49	43.20
217A	Refinery Feedstocks	A	41.87	42.24	42.56	42.63	42.68	42.25	42.27	42.56	42.65	42.77	42.05	42.72	42.24	42.75
219A	Lubricants	A	41.40	41.30	41.10	41.30	41.40	40.90	40.24	40.61	40.75	36.87	37.73	37.73	37.73	37.73
220A	White Spirit	A	41.60	41.60	42.50	42.50	42.50	42.50	44.10	44.10	44.10	44.10	44.10	44.10	44.10	49.75
222A	Bitumen	A	41.80	41.80	41.80	41.80	41.80	41.80	44.04	43.62	43.47	44.15	43.95	43.52	44.01	44.10
224A	Other Petroleum Products	FC	34.30	34.30	28.40	32.20	32.80	34.00	33.92	33.92	33.92	31.33	31.33	31.33	31.33	30.89
		NE	41.80	41.80	41.80	41.80	41.80	41.80	44.04	43.62	43.47	44.15	43.95	43.52	44.01	44.10
302A	NGL	A	42.50	42.50	42.50	42.50	42.50	42.50	42.52	42.52	42.50	42.50	42.52	42.52	42.51	42.52
303A	LPG	A	46.30	46.20	46.30	46.30	46.30	46.30	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
308A	Refinery Gas	A	49.00	49.00	49.00	49.00	49.00	49.00	42.23	45.93	45.93	45.93	45.93	45.93	45.93	45.93
301A	Natural Gas	A	36.00	36.00	36.00	36.00	36.00	36.00	35.85	35.85	35.85	35.85	35.85	35.85	36.36	36.36

Legend: A..Average; T..Transformation; FC..Final Consumption; P..Production; NE..Non Energy use; NGL..Natural Gas Liquids; LPG..Liquified Petroleum Gas

Table 36 present the net calorific values from STATISTIK AUSTRIA, which are used for default unit conversion.

Table 36: Default net calorific values from STATISTIK AUSTRIA.

Fuel Name	NCV	Unit
Municipal Waste / renewable	8.93	MJ/kg
Municipal Waste / non renewable	9.14	MJ/kg
Industrial Waste	15.76	MJ/kg
Fuel Wood	15.50	MJ/kg
Wood Wastes	11.36	MJ/kg
Bark	7.54	MJ/kg
Sewage Sludge (wet substance)	3.64	MJ/kg
Black Liquor	7.92	MJ/kg
Carcass meal	17.30	MJ/kg
Adipose	36.59	MJ/kg
Liquid Biofuels	42.00	MJ/kg
Biogas	22.06	MJ/m^3
Gas from Waste Disposal Site	17.00	MJ/m^3

Table 37 present IPCC default values of net calorific values of gaseous biofuels which are used for default unit conversion.

Table 37: Default net calorific values from IPCC Guidelines.

Fuel Name	NCV	Unit
Sewage Sludge Gas	27.00	MJ/m^3

ANNEX 5: RECALCULATIONS

This Annex presents the implication of recalculations for emission levels by category for CO_2, CH_4, N_2O and FCs and the recalculation differences of national total emissions by gas.

Table 1: IPCC codes and names of categories

Category	Name	Category	Name
Total	National Total without LULUCF	4 D 1	Direct Soil Emissions
1	ENERGY	4 D 3	Indirect Emissions
1 A 1	Energy Industries	4 F 5	Other
1 A 2	Manufacturing Industries and Construction	5	LAND USE, LAND USE CHANGE AND FORESTRY
1 A 3	Transport	5 A 1	Forest land remaining forest land
1 A 4	Other Sectors	5 A 2	Land converted to forest land
1 A 5	Other	5 B 1	Cropland remaining cropland
1 B	Fugitive Emissions From Fuels	5 B 2	Land converted to cropland
2	INDUSTRIAL PROCESSES	5 C 1	Grassland remaining grassland
2 B 1	Ammonia Production	5 C 2	Land converted to grassland
2 C 2	Ferroalloys Production	5 D 2	Land converted to Wetlands
3	SOLVENT AND OTHER PRODUCT USE	5 E 2	Land converted to Settlements
3 A	Paint Application	5 F 2	Land converted to Other land
3 B	Degreasing and Dry Cleaning	6	WASTE
3 C	Chemical Products, Manufacture and Processing	6 A 1	Managed Waste Disposal
3 D	Other	6 B 1	Industrial Wastewater
4	AGRICULTURE	6 B 2	Domestic and Commercial Wastewater
4 A 1	Cattle	6 D 2	Compost Production
4 B 1	Cattle		

Recalculation of CO_2 Emissions by Categories

Explanations are provided in Chapter 9 Recalculations and Improvements and in the sector specific chapters of this report.

Table 2: Recalculation Difference of CO_2 Emissions 1990-1999

IPCC Cat.	CO_2 [Gg] Differences with respect to Submission 2007									
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Total	154.60	191.14	187.17	132.80	167.13	304.28	79.55	50.51	-38.65	203.89
1	154.60	191.14	187.17	132.80	167.13	304.28	79.52	50.50	-38.68	203.89
1 A 1	133.20	170.11	166.83	113.70	149.51	281.45	68.83	52.63	141.89	391.63
1 A 2	-133.44	-4.50	-150.63	-81.85	-60.98	-35.88	-2.73	-4.66	-200.28	196.27
1 A 3	25.22	25.51	25.10	22.17	20.57	21.49	19.79	10.43	9.75	11.04
1 A 4	129.63	0.03	145.87	78.79	58.03	37.23	-6.37	-7.89	9.97	-395.05
1 A 5	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.02	0.00
2 B 1	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.02	0.00
2 C 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	NA=	NA=	NA=	NA=	NA=	NA=	NA=	NA=	NA=	NA=
5	-2 498.96	-2 667.22	-2 664.57	-2 734.88	-2 661.36	-2 464.85	-2 473.40	-2 137.97	-1 992.59	-1 795.75
5 A 1	714.75	736.46	758.17	767.64	725.78	962.07	880.51	811.19	741.87	713.68
5 A 2	-4 509.97	-4 646.95	-4 783.93	-4 935.41	-4 675.60	-4 358.45	-4 054.19	-3 735.42	-3 416.66	-3 286.74
5 B 1	410.63	410.09	399.55	354.35	368.88	198.16	242.55	247.74	230.60	238.17
5 B 2	1 678.25	1 682.96	1 690.34	1 703.24	1 705.50	1 699.35	1 704.34	1 706.79	1 709.03	1 715.23
5 C 1	32.97	33.34	33.29	33.70	33.41	33.05	32.69	32.34	31.97	31.85
5 C 2	-1 320.06	-1 309.77	-1 301.06	-1 265.20	-1 282.29	-1 405.37	-1 398.08	-1 419.90	-1 441.42	-1 451.90
5 D 2	-23.79	-7.63	8.52	26.78	32.72	33.36	55.12	60.84	52.38	62.72
5 E 2	-332.47	-437.24	-359.57	-343.76	-458.85	-429.46	-709.78	-571.82	-586.36	-487.04
5 F 2	670.11	689.40	708.69	742.39	707.61	618.51	589.52	546.10	502.69	485.01
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 3: Recalculation Difference of CO_2 Emissions 2000-2005

IPCC Cat.	CO_2 [Gg] Differences with respect to Submission 2007					
	2000	**2001**	**2002**	**2003**	**2004**	**2005**
Total	-31.75	155.44	405.66	298.93	389.10	-134.94
1	-31.75	133.95	369.67	266.83	354.87	-150.03
1 A 1	62.38	479.23	239.83	137.53	310.80	261.73
1 A 2	179.20	70.92	279.02	322.78	158.82	369.98
1 A 3	10.63	6.52	6.83	7.30	6.88	-14.99
1 A 4	-283.96	-422.72	-156.01	-200.79	-121.62	-766.73
1 A 5	0.00	0.00	0.00	0.00	0.00	-0.03
1 B	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	2.19	2.36
2 B 1	0.00	0.00	0.00	0.00	2.19	0.00
2 C 2	0.00	0.00	0.00	0.00	0.00	2.36
3	0.00	21.49	35.99	32.10	32.03	12.74
3 A	0.00	8.09	13.64	12.81	13.08	6.88
3 B	0.00	3.48	5.40	4.57	4.22	1.08
3 C	0.00	-1.28	-1.40	-1.92	-1.75	-2.57
3 D	0.00	11.20	18.35	16.65	16.48	7.35
4	NA=	NA=	NA=	NA=	NA=	NE->NA
5	-1 749.75	-1 707.81	-1 583.24	-1 468.33	-1 600.52	-1 170.54
5 A 1	685.49	657.29	627.72	599.42	591.89	584.36
5 A 2	-3 156.82	-3 026.90	-2 896.97	-2 767.05	-2 732.46	-2 697.88
5 B 1	236.36	237.08	261.48	239.52	169.29	244.94
5 B 2	1 721.86	1 696.67	1 760.20	1 789.11	1 751.51	1 792.28
5 C 1	31.73	31.44	31.51	31.33	31.27	32.48
5 C 2	-1 462.47	-1 460.63	-1 503.37	-1 505.10	-1 545.87	-1 491.14
5 D 2	73.06	81.30	89.53	97.76	106.31	229.47
5 E 2	-526.99	-554.25	-564.57	-548.14	-553.49	-432.47
5 F 2	467.32	449.64	431.95	414.27	400.57	386.86
6	0.00	0.00	0.00	0.00	0.00	0.00

Recalculation of CH_4 Emissions by Categories

Explanations are provided in Chapter 9 Recalculations and Improvements and in the sector specific chapters of this report.

Table 4: Recalculation Difference of CH_4 Emissions 1990-1999

IPCC Cat.	CH_4 [Gg] Differences with respect to Submission 2007									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	0.16	0.49	0.76	0.97	1.01	1.00	0.90	0.81	0.80	0.78
1	0.16	0.49	0.76	0.97	1.02	1.00	0.90	0.81	0.80	0.79
1 A 1	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01
1 A 2	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
1 A 3	0.16	0.49	0.75	0.97	1.01	0.99	0.89	0.81	0.80	0.68
1 A 4	0.01	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.10
1 B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	NA=	NA=	NA=	NA=	NA=	NA=	NA=	NA=	NA=	NA=
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 A 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 B 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 D 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 F 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 A 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 B 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 D 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5: Recalculation Difference of CH_4 Emissions 2000-2005

IPCC Cat.	CH_4 [Gg] Differences with respect to Submission 2007					
	2000	2001	2002	2003	2004	2005
Total	0.80	0.94	1.18	0.46	0.12	0.68
1	0.81	0.46	0.55	0.67	0.38	0.42
1 A 1	0.00	0.02	0.01	0.01	0.01	0.01
1 A 2	0.02	0.00	0.00	0.00	0.01	0.02
1 A 3	0.61	0.57	0.55	0.50	0.42	0.35
1 A 4	0.18	-0.13	0.00	0.17	-0.06	-0.14
1 B	0.00	0.00	0.00	0.00	0.00	0.18
2	0.00	0.00	0.00	0.00	0.00	0.00
3	NA=	NA=	NA=	NA=	NA=	NA=
4	0.00	0.00	0.00	-0.66	-1.39	-0.64
4 A 1	0.00	0.00	0.00	-0.64	-1.32	-0.61

IPCC Cat.	CH_4 [Gg] Differences with respect to Submission 2007					
	2000	2001	2002	2003	2004	2005
4 B 1	0.00	0.00	0.00	-0.03	-0.07	-0.03
4 D 1	0.00	0.00	0.00	0.00	0.00	0.00
4 F 5	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00
6	-0.01	0.48	0.63	0.45	1.13	0.90
6 A 1	0.00	0.49	0.62	0.53	0.94	0.81
6 B 2	0.00	0.00	0.00	0.00	0.00	0.00
6 D 2	-0.01	0.00	0.01	-0.09	0.18	0.09

Recalculation of N_2O Emissions by Categories

Explanations are provided in Chapter 9 Recalculations and in the sector specific chapters of this report.

Table 6: Recalculation Difference of N_2O Emissions 1990-1999

IPCC Cat.	N_2O [Gg] Differences with respect to Submission 2007									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	-0.13	-0.19	-0.23	-0.27	-0.14	0.01	-0.09	-0.03	0.03	0.16
1	-0.27	-0.36	-0.39	-0.41	-0.38	-0.32	-0.24	-0.19	-0.15	-0.09
1 A 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
1 A 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00
1 A 3	-0.27	-0.36	-0.39	-0.41	-0.38	-0.32	-0.24	-0.18	-0.15	-0.07
1 A 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01
1 A 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 B	IE=	IE=	IE=	IE=	IE=	IE=	IE=	IE=	IE=	IE=
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.14	0.17	0.17	0.16	0.28	0.34	0.17	0.18	0.18	0.26
4 D 1	0.14	0.17	0.17	0.16	0.28	0.34	0.17	0.18	0.18	0.26
4 D 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 F 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.78	0.78	0.78	0.78	0.79	0.79	0.79	0.79	0.80	0.80
5.B.2	0.78	0.78	0.78	0.78	0.79	0.79	0.79	0.79	0.80	0.80
6	0.00	0.00	-0.01	-0.03	-0.04	0.00	-0.01	-0.02	0.00	-0.01
6 B 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 B 2	0.00	0.00	-0.01	-0.03	-0.04	0.00	-0.01	-0.02	0.00	0.00
6 D 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01

Table 7: Recalculation Difference of N_2O Emissions 2000-2005

IPCC Cat.	**N_2O [Gg] Differences with respect to Submission 2007**					
	2000	**2001**	**2002**	**2003**	**2004**	**2005**
Total	0.11	0.16	0.18	0.13	0.27	0.31
1	-0.04	-0.03	0.02	0.05	0.09	0.12
1 A 1	-0.01	-0.01	0.00	0.00	0.00	0.01
1 A 2	0.00	-0.02	-0.02	-0.02	-0.01	-0.02
1 A 3	-0.03	0.00	0.03	0.06	0.09	0.12
1 A 4	0.00	-0.01	0.00	0.01	0.01	0.00
1 A 5	0.00	0.00	0.00	0.00	0.00	0.00
1 B	IE=	IE=	IE=	IE=	IE=	IE=
2	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00
4	0.17	0.20	0.17	0.11	0.16	0.14
4 D 1	0.17	0.20	0.17	0.11	0.16	0.14
4 D 3	0.00	0.00	0.00	0.00	0.00	0.00
4 F 5	0.00	0.00	0.00	0.00	0.00	0.00
5	0.80	0.81	0.82	0.82	0.83	0.83
5.B.2.	0.80	0.81	0.82	0.82	0.83	0.83
6	-0.02	-0.01	-0.01	-0.02	0.02	0.05
6 B 1	0.00	0.00	0.00	0.00	0.00	0.01
6 B 2	-0.01	0.00	0.00	0.00	0.00	0.04
6 D 2	-0.01	-0.01	-0.01	-0.02	0.02	0.01

Recalculation of National Total GHG Emissions

Table 8 compares national total GHG emissions of UNFCCC submission 2008 with UNFCCC submission 2007. Explanations are provided in Chapter 9 Recalculations and in the sector specific chapters of this report.

Table 8: Recalculation Difference of National Total GHG Emissions

Year	National Total GHG emissions without LUCF		
	Submission 2007 [Gg CO_2e]	Submission 2008 [Gg CO_2e]	Recalculation Difference [%]
1990*	79053	79172	0.15%
1991	83101	83243	0.17%
1992	76394	76525	0.17%
1993	76357	76425	0.09%
1994	77195	77340	0.19%
1995	80294	80624	0.41%
1996	83624	83695	0.08%
1997	83201	83259	0.07%
1998	82627	82614	-0.02%
1999	80749	81018	0.33%
2000	81116	81136	0.02%
2001	85056	85279	0.26%
2002	86680	87166	0.56%
2003	92953	93300	0.37%
2004	91177	91663	0.53%
2005	93280	93260	-0.02%

*Base year is 1990 for all gases

Table 9 and Table 10 present recalculation differences per gas.

Table 9: Recalculation Difference of National CO_2 and CH_4 Emissions.

Year	CO_2 [Gg CO_2e]			CH_4 [Gg CO_2e]		
	Submission 2007	Submission 2008	Recalc. Difference [%]	Submission 2007	Submission 2008	Recalc. Difference [%]
1990*	61 930.34	62 084.94	0.25%	9 180.67	9 184.05	0.04%
1991	65 483.30	65 674.44	0.29%	9 152.25	9 162.64	0.11%
1992	60 041.64	60 228.81	0.31%	8 859.08	8 875.04	0.18%
1993	60 411.34	60 544.14	0.22%	8 831.72	8 852.11	0.23%
1994	60 763.27	60 930.40	0.28%	8 638.61	8 659.92	0.25%
1995	63 660.94	63 965.22	0.48%	8 522.03	8 543.04	0.25%
1996	67 327.21	67 406.76	0.12%	8 334.90	8 353.70	0.23%
1997	67 147.96	67 198.47	0.08%	8 059.81	8 076.73	0.21%
1998	66 811.89	66 773.24	-0.06%	7 938.25	7 955.03	0.21%

Year	CO_2 [Gg CO_2e]			CH_4 [Gg CO_2e]		
	Submission 2007	Submission 2008	Recalc. Difference [%]	Submission 2007	Submission 2008	Recalc. Difference [%]
1999	65 336.62	65 540.51	0.31%	7 764.56	7 781.04	0.21%
2000	65 960.13	65 928.38	-0.05%	7 604.98	7 621.74	0.22%
2001	70 044.56	70 200.00	0.22%	7 487.32	7 507.02	0.26%
2002	71 709.42	72 115.08	0.57%	7 356.12	7 380.94	0.34%
2003	77 972.46	78 271.39	0.38%	7 373.07	7 382.76	0.13%
2004	77 139.93	77 529.03	0.50%	7 221.97	7 224.40	0.03%
2005	79 650.36	79 515.42	-0.17%	7 057.09	7 071.42	0.20%

*Base year is 1990 for all gases

Table 10: Recalculation Difference of National N_2O and HFC, PFC, SF_6 Emissions

Year	N_2O [Gg CO_2e]			HFC, PFC, SF_6 [Gg CO_2e]		
	Submission 2006	Submission 2007	Recalc. Difference [%]	Submission 2006	Submission 2007	Recalc. Difference [%]
1990*	6 337.12	6 297.68	-0.62%	1 604.86	1 604.86	0.00%
1991	6 679.74	6 620.09	-0.89%	1 785.66	1 785.66	0.00%
1992	6 284.25	6 211.79	-1.15%	1 209.19	1 209.19	0.00%
1993	6 110.31	6 025.27	-1.39%	1 003.96	1 003.95	0.00%
1994	6 541.59	6 498.06	-0.67%	1 251.17	1 251.14	0.00%
1995	6 636.25	6 640.48	0.06%	1 475.24	1 475.19	0.00%
1996	6 330.75	6 303.29	-0.43%	1 631.16	1 631.10	0.00%
1997	6 349.04	6 339.64	-0.15%	1 644.41	1 644.33	0.00%
1998	6 429.18	6 438.58	0.15%	1 447.63	1 447.54	-0.01%
1999	6 357.00	6 405.50	0.76%	1 290.70	1 290.60	-0.01%
2000	6 248.71	6 284.00	0.56%	1 301.90	1 301.78	-0.01%
2001	6 110.55	6 159.04	0.79%	1 413.86	1 413.09	-0.05%
2002	6 104.10	6 161.31	0.94%	1 510.12	1 508.64	-0.10%
2003	6 047.04	6 086.95	0.66%	1 560.87	1 558.66	-0.14%
2004	5 288.51	5 373.74	1.61%	1 526.86	1 535.37	0.56%
2005	5 255.81	5 353.37	1.86%	1 316.29	1 319.40	0.24%

*Base year is 1990 for all gases

ANNEX 6: UNCERTAINTY ASSESSMENT

This Annex includes the Tier 1 Uncertainty assessment that complies with Table 6.1 of the IPCC GPG as well as the Tier 2 Uncertainty assessment that complies with Table 6.2 of the IPCC GPG.

A	B	C	D	E	F	G	H
IPCC Source category	Gas	Base year emissions 1990	Year 2006 emissions	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t
		Gg CO2 equivalent		%	%	%	%
1.A.1.a liquid: Public Electricity and Heat Production	CO2	1 228.7	1 170.6	0.5	0.5	0.7	0.01
1.A 1.a other: Public Electricity and Heat Production	CO2	118.0	695.5	10.0	20.0	22.4	0.18
1.A 1.a solid: Public Electricity and Heat Production	CO2	6 247.0	5 642.5	0.5	0.5	0.7	0.05
1.A 1.b liquid: Petroleum refining	CO2	1 957.7	2 153.4	0.5	0.3	0.6	0.01
1.A.2 mobile-liquid: Manufacturing Industries and Construction	CO2	1 016.0	1 119.0	3.0	0.5	3.0	0.04
1.A.2 other: Manufacturing Industries and Construction	CO2	264.1	861.7	10.0	20.0	22.4	0.22
1.A.2 solid: Manufacturing Industries and Construction	CO2	5 016.3	5 666.2	1.0	0.5	1.1	0.07
1.A.2 stat-liquid: Manufacturing Industries and Construction	CO2	2 883.6	1 880.7	3.0	0.5	3.0	0.06
1.A.3.a jet kerosene: Civil Aviation	CO2	24.2	218.2	3.0	3.0	4.2	0.01
1.A.3.b diesel oil: Road Transportation	CO2	4 012.9	15 788.4	3.0	3.0	4.2	0.76
1.A.3.b gasoline: Road Transportation	CO2	7 930.3	6 144.1	3.0	3.0	4.2	0.29
1.A.4 biomass: Other Sectors	CH4	314.7	228.2	10.0	50.0	51.0	0.13
1.A.4 mobile-diesel: Other Sectors	CO2	1 311.6	1 348.7	3.0	0.5	3.0	0.05
1.A.4 other: Other Sectors	CO2	349.6	75.9	10.0	20.0	22.4	0.02
1.A.4 solid: Other Sectors	CO2	2 654.1	560.7	1.0	0.5	1.1	0.01
1.A.4 stat-liquid: Other Sectors	CO2	7 319.1	7 188.6	3.0	0.5	3.0	0.25
1.A gaseous: Fuel Combustion (stationary)	CO2	11 300.5	16 792.1	2.0	0.5	2.1	0.39
1.B.2.b: Natural gas	CH4	272.7	577.6	4.2	14.1	14.7	0.10
2.A.1: Cement Production	CO2	2 033.4	1 954.1	5.0	2.0	5.4	0.12
2.A.2: Lime Production	CO2	396.2	585.7	20.0	5.0	20.6	0.14
2.A.3: Limestone and Dolomite Use	CO2	222.4	296.2	19.6	2.0	19.7	0.07
2.A.7.b: Sinter Production	CO2	481.2	312.4	2.0	5.0	5.4	0.02
2.B.1: Ammonia Production	CO2	516.6	541.8	2.0	4.6	5.0	0.03
2.B.2: Nitric Acid Production	N2O	912.0	280.1	0.0	5.0	5.0	0.02
2.C.1: Iron and Steel Production	CO2	3 545.7	5 089.5	0.5	0.5	0.7	0.04
2.C.3: Aluminium production	CO2	1 050.2	0.0	2.0	0.5	2.1	0.00
2.C.3: Aluminium production	PFCs	158.4	0.0	0.0	50.0	50.0	0.00
2.C.4: SF6 Used in Al and Mg Foundries	SF6	253.3	0.0	0.0	5.0	5.0	0.00
2.F.1/2/3/4./5: ODS Substitutes	HFCs	133.1	308.7	20.0	50.0	53.9	0.19
2.F.7: Semiconductor Manufacture	FCs	126.6	274.0	5.0	10.0	11.2	0.03
2.F.9: Other Sources of SF6	SF6	21.1	852.9	25.0	50.0	55.9	0.54
3: Solvent and Other Product Use	CO2	282.7	221.0	5.0	10.0	11.2	0.03
4.A.1: Cattle	CH4	3 560.9	3 009.5	10.0	20.0	22.4	0.76
4.B.1: Cattle	N2O	908.1	787.8	10.0	100.0	100.5	0.90
4.B.1: Cattle	CH4	587.1	454.9	10.0	70.0	70.7	0.36
4.B.8: Swine	CH4	447.7	395.0	10.0	70.0	70.7	0.32
4.D.1: Direct Soil Emissions	N2O	1 804.9	1 610.3	5.0	150.0	150.1	2.73
4.D.2: Pasture, Range and Paddock Manure	N2O	218.5	217.3	5.0	150.0	150.1	0.37
4.D.3: Indirect Emissions	N2O	1 309.7	1 091.9	5.0	150.0	150.1	1.85
6.A: Solid Waste Disposal on Land	CH4	3 376.6	1 759.6	12.0	25.0	27.7	0.55
6.B: Wastewater Handling	N2O	108.4	278.3	20.0	50.0	53.9	0.17
Total		**76676.2**	**88432.9**				**3.79**
% of National Total		96.8%	97.1%				
National Total without LULUCF		**79 171.5**	**91 090.3**				

A	B	I	J	K	L	M
IPCC Source category	Gas	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activiyt data uncertainty	Uncertainty introduced into the trend in total national emissions
		%	%	%	%	%
1.A.1.a liquid: Public Electricity and Heat Production	CO2	- 0.00	0.02	- 0.0016	0.0108	0.01
1.A 1.a other: Public Electricity and Heat Production	CO2	0.01	0.01	0.1459	0.1283	0.19
1.A 1.a solid: Public Electricity and Heat Production	CO2	- 0.02	0.07	- 0.0102	0.0520	0.05
1.A 1.b liquid: Petroleum refining	CO2	- 0.00	0.03	- 0.0004	0.0199	0.02
1.A.2 mobile-liquid: Manufacturing Industries and Construction	CO2	- 0.00	0.01	- 0.0003	0.0619	0.06
1.A.2 other: Manufacturing Industries and Construction	CO2	0.01	0.01	0.1453	0.1589	0.22
1.A.2 solid: Manufacturing Industries and Construction	CO2	- 0.00	0.07	- 0.0008	0.1045	0.10
1.A.2 stat-liquid: Manufacturing Industries and Construction	CO2	- 0.02	0.02	- 0.0094	0.1041	0.10
1.A.3.a jet kerosene: Civil Aviation	CO2	0.00	0.00	0.0074	0.0121	0.01
1.A.3.b diesel oil: Road Transportation	CO2	0.15	0.21	0.4364	0.8736	0.98
1.A.3.b gasoline: Road Transportation	CO2	- 0.04	0.08	- 0.1173	0.3400	0.36
1.A.4 biomass: Other Sectors	CH4	- 0.00	0.00	- 0.0879	0.0421	0.10
1.A.4 mobile-diesel: Other Sectors	CO2	- 0.00	0.02	- 0.0011	0.0746	0.07
1.A.4 other: Other Sectors	CO2	- 0.00	0.00	- 0.0854	0.0140	0.09
1.A.4 solid: Other Sectors	CO2	- 0.03	0.01	- 0.0163	0.0103	0.02
1.A.4 stat-liquid: Other Sectors	CO2	- 0.02	0.09	- 0.0082	0.3978	0.40
1.A gaseous: Fuel Combustion (stationary)	CO2	0.05	0.22	0.0245	0.6194	0.62
1.B.2.b: Natural gas	CH4	0.00	0.01	0.0484	0.0447	0.07
2.A.1: Cement Production	CO2	- 0.01	0.03	- 0.0102	0.1802	0.18
2.A.2: Lime Production	CO2	0.00	0.01	0.0084	0.2160	0.22
2.A.3: Limestone and Dolomite Use	CO2	0.00	0.00	0.0010	0.1070	0.11
2.A.7.b: Sinter Production	CO2	- 0.00	0.00	- 0.0158	0.0115	0.02
2.B.1: Ammonia Production	CO2	- 0.00	0.01	- 0.0032	0.0200	0.02
2.B.2: Nitric Acid Production	N2O	- 0.01	0.00	- 0.0503	-	0.05
2.C.1: Iron and Steel Production	CO2	0.01	0.07	0.0065	0.0469	0.05
2.C.3: Aluminium production	CO2	- 0.02	0.00	- 0.0079	-	0.01
2.C.3: Aluminium production	PFCs	- 0.00	0.00	- 0.1192	-	0.12
2.C.4: SF6 Used in Al and Mg Foundries	SF6	- 0.00	0.00	- 0.0191	-	0.02
2.F.1/2/3/4./5: ODS Substitutes	HFCs	0.00	0.00	0.1012	0.1139	0.15
2.F.7: Semiconductor Manufacture	FCs	0.00	0.00	0.0167	0.0253	0.03
2.F.9: Other Sources of SF6	SF6	0.01	0.01	0.5403	0.3933	0.67
3: Solvent and Other Product Use	CO2	- 0.00	0.00	- 0.0137	0.0204	0.02
4.A.1: Cattle	CH4	- 0.01	0.04	- 0.2861	0.5551	0.62
4.B.1: Cattle	N2O	- 0.00	0.01	- 0.3386	0.1453	0.37
4.B.1: Cattle	CH4	- 0.00	0.01	- 0.2028	0.0839	0.22
4.B.8: Swine	CH4	- 0.00	0.01	- 0.1108	0.0728	0.13
4.D.1: Direct Soil Emissions	N2O	- 0.01	0.02	- 0.9217	0.1485	0.93
4.D.2: Pasture, Range and Paddock Manure	N2O	- 0.00	0.00	- 0.0677	0.0200	0.07
4.D.3: Indirect Emissions	N2O	- 0.01	0.01	- 0.8190	0.1007	0.83
6.A: Solid Waste Disposal on Land	CH4	- 0.03	0.02	- 0.6957	0.3894	0.80
6.B: Wastewater Handling	N2O	0.00	0.00	0.0999	0.1026	0.14
Total						**2.27**
% of National Total						
National Total without LULUCF						

A	B	C	D	E	F	G
IPCC Source category	Gas	Base year emissions 1990	Year 2006 emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year 2005
		Gg CO2 equivalent	Gg CO2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%
1.A.1.a liquid: Public Electricity and Heat Production	CO2	1228.7	1170.6	0.7	0.7	0.01
1 A 1 a other: Public Electricity and Heat Production	CO2	118.0	695.4	21.3	22.7	0.2
1 A 1 a solid: Public Electricity and Heat Production	CO2	6246.7	5642.4	0.7	0.7	0.0
1 A 1 b liquid: Petroleum refining	CO2	1957.7	2153.4	0.6	0.6	0.01
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO2	1015.9	1118.8	3.0	3.0	0.04
1 A 2 other: Manufacturing Industries and Construction	CO2	264.0	862.0	21.4	22.9	0.21
1 A 2 solid: Manufacturing Industries and Construction	CO2	5015.9	5666.1	1.1	1.1	0.07
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO2	2883.5	1880.3	2.6	2.6	0.06
1 A 3 a jet kerosene: Civil Aviation	CO2	24.2	218.2	4.1	4.1	0.01
1 A 3 b diesel oil: Road Transportation	CO2	4012.4	15792.8	4.1	4.1	0.73
1 A 3 b gasoline: Road Transportation	CO2	7929.4	6145.8	4.1	4.1	0.29
1 A 4 biomass: Other Sectors	CH4	313.5	227.4	50.3	50.7	0.13
1 A 4 mobile-diesel: Other Sectors	CO2	1375.5	1407.5	3.0	3.0	0.05
1 A 4 other: Other Sectors	CO2	349.4	75.9	21.4	22.9	0.02
1 A 4 solid: Other Sectors	CO2	2653.9	560.7	1.1	1.1	0.01
1 A 4 stat-liquid: Other Sectors	CO2	7318.8	7187.0	2.8	2.8	0.23
1 A gaseous: Fuel Combustion	CO2	11300.0	16788.2	3.2	3.2	0.60
1 B 2 b: Natural gas	CH4	272.4	577.1	14.6	14.8	0.10
2 A 1: Cement Production	CO2	2033.7	1954.1	5.2	5.3	0.11
2 A 2: Lime Production	CO2	396.0	585.8	20.4	20.4	0.13
2 A 3: Limestone and Dolomite Use	CO2	222.5	301.3	19.1	19.3	0.07
2 A 7 b: Sinter Production	CO2	481.2	312.3	5.2	5.3	0.02
2 B 1: Ammonia Production	CO2	516.5	541.5	4.8	4.8	0.03
2 B 2: Nitric Acid Production	N2O	911.1	279.8	19.6	20.1	0.06
2 C 1: Iron and Steel Production	CO2	3545.6	5089.3	0.7	0.7	0.04
2 C 3: Aluminium production	CO2	158.4	0.0	0.0	0.0	0.00
2C3: Aluminium production	PFC	1049.2	0.0	0.0	0.0	0.00
2C4: SF6 Used in Al and Mg Foundries	SF6	253.3	0.0	0.0	0.0	0.00
2F1/2/3/4/5: ODS Substitutes	HFC	21.2	851.1	53.3	53.1	0.51
2F7: Semiconductor Manufacture	FCs	133.1	308.7	10.8	11.0	0.04
2F9: Other Sources of SF6	SF6	126.7	272.6	54.6	56.0	0.17
3: Solvent and Other Product Use	CO2	282.7	220.9	4.7	4.9	0.01
4 A 1: Cattle	CH4	3556.5	3006.0	20.9	21.0	0.71
4 B 1: Cattle	CH4	589.1	456.5	68.0	69.2	0.35
4 B 1: Cattle	N2O	912.2	791.4	50.3	99.7	0.69
4 B 8: Swine	CH4	449.3	396.3	67.9	68.7	0.30
4 D 1: Direct Soil Emissions	N2O	1810.3	1615.6	70.0	209.5	2.70
4 D 2: Pasture, Range and Paddock Manure	N2O	219.1	218.0	70.0	209.5	0.36
4 D 3: Indirect Emissions	N2O	1313.7	1095.4	70.0	209.5	1.83
6 A: Solid Waste Disposal on Land	CH4	3378.6	1759.7	26.1	28.6	0.53
6 B: Wastewater Handling	N2O	108.1	277.6	42.4	45.2	0.13
Total		**76748.1**	**88503.9**			
% of National Total		96.9%	97.2%			
National Total without LULUCF		**79 171.5**	**91 090.3**			**5.32**

A	B	C	D	E	F	G
IPCC Source category	Gas	Base year emissions 1990	Year 2006 emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year 2005
		Gg CO2 equivalent	Gg CO2 equivalent	% below (2.5 percentile)	% above (97.5 percentile)	%
Non-Key Sources	CO2	750.4	916.8	1.5	1.5	0.02
Non-Key Sources	CH4	623.6	511.6	18.3	18.5	0.11
Non-Key Sources	N2O	1037.1	1132.5	15.1	16.3	0.20
Non-Key Sources	PFC	0.0	0.2	53.3	53.1	0.00
Non-Key Sources	HFC	0.0	0.0	-	-	0.00
Non-Key Sources	SF6	20.6	37.9	54.6	56.0	0.02

A	B	H	I	J	K
IPCC Source category	Gas	% change in emissions between year t and base year	Range of likely % change between year t and base year		Uncertainty introduced into the trend in total national emissions
		%	Lower % (2.5 percentile)	Upper % (97.5 percentile)	%-points
1.A.1.a liquid: Public Electricity and Heat Production	CO2	-4.7	-6.2	-3.4	0.01
1 A 1 a other: Public Electricity and Heat Production	CO2	489.4	287.7	758.0	0.2
1 A 1 a solid: Public Electricity and Heat Production	CO2	-9.7	-11.0	-8.3	0.1
1 A 1 b liquid: Petroleum refining	CO2	10.0	8.3	11.4	0.02
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO2	10.1	0.8	17.9	0.06
1 A 2 other: Manufacturing Industries and Construction	CO2	226.5	128.7	337.9	0.19
1 A 2 solid: Manufacturing Industries and Construction	CO2	13.0	9.0	16.4	0.11
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO2	-34.8	-41.1	-29.1	0.12
1 A 3 a jet kerosene: Civil Aviation	CO2	803.1	730.9	869.0	0.01
1 A 3 b diesel oil: Road Transportation	CO2	293.6	264.5	322.0	0.76
1 A 3 b gasoline: Road Transportation	CO2	-22.5	-29.5	-15.6	0.39
1 A 4 biomass: Other Sectors	CH4	-27.5	-73.0	-3.2	0.07
1 A 4 mobile-diesel: Other Sectors	CO2	2.3	-6.6	9.7	0.08
1 A 4 other: Other Sectors	CO2	-78.3	-115.2	-44.8	0.08
1 A 4 solid: Other Sectors	CO2	-78.9	-81.0	-76.8	0.04
1 A 4 stat-liquid: Other Sectors	CO2	-1.8	-10.3	5.1	0.38
1 A gaseous: Fuel Combustion	CO2	48.6	38.0	59.9	0.81
1 B 2 b: Natural gas	CH4	111.9	79.5	153.5	0.06
2 A 1: Cement Production	CO2	-3.9	-18.0	9.6	0.18
2 A 2: Lime Production	CO2	47.9	-24.7	121.5	0.18
2 A 3: Limestone and Dolomite Use	CO2	35.4	-24.8	95.7	0.09
2 A 7 b: Sinter Production	CO2	-35.1	-41.3	-29.6	0.02
2 B 1: Ammonia Production	CO2	4.8	-0.9	10.8	0.02
2 B 2: Nitric Acid Production	N2O	-69.3	-100.9	-45.1	0.16
2 C 1: Iron and Steel Production	CO2	43.5	41.8	45.2	0.04
2 C 3: Aluminium production	CO2	-100.0	-103.8	-96.0	0.00
2C3: Aluminium production	PFC	-100.0	-195.7	-4.3	0.67
2C4: SF6 Used in Al and Mg Foundries	SF6	-100.0	-110.2	-90.4	0.02
2F1/2/3/4/5: ODS Substitutes	HFC	3916.5	-107.6	8287.9	0.58
2F7: Semiconductor Manufacture	FCs	132.0	79.1	183.8	0.05
2F9: Other Sources of SF6	SF6	115.2	-108.7	335.8	0.21
3: Solvent and Other Product Use	CO2	-21.9	-31.8	-12.4	0.02
4 A 1: Cattle	CH4	-15.5	-38.5	0.6	0.44
4 B 1: Cattle	CH4	-22.5	-63.2	10.0	0.14
4 B 1: Cattle	N2O	-13.2	-61.5	3.7	0.17
4 B 8: Swine	CH4	-11.8	-45.9	8.0	0.07
4 D 1: Direct Soil Emissions	N2O	-10.8	-147.4	3.4	0.42
4 D 2: Pasture, Range and Paddock Manure	N2O	-0.5	-70.9	50.6	0.03
4 D 3: Indirect Emissions	N2O	-16.6	-191.1	-2.4	0.44
6 A: Solid Waste Disposal on Land	CH4	-47.9	-89.7	-18.5	0.79
6 B: Wastewater Handling	N2O	156.8	14.5	294.9	0.09
Total					
% of National Total					
National Total without LULUCF					**2.27**

A	B	H	I	J	K
IPCC Source category	Gas	% change in emissions between year t and base year	Range of likely % change between year t and base year		Uncertainty introduced into the trend in total national emissions
		%	Lower % (2.5 percentile)	Upper % (97.5 percentile)	%-points
Non-Key Sources	CO2	22.2	17.9	26.0	0.02
Non-Key Sources	CH4	-18.0	-30.7	-4.6	0.05
Non-Key Sources	N2O	9.2	-5.5	27.0	0.10
Non-Key Sources	PFC	-	-	-	0.00
Non-Key Sources	HFC	-	-	-	0.00
Non-Key Sources	SF6	83.8	-110.4	277.3	0.03

ANNEX 7: CRF FOR 2006

This Annex includes the CRF-Tables for the year 2006 as included in Austria's data submission 2008 to the UNFCCC.

TABLE 1 SECTORAL REPORT FOR ENERGY
(Sheet 1 of 2)

Inventory 2006
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AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_X	CO	NMVOC	SO_2
	(Gg)						
Total Energy	68 049.56	47.01	2.61	218.27	754.06	70.12	27.18
A. Fuel Combustion Activities (Sectoral Approach)	67 817.52	13.73	2.61	218.27	754.06	66.99	27.01
1. Energy Industries	15 426.28	0.30	0.24	15.37	4.67	0.71	7.85
a. Public Electricity and Heat Production	12 048.98	0.28	0.23	10.50	4.11	0.70	4.16
b. Petroleum Refining	2 829.98	IE,NO	0.02	3.39	0.46	IE	3.69
c. Manufacture of Solid Fuels and Other Energy Industries	547.31	0.01	0.00	1.48	0.10	0.00	NA
2. Manufacturing Industries and Construction	15 812.24	0.62	0.51	35.37	168.71	3.06	10.29
a. Iron and Steel	6 449.52	0.11	0.07	5.23	148.00	0.33	5.76
b. Non-Ferrous Metals	228.22	0.01	0.00	0.21	0.04	0.00	0.10
c. Chemicals	1 432.13	0.09	0.02	1.20	1.29	0.16	0.44
d. Pulp, Paper and Print	2 183.04	0.14	0.08	5.12	2.01	0.25	1.17
e. Food Processing, Beverages and Tobacco	842.02	0.02	0.00	0.78	0.13	0.01	0.24
f. Other *(as specified in table 1.A(a) sheet 2)*	4 677.32	0.26	0.35	22.83	17.24	2.30	2.58
Other non-specified	4 677.32	0.26	0.35	22.83	17.24	2.30	2.58
3. Transport	22 807.93	1.11	0.93	133.71	241.93	22.32	0.28
a. Civil Aviation	227.20	0.02	0.01	0.76	2.81	0.28	0.07
b. Road Transportation	21 932.43	1.06	0.89	129.92	235.80	21.25	0.13
c. Railways	144.10	0.00	0.02	1.36	0.36	0.17	0.06
d. Navigation	52.37	0.01	0.01	0.45	2.88	0.62	0.01
e. Other Transportation *(as specified in table 1.A(a) sheet 3)*	451.83	0.01	0.00	1.22	0.08	0.00	NA
Pipeline transport	451.83	0.01	0.00	1.22	0.08	0.00	NA

TABLE 1 SECTORAL REPORT FOR ENERGY
(Sheet 2 of 2)

Inventory 2006
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AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_X	CO	NMVOC	SO_2
	(Gg)						
4. Other Sectors	13 645.61	11.70	0.92	33.62	338.00	40.86	8.55
a. Commercial/Institutional	3 402.84	0.52	0.07	2.79	13.04	1.34	1.73
b. Residential	8 665.57	10.29	0.42	12.98	285.14	31.95	6.49
c. Agriculture/Forestry/Fisheries	1 577.20	0.89	0.43	17.85	39.83	7.57	0.33
5. Other *(as specified in table 1.A(a) sheet 4)*	125.46	0.00	0.01	0.21	0.75	0.05	0.04
a. Stationary	NA	NA	NA	NA	NA	NA	NA
b. Mobile	125.46	0.00	0.01	0.21	0.75	0.05	0.04
Military use	125.46	0.00	0.01	0.21	0.75	0.05	0.04
B. Fugitive Emissions from Fuels	232.04	33.28	IE,NA	IE,NA	IE,NA	3.12	0.17
1. Solid Fuels	IE,NA,NO	0.00	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
a. Coal Mining and Handling	IE,NA,NO	0.00	NA	NA	NA	NA	
b. Solid Fuel Transformation	IE	IE	IE	IE	IE	IE	IE
c. Other *(as specified in table 1.B.1)*	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	232.04	33.28	IE,NA	IE,NA	IE,NA	3.12	0.17
a. Oil	140.00	5.77	IE,NA	NA	NA	2.86	NA
b. Natural Gas	92.04	27.50				0.26	0.17
c. Venting and Flaring	IE	IE	IE	IE	IE	IE	IE
Venting	IE	IE				IE	IE
Flaring	IE	IE	IE	IE	IE	IE	IE
d. Other *(as specified in table 1.B.2)*	NA	NA	NA	NA	NA	NA	NA
Memo Items: (1)							
International Bunkers	1 810.00	0.03	0.06	5.79	1.79	0.75	0.57
Aviation	1 810.00	0.03	0.06	5.79	1.79	0.75	0.57
Marine	NA,NO	NA,NO	NA,NO	NO	NO	NO	NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	16 481.89						

(1) Countries are asked to report emissions from international aviation and marine bunkers and multilateral operations, as well as CO_2 emissions from biomass, under Memo Items. These emissions should not be included in the national total emissions from the Energy sector. Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO_2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO_2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-Use Change and Forestry sector.

Documentation Box:
Parties should provide detailed explanations on the Energy sector in Chapter 3: Energy (CRF sector 1) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
1.AA Fuel Combustion - Sectoral Approach/2006:Usage of "NO" notation keys in table 1.A(a)s1 to s4 : Energy statistics does not inquire all consumers but is limited to statistical samples. In the case that a statistical inquiry results in zero consumption of a specific sector and fuel group it is not always possible to decide if there occurs a consumption of a specific fuel category in a specific sector and year. However, as the energy statistics is based on a top down/bottom up approach it is assured that total national fuel consumption is equivalent to category 1A fuel consumption. Thus "NO" may be sometimes interpreted as "included elsewhere".
1.B.1 Solid Fuels/2006:1 B 1 b: Emissions from coke ovens are included in 1 A 2 a Iron and Steel.
1 B 1 a ii: emissions from Post-Mining are included in Mining.
1.B.2 Oil and Natural Gas/2006:1 B 2 a i, 1 B 2 b i and 1 B 2 b ii exept CO2 emissions from processing of sour gas are included in 1 B 2 a ii.
1 B 2 a v also includes storage in storage tanks and refinery dispatch station - only NMVOC emissions are estimated.
1 B 2 a iv CO2 is included in 1 A 1 b, flaring in the refinery is also included in 1 A 1 b.
1 B 2 b iiiTransmission includes fugitve and venting.
1.C1 International Bunkers/2006:Kerosene consumption in Austria is divided into national and international transport by using national LTO-statistics.

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 1 of 4)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]			EMISSIONS		
	Consumption		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	(TJ)	NCV/GCV[1]	(t/TJ)	(kg/TJ)		(Gg)		
1.A. Fuel Combustion	1 132 908.85	NCV				67 817.52	13.73	2.61
Liquid Fuels	526 288.27	NCV	71.29	2.64	3.35	37 520.87	1.39	1.76
Solid Fuels	122 518.37	NCV	96.90	5.69	0.94	11 871.52	0.70	0.11
Gaseous Fuels	303 197.75	NCV	55.38	0.99	0.45	16 792.06	0.30	0.14
Biomass	155 423.96	NCV	106.04	70.99	3.60 [3]		11.03	0.56
Other Fuels	25 480.50	NCV	64.09	12.00	1.40	1 633.08	0.31	0.04
1.A.1. Energy Industries	255 346.39	NCV				15 426.28	0.30	0.24
Liquid Fuels	49 461.64	NCV	67.20	0.34	0.72	3 324.00	0.02	0.04
Solid Fuels	60 199.44	NCV	93.73	0.10	0.50	5 642.54	0.01	0.03
Gaseous Fuels	104 048.13	NCV	55.40	0.56	0.46	5 764.27	0.06	0.05
Biomass	29 084.50	NCV	110.03	2.28	3.86 [3]	3 200.14	0.07	0.11
Other Fuels	12 552.68	NCV	55.40	12.00	1.40	695.47	0.15	0.02
a. Public Electricity and Heat Production	198 666.90	NCV				12 048.98	0.28	0.23
Liquid Fuels	14 874.01	NCV	78.70	1.14	1.34	1 170.59	0.02	0.02
Solid Fuels	60 199.44	NCV	93.73	0.10	0.50	5 642.54	0.01	0.03
Gaseous Fuels	81 956.28	NCV	55.40	0.53	0.56	4 540.38	0.04	0.05
Biomass	29 084.50	NCV	110.03	2.28	3.86 [3]	3 200.14	0.07	0.11
Other Fuels	12 552.68	NCV	55.40	12.00	1.40	695.47	0.15	0.02
b. Petroleum Refining	46 800.16	NCV				2 829.98	IE,NO	0.02
Liquid Fuels	34 587.64	NCV	62.26	IE	0.46	2 153.41	IE	0.02
Solid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Gaseous Fuels	12 212.53	NCV	55.40	IE	0.10	676.57	IE	0.00
Biomass	NO	NCV	NO	NO	NO [3]	NO	NO	NO
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
c. Manufacture of Solid Fuels and Other Energy Industries	9 879.33	NCV				547.31	0.01	0.00
Liquid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Solid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Gaseous Fuels	9 879.33	NCV	55.40	1.50	0.10	547.31	0.01	0.00
Biomass	NO	NCV	NO	NO	NO [3]	NO	NO	NO
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO

Note: All footnotes for this table are given at the end of the table on sheet 4.

Note: For the coverage of fuel categories, refer to the IPCC Guidelines (Volume 1. Reporting Instructions - Common Reporting Framework, section 1.2, p. 1.19). If some derived gases (e.g. gas works, gas, coke oven gas, blast furnace gas are considered, Parties should provide information on the allocation of these derived gases under the above fuel categories (liquid, solid, gaseous, biomass and other fuels) in the NIR (see also documentation box at the end of sheet 4 of this table)

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 2 of 4)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]			EMISSIONS		
	Consumption		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	(TJ)	NCV/GCV[1]	(t/TJ)	(kg/TJ)		(Gg)		
1.A.2 Manufacturing Industries and Construction	272 494.43	NCV				15 812.24	0.62	0.51
Liquid Fuels	40 240.96	NCV	74.54	1.98	7.09	2 999.74	0.08	0.29
Solid Fuels	56 305.79	NCV	100.63	2.26	1.25	5 666.25	0.13	0.07
Gaseous Fuels	113 531.71	NCV	55.36	1.47	0.10	6 284.56	0.17	0.01
Biomass	50 216.79	NCV	109.73	2.00	2.52 [3]	5 510.41	0.10	0.13
Other Fuels	12 199.18	NCV	70.64	12.00	1.40	861.70	0.15	0.02
a. Iron and Steel	74 898.85	NCV				6 449.52	0.11	0.07
Liquid Fuels	9 845.68	NCV	77.98	1.67	1.00	767.81	0.02	0.01
Solid Fuels	44 014.51	NCV	102.72	1.44	1.21	4 521.21	0.06	0.05
Gaseous Fuels	21 038.65	NCV	55.16	1.33	0.10	1 160.49	0.03	0.00
Biomass	NO	NCV	NO	NO	NO [3]	NO	NO	NO
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
b. Non-Ferrous Metals	3 853.55	NCV				228.22	0.01	0.00
Liquid Fuels	465.56	NCV	74.23	0.90	0.94	34.56	0.00	0.00
Solid Fuels	122.73	NCV	104.00	2.00	1.40	12.76	0.00	0.00
Gaseous Fuels	3 265.26	NCV	55.40	1.50	0.10	180.90	0.00	0.00
Biomass	NO	NCV	NO	NO	NO [3]	NO	NO	NO
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
c. Chemicals	23 519.92	NCV				1 432.13	0.09	0.02
Liquid Fuels	585.28	NCV	77.78	0.61	0.71	45.52	0.00	0.00
Solid Fuels	1 116.19	NCV	94.06	4.87	1.40	104.99	0.01	0.00
Gaseous Fuels	14 965.73	NCV	55.40	1.50	0.10	829.10	0.02	0.00
Biomass	2 241.69	NCV	110.51	1.87	3.23 [3]	247.74	0.00	0.01
Other Fuels	4 611.04	NCV	98.14	12.00	1.40	452.52	0.06	0.01
d. Pulp, Paper and Print	69 991.54	NCV				2 183.04	0.14	0.08
Liquid Fuels	1 586.12	NCV	77.82	1.77	0.95	123.43	0.00	0.00
Solid Fuels	5 188.88	NCV	89.74	5.01	1.40	465.64	0.03	0.01
Gaseous Fuels	28 648.32	NCV	55.40	1.50	0.10	1 587.12	0.04	0.00
Biomass	34 415.26	NCV	110.02	2.00	1.90 [3]	3 786.36	0.07	0.07
Other Fuels	152.96	NCV	44.82	12.00	1.40	6.86	0.00	0.00
e. Food Processing, Beverages and Tobacco	14 774.98	NCV				842.02	0.02	0.00
Liquid Fuels	1 903.97	NCV	75.94	0.68	0.76	144.59	0.00	0.00
Solid Fuels	102.13	NCV	103.80	2.11	1.40	10.60	0.00	0.00
Gaseous Fuels	12 397.63	NCV	55.40	1.50	0.10	686.83	0.02	0.00
Biomass	371.25	NCV	109.70	1.94	3.66 [3]	40.73	0.00	0.00
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
f. Other *(please specify)* [4]	85 455.59	NCV				4 677.32	0.26	0.35
Other non-specified								
Liquid Fuels	25 854.35	NCV	72.86	2.25	10.51	1 883.82	0.06	0.27
Solid Fuels	5 761.35	NCV	95.64	5.58	1.40	551.04	0.03	0.01
Gaseous Fuels	33 216.12	NCV	55.40	1.50	0.10	1 840.13	0.05	0.00
Biomass	13 188.59	NCV	108.85	2.04	3.97 [3]	1 435.58	0.03	0.05
Other Fuels	7 435.18	NCV	54.11	12.00	1.40	402.33	0.09	0.01

Note: All footnotes for this table are given at the end of the table on sheet 4.

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 3 of 4)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]			EMISSIONS		
	Consumption		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	(TJ)	NCV/GCV[1]	(t/TJ)	(kg/TJ)		(Gg)		
1.A.3 Transport	324 661.25	NCV				22 807.93	1.11	0.93
Liquid Fuels	316 483.81	NCV	70.63	3.46	2.93	22 354.05	1.10	0.93
Solid Fuels	21.66	NCV	95.00	6.83	6.83	2.06	0.00	0.00
Gaseous Fuels	8 155.78	NCV	55.40	1.50	0.10	451.83	0.01	0.00
Biomass	NO	NCV	NO	NO	NO	NO	NO	NO
Other Fuels	NA,NO	NCV	NA,NO	NA,NO	NA,NO [3]	NA,NO	NA,NO	NA,NO
a. Civil Aviation	3 123.21	NCV				227.20	0.02	0.01
Aviation Gasoline	124.19	NCV	72.75	NO	NO	9.03	NO	NO
Jet Kerosene	2 999.02	NCV	72.75	5.19	2.84	218.17	0.02	0.01
b. Road Transportation	310 578.32	NCV				21 932.43	1.06	0.89
Gasoline	84 186.29	NCV	72.98	11.03	5.36	6 144.06	0.93	0.45
Diesel Oil	226 392.03	NCV	69.74	0.60	1.96	15 788.37	0.14	0.44
Liquefied Petroleum Gases (LPG)	NO	NCV	NO	NO	NO	NO	NO	NO
Other Liquid Fuels (please specify)	NA	NCV				NA	NA	NA
Gaseous Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Biomass	NO	NCV	NO	NO	NO [3]	NO	NO	NO
Other Fuels *(please specify)*	NA	NCV				NA	NA	NA
c. Railways	2 058.52	NCV				144.10	0.00	0.02
Liquid Fuels	2 036.86	NCV	69.74	2.00	7.37	142.04	0.00	0.02
Solid Fuels	21.66	NCV	95.00	6.83	6.83	2.06	0.00	0.00
Gaseous Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Other Fuels *(please specify)*	NA	NCV				NA	NA	NA
d. Navigation	745.42	NCV				52.37	0.01	0.01
Residual Oil (Residual Fuel Oil)	NO	NCV	NO	NO	NO	NO	NO	NO
Gas/Diesel Oil	625.57	NCV	69.74	1.47	16.55	43.63	0.00	0.01
Gasoline	119.86	NCV	72.98	87.10	1.84	8.75	0.01	0.00
Other Liquid Fuels *(please specify)*	NA	NCV				NA	NA	NA
Solid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Gaseous Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Other Fuels *(please specify)*	NA	NCV				NA	NA	NA
e. Other Transportation *(please specify)* [5]	8 155.78	NCV				451.83	0.01	0.00
Pipeline transport	8 155.78	NCV				451.83	0.01	0.00
Liquid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Solid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Gaseous Fuels	8 155.78	NCV	55.40	1.50	0.10	451.83	0.01	0.00
Biomass	NO	NCV	NO	NO	NO [3]	NO	NO	NO
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO

Note: All footnotes for this table are given at the end of the table on sheet 4.

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 4 of 4)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]			EMISSIONS		
	Consumption		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	(TJ)	NCV/GCV[1]	(t/TJ)	(kg/TJ)		(Gg)		
1.A.4 Other Sectors	278 681.09	NCV				13 645.61	11.70	0.92
Liquid Fuels	118 376.18	NCV	73.64	1.65	4.26	8 717.63	0.19	0.50
Solid Fuels	5 991.48	NCV	93.58	94.17	2.37	560.68	0.56	0.01
Gaseous Fuels	77 462.12	NCV	55.40	0.80	1.00	4 291.40	0.06	0.08
Biomass	76 122.66	NCV	102.09	142.75	4.21 [3]	7 771.34	10.87	0.32
Other Fuels	728.65	NCV	104.17	12.00	1.40	75.90	0.01	0.00
a. Commercial/Institutional	56 677.08	NCV				3 402.84	0.52	0.07
Liquid Fuels	27 735.50	NCV	73.55	0.40	0.96	2 039.97	0.01	0.03
Solid Fuels	672.98	NCV	95.23	90.00	2.91	64.09	0.06	0.00
Gaseous Fuels	22 073.60	NCV	55.40	0.80	1.00	1 222.88	0.02	0.02
Biomass	5 466.35	NCV	109.23	76.57	2.87 [3]	597.07	0.42	0.02
Other Fuels	728.65	NCV	104.17	12.00	1.40	75.90	0.01	0.00
b. Residential	192 687.76	NCV				8 665.57	10.29	0.42
Liquid Fuels	68 842.06	NCV	74.73	0.81	1.18	5 144.46	0.06	0.08
Solid Fuels	5 214.83	NCV	93.36	94.79	2.29	486.87	0.49	0.01
Gaseous Fuels	54 769.56	NCV	55.40	0.80	1.00	3 034.23	0.04	0.05
Biomass	63 861.30	NCV	101.19	151.86	4.25 [3]	6 462.28	9.70	0.27
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
c. Agriculture/Forestry/Fisheries	29 316.25	NCV				1 577.20	0.89	0.43
Liquid Fuels	21 798.61	NCV	70.33	5.87	18.23	1 533.20	0.13	0.40
Solid Fuels	103.67	NCV	93.73	90.00	2.67	9.72	0.01	0.00
Gaseous Fuels	618.96	NCV	55.40	0.80	1.00	34.29	0.00	0.00
Biomass	6 795.01	NCV	104.78	110.32	4.91 [3]	711.99	0.75	0.03
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
1.A.5 Other *(Not specified elsewhere)* [6]	1 725.68	NCV				125.46	0.00	0.01
a. Stationary *(please specify)* [7]	NA	NCV				NA	NA	NA
b. Mobile *(please specify)* [8]	1 725.68	NCV				125.46	0.00	0.01
Military use								
Liquid Fuels	1 725.68	NCV	72.70	2.39	4.35	125.46	0.00	0.01
Solid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Gaseous Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Biomass	NO	NCV	NO	NO	NO [3]	NO	NO	NO
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO

(1) If activity data are calculated using net calorific values (NCV) as specified by the IPCC Guidelines, write NCV in this column. If gross calorific values (GCV) are used, write GCV in this column.

(2) Accurate estimation of CH_4 and N_2O emissions depends on combustion conditions, technology and emission control policy, as well as on fuel characteristics. Therefore, caution should be used when comparing the implied emission factors across countries.

(3) Although carbon dioxide emissions from biomass are reported in this table, they will not be included in the total CO_2 emissions from fuel combustion. The value for total CO_2 from biomass is recorded in Table1 sheet 2 under the Memo Items.

(4) Use the cell below to list all activities covered under "f. Other"

(5) Use the cell below to list all activities covered under "e. Other transportation"

(6) Include military fuel use under this category

(7) Use the cell below to list all activities covered under "1.A.5.a Other - stationary".

(8) Use the cell below to list all activities covered under "1.A.5.b Other - mobile".

Documentation Box:
• Parties should provide detailed explanations on the fuel combustion sub-sector in the corresponding part of Chapter 3: Energy (CRF sub-sector 1.A) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
• If estimates are based on GCV, use this documentation box to provide reference to the relevant section of the NIR where the information necessary to allow the calculation of the activity data based on NCV can be found.
• If some derived gases (e.g. gas works gas, coke oven gas, blast furnace gas) are considered, use this documentation box to provide a reference to the relevant section of the NIR containing the information on the allocation of these derived gases under the above fuel categories (liquid, soild, gaseous, biomass and other fuels).

1.AA Fuel Combustion - Sectoral Approach/2006:Usage of "NO" notation keys in table 1.A(a)s1 to s4 : Energy statistics does not inquire all consumers but is limited to statistical samples. In the case that a statistical inquiry results in zero consumption of a specific sector and fuel group it is not always possible to decide if there occurs a consumption of a specific fuel category in a specific sector and year. However, as the energy statistics is based on a top down/bottom up approach it is assured that total national fuel consumption is equivalent to category 1A fuel consumption. Thus "NO" may be sometimes interpreted as "included elsewhere".

TABLE 1.A(b) SECTORAL BACKGROUND DATA FOR ENERGY
CO_2 from Fuel Combustion Activities - Reference Approach (IPCC Worksheet 1-1)
(Sheet 1 of 1)

FUEL TYPES			Unit	Production	Imports	Exports	International bunkers	Stock change	Apparent consumption	Conversion factor (TJ/Unit)	NCV/ GCV [1]	Apparent consumption (TJ)	Carbon emission factor (t C/TJ)	Carbon content (Gg C)	Carbon stored (Gg C)	Net carbon emissions (Gg C)	Fraction of carbon oxidized	Actual CO_2 emissions (Gg CO_2)
Liquid Fossil	Primary Fuels	Crude Oil	Gg	863.32	7 698.58	NO		89.89	8 472.01	42.75	NCV	362 178.39	20.00	7 243.57	NO	7 243.57	0.99	26 294.15
		Orimulsion		NO	NO	NO		NO	NO	NA	NCV	NA,NO	NA	NA,NO	NA	NA,NO	NA	NA,NO
		Natural Gas Liquids	Gg	124.85	NO	NO		NO	124.85	45.22	NCV	5 645.83	17.20	97.11	NO	97.11	0.99	352.50
	Secondary Fuels	Gasoline	Gg		966.35	564.87	NO	8.84	392.64	44.80	NCV	17 590.41	18.90	332.46	NO	332.46	0.99	1 206.83
		Jet Kerosene	Gg		190.34	0.89	557.99	32.02	-400.56	44.59	NCV	-17 860.83	19.50	-348.29	NO	-348.29	0.99	-1 264.28
		Other Kerosene	Gg		2.40	0.05	NO	0.03	2.32	44.75	NCV	104.00	19.60	2.04	NO	2.04	0.99	7.40
		Shale Oil			NO	NO		NO	NO	NA	NCV	NA,NO	NA	NA,NO	NA	NA,NO	NA	NA,NO
		Gas / Diesel Oil	Gg		5 004.17	617.39	NO	151.31	4 235.47	43.33	NCV	183 522.78	20.20	3 707.16	NO	3 707.16	0.99	13 456.99
		Residual Fuel Oil	Gg		199.29	57.95	NO	-24.75	166.09	40.19	NCV	6 675.20	21.10	140.85	NO	140.85	0.99	511.27
		Liquefied Petroleum Gas (LPG)	Gg		154.64	20.68		1.62	132.34	47.31	NCV	6 260.97	17.20	107.69	NO	107.69	0.99	390.91
		Ethane			IE	IE		IE	IE	NA	NCV	IE,NA	NA	IE,NA	NO	IE,NA,NO	NA	IE,NA,NO
		Naphtha			30.00	147.00		-8.00	-109.00	45.01	NCV	-4 906.09	20.00	-98.12	478.68	-576.80	0.99	-2 093.80
		Bitumen	Gg		414.61	122.08		-0.68	293.21	40.19	NCV	11 783.95	22.00	259.25	605.45	-346.20	0.99	-1 256.71
		Lubricants	Gg		52.81	91.02	NO	2.74	-40.95	40.19	NCV	-1 645.92	20.00	-32.92	32.74	-65.66	0.99	-238.34
		Petroleum Coke	Gg		76.24	4.01		-3.83	76.06	31.00	NCV	2 357.77	27.50	64.84	27.63	37.21	0.99	135.06
		Refinery Feedstocks	Gg		502.46	44.82		-30.86	488.50	42.50	NCV	20 761.23	20.00	415.22	NO	415.22	0.99	1 507.27
		Other Oil	Gg		60.39	144.57		-2.58	-81.61	40.19	NCV	-3 279.80	20.00	-65.60	20.19	-85.79	0.99	-311.42
Other Liquid Fossil												NA		NA	NA	NA		NA
Liquid Fossil Totals												589 187.89		11 825.26	1 164.70	10 660.56		38 697.83
Solid Fossil	Primary Fuels	Anthracite [2]		NO	91.00	NO		NO	91.00	28.00	NCV	2 548.00	26.80	68.29	0.38	67.91	0.98	244.03
		Coking Coal	Gg	NO	1 805.57	NO		-85.64	1 891.21	28.00	NCV	52 953.99	25.80	1 366.21	79.01	1 287.21	0.98	4 625.36
		Other Bituminous Coal	Gg	NO	2 221.00	NO	NO	-25.00	2 246.00	28.07	NCV	63 036.24	25.80	1 626.33	NO	1 626.33	0.98	5 843.96
		Sub-bituminous Coal		NO	78.00	NO	NO	NO	78.00	22.20	NCV	1 731.60	26.20	45.37	NO	45.37	0.98	163.02
		Lignite	Gg	NO	62.00	NO		-613.00	675.00	10.95	NCV	7 390.34	27.60	203.97	NO	203.97	0.98	732.94
		Oil Shale		NO	NO	NO		NO	NO	NA	NCV	NA,NO	NA	NA,NO	NA	NA,NO	NA	NA,NO
		Peat	Gg	0.50	NO	NO		NO	0.50	8.80	NCV	4.40	28.90	0.13	NO	0.13	0.98	0.46
	Secondary Fuels	BKB [3] and Patent Fuel	Gg		58.04	0.59		NO	57.44	19.30	NCV	1 108.63	25.80	28.60	NO	28.60	0.98	102.78
		Coke Oven/Gas Coke	Gg		1 282.10	2.78		-98.15	1 377.47	28.20	NCV	38 844.70	29.50	1 145.92	7.60	1 138.32	0.98	4 090.36
Other Solid Fossil												NA		NA	NA	NA		NA
Solid Fossil Totals												167 617.90		4 484.82	86.98	4 397.84		15 802.92
Gaseous Fossil		Natural Gas (Dry)	TJ	66 141.96	372 472.73	95 856.92		27 367.17	315 390.59	1.00	NCV	315 390.59	15.30	4 825.48	NO	4 825.48	1.00	17 604.95
Other Gaseous Fossil												NA		NA	NA	NA		NA
Gaseous Fossil Totals												315 390.59		4 825.48	NA,NO	4 825.48		17 604.95
Total												1 072 196.38		21 135.56	1 251.68	19 883.88		72 105.69
Biomass total												150 093.50		4 487.80	NA,NO	4 487.80		14 498.73
		Solid Biomass	TJ	140 135.72	20 602.06	12 146.02		NO	148 591.77	1.00	NCV	148 591.77	29.90	4 442.89	NO	4 442.89	0.88	14 335.74
		Liquid Biomass		IE	IE	IE		IE	IE	NA	NCV	IE,NA	NA	IE,NA	NA	IE,NA	NA	IE,NA
		Gas Biomass	TJ	1 501.73	NO	NO		NO	1 501.73	1.00	NCV	1 501.73	29.90	44.90	NO	44.90	0.99	162.99

(1) To convert quantities in previous columns to energy units, use net calorific values (NCV) and write NCV in this column. If gross calorific values (GCV) are used, write GCV in this column.

(2) If data for Anthracite are not available separately, include with Other Bituminous Coal.

(3) BKB: Brown coal/peat briquettes.

Documentation Box:
Parties should provide detailed explanations on the fuel combustion sub-sector, including information relating to CO2 from the Reference approach, in the corresponding part of Chapter 3: Energy (CRF sub-sector 1.A) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 1.A(c) COMPARISON OF CO2 EMISSIONS FROM FUEL COMBUSTION
(Sheet 1 of 1)

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FUEL TYPES	REFERENCE APPROACH			SECTORAL APPROACH [1]		DIFFERENCE [2]	
	Apparent energy consumption [3] (PJ)	Apparent energy consumption (excluding non-energy use and feedstocks) [4] (PJ)	CO_2 emissions (Gg)	Energy consumption (PJ)	CO_2 emissions (Gg)	Energy consumption (%)	CO_2 emissions (%)
Liquid Fuels (excluding international bunkers)	589.19	512.29	38 697.83	526.29	37 520.87	-2.66	3.14
Solid Fuels (excluding international bunkers) [5]	167.62	129.74	15 802.92	122.52	11 871.52	5.90	33.12
Gaseous Fuels	315.39	303.80	17 604.95	303.20	16 792.06	0.20	4.84
Other [5]	NA	NE	NA	25.48	1 633.08	-100.00	-100.00
Total [5]	***1 072.20***	***945.83***	***72 105.69***	***977.48***	***67 817.52***	***-3.24***	***6.32***

(1) "Sectoral approach" is used to indicate the approach (if different from the Reference approach) used by the Party to estimate CO_2 emissions from fuel combustion as reported in table 1.A(a), sheets 1-4.

(2) Difference in CO_2 emissions estimated by the Reference approach (RA) and the Sectoral approach (SA) (difference = 100% x ((RA-SA)/SA)). For calculating the difference in energy consumption between the two approaches, data as reported in the column "Apparent energy consumption (excluding non-energy use and feedstocks)" are used for the Reference approach.

(3) Apparent energy consumption data shown in this column are as in table 1.A(b).

(4) For the purposes of comparing apparent energy consumption from the Reference approach with energy consumption from the Sectoral approach, Parties should, in this column, subtract from the apparent energy consumption (Reference approach) the energy content corresponding to the fuel quantities used as feedstocks and/or for non-energy purposes, in accordance with the accounting of energy use in the Sectoral approach

(5) Emissions from biomass are not included.

Note: The Reporting Instructions of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories require that estimates of CO_2 emissions from fuel combustion, derived using a detailed Sectoral approach, be compared to those from the Reference approach (Worksheet 1-1 of the IPCC Guidelines, Volume 2, Workbook). This comparison is to assist in verifying the Sectoral data.

Documentation Box:
Parties should provide detailed explanations on the fuel combustion sub-sector, including information related to the comparison of CO_2 emissions calculated using the Sectoral approach with those calculated using the Reference approach, in the corresponding part of Chapter 3: Energy (CRF sub-sector 1.A) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
If the CO_2 emission estimates from the two approaches differ by more than 2 per cent, Parties should briefly explain the cause of this difference in this documentation box and provide a reference to relevant section of the NIR where this difference is explained in more detail.
1.AA Fuel Combustion - Sectoral Approach/2006:Usage of "NO" notation keys in table 1.A(a)s1 to s4 : Energy statistics does not inquire all consumers but is limited to statistical samples. In the case tha

TABLE 1.A(d) SECTORAL BACKGROUND DATA FOR ENERGY
Feedstocks and Non-Energy Use of Fuels
(Sheet 1 of 1)

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Additional information [(a)]

FUEL TYPE	ACTIVITY DATA AND RELATED INFORMATION		IMPLIED EMISSION FACTOR	ESTIMATE	Additional information: CO_2 not emitted	Subtracted from energy sector	Associated CO_2 emissions	Allocated under
	Fuel quantity (TJ)	Fraction of carbon stored	Carbon emission factor (t C/TJ)	Carbon stored in non-energy use of fuels (Gg C)	(Gg CO_2)	*(specify source category)*	(Gg)	*(Specify source category, e.g. Waste Incineration)*
Naphtha [(1)]	31 912.09	0.75	20.00	478.68	1 755.16	NA	NE	NE
Lubricants	3 274.14	0.50	20.00	32.74	120.05	NA	NE	NE
Bitumen	27 520.31	1.00	22.00	605.45	2 219.97	NA	NE	NE
Coal Oils and Tars (from Coking Coal)	2 330.68	0.75	45.20	79.01	289.69	NA	NE	NE
Natural Gas[(1)]	11 511.58	NO	NO	NO	NO	NA	NE	NE
Gas/Diesel Oil [(1)]	NO	0.50	NO	NO	NO	NA	NE	NE
LPG [(1)]	NO	1.00	NO	NO	NO	NA	NE	NE
Ethane [(1)]	NO	NO	NO	NO	NO	NA	NE	NE
Other *(please specify)*				28.17				
Coal	28.00	0.50	26.80	0.38	1.38	NA	NE	NE
Gasoline	NO	0.50	NO	NO	NO	NA	NE	NE
Butane	NO	0.75	NO	NO	NO	NA	NE	NE
Coke	36 802.77	0.01	29.50	7.60	27.87	NA	NE	NE
Other petroleum products	1 346.27	0.75	20.00	20.19	74.04	NA	NE	NE

	Carbon stored (Gg C)	CO_2 not emitted (Gg CO_2)
Total	1 224.04	4 488.16
Total amount of C and CO_2 from feedstocks and non-energy use of fuels that is included as emitted CO_2 in the Reference approach	1 303.83	4 780.69

[(1)] Enter data for those fuels that are used as feedstocks (fuel used as raw materials for manufacture of products such as plastics or fertilizers) or for other non-energy use (fuels not used as fuel or transformed into another fuel (e.g. bitumen for road construction, lubricants)).

[(a)] The fuel lines continue from the table to the left.

A fraction of energy carriers is stored in such products as plastics or asphalt. The non-stored fraction of the carbon in the energy carrier or product is oxidized, resulting in carbon dioxide emissions, either during use of the energy carriers in the industrial production (e.g. fertilizer production), or during use of the products (e.g. solvents, lubricants), or in both (e.g. monomers). To report associated emissions, use the above table.

Documentation box:

• Parties should provide detailed explanations on the fuel combustion sub-sector, including information related to feedstocks, in the corresponding part of Chapter 3: Energy (CRF sub-sector 1.A) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of table.

• The above table is consistent with the IPCC Guidelines. Parties that take into account the emissions associated with the use and disposal of these feedstocks could continue to use their methodology, but should indicate this in this documentation box and provide a reference to the relevant section of the NIR where further explanation can be found.

TABLE 1.B.1 SECTORAL BACKGROUND DATA FOR ENERGY
Fugitive Emissions from Solid Fuels
(Sheet 1 of 1)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS		EMISSIONS		
	Amount of fuel produced	CH_4 [1]	CO_2	CH_4		CO_2
				Recovery/Flaring [2]	Emissions [3]	
	(Mt)	(kg/t)		(Gg)		
1. B. 1. a. Coal Mining and Handling	0.01			NO	0.00	IE,NA,NO
i. Underground Mines[4]	NO	NO	NO	NO	NO	NO
Mining Activities		NO	NO	NO	NO	NO
Post-Mining Activities		NO	NO	NO	NO	NO
ii. Surface Mines[4]	0.01	0.21	IE,NA	NO	0.00	IE,NA
Mining Activities		0.21	NA	NO	0.00	NA
Post-Mining Activities		IE	IE	NO	IE	IE
1. B. 1. b. Solid Fuel Transformation	1.40	IE	IE	NO	IE	IE
1. B. 1. c. Other *(please specify)* [5]				NA	NA	NA

(1) The IEFs for CH_4 are estimated on the basis of gross emissions as follows: (CH_4 emissions + amounts of CH_4 flared/recovered) / activity data.

(2) Amounts of CH4 drained (recovered), utilized or flared.

(3) Final CH4 emissions after subtracting the amounts of CH4 utilized or recovered.

(4) In accordance with the IPCC Guidelines, emissions from Mining Activities and Post-Mining Activities are calculated using the activity data of the amount of fuel produced for Underground Mines and Surface Mines.

(5) This category is to be used for reporting any other solid-fuel-related activities resulting in fugitive emissions, such as emissions from abandoned mines and waste piles.

Note: There are no clear references to the coverage of 1.B.1.b. and 1.B.1.c. in the IPCC Guidelines. Make sure that the emissions entered here are not reported elsewhere. If they are reported under another source category, indicate this by using notation key IE and making the necessary reference in Table 9 (completeness).

Documentation box:

- Parties should provide detailed explanations on the fugitive emissions from source category 1.B.1 Solid Fuels, in the corresponding part of Chapter 3: Energy (CRF source category 1.B.1) of the NIR. Use this documentation box to provide
- Regarding data on the amount of fuel produced entered in the above table, specify in this documentation box whether the fuel amount is based on the run-of-mine (ROM) production or on the saleable production.
- If entries are made for "Recovery/Flaring", indicate in this documentation box whether CH_4 is flared or recovered and provide a reference to the section in the NIR where further details on recovery/flaring can be found.
- If estimates are reported under 1.B.1.b. and 1.B.1.c., use this documentation box to provide information regarding activities covered under these categories and to provide a reference to the section in the NIR where the background information can be found.

TABLE 1.B.2 SECTORAL BACKGROUND DATA FOR ENERGY
Fugitive Emissions from Oil, Natural Gas and Other Sources
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA [1]			IMPLIED EMISSION FACTORS			EMISSIONS		
	Description [1]	Unit [1]	Value	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
				(kg/unit) [2]			(Gg)		
1. B. 2. a. Oil [3]							140.00	5.77	IE,NA
I. Exploration	*number of wells drilled*	number	720.00	IE	IE	IE	IE	IE	IE
ii. Production [4]	*Oil throughput*	Mt	0.86	163 551 401.87	6 433 411.21		140.00	5.51	
iii. Transport	*oil loaded in tankers*	number	NA	IE	IE		IE	IE	
iv. Refining / Storage	*Oil refined (SNAP 0401)*	Mt	8 433.12	NA	31.66	NA	NA	0.27	NA
v. Distribution of Oil Products	*Gasoline Consumption (SNAP 0505)*	Mt	1.99	NA	NA		NA	NA	
vi. Other	*(specify)*		NO	NO	NO		NO	NO	
1. B. 2. b. Natural Gas							92.04	27.50	
i. Exploration	*(specify)*		1 819.00	NA	IE		NA	IE	
ii. Production [4] / Processing	*Gas throughput (a)*	10^6 m^3	1 819.00	50 577.24	IE		92.00	IE	
iii. Transmission	*Pipelines length (km)*	km	1 548.00	24.50	2 900.00		0.04	4.49	
iv. Distribution	*Distribution network length*	km	35 350.00	NA	651.04		NA	23.01	
v. Other Leakage	*(e.g. PJ gas consumed)*	PJ	2 962.42	NO	NO		NO	NO	
at industrial plants and power stations	*(specify)*		NE	NO	NO		NO	NO	
in residential and commercial sectors	*(specify)*		NE	NO	NO		NO	NO	
1. B. 2. c. Venting [5]							IE	IE	
i. Oil	*(specify)*		NA	IE	IE		IE	IE	
ii. Gas	*(specify)*		NA	IE	IE		IE	IE	
iii. Combined	*(specify)*		NA	IE	IE		IE	IE	
Flaring							IE	IE	IE
i. Oil	*(specify)*		NA	IE	IE	IE	IE	IE	IE
ii. Gas	*(specify)*		NA	IE	IE	IE	IE	IE	IE
iii. Combined	*(specify)*		NA	IE	IE	IE	IE	IE	IE
1.B.2.d. Other *(please specify)* [6]							NA	NA	NA

(1) Specify the activity data used in the Description column (see examples). Specify the unit of the activity data in the Unit column using one of the following units: PJ, Tg, 10^6 m^3, 10^6 bbl/yr, km, number of sources (e.g. wells).

(2) The unit of the implied emission factor will depend on the unit of the activity data used, and is therefore not specified in this column.

(3) Use the category also to cover emissions from combined oil and gas production fields. Natural gas processing and distribution from these fields should be included under 1.B.2.b.ii and 1.B.2.b.iv, respectively.

(4) If using default emission factors, these categories will include emissions from production other than venting and flaring.

(5) If using default emission factors, emissions from Venting and Flaring from all oil and gas production should be accounted for under Venting.

(6) For example, fugitive CO_2 emissions from production of geothermal power could be reported here.

Documentation box:

- Parties should provide detailed explanations on the fugitive emissions from source category 1.B.2 Oil and Natural Gas, in the corresponding part of Chapter 3: Energy (CRF source category 1.B.2) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
- Regarding data on the amount of fuel produced entered in this table, specify in this documentation box whether the fuel amount is based on the raw material production or on the saleable production. Note cases where more than one type of activity data is used to estimate emissions.
- Venting and Flaring: Parties using the IPCC software could report venting and flaring emissions together, indicating this in this documentation box.
- If estimates are reported under "1.B.2.d Other", use this documentation box to provide information regarding activities covered under this category and to provide a reference to the section in the NIR where background information can be found.

TABLE 1.C SECTORAL BACKGROUND DATA FOR ENERGY
International Bunkers and Multilateral Operations
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS			EMISSIONS		
	Consumption	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	(TJ)	(t/TJ)			(Gg)		
Aviation Bunkers	24 880.88				1 810.00	0.03	0.06
Jet Kerosene	24 880.88	72.75	0.00	0.00	1 810.00	0.03	0.06
Gasoline	NO	NO	NO	NO	NO	NO	NO
Marine Bunkers	NA,NO				NA,NO	NA,NO	NA,NO
Gasoline	NO	NO	NO	NO	NO	NO	NO
Gas/Diesel Oil	NO	NO	NO	NO	NO	NO	NO
Residual Fuel Oil	NO	NO	NO	NO	NO	NO	NO
Lubricants	NO	NO	NO	NO	NO	NO	NO
Coal	NO	NO	NO	NO	NO	NO	NO
Other *(please specify)*	NA				NA	NA	NA
Multilateral Operations [(1)]	NO	NO	NO	NO	NO	NO	NO

Additional information

Fuel consumption	Distribution [(a)] (per cent)	
	Domestic	International
Aviation	11.15	88.85
Marine	100.00	NA,NO

[(a)] For calculating the allocation of fuel consumption, the sums of fuel consumption for domestic navigation and aviation (table 1.A(a)) and for international bunkers (table 1.C) are used.

[(1)] Parties may choose to report or not report the activity data and implied emission factors for multilateral operations consistent with the principle of confidentiality stated in the UNFCCC r
In any case, Parties should report the emissions from multilateral operations, where available, under the Memo Items section of the Summary tables and in the Sectoral report table for energy.

Note: In accordance with the IPCC Guidelines, international aviation and

Documentation box:
• Parties should provide detailed explanations on the fuel combustion sub-sector, including international bunker fuels, in the corresponding part of Chapter 3: Energ (CRF sub-sector 1.A) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
• Provide in this documentation box a brief explanation on how the consumption of international marine and aviation bunker fuels was estimated and separated from domestic consumption, and include a reference to the section of the NIR where the explanation is provided in more detail.

TABLE 2(I) SECTORAL REPORT FOR INDUSTRIAL PROCESSES
(Sheet 1 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total Industrial Processes	8 999.94	0.92	0.90	1 336.59	857.80	380.99	135.67	0.02	0.02	1.63	24.37	4.73	1.22
A. Mineral Products	3 294.35	IE,NA	IE,NA							IE,NA	9.78	IE,NA	IE,NA
1. Cement Production	1 954.14												NA
2. Lime Production	585.66												
3. Limestone and Dolomite Use	296.24												
4. Soda Ash Production and Use	16.02												
5. Asphalt Roofing	IE										9.78	IE	
6. Road Paving with Asphalt	IE									NA	NA	IE	NA
7. Other *(as specified in table 2(I).A-G)*	442.29	IE,NA	IE,NA							IE,NA	IE,NA	IE,NA	IE,NA
Glass Production	IE	IE	IE							IE	IE	IE	IE
Sinter Production	312.35	NA	NA							NA	NA	NA	NA
Bricks and Tiles (decarbonizing)	129.94	NA	NA							NA	NA	NA	NA
B. Chemical Industry	599.25	0.92	0.90	NO	NO	NO	NO	NO	NO	0.45	11.14	1.32	0.77
1. Ammonia Production	541.76	0.11	NA							0.22	0.08	IE	NA
2. Nitric Acid Production			0.90							0.17			
3. Adipic Acid Production	NO		NO							NO	NO	NO	
4. Carbide Production	30.52	NA,NO								NA	NA	NA	NA
5. Other *(as specified in table 2(I).A-G)*	26.96	0.81	NA,NO	NO	NA,NO	NO	NA,NO	NO	NO	0.07	11.07	1.32	0.77
Carbon Black		NO											
Ethylene	NA	0.50	NA										
Dichloroethylene		NO											
Styrene		NO											
Methanol		NO											
Other Chemical Industry	26.54	0.31	NA	NO	NO	NO	NO	NO	NO	0.07	11.07	1.32	0.77
CO2 from nitric acid production	0.42	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	5 106.34	0.00	NA	NO	NO	NO	NO	NA,NO	NO	0.11	2.67	0.47	0.45
1. Iron and Steel Production	5 089.49	0.00								0.08	2.35	0.29	0.05
2. Ferroalloys Production	16.85	NA								NA	NA	NA	NA
3. Aluminium Production	NO	NO				NO	NO			NO	NO	NO	NO
4. SF_6 Used in Aluminium and Magnesium Foundries								NA	NO				
5. Other *(as specified in table 2(I).A-G)*	NA	NA	NA	NO	NA,NO	NO	NA,NO	NO	NO	0.02	0.32	0.18	0.40
Non-ferrous metals	NA	NA	NA	NO	NO	NO	NO	NO	NO	0.02	0.32	0.18	0.40

Note: P = Potential emissions based on Tier 1 approach of the IPCC Guidelines. A = Actual emissions based on Tier 2 approach of the IPCC Guidelines. This applies only to source categories where methods exist for both tiers.

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II).

TABLE 2(I) SECTORAL REPORT FOR INDUSTRIAL PROCESSES
(Sheet 2 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)				(Gg)					
D. Other Production	NA									1.07	0.78	2.94	NA
1. Pulp and Paper										1.07	0.78	0.79	NA
2. Food and Drink[2]	NA											2.15	
E. Production of Halocarbons and SF_6					NA		NA		NA				
1. By-product Emissions					NA		NA		NA				
Production of HCFC-22					NA								
Other					NA		NA		NA				
2. Fugitive Emissions					NA		NA		NA				
3. Other *(as specified in table 2(II))*					NA		NA		NA				
F. Consumption of Halocarbons and SF_6				1 336.59	857.80	380.99	135.67	0.02	0.02				
1. Refrigeration and Air Conditioning Equipment				NA	642.07	NA	NO	NA	NA				
2. Foam Blowing				NA	152.98	NA	NO	NA	NA				
3. Fire Extinguishers				NA	29.10	NO	0.17	NA	NA				
4. Aerosols/ Metered Dose Inhalers				NA	26.67	NA	NO	NA	NA				
5. Solvents				NA	1.94	NA	NO	NA	NA				
6. Other applications using ODS[3] substitutes				NA	NO	NA	NO	NA	NA				
7. Semiconductor Manufacture				NA	5.03	NA	135.50	NA	0.01				
8. Electrical Equipment				NA	NO	NA	NO	NA	0.00				
9. Other *(as specified in table 2(II)*				NA	NA,NO	NA	NA,NO	NA	0.01				
Double glaze windows				NA	NA,NO	NA	NO	NA	0.01				
Research and other use				NA	NA,NO	NA	NO	NA	0.00				
G. Other *(as specified in tables 2(I).A-G and 2(II))*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: P = Potential emissions based on Tier 1 approach of the IPCC Guidelines. A = Actual emissions based on Tier 2 approach of the IPCC Guidelines. This applies only to source categories where methods exist for both tie

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II).

(2) CO_2 from Food and Drink Production (e.g. gasification of water) can be of biogenic or non-biogenic origin. Only information on CO_2 emissions of non-biogenic origin should be reported.

(3) ODS: ozone-depleting substances.

Documentation box:
Parties should provide detailed explanations on the industrial processes sector in Chapter 4: Industrial processes (CRF sector 2) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 2(I).A-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES

Emissions of CO_2, CH_4 and N_2O

(Sheet 1 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]			EMISSIONS					
	Production/Consumption quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
						Emissions[3]	Recovery[4]	Emissions[3]	Recovery[4]	Emissions[3]	Recovery[4]
	Description [1]	(kt)	(t/t)			(Gg)					
A. Mineral Products						3 294.35	IE,NO	IE,NA	NO	IE,NA	NO
1. Cement Production	Clinker Production [kt]	3 653.48	0.53			1 954.14	NO				
2. Lime Production	Lime Produced [kt]	780.87	0.75			585.66	NO				
3. Limestone and Dolomite Use	Limestone and Dolomite used [kt]	682.81	0.43			296.24	NO				
4. Soda Ash						16.02	IE,NO				
Soda Ash Production	Soda Ash Production	NA	IE			IE	IE				
Soda Ash Use	Soda Ash Used [kt]	38.64	0.41			16.02	NO				
5. Asphalt Roofing	Roofing Material Production [Mio m2]	27.95	IE			IE	NO				
6. Road Paving with Asphalt	Asphalt Production [kt]	1 304.86	IE			IE	NO				
7. Other *(please specify)*						442.29	NO	IE,NA	NO	IE,NA	NO
Glass Production	(specify)	IE	IE	IE	IE	IE	NO	IE	NO	IE	NO
Sinter Production	MgCO3 sintered [kt]	608.74	0.51	NA	NA	312.35	NO	NA	NO	NA	NO
Bricks and Tiles (decarbonizing)	Bricks Production [kt]	2 130.87	0.06	NA	NA	129.94	NO	NA	NO	NA	NO
B. Chemical Industry						599.25	NO	0.92	NO	0.90	NO
1. Ammonia Production[5]	Ammonia Production [kt]	502.29	1.08	0.00	NA	541.76	NO	0.11	NO	NA	NO
2. Nitric Acid Production	Nitric Acid Production [kt]	579.62			0.00					0.90	NO
3. Adipic Acid Production	Adipic Acid Production	NO	NO		NO	NO	NO			NO	NO
4. Carbide Production	Carbide Production	23.56	1.30	NA,NO		30.52	NO	NA,NO	NO		
Silicon Carbide	Silicon Carbide Production	NO	NO	NO		NO	NO	NO	NO		
Calcium Carbide	Calcium Carbide Production	23.56	1.30	NA		30.52	NO	NA	NO		
5. Other *(please specify)*						26.96	NO	0.81	NO	NA,NO	NO
Carbon Black	Carbon Black Production	NO		NO				NO	NO		
Ethylene	Ethylene Production [kt]	500.00	NA	0.00	NA	NA	NO	0.50	NO	NA	NO
Dichloroethylene	Dichloroethylene Production	NO		NO				NO	NO		
Styrene	Styrene Production [kt]	NO		NO				NO	NO		
Methanol	Methanol Production	NO		NO				NO	NO		
Other Chemical Industry	Other Chemical Products [kt]	NA	NA	NA	NA	26.54	NO	0.31	NO	NA	NO
CO2 from nitric acid production	(Specify)	NO	NO	NO	NO	0.42	NO	NO	NO	NO	NO

(1) Where the IPCC Guidelines provide options for activity data, e.g. cement production or clinker production for estimating the emissions from Cement Production, specify the activity data used (as shown in the example in parentheses) in order to make the choice of emission factor more transparent and to facilitate comparisons of implied emission factors.
(2) The implied emission factors (IEF) are estimated on the basis of gross emissions as follows: IEF = (emissions plus amounts recovered, oxidized, destroyed or transformed) / activity data.
(3) Final emissions are to be reported (after subtracting the amounts of emission recovery, oxidation, destruction or transformation).
(4) Amounts of emission recovery, oxidation, destruction or transformation.
(5) To avoid double counting, make offsetting deductions for fuel consumption (e.g. natural gas) in Ammonia Production, first for feedstock use of the fuel, and then for a sequestering use of the feedstock.

TABLE 2(I).A-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO_2, CH_4 and N_2O
(Sheet 2 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS [(2)]			EMISSIONS					
	Production/Consumption quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
						Emissions[(3)]	Recovery[(4)]	Emissions[(3)]	Recovery[(4)]	Emissions[(3)]	Recovery[(4)]
	Description [(1)]	(kt)	(t/t)			(Gg)					
C. Metal Production						5 106.34	NO	0.00	NO	NA	NO
1. Iron and Steel Production			0.31	0.00		5 089.49	NO	0.00	NO		
Steel	Steel Production [kt]	7 127.00	0.11	IE		778.03	NO	IE	NO		
Pig Iron	Iron Production [kt]	5 565.09	0.77	IE		4 262.83	NO	IE	NO		
Sinter	Sinter Production [kt]	3 527.74	IE	IE		IE	NO	IE	NO		
Coke	Coke Production [kt]	1.40	IE	IE		IE	NO	IE	NO		
Other *(please specify)*						48.64	NO	0.00	NO		
Electric Furnace Steel production	Electric Furnace Steel Production	639.85	0.08	0.00		48.64	NO	0.00	NO		
Rolling mills	Product	6 487.16	NA	0.00		NA	NO	0.00	NO		
Foundries	Product	207.13	NA	NA		NA	NO	NA	NO		
2. Ferroalloys Production	Ferroalloys Production [kt]	12.39	1.36	NA		16.85	NO	NA	NO		
3. Aluminium Production	Aluminium production [kt]	NO	NO	NO		NO	NO	NO	NO		
4. SF_6 Used in Aluminium and Magnesium Foundries											
5. Other *(please specify)*						NA	NO	NA	NO	NA	NO
Non-ferrous metals	Non-ferrous metal Production [kt]	130.83	NA	NA	NA	NA	NO	NA	NO	NA	NO
D. Other Production						NA	NO				
1. Pulp and Paper											
2. Food and Drink	Bread, Wine, Beer, Spirits Production [kt]	1 464.55	NA			NA	NO				
G. Other *(please specify)*						NA	NA	NA	NA	NA	NA

(1) Where the IPCC Guidelines provide options for activity data, e.g. cement production or clinker production for estimating the emissions from Cement Production, specify the activity data used (as shown in the example in parentheses) in order to make the choice of emission fac more transparent and to facilitate comparisons of implied emission factors.

(2) The implied emission factors (IEF) are estimated on the basis of gross emissions as follows: IEF = (emissions + amounts recovered, oxidized, destroyed or transformed) / activity data

(3) Final emissions are to be reported (after subtracting the amounts of emission recovery, oxidation, destruction or transformation)

(4) Amounts of emission recovery, oxidation, destruction or transformation

Documentation box:
• Parties should provide detailed explanations on the industrial processes sector in Chapter 4: Industrial processes (CRF sector 2) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
• In relation to metal production, more specific information (e.g. data on virgin and recycled steel production) could be provided in this documentation box, or in the NIR, together with a reference to the relevant section.
• Confidentiality: Where only aggregate figures for activity data are provided, e.g. due to reasons of confidentiality, a note indicating this should be provided in this documentation box.

TABLE 2(II) SECTORAL REPORT FOR INDUSTRIAL PROCESSES - EMISSIONS OF HFCs, PFCs AND SF_6
(Sheet 1 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFC-23	HFC-32	HFC-41	HFC-43-10mee	HFC-125	HFC-134	HFC-134a	HFC-152a	HFC-143	HFC-143a	HFC-227ea	HFC-236fa	HFC-245ca	Unspecified mix of listed HFCs (1)	Total HFCs	CF_4	C_2F_6	C_3F_8	C_4F_{10}	$c\text{-}C_4F_8$	C_5F_{12}	C_6F_{14}	Unspecified mix of listed PFCs (1)	Total PFCs	SF_6
	(t) (2)													CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(t) (2)							CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(t) (2)
Total Actual Emissions of Halocarbons (by chemical) and SF_6	1.90	6.18	NA,NO	1.49	58.81	NA,NO	292.62	415.64	NA,NO	49.41	2.37	NA,NO	NA,NO	31.70		IE,NA,NO	IE,NA,NO	IE,NA,NO	0.02	IE,NA,NO	NA,NO	NA,NO	135.50		20.09
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		NO
Aluminium Production																NO	NO	NO	NO	NO	NO	NO	NO		
SF_6 Used in Aluminium Foundries																									NO
SF_6 Used in Magnesium Foundries																									NO
E. Production of Halocarbons and SF_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA		NA
1. By-product Emissions	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA		NA
Production of HCFC-22	NA																								
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA		NA
2. Fugitive Emissions	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA		NA
3. Other *(as specified in table 2(II).C,E)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA		NA
F(a). Consumption of Halocarbons and SF_6 (actual	1.90	6.18	NO	1.49	58.81	NO	292.62	415.64	NO	49.41	2.37	NO	NO	31.70		IE,NO	IE,NO	IE,NO	0.02	IE,NO	NO	NO	135.50		20.09
1. Refrigeration and Air Conditioning Equipment	NO	6.18	NO	NO	58.81	NO	219.61	0.86	NO	49.41	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		NA
2. Foam Blowing	NO	NO	NO	NO	NO	NO	73.01	414.77	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		NA
3. Fire Extinguishers	1.90	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.37	NO	NO	NO		NO	NO	NO	0.02	NO	NO	NO	NO		NA
4. Aerosols/Metered Dose Inhalers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	26.67		NO	NO	NO	NO	NO	NO	NO	NO		NA
5. Solvents	NO	NO	NO	1.49	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		NA
6. Other applications using ODS (3) substitutes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		NA
7. Semiconductor Manufacture	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	5.03		IE	IE	IE	NO	IE	NO	NO	135.50		7.04
8. Electrical Equipment	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		1.59
9. Other *(as specified in table 2(II)F)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA		NO	NO	NO	NO	NO	NO	NO	NO		11.47
Double glaze windows	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA		NO	NO	NO	NO	NO	NO	NO	NO		11.38
Research and other use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA		NO	NO	NO	NO	NO	NO	NO	NO		0.09
G. Other *(please specify)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA		NA

Note: All footnotes for this table are given at the end of the table on sheet 2.

Note: Gases with global warming potential (GWP) values not yet agreed upon by the Conference of the Parties should be reported in table 9(b).

TABLE 2(II) SECTORAL REPORT FOR INDUSTRIAL PROCESSES - EMISSIONS OF HFCs, PFCs AND SF_6
(Sheet 2 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFC-23	HFC-32	HFC-41	HFC-43-10mee	HFC-125	HFC-134	HFC-134a	HFC-152a	HFC-143	HFC-143a	HFC-227ea	HFC-236fa	HFC-245ca	Unspecified mix of listed HFCs [1]	Total HFCs	CF_4	C_2F_6	C_3F_8	C_4F_{10}	$c\text{-}C_4F_8$	C_5F_{12}	C_6F_{14}	Unspecified mix of listed PFCs [1]	Total PFCs	SF_6
	(t)[2]													CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(t)[2]							CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(t)[2]
F(p). Total Potential Emissions of Halocarbons (by chemical) and SF_6 [4]	1.90	15.25	NE,NO	1.52	121.57	NE,NO	378.82	103.16	NE,NO	106.35	8.00	NE,NO	NE,NO	27.83		IE,NE,NO	IE,NE,NO	IE,NE,NO	IE,NE,NO	IE,NO	NO	NO	380.99		17.33
Production[5]	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		NO
Import:	1.90	15.25	NE,NO	1.52	121.57	NE,NO	378.82	103.16	NE,NO	106.35	8.00	NE,NO	NE,NO	27.83		IE,NO	IE,NO	IE,NO	NO	IE,NO	NO	NO	380.99		17.33
In bulk	1.90	15.25	NO	1.52	121.57	NO	378.82	103.16	NO	106.35	8.00	NO	NO	27.83		IE	IE	IE	NO	IE	NO	NO	380.99		17.33
In products[6]	IE	IE	NE	NE	IE	NE	IE	IE	NE	IE	IE	NE	NE	NO		NO	NO	NO	NO	NO	NO	NO	NO		IE
Export:	IE	IE	NE,NO	NE,NO	IE	NE,NO	IE	IE	NE,NO	IE	IE	NE,NO	NE,NO	NO		IE,NO	IE,NO	IE,NO	IE,NO	NO	NO	NO	NO		IE
In bulk	IE	IE	NO	NO	IE	NO	IE	IE	NO	IE	IE	NO	NO	NO		IE	IE	IE	IE	NO	NO	NO	NO		IE
In products[6]	IE	IE	NE	NE	IE	NE	IE	IE	NE	IE	IE	NE	NE	NO		NO	NO	NO	NO	NO	NO	NO	NO		IE
Destroyed amount	NE	NE	NO	NO	NE	NO	NE	NE	NO	NE	NE	NO	NO	NO		NE	NE	NE	NE	NO	NO	NO	NO		NE
GWP values used	**11700**	**650**	**150**	**1300**	**2800**	**1000**	**1300**	**140**	**300**	**3800**	**2900**	**6300**	**560**			**6500**	**9200**	**7000**	**7000**	**8700**	**7500**	**7400**			**23900**
Total Actual Emissions[7] (CO_2 equivalent (Gg))	22.24	4.02	NA,NO	1.94	164.67	NA,NO	380.40	58.19	NA,NO	187.77	6.86	NA,NO	NA,NO	31.70	857.80	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.17	IE,NA,NO	NA,NO	NA,NO	135.50	135.67	480.24
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F(a). Consumption of Halocarbons and SF_6	22.24	4.02	NO	1.94	164.67	NO	380.40	58.19	NO	187.77	6.86	NO	NO	31.70	857.80	IE,NO	IE,NO	IE,NO	0.17	IE,NO	NO	NO	135.50	135.67	480.24
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ratio of Potential/Actual Emissions from Consumption of Halocarbons and SF_6																									
Actual emissions - F(a) (Gg CO_2 eq.)	22.24	4.02	NO	1.94	164.67	NO	380.40	58.19	NO	187.77	6.86	NO	NO	31.70	857.80	IE,NO	IE,NO	IE,NO	0.17	IE,NO	NO	NO	135.50	135.67	480.24
Potential emissions - F(p)[8] (Gg CO_2 eq.)	22.23	9.91	NE,NO	1.97	340.39	NE,NO	492.46	14.44	NE,NO	404.15	23.20	NE,NO	NE,NO	27.83	1 336.59	IE,NE,NO	IE,NE,NO	IE,NE,NO	IE,NE,NO	IE,NO	NO	NO	380.99	380.99	414.22
Potential/Actual emissions ratio	1.00	2.47	NE,NO	1.02	2.07	NE,NO	1.29	0.25	NE,NO	2.15	3.38	NE,NO	NE,NO	0.88	1.56	IE,NE,NO	IE,NE,NO	IE,NE,NO	IE,NE,NO	IE,NO	NO	NO	2.81	2.81	0.86

(1) In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), these columns could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for these columns is Gg of CO_2 equivalent.

(2) Note that the units used in this table differ from those used in the rest of the Sectoral report tables, i.e. *t* instead of *Gg* .

(3) ODS: ozone-depleting substances.

(4) Potential emissions of each chemical of halocarbons and SF_6 estimated using Tier 1a or Tier 1b of the IPCC Guidelines (Volume 3. Reference Manual, pp. 2.47-2.50). Where potential emission estimates are available in a disaggregated manner for the source categories F.1 to F.9, these should be reported in the NIR and a reference should be provided in the documentation box. Use table Summary 3 to indicate whether Tier 1a or Tier 1b was used.

(5) Production refers to production of new chemicals. Recycled substances could be included here, but avoid double counting of emissions. An indication as to whether recycled substances are included should be provided in the documentation box to this table.

(6) Relevant only for Tier 1b

(7) Total actual emissions equal the sum of the actual emissions of each halocarbon and SF_6 from the source categories 2.C, 2.E, 2.F and 2.G as reported in sheet 1 of this table multiplied by the corresponding GWP values.

(8) Potential emissions of each halocarbon and SF_6 taken from row F(p) multiplied by the corresponding GWP values.

Note: As stated in the UNFCCC reporting guidelines, Parties should report actual emissions of HFCs, PFCs and SF_6 where data are available, providing disaggregated data by chemical and source category in units of mass and in CO_2 equivalent. Parties reporting actual emissions should also report potential emissions for the sources where the concept of potential emissions applies, for reasons of transparency and comparability. Gases with GWP values not yet agreed upon by the COP should be reported in Table 9 (b).

Documentation box:
- Parties should provide detailed explanations on the industrial processes sector in Chapter 4: Industrial processes (CRF sector 2) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
- If estimates are reported under "2.G Other", use this documentation box to provide information regarding activities covered under this category and to provide reference to the section in the NIR where background information can be found.

TABLE 2(II).C SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Metal Production
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS[(2)]			EMISSIONS					
			CF_4	C_2F_6	SF_6	CF_4		C_2F_6		SF_6	
						Emissions[(3)]	Recovery[(4)]	Emissions[(3)]	Recovery[(4)]	Emissions[(3)]	Recovery[(4)]
	Description [(1)]	(t)	(kg/t)			(t)					
C. PFCs and SF_6 from Metal Production						NO	NO	NO	NO	NO	NO
PFCs from Aluminium Production	Aluminium production [kt]	NO	NO	NO		NO	NO	NO	NO		
SF_6 used in Aluminium and Magnesium Foundries										NO	NO
Aluminium Foundries	cast Aluminium [t]	C			NO					NO	NO
Magnesium Foundries	cast Magnesium [t]	3 600.00			NO					NO	NO

(1) Specify the activity data used as shown in the examples in parentheses.

(2) The implied emission factors (IEFs) are estimated on the basis of gross emissions as follows: IEF = (emissions + amounts recovered, oxidized, destroyed or transformed) / activity data.

(3) Final emissions (after subtracting the amounts of emission recovery, oxidation, destruction or transformation).

(4) Amounts of emission recovery, oxidation, destruction or transformation.

Documentation box:
• Parties should provide detailed explanations on the industrial processes sector in Chapter 4: Industrial processes (CRF sector 2) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
• Where only aggregate figures for activity data are provided, e.g. due to reasons of confidentiality (see footnote 1 to table 2(II)), a note indicating this should be provided in this documentation box.
• Where applying Tier 1b and country-specific methods, specify any other relevant activity data used in this documentation box, including a reference to the section of the NIR where more detailed information can be found.
• Use this documentation box for providing clarification on emission recovery, oxidation, destruction and/or transformation, and provide a reference to the section of the NIR where more detailed information can be found.

TABLE 2(II).E SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Production of Halocarbons and SF_6
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]	EMISSIONS	
				Emissions[3]	Recovery[4]
	Description [1]	(t)	(kg/t)	(t)	
E. Production of Halocarbons and SF_6					
1. By-product Emissions					
Production of HCFC-22					
HFC-23	HFC-23 production	NO	NA	NA	NO
Other *(specify activity and chemical)*					
2. Fugitive Emissions *(specify activity and chemical)*					
HFCs				NA	
HFC-23				NA	
HFC-32				NA	
HFC-41				NA	
HFC-43-10-mee				NA	
HFC-125				NA	
HFC-134				NA	
HFC-134a				NA	
HFC-152a				NA	
HFC-143				NA	
HFC-143a				NA	
HFC-227ea				NA	
HFC-236fa				NA	
HFC-245ca				NA	
Unspecified mix of HFCs				NA	
PFCs				NA	
CF4				NA	
C2F6				NA	
C3F8				NA	
C4F10				NA	
c-C4F8				NA	
C5F12				NA	
C6F14				NA	
Unspecified mix of PFCs				NA	
SF6				NA	
3. Other *(specify activity and chemical)*					
HFCs				NA	
HFC-23				NA	
HFC-32				NA	
HFC-41				NA	
HFC-43-10-mee				NA	
HFC-125				NA	
HFC-134				NA	
HFC-134a				NA	
HFC-152a				NA	
HFC-143				NA	
HFC-143a				NA	
HFC-227ea				NA	
HFC-236fa				NA	
HFC-245ca				NA	
Unspecified mix of HFCs				NA	
PFCs				NA	
CF4				NA	
C2F6				NA	
C3F8				NA	
C4F10				NA	
c-C4F8				NA	
C5F12				NA	
C6F14				NA	
Unspecified mix of PFCs				NA	
SF6				NA	

(1) Specify the activity data used as shown in the examples within parentheses
(2) The implied emission factors (IEFs) are estimated on the basis of gross emissions as follows: IEF = (emissions + amounts recovered, oxidized, destroyed or transformed) / activity dat
(3) Final emissions are to be reported (after subtracting the amounts of emission recovery, oxidation, destruction or transformation).
(4) Amounts of emission recovery, oxidation, destruction or transformatioı

Documentation box:
• Parties should provide detailed explanations on the industrial processes sector in Chapter 4: Industrial processes (CRF sector 2) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further
• Where only aggregate figures for activity data are provided, e.g. due to reasons of confidentiality (see footnote 1 to table 2(II)), a note indicating this should be provided in this documentation box.

• Where applying Tier 2 and country-specific methods, specify any other relevant activity data used in this documentation box, including a reference to the section of the NIR where more detailed information can be found.

• Use this documentation box for providing clarification on emission recovery, oxidation, destruction and/or transformation, and provide a reference to the section of the NIR where more detailed information can be found

TABLE 2(II).F SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Consumption of Halocarbons and SF_6
(Sheet 1 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA *Amount of fluid*			IMPLIED EMISSION FACTORS			EMISSIONS		
	Filled into new manufactured products	In operating systems (average annual stocks)	Remaining in products at decommissioning	Product manufacturing factor	Product life factor	Disposal loss factor	From manufacturing	From stocks	From disposal
	(t)			(% per annum)			(t)		
1. Refrigeration[1]									
Air Conditioning Equipment									
Domestic Refrigeration *(please specify chemical)* [1]									
HFC-134a	NO	34.36	19.23	NA	1.50	20.00	NA	0.52	3.85
Commercial Refrigeration									
HFC-134a	4.00	40.69	3.44	NA	1.50	20.00	NA	0.61	0.69
Transport Refrigeration									
HFC-134a	5.00	29.22	2.15	NA	10.00	20.00	NA	2.92	0.43
Industrial Refrigeration									
HFC-125	107.88	668.75	NO	NA	8.00	NA	IE	53.50	NO
HFC-152a	1.17	10.79	NO	NA	8.00	NA	IE	0.86	NO
HFC-134a	126.40	902.68	NO	NA	8.00	NA	IE	72.21	NO
HFC-143a	105.04	610.24	NO	NA	8.00	NA	IE	48.82	NO
HFC-32	3.68	21.92	NO	NA	8.00	NA	IE	1.75	NO
Stationary Air-Conditioning									
HFC-143a	1.31	15.88	NO	NA	3.74	NA	IE	0.59	NO
HFC-32	11.57	81.74	NO	NA	5.41	NA	IE	4.42	NO
HFC-125	13.69	102.28	NO	NA	5.19	NA	IE	5.31	NO
HFC-134a	36.34	352.04	NO	NA	5.12	NA	IE	18.04	NO
Mobile Air-Conditioning									
HFC-134a	181.82	862.52	8.90	NA	13.69	25.00	NA	118.12	2.22
2. Foam Blowing[1]									
Hard Foam									
HFC-152a	50.51	1 231.31	NO	NA	24.21	NA	IE	298.15	NO
HFC-134a	25.26	1 571.59	NO	NA	0.66	NA	IE	10.30	NO
Soft Foam									
HFC-134a	NO	169.47	NO	NA	37.00	NO	NA	62.71	NO
HFC-152a	51.48	245.60	NO	NA	47.48	NO	NA	116.62	NO

[1] Under each of the listed source categories, specify the chemical consumed (*e.g. HFC-32)* as indicated under category Domestic Refrigeration; use one row per chemical.

Note: This table provides for reporting of the activity data and emission factors used to calculate actual emissions from consumption of halocarbons and SF_6 using the "bottom-up approach" (based on the total stock of equipment and estimated emission rates from this equipment). Some Parties may prefer to estimate actual emissions following the alternative "top-down approach" (based on annual sales of equipment and/or gas). Those Parties should indicate the activity data used and provide any other information needed to understand the content of the table in the documentation box at the end of sheet 2 to this table, including a reference to the section of the NIR where further details can be found. Those Parties should provide the following data in the NIR:

1. the amount of fluid used to fill new products,
2. the amount of fluid used to service existing products,
3. the amount of fluid originally used to fill retiring products (the total nameplate capacity of retiring products),
4. the product lifetime, and
5. the growth rate of product sales, if this has been used to calculate the amount of fluid originally used to fill retiring products.

In the NIR, Parties may provide alternative formats for reporting equivalent information with a similar level of detail.

TABLE 2(II).F SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Consumption of Halocarbons and SF_6
(Sheet 2 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA *Amount of fluid*			IMPLIED EMISSION FACTORS			EMISSIONS		
	Filled into new manufactured products	In operating systems (average annual stocks)	Remaining in products at decommissioning	Product manufacturing factor	Product life factor	Disposal loss factor	From manufacturing	From stocks	From disposal
	(t)			(% per annum)			(t)		
3. Fire Extinguishers *(please specify chemical)* [(1)]									
HFC-227ea	8.00	47.32	NE	NE	5.00	NE	NE	2.37	NE
C4F10	NO	0.49	NE	NE	5.00	NE	NE	0.02	NE
HFC-23	1.90	38.02	NE	NE	5.00	NE	NE	1.90	NE
4. Aerosols [(1)]									
Metered Dose Inhalers									
Unspecified mix of HFCs	10 120.34	NA	NA	NA	NA	NA	NA	26 673.41	NA
Other									
5. Solvents [(1)]									
HFC-43-10 mee	1.52	NA	NA	NA	NA	NA	NA	1.49	NA
6. Other applications using ODS[(2)] substitutes [(1)]									
7. Semiconductor Manufacture[(1)]									
Unspecified mix of HFCs	17 713.80	NA	NA	0.28	NA	NA	5 031.00	NA	NA
Unspecified mix of PFCs	380 986.00	NA	NA	0.36	NA	NA	135 499.20	NA	NA
SF6	8.41	NA	NA	0.84	NA	NA	7.04	NA	NA
8. Electrical Equipment[(1)]									
SF6	8.91	159.23	NE	NE	1.00	NE	NE	1.59	NE
9. Other *(please specify)* [(1)]									
Double glaze windows									
SF6	NO	276.40	8.16	NO	1.16	NA	NO	3.22	8.16
Research and other use									
SF6	0.02	0.50	NA	NE	NA	NA	NE	0.09	NA

(1) Under each of the listed source categories, specify the chemical consumed (e.g. HFC-32) as indicated under category Fire Extinguishers; use one row per chemical.
(2) ODS: ozone-depleting substances.

Documentation box:
- Parties should provide detailed explanations on the industrial processes sector in Chapter 4: Industrial processes (CRF sector 2) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
- Where only aggregate figures for activity data are provided, e.g. due to reasons of confidentiality (see footnote 1 to table 2(II)), a note indicating this should be provided in this documentation box.
- With regard to data on the amounts of fluid that remained in retired products at decommissioning, use this documentation box to provide a reference to the section of the NIR where information on the amount of the chemical recovered (recovery efficiency) and other relevant information used in the emission estimation can be found.
- Parties that estimate their actual emissions following the alternative top-down approach might not be able to report emissions using this table. As indicated in the note to sheet 1 of this table, Parties should in these cases provide, in the NIR, alternative formats for reporting equivalent

TABLE 3 SECTORAL REPORT FOR SOLVENT AND OTHER PRODUCT USE
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	N_2O	NMVOC
	(Gg)		
Total Solvent and Other Product Use	220.99	0.53	94.92
A. Paint Application	70.10		27.25
B. Degreasing and Dry Cleaning	30.16	NA	11.80
C. Chemical Products, Manufacture and Processing	23.66		11.37
D. Other	97.07	0.53	44.51
1. Use of N_2O for Anaesthesia		0.13	
2. N_2O from Fire Extinguishers		NO	
3. N_2O from Aerosol Cans		0.40	
4. Other Use of N_2O		NO	
5. Other *(as specified in table 3.A-D)*	97.07	NA	44.51
Other non-specified	97.07	NA	44.51

Note: The quantity of carbon released in the form of NMVOCs should be accounted for in both the NMVOC and the CO_2 columns. The quantites of NMVOCs should be converted into CO_2 equivalent emissions before being added to the CO_2 amounts in the CO_2 column.

Documentation box:

• Parties should provide detailed explanations about the Solvent and Other Product Use sector in Chapter 5: Solvent and Other Product Use (CRF sector 3) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

• The IPCC Guidelines do not provide methodologies for the calculation of emissions of N_2O from Solvent and Other Product Use. If reporting such data, Parties should provide in the NIR additional information (activity data and emission factors) used to derive these estimates, and provide in this documentation box a reference to the section of the NIR where this information can be found.

TABLE 3.A-D SECTORAL BACKGROUND DATA FOR SOLVENT AND OTHER PRODUCT USE
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS [(1)]	
	Description	(kt)	CO_2 (t/t)	N_2O (t/t)
A. Paint Application	Solvents used [kt]	60.37	1.16	
B. Degreasing and Dry Cleaning	Solvents used [kt]	21.29	1.42	NA
C. Chemical Products, Manufacture and Processing	Solvents used [kt]	83.41	0.28	
D. Other				
1. Use of N_2O for Anaesthesia	Use of N2O for Anaesthesia [kt]	0.13		1.00
2. N_2O from Fire Extinguishers	N2O from Fire Extinguishers	NO		NO
3. N_2O from Aerosol Cans	N2O from Aerosol Cans	NA		NA
4. Other Use of N_2O	(specify)	NO		NO
5. Other *(please specify)* [(2)]				
Other non-specified	Solvents used [kt]	60.91	1.59	NA

(1) The implied emission factors will not be calculated until the corresponding emission estimates are entered directly into table 3.

(2) Some probable sources to be reported under 3.D Other are listed in this table. Complement the list with other relevant sources, as appropriate.

Documentation box:
Parties should provide detailed explanations on the Solvent and Other Product Use sector in Chapter 5: Solvent and Other Product Use (CRF sector 3) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 4 SECTORAL REPORT FOR AGRICULTURE
(Sheet 1 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4	N_2O	NO_x	CO	NMVOC
	(Gg)				
Total Agriculture	**194.99**	12.24	5.21	1.01	1.79
A. Enteric Fermentation	152.85				
1. Cattle [1]	143.31				
Option A:					
Dairy Cattle	60.67				
Non-Dairy Cattle	82.64				
Option B:					
Mature Dairy Cattle					
Mature Non-Dairy Cattle					
Young Cattle					
2. Buffalo	NO				
3. Sheep	2.50				
4. Goats	0.27				
5. Camels and Llamas	NO				
6. Horses	1.57				
7. Mules and Asses	IE				
8. Swine	4.71				
9. Poultry	0.17				
10. Other *(as specified in table 4.A)*	0.33				
Deer	0.33				
B. Manure Management	41.68	2.82			NE,NO
1. Cattle [1]	21.66				
Option A:					
Dairy Cattle	10.74				
Non-Dairy Cattle	10.92				
Option B:					
Mature Dairy Cattle					
Mature Non-Dairy Cattle					
Young Cattle					
2. Buffalo	NO				
3. Sheep	0.06				
4. Goats	0.01				
5. Camels and Llamas	NO				
6. Horses	0.12				
7. Mules and Asses	IE				
8. Swine	18.81				
9. Poultry	1.02				
10. Other livestock *(as specified in table 4.B(a))*	0.01				
Deer	0.01				

Note: All footnotes for this table are given at the end of the table on sheet 2.

TABLE 4 SECTORAL REPORT FOR AGRICULTURE
(Sheet 2 of 2)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4	N_2O	NO_x	CO	NMVOC
	(Gg)				
B. Manure Management (continued)					
11. Anaerobic Lagoons		NO			NO
12. Liquid Systems		0.07			NE
13. Solid Storage and Dry Lot		2.70			NE
14. Other AWMS		0.05			NE
C. Rice Cultivation	NO				**NO**
1. Irrigated	NO				NO
2. Rainfed	NO				NO
3. Deep Water	NO				NO
4. Other *(as specified in table 4.C)*	NO				NO
Other non-specified	NO				NO
D. Agricultural Soils (2)	0.41	9.42			1.67
1. Direct Soil Emissions	0.41	5.19			1.67
2. Pasture, Range and Paddock Manure (3)		0.70			NA
3. Indirect Emissions	NA	3.52			NA
4. Other *(as specified in table 4.D)*	NA	NA			NA
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.06	0.00	0.03	1.01	0.11
1 . Cereals	0.04	0.00	0.03	0.79	0.06
2. Pulses	NA,NO	NA,NO	NO	NO	NO
3 . Tubers and Roots	NA,NO	NA,NO	NO	NO	NO
4 . Sugar Cane	NO	NO	NO	NO	NO
5 . Other *(as specified in table 4.F)*	0.02	0.00	0.00	0.22	0.05
Vine	0.02	0.00	0.00	0.22	0.05
G. Other *(please specify)*	**NA**	**NA**	**5.18**	**NA**	**NA**
NOX from Agricultural Soils	NA	NA	5.18	NA	NA

(1) The sum for cattle would be calculated on the basis of entries made under either option A (dairy and non-dairy cattle) or option B (mature dairy cattle, mature non-dairy cattle and young cattle).

(2) See footnote 4 to Summary 1.A of this common reporting format. Parties which choose to report CO_2 emissions and removals from agricultural soils under 4.D Agricultural Soils of the sector Agriculture should report the amount (in Gg) of these emissions or removals in table Summary 1.A of the CRF. References to additional information (activity data, emissions factors) reported in the NIR should be provided in the documentation box to table 4.D. In line with the corresponding table in the IPCC Guidelines (i.e. IPCC Sectoral Report for Agriculture), this table does not include provisions for reporting CO_2 estimates.

(3) Direct N_2O emissions from pasture, range and paddock manure are to be reported in the "4.D Agricultural Soils" category. All other N_2O emissions from animal manure are to be reported in the "4.B Manure Management" category. See also chapter 4.4 of the IPCC good practice guidance report.

Note: The IPCC Guidelines do not provide methodologies for the calculation of CH_4 emissions and CH_4 and N_2O removals from agricultural soils, or CO_2 emissions from prescribed burning of savannas and field burning of agricultural residues. Parties that have estimated such emissions should provide, in the NIR, additional information (activity data and emission factors) used to derive these estimates and include a reference to the section of the NIR in the documentation box of the corresponding Sectoral background data tables.

Documentation box:
• Parties should provide detailed explanations on the agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table. • If estimates are reported under "4.G Other", use this documentation box to provide information regarding activities covered under this category and to provide reference to the section in the NIR where background information can be found.
4.B Swine:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.
4.B Swine/2006:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.

TABLE 4.A SECTORAL BACKGROUND DATA FOR AGRICULTURE
Enteric Fermentation
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTORS [3]
	Population size [1] (1000s)	Average gross energy intake (GE) (MJ/head/day)	Average CH_4 conversion rate (Y_m) [2] (%)	CH_4 (kg CH_4/head/yr)
1. Cattle	2 002.92			71.55
Option A:				
Dairy Cattle [4]	527.42	292.32	6.00	115.04
Non-Dairy Cattle	1 475.50	142.32	6.00	56.01
Option B:				
Mature Dairy Cattle				
Mature Non-Dairy Cattle				
Young Cattle				
2. Buffalo	NO	NO	NO	NO
3. Sheep	312.38	20.00	6.00	8.00
4. Goats	53.11	14.00	5.00	5.00
5. Camels and Llamas	NO	NO	NO	NO
6. Horses	87.07	110.00	2.50	18.00
7. Mules and Asses	IE	IE	IE	IE
8. Swine	3 139.44	38.00	0.60	1.50
9. Poultry	13 027.15	2.18	0.09	0.01
10. Other *(please specify)*				
Deer	41.19	20.00	6.00	8.00

[1] Parties are encouraged to provide detailed livestock population data by animal type and region, if available, in the NIR, and provide in the documentation box below a reference to the relevant section. Parties should use the same animal population statistics to estimate CH4 emissions from enteric fermentation, CH4 and N2O from manure management, N2O direct emissions from soil and N2O emissions associated with manure production, as well as emissions from the use of manure as fuel, and sewage-related emissions reported in the Waste sector.

[2] Y_m refers to the fraction of gross energy in feed converted to methane and should be given in per cent in this table.

[3] The implied emission factors will not be calculated until the corresponding emission estimates are entered directly into Table 4.

[4] Including data on dairy heifers, if available.

Documentation box:
• Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
• Indicate in this documentation box whether the activity data used are one-year estimates or a three-year averages.
• Provide a reference to the relevant section in the NIR, in particular with regard to:
(a) disaggregation of livestock population (e.g. according to the classification recommended in the IPCC good practice guidance), including information on whether these data are one-year estimates
(b) parameters relevant to the application of IPCC good practice guidance.

Additional information (only for those livestock types for which Tier 2 was used) [a]

Disaggregated list of animals [b] / Indicators:		Dairy Cattle	Non-Dairy Cattle	Mature Dairy Cattle	Mature Non-Dairy Cattle	Young Cattle	Buffalo	Sheep	Goats	Camels and Llamas	Horses	Mules and Asses	Swine	Poultry	Other *(specify)*	Deer
Weight	(kg)	700.00	427.07				NO	NE	NE	NO	NE	NE	NE	NE		NE
Feeding situation [c]		Stall/Pasture	Stall/Pastur				NO	NE	NE	NO	NE	NE	NE	NE		NE
Milk yield	(kg/day)	16.17	NO				NO	NE	NE	NO	NE	NE	NE	NE		NE
Work	(h/day)	NO	NO				NO	NE	NE	NO	NE	NE	NE	NE		NE
Pregnant	(%)	90.00	16.55				NO	NE	NE	NO	NE	NE	NE	NE		NE
Digestibility of feed	(%)	70.00	72.35				NO	NE	NE	NO	NE	NE	NE	NE		NE

[a] See also Tables A-1 and A-2 of the IPCC Guidelines (Volume 3. Reference Manual, pp. 4.31-4.34). These data are relevant if Parties do not have data on average feed intake.
[b] Disaggregate to the split actually used. Add columns to the table if necessary.
[c] Specify feeding situation as pasture, stall fed, confined, open range, etc.

TABLE 4.B(a) SECTORAL BACKGROUND DATA FOR AGRICULTURE
CH_4 Emissions from Manure Management
(Sheet 1 of 2)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION							IMPLIED EMISSION FACTORS (4)
	Population size (1000s)	Allocation by climate region (1) (%)			Typical animal mass (average) (kg)	VS(2) daily excretion (average) (kg dm/head/day)	CH_4 producing potential (Bo)(2) (average) (m^3 CH_4/kg VS)	CH_4 (kg CH_4/head/yr)
		Cool	Temperate	Warm				
1. Cattle	2 002.92							10.82
Option A:								
Dairy Cattle (3)	527.42	100.00	NO	NO	700.00	4.23	0.24	20.36
Non-Dairy Cattle	1 475.50	100.00	NO	NO	427.07	1.95	0.17	7.40
Option B:								
Mature Dairy Cattle								
Mature Non-Dairy Cattle								
Young Cattle								
2. Buffalo	NO	NO	NO	NO	NO	NO	NO	NO
3. Sheep	312.38	100.00	NO	NO	43.00	0.40	0.19	0.19
4. Goats	53.11	100.00	NO	NO	30.00	0.28	0.17	0.12
5. Camels and Llamas	NO	NO	NO	NO	NO	NO	NO	NO
6. Horses	87.07	100.00	NO	NO	238.00	1.72	0.33	1.39
7. Mules and Asses	IE	IE	NO	NO	238.00	627.80	0.33	IE
8. Swine	3 139.44	100.00	NA	NA	82.00	0.40	0.45	5.99
9. Poultry	13 027.15	100.00	NA	NA	1.10	0.10	0.32	0.08
10. Other livestock *(please specify)*								
Deer	41.19	NA	NA	NA	43.00	0.40	0.19	0.19

(1) Climate regions are defined in terms of annual average temperature as follows: Cool = less than 15°C; Temperate = 15 - 25°C inclusive; and Warm = greater than 25°C (see table 4.2 of the IPCC Guidelines (Volume 3, Reference Manual, p. 4.8)).

(2) VS = Volatile Solids; Bo = maximum methane producing capacity for manure IPCC Guidelines (Volume 3, Reference Manual, p.4.23 and p.4.15); dm = dry matter. Provide average values for VS and Bo where original calculations were made at a more disaggregated level of these livestock categories.

(3) Including data on dairy heifers, if available

(4) The implied emission factors will not be calculated until the corresponding emission estimates are entered directly into table 4

Documentation box:
- Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.
- Indicate in this documentation box whether the activity data used are one-year estimates or three-year averages.
- Provide a reference to the relevant section in the NIR, in particular with regard to:
  (a) disaggregation of livestock population (e.g. according to the classification recommended in the IPCC good practice guidance), including information on whether these data are one-year estimates or three-year averages.
  (b) parameters relevant to the application of IPCC good practice guidance;
  (c) information on how the MCFs are derived, if relevant data could not be provided in the additional information box.

4.B Swine:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.
4.B Swine/2006:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.

TABLE 4.B(a) SECTORAL BACKGROUND DATA FOR AGRICULTURE
CH_4 Emissions from Manure Management
(Sheet 2 of 2)

Additional information (for Tier 2)[(a)]

Animal category	Indicator	Climate region	Animal waste management system						
			Anaerobic lagoon	Liquid system	Daily spread	Solid storage	Dry lot	Pasture range paddock	Other
Dairy Cattle	Allocation (%)	Cool	NO	18,95	NO	70,4	NO	10,65	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[(b)]	Cool	90.00	39.00	NO	1.00	NO	1.00	1.00
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
Non-Dairy Cattle	Allocation (%)	Cool	NO	23,85	NO	66,47	NO	9,68	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[(b)]	Cool	90.00	39.00	NO	1.00	NO	1.00	1.00
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
Mature Dairy Cattle	Allocation (%)	Cool							
		Temperate							
		Warm							
	MCF[(b)]	Cool							
		Temperate							
		Warm							
Mature Non-Dairy Cattle	Allocation (%)	Cool							
		Temperate							
		Warm							
	MCF[(b)]	Cool							
		Temperate							
		Warm							
Young Cattle	Allocation (%)	Cool							
		Temperate							
		Warm							
	MCF[(b)]	Cool							
		Temperate							
		Warm							
Buffalo	Allocation (%)	Cool	NO	NO	NO	NO	NO	NO	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[(b)]	Cool	NO	NO	NO	NO	NO	NO	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
Sheep	Allocation (%)	Cool	NA	NA	NA	NA	NA	NA	NA
		Temperate	NA	NA	NA	NA	NA	NA	NA
		Warm	NA	NA	NA	NA	NA	NA	NA
	MCF[(b)]	Cool	NA	NA	NA	NA	NA	NA	NA
		Temperate	NA	NA	NA	NA	NA	NA	NA
		Warm	NA	NA	NA	NA	NA	NA	NA
Goats	Allocation (%)	Cool							
		Temperate							
		Warm							
	MCF[(b)]	Cool							
		Temperate							
		Warm							
Camels and Llamas	Allocation (%)	Cool	NO	NO	NO	NO	NO	NO	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[(b)]	Cool	NO	NO	NO	NO	NO	NO	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
Horses	Allocation (%)	Cool							
		Temperate							
		Warm							
	MCF[(b)]	Cool							
		Temperate							
		Warm							
Mules and Asses	Allocation (%)	Cool	IE	IE	IE	IE	NO	IE	IE
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[(b)]	Cool	IE	IE	IE	IE	NO	IE	IE
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
Swine	Allocation (%)	Cool	NO	71,5	NO	28,5	NO	NO	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[(b)]	Cool	90.00	39.00	NO	1.00	NO	1.00	1.00
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
Poultry	Allocation (%)	Cool							
		Temperate							
		Warm							
	MCF[(b)]	Cool							
		Temperate							
		Warm							
Other livestock *(please specify)*	Allocation (%)	Cool							
		Temperate							
		Warm							
	MCF[(b)]	Cool							
		Temperate							
		Warm							

[(a)] The information required in this table may not be directly applicable to country-specific methods developed for MCF calculations. In such cases, information on MCF derivation should be described in the NIR and references to the relevant sections of the NIR should be provided in the documentation box.

[(b)] MCF = Methane Conversion Factor (IPCC Guidelines, (Volume 3. Reference Manual, p. 4.9)). If another climate region categorization is used, replace the entries in the cells with the climate regions for which the MCFs are specified.

TABLE 4.B(b) SECTORAL BACKGROUND DATA FOR AGRICULTURE
N_2O Emissions from Manure Management
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION							
	Population size	Nitrogen excretion	Nitrogen excretion per animal waste management system (AWMS) (kg N/yr)					
	(1000s)	(kg N/head/yr)	Anaerobic lagoon	Liquid system	Daily spread	Solid storage and dry lot	Pasture range and paddock	Other
Cattle	2 002.92		NO	25 206 141.95	NO	79 595 721.03	13 453 789.55	NO
Option A:								
Dairy Cattle	527.42	95.63	NO	9 583 086.81	NO	35 507 858.51	5 346 353.70	NO
Non-Dairy Cattle	1 475.50	45.96	NO	15 623 055.13	NO	44 087 862.52	8 107 435.85	NO
Option B:								
Mature Dairy Cattle								
Mature Non-Dairy Cattle								
Young Cattle								
Sheep	312.38	13.10	NO	NO	NO	81 842.25	3 560 137.88	450 132.38
Swine	3 139.44	14.28	NO	15 421 177.57	NO	6 274 394.43	NO	NO
Poultry	13 027.15	0.55	NO	931 363.14	NO	71 643.32	143 286.64	6 018 038.76
Buffalo	NO	NO	NO	NO	NO	NO	NO	NO
Goats	53.11	12.30	NO	NO	NO	NO	627 099.26	26 129.14
Camels and Liamas	NO	NO	NO	NO	NO	NO	NO	NO
Horses	87.07	47.90	NO	NO	NO	NO	4 003 918.85	166 829.95
Mules and Asses	IE	IE	IE	IE	IE	IE	IE	IE
Other livestock *(please specify)*								
Deer	41.19	13.10	NO	NO	NO	NO	518 005.44	21 583.56
Total per AWMS			IE,NO	41 558 682.66	IE,NO	86 023 601.03	22 306 237.61	6 682 713.79

IMPLIED EMISSION FACTORS (1)	
Emission factor per animal waste management system	
(kg N_2O-N/kg N)	
Anaerobic lagoon	NO
Liquid system	0.00
Solid storage and dry lot	0.02
Other AWMS	0.00

(1) The implied emission factor will not be calculated until the emissions are entered directly into table

Documentation box:

• Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

• Indicate in this documentation box whether the activity data used are one-year estimates or three-year averages.
• Provide a reference to the relevant section in the NIR, in particular with regard to:
(a) disaggregation of livestock population (e.g. according to the classification recommended in the IPCC good practice guidance), including information on whether these data are one-year estimates or three-year averages.
(b) information on other AWMS, if reported.

4.B Swine:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.
4.B Swine/2006:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine

TABLE 4.C SECTORAL BACKGROUND DATA FOR AGRICULTURE
Rice Cultivation
(Sheet 1 of 1)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTOR (1)	EMISSIONS
		Harvested area (2)	Organic amendments added(3)		CH_4	CH_4
		(10^9 m^2/yr)	type	(t/ha)	(g/m^2)	(Gg)
1. Irrigated						NO
Continuously Flooded		NO	(specify type)	NO	NO	NO
Intermittently Flooded	Single Aeration	NO	(specify type)	NO	NO	NO
	Multiple Aeration	NO	(specify type)	NO	NO	NO
2. Rainfed						NO
Flood Prone		NO	(specify type)	NO	NO	NO
Drought Prone		NO	(specify type)	NO	NO	NO
3. Deep Water						NO
Water Depth 50-100 cm		NO	(specify type)	NO	NO	NO
Water Depth > 100 cm		NO	(specify type)	NO	NO	NO
4. Other *(please specify)*		NO				NO
Other non-specified		NO	(specify type)	NO	NO	NO
Upland Rice(4)		NO				
Total (4)		NO				

(1) The implied emission factor implicitly takes account of all relevant corrections for continuously flooded fields without organic amendment, the correction for the organic amendments and the effect of different soil characteristics, if considered in the calculation of methane emissions.

(2) Harvested area is the cultivated area multiplied by the number of cropping seasons per year.

(3) Specify dry weight or wet weight for organic amendments in the documentation box.

(4) These rows are included to allow comparison with international statistics. Methane emissions from upland rice are assumed to be zero.

Documentation box:

- Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
- When disaggregating by more than one region within a country, and/or by growing season, provide additional information on disaggregation and related data in the NIR and provide a reference to the relevant section in the NIR.
- Where available, provide activity data and scaling factors by soil type and rice cultivar in the NIR.

TABLE 4.D SECTORAL BACKGROUND DATA FOR AGRICULTURE

Agricultural Soils

(Sheet 1 of 2)

Inventory 2006

Submission 2008 v1.1

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION		IMPLIED EMISSION FACTORS	EMISSIONS
	Description	Value		N_2O
		kg N/yr	kg N_2O-N/kg N [2]	(Gg)
1. Direct Soil Emissions	**N input to soils**			5.19
1. Synthetic Fertilizers	Nitrogen input from application of synthetic fertilizers	98 127 046.60	0.01	1.93
2. Animal Manure Applied to Soils	Nitrogen input from manure applied to soils	102 941 934.36	0.01	2.02
3. N-fixing Crops	Nitrogen fixed by N-fixing crops	23 074 347.20	0.01	0.45
4. Crop Residue	Nitrogen in crop residues returned to soils	38 770 985.90	0.01	0.76
5. Cultivation of Histosols [2]	Area of cultivated organic soils (ha/yr)	NO	NO	NO
6. Other direct emissions *(please specify)*				0.03
Sewage Sludge Spreading	(specify)	1 541 037.97	0.01	0.03
2. Pasture, Range and Paddock Manure	**N excretion on pasture range and paddock**	22 306 237.61	0.02	0.70
3. Indirect Emissions				3.52
1. Atmospheric Deposition	Volatized N from fertilizers, animal manures and other	36 026 136.24	0.01	0.57
2. Nitrogen Leaching and Run-off	N from fertilizers, animal manures and other that is lost through leaching and run-off	75 243 626.29	0.02	2.96
4. Other *(please specify)*				NA

(1) To convert from N_2O-N to N_2O emissions, multiply by 44/28. Note that for cultivation of Histosols the unit of the IEF is kg N_2O-N/ha.

Documentation box:

• Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

• Provide a reference to the relevant section in the NIR, in particular with regard to:

(a) Background information on CH_4 emissions from agricultural soils, if accounted for under the Agriculture sector;

(b) Disaggregated values for $Frac_{GRAZ}$ according to animal type, and for $Frac_{BURN}$ according to crop types;

(c) Full list of assumptions and fractions used.

TABLE 4.D SECTORAL BACKGROUND DATA FOR AGRICULTURE

Inventory 2006

Agricultural Soils[1]

Submission 2008 v1.1

(Sheet 2 of 2)

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Additional information

Fraction [a]	Description	Value
$Frac_{BURN}$	Fraction of crop residue burned	0.00
$Frac_{FUEL}$	Fraction of livestock N excretion in excrements burned for fuel	0.00
$Frac_{GASF}$	Fraction of synthetic fertilizer N applied to soils that volatilizes as NH_3 and NOx	0.03
$Frac_{GASM}$	Fraction of livestock N excretion that volatilizes as NH_3 and NOx	0.21
$Frac_{GRAZ}$	Fraction of livestock N excreted and deposited onto soil during grazing	0.14
$Frac_{LEACH}$	Fraction of N input to soils that is lost through leaching and run-off	0.30
$Frac_{NCRBF}$	Fraction of total above-ground biomass of N-fixing crop that is N	0.01
$Frac_{NCRO}$	Fraction of residue dry biomass that is N	0.03
$Frac_{R}$	Fraction of total above-ground crop biomass that is removed from the field as a crop product	0.34
Other fractions *(please specify)*		NO

[a] Use the definitions for fractions as specified in the IPCC Guidelines (Volume 3. Reference Manual, pp. 4.92-4.113) as elaborated by the IPCC good practice guidance (pp. 4.54-4.74).

TABLE 4.E SECTORAL BACKGROUND DATA FOR AGRICULTURE
Prescribed Burning of Savannas
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION					IMPLIED EMISSION FACTORS		EMISSIONS	
	Area of savanna burned (k ha/yr)	Average above-ground biomass density (t dm/ha)	Fraction of savanna burned	Biomass burned (Gg dm)	Nitrogen fraction in biomass	CH_4 (kg/t dm)	N_2O (kg/t dm)	CH_4 (Gg)	N_2O (Gg)
(specify ecological zone)								NO	NO
Other non-specified	NO	NO	NO	NO	NO	NO	NO	NO	NO

Additional information

	Living Biomass	Dead Biomass
Fraction of above-ground biomass	NO	NO
Fraction oxidized	NO	NO
Carbon fraction	NO	NO

Documentation box:
Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 4.F SECTORAL BACKGROUND DATA FOR AGRICULTURE
Field Burning of Agricultural Residues
(Sheet 1 of 1)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION								IMPLIED EMISSION FACTORS		EMISSIONS	
	Crop production	Residue/ Crop ratio	Dry matter (dm) fraction of residue	Fraction burned in fields	Fraction oxidized	Total biomass burned	C fraction of residue	N-C ratio in biomass residues	CH_4	N_2O	CH_4	N_2O
	(t)					(Gg dm)			(kg/t dm)		(Gg)	
1. Cereals											0.04	0.00
Wheat	4 439 547.33	1.30	0.86	0.00	0.90	12.93	0.49	0.01	2.91	0.06	0.04	0.00
Barley	NA	NA	NA	NA	NO	IE	NO	NA	IE	IE	IE	IE
Maize	NA	NA	NA	NA	NO	IE	IE	NA	IE	IE	IE	IE
Oats	NA	NA	NA	NA	NO	IE	IE	NA	IE	IE	IE	IE
Rye	NA	NA	NA	NA	NO	IE	IE	NA	IE	IE	IE	IE
Rice	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other *(please specify)*											NA	NA
2. Pulses											NA,NO	NA,NO
Dry bean	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Soybeans	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other *(please specify)*											NA	NA
3 Tubers and Roots											NA,NO	NA,NO
Potatoes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other *(please specify)*											NA	NA
4 Sugar Cane	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 Other *(please specify)*											0.02	0.00
Vine	NA	NA	NA	NA	NA	3.01	NA	NA	6.04	0.06	0.02	0.00

Documentation box:
Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 SECTORAL REPORT FOR LAND USE, LAND-USE CHANGE AND FORESTRY
(Sheet 1 of 1)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals (1), (2)	CH_4 (2)	N_2O (2)	NO_x	CO	NMVOC
	(Gg)					
Total Land-Use Categories	**-18 422.04**	**0.00**	**0.86**	**IE,NA,NE**	**IE,NA,NE**	**NA,NE**
A. Forest Land	**-19 729.23**	**0.00**	**0.00**	**NE**	**NE**	**NE**
1. Forest Land remaining Forest Land	-16 959.25	0.00	0.00	NE	NE	NE
2. Land converted to Forest Land	-2 769.98	NO	NO	NE	NE	NE
B. Cropland	**1 876.76**	**NA,NO**	**0.86**	**IE**	**IE**	**NE**
1. Cropland remaining Cropland	160.88	NA	NA	IE	IE	NE
2. Land converted to Cropland	1 715.88	NO	0.86	IE	IE	NE
C. Grassland	**-1 148.69**	**NO**	**NO**	**IE**	**IE**	**NE**
1. Grassland remaining Grassland	48.34	NO	NO	IE	IE	NE
2. Land converted to Grassland	-1 197.03	NO	NO	IE	IE	NE
D. Wetlands	**328.77**	**NO**	**NO**	**NA**	**NA**	**NA**
1. Wetlands remaining Wetlands (3)	NE,NO	NO	NO	NA	NA	NA
2. Land converted to Wetlands	328.77	NO	NO	NA	NA	NA
E. Settlements	**-233.79**	**NA,NO**	**NA,NO**	**NA**	**NA**	**NA**
1. Settlements remaining Settlements (3)	NE,NO	NA	NA	NA	NA	NA
2. Land converted to Settlements	-233.79	NA	NA	NA	NA	NA
F. Other Land	**484.15**	**NA,NO**	**NA,NO**	**NA**	**NA**	**NA**
1. Other Land remaining Other Land (4)						
2. Land converted to Other Land	484.15	NA	NA	NA	NA	NA
G. Other *(please specify)* (5)	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**
Harvested Wood Products (6)	NE	NA	NA	NA	NA	NA
Information items(7)						
Forest Land converted to other Land-Use Categories	1 294.53	NA	NA	NA	NA	NA
Grassland converted to other Land-Use Categories	500.42	NE	0.86	NA	NA	NA

(1) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) For each land-use category and sub-category, this table sums net CO_2 emissions and removals shown in tables 5.A to 5.F, and the CO_2, CH_4 and N_2O emissions showing in tables 5(I) to 5(V).

(3) Parties may decide not to prepare estimates for these categories contained in appendices 3a.3 and 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

(4) This land-use category is to allow the total of identified land area to match the national area.

(5) The total for category 5.G Other includes items specified only under category 5.G in this table as well as sources and sinks specified in category 5.G in tables 5(I) to 5(V).

(6) Parties may decide not to prepare estimates for this category contained in appendix 3a.1 of the IPCC good practice guidance for LULUCF, although they may do so if they wish and report in this row.

(7) These items are listed for information only and will not be added to the totals, because they are already included in subcategories 5.A.2 to 5.F.2.

Documentation box:

• Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

• If estimates are reported under 5.G Other, use this documentation box to provide information regarding activities covered under this category and to provide reference to the section in the NIR where background information can be found.

TABLE 5.A SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Forest Land
(Sheet 1 of 1)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA		IMPLIED CARBON-STOCK-CHANGE FACTORS						CHANGES IN CARBON STOCK						Net CO_2 emissions/ removals[8] [9]
Land-Use Category	Sub-division[1]	Area[2] (kha)	Area of organic soil[2] (kha)	Carbon stock change in living biomass per area[3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]		Carbon stock change in living biomass[3] [4]			Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils [4] [6]		
				Gains	Losses	Net change		Mineral soils[5]	Organic soils	Gains	Losses	Net change		Mineral soils	Organic soils[7]	
				(Mg C/ha)						(Gg C)						(Gg)
A. Total Forest Land		3 619.89	NA,NO	3.00	-1.69	1.31	0.05	0.13	NO	10 842.59	-6 111.17	4 731.42	163.95	485.33	NO	-19 729.23
1. Forest Land remaining Forest Land		3 389.45	NA	3.12	-1.80	1.32	0.05	NO	NO	10 571.60	-6 110.30	4 461.30	163.95	NO	NO	-16 959.25
	Coniferous	2 501.41	NA	3.14	-1.97	1.17	0.05	NO	NO	7 849.07	-4 924.17	2 924.90	124.51	NO	NO	-11 181.19
	Deciduous	888.04	NA	3.07	-1.34	1.73	0.04	NO	NO	2 722.53	-1 186.13	1 536.40	39.44	NO	NO	-5 778.07
2. Land converted to Forest Land[10]		230.44	NO	1.18	0.00	1.17	NO	2.11	NO	270.99	-0.88	270.12	NO	485.33	NO	-2 769.98
2.1 Cropland converted to Forest Land		36.87	NO	1.18	IE	1.18	NO	3.02	NO	43.36	IE	43.36	NO	111.19	NO	-566.68
	Total	36.87	NO	1.18	IE	1.18	NO	3.02	NO	43.36	IE	43.36	NO	111.19	NO	-566.68
2.2 Grassland converted to Forest Land		135.96	NO	1.18	IE	1.18	NO	0.97	NO	159.89	IE	159.89	NO	131.80	NO	-1 069.51
	Total	135.96	NO	1.18	IE	1.18	NO	0.97	NO	159.89	IE	159.89	NO	131.80	NO	-1 069.51
2.3 Wetlands converted to Forest Land		11.52	NO	1.18	IE	1.18	NO	4.55	NO	13.55	IE	13.55	NO	52.47	NO	-242.09
	Total	11.52	NO	1.18	IE	1.18	NO	4.55	NO	13.55	IE	13.55	NO	52.47	NO	-242.09
2.4 Settlements converted to Forest Land		32.26	NO	1.18	-0.03	1.15	NO	3.91	NO	37.94	-0.88	37.06	NO	126.01	NO	-597.92
	Total	32.26	NO	1.18	-0.03	1.15	NO	3.91	NO	37.94	-0.88	37.06	NO	126.01	NO	-597.92
2.5 Other Land converted to Forest Land		13.83	NO	1.18	IE	1.18	NO	4.62	NO	16.26	IE	16.26	NO	63.86	NO	-293.78
	Total	13.83	NO	1.18	IE	1.18	NO	4.62	NO	16.26	IE	16.26	NO	63.86	NO	-293.78

[1] Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

[2] The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Forest Land report the cumulative area remaining in the category in the reporting year.

[3] Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

[4] The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

[5] Implied carbon-stock-change factors for mineral soils are calculated by dividing the net C stock change estimate for mineral soil by the difference between the area and the area of organic soil.

[6] When Parties are estimating fluxes for organic soils but cannot separate these fluxes from mineral soils, these fluxes should be reported under mineral soils.

[7] The value reported for organic soils is estimated as a flux. For consistency with other entries in this column, these fluxes should be expressed in the unit required in this column, i.e. in Gg C.

[8] According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

[9] Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change columns.

[10] A Party may report aggregate estimates for all conversions of land to forest land when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for grassland conversion should be provided in table 5 as an information item.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5.B SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Cropland
(Sheet 1 of 1)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA		IMPLIED CARBON-STOCK-CHANGE FACTORS						CHANGES IN CARBON STOCK						Net CO_2 emissions/ removals [10] [11]
Land-Use Category	Sub-division [1]	Area[2] (kha)	Area of organic soil[2] (kha)	Carbon stock change in living biomass per area[3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]		Carbon stock change in living biomass[3], [4], [6]			Net carbon stock change in dead organic matter[4] [7]	Net carbon stock change in soils [4] [8]		
				Gains	Losses	Net change		Mineral soils[5]	Organic soils	Gains	Losses	Net change		Mineral soils	Organic soils[9]	
				(Mg C/ha)						(Gg C)						(Gg)
B. Total Cropland		1 475.45	NO	0.05	-0.06	-0.01	NO	-0.32	NO	75.32	-90.04	-14.72	NO	-472.56	NO	1 786.67
1. Cropland remaining Cropland		941.78	NO	IE	-0.09	-0.09	NO	0.07	NO	IE	-85.23	-85.23	NO	65.92	NO	70.79
	Annual remaining anr	920.23	NO	IE	-0.04	-0.04	NO	0.07	NO	IE	-39.07	-39.07	NO	64.88	NO	-94.62
	Annual converted to p	12.27	NO	IE	-1.93	-1.93	NO	0.35	NO	IE	-23.63	-23.63	NO	4.30	NO	70.90
	Perennial converted to	9.28	NO	IE	-2.43	-2.43	NO	-0.35	NO	IE	-22.53	-22.53	NO	-3.25	NO	94.51
2. Land converted to Croplan[12]		533.66	NO	0.14	-0.01	0.13	NO	-1.01	NO	75.32	-4.81	70.51	NO	-538.48	NO	1 715.88
2.1 Forest Land converted to Cropland		5.67	NO	IE	-0.85	-0.85	NO	-1.96	NO	IE	-4.81	-4.81	NO	-11.12	NO	58.40
	Total	5.67	NO	IE	-0.85	-0.85	NO	-1.96	NO	IE	-4.81	-4.81	NO	-11.12	NO	58.40
2.2 Grassland converted to Cropland		527.99	NO	0.14	IE	0.14	NO	-1.00	NO	75.32	IE	75.32	NO	-527.36	NO	1 657.48
	Total	527.99	NO	0.14	IE	0.14	NO	-1.00	NO	75.32	IE	75.32	NO	-527.36	NO	1 657.48
2.3 Wetlands converted to Cropland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.4 Settlements converted to Cropland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Cropland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.
(2) The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Cropland report the cumulative area remaining in the category in the reporting year.
(3) Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.
(4) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).
(5) Implied carbon-stock-change factors for mineral soils are calculated by dividing the net C stock change estimate for mineral soil by the difference between the area and the area of organic soil.
(6) For category 5.B.1 Cropland remaining Cropland this column only includes changes in perennial woody biomass.
(7) No reporting on dead organic matter pools is required for category 5.B.1. Cropland remaining Cropland.
(8) When Parties are estimating fluxes for organic soils but cannot separate these fluxes from mineral soils, these fluxes should be reported under mineral soils.
(9) The value reported for organic soils is estimated as a flux. For consistency with other entries in this column, these fluxes should be expressed in the unit required in this column, i.e. in Gg C.
(10) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.
(11) Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change colu
(12) A Party may report aggregate estimates for all land conversions to cropland, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land and grassland conversion should be provided in table 5 as an information item.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5.C SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Grassland

(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA		IMPLIED CARBON-STOCK-CHANGE FACTORS						CHANGES IN CARBON STOCK						Net CO_2 emissions/ removals [10] [11]
Land-Use Category	Sub-division [1]	Area[2] (kha)	Area of organic soil[2] (kha)	Carbon stock change in living biomass per area[3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]		Carbon stock change in living biomass[3], [4], [6]			Net carbon stock change in dead organic matter[4] [7]	Net carbon stock change in soils [4] [8]		
				Gains	Losses	Net change		Mineral soils[5]	Organic soils	Gains	Losses	Net change		Mineral soils	Organic soils[9]	
				(Mg C/ha)						(Gg C)						(Gg)
C. Total Grassland		1 789.41	IE,NO	IE,NO	-0.07	-0.07	NO	0.24	IE,NO	IE,NO	-118.49	-118.49	NO	431.77	IE,NO	-1 148.69
1. Grassland remaining Grassland		1 232.11	IE	NO	NO	NO	NO	-0.01	IE	NO	NO	NO	NO	-13.18	IE	48.34
	Total	1 232.11	IE	NO	NO	NO	NO	-0.01	IE	NO	NO	NO	NO	-13.18	IE	48.34
2. Land converted to Grassland[12]		557.30	NO	IE,NO	-0.21	-0.21	NO	0.80	NO	IE,NO	-118.49	-118.49	NO	444.95	NO	-1 197.03
2.1 Forest Land converted to Grassland		60.13	NO	IE	-0.85	-0.85	NO	-0.85	NO	IE	-51.02	-51.02	NO	-51.29	NO	375.13
	Total	60.13	NO	IE	-0.85	-0.85	NO	-0.85	NO	IE	-51.02	-51.02	NO	-51.29	NO	375.13
2.2 Cropland converted to Grassland		497.17	NO	IE	-0.14	-0.14	NO	1.00	NO	IE	-67.47	-67.47	NO	496.24	NO	-1 572.16
	Total	497.17	NO	IE	-0.14	-0.14	NO	1.00	NO	IE	-67.47	-67.47	NO	496.24	NO	-1 572.16
2.3 Wetlands converted to Grassland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.4 Settlements converted to Grassland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Grassland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

(2) The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Grassland report the cumulative area remaining in the category in the reporting year.

(3) Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

(4) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

(5) Implied carbon-stock-change factors for mineral soils are calculated by dividing the net C stock change estimate for mineral soil by the difference between the area and the area of organic soil.

(6) For category 5.C.1 Grassland remaining Grassland this column only includes changes in perennial woody biomass.

(7) No reporting on dead organic matter pools is required for category 5.C.1 Grassland remaining Grassland.

(8) When Parties are estimating fluxes for organic soils but cannot separate these fluxes from mineral soils, these fluxes should be reported under mineral soils.

(9) The value reported for organic soils is estimated as a flux. For consistency with other entries in this column, these fluxes should be expressed in the unit required in this column, i.e. in Gg C.

(10) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

(11) Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change colu

(12) A Party may report aggregate estimates for all land conversions to grassland, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land conversion should be provided in table 5 as an information item.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5.D SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Wetlands
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED CARBON-STOCK-CHANGE FACTORS					CHANGES IN CARBON STOCK					Net CO_2 emissions/ removals [5] [6]
Land-Use Category	Sub-division [1]	Area[2] (kha)	Carbon stock change in living biomass per area [3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]	Carbon stock change in living biomass[3] [4]			Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils [4]	
			Gains	Losses	Net change			Gains	Losses	Net change			
			(Mg C/ha)					(Gg C)					(Gg)
D. Total Wetlands		142.57	IE,NE,NO	-0.07	-0.07	NE,NO	-0.56	IE,NE,NO	-10.31	-10.31	NE,NO	-79.35	328.77
1. Wetlands remaining Wetlands [7]		121.74	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Total	121.74	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Land converted to Wetlands [8]		20.84	IE,NO	-0.49	-0.49	NO	-3.81	IE,NO	-10.31	-10.31	NO	-79.35	328.77
2.1 Forest Land converted to Wetlands		3.40	IE	-0.85	-0.85	NO	-6.05	IE	-2.89	-2.89	NO	-20.59	86.09
	Total	3.40	IE	-0.85	-0.85	NO	-6.05	IE	-2.89	-2.89	NO	-20.59	86.09
2.2 Cropland converted to Wetlands		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.3 Grassland converted to Wetlands		14.62	NO	NO	NO	NO	-3.50	NO	NO	NO	NO	-51.17	187.62
	Total	14.62	NO	NO	NO	NO	-3.50	NO	NO	NO	NO	-51.17	187.62
2.4 Settlements converted to Wetlands		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Wetlands		2.81	NO	-2.64	-2.64	NO	-2.70	NO	-7.42	-7.42	NO	-7.60	55.06
	Total	2.81	NO	-2.64	-2.64	NO	-2.70	NO	-7.42	-7.42	NO	-7.60	55.06

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

(2) The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Wetlands report the cumulative area remaining in the category in the reporting year.

(3) Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

(4) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

(5) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

(6) Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change columns.

(7) Parties may decide not to prepare estimates for this category contained in appendix 3a.3 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

(8) A Party may report aggregate estimates for all land conversions to wetlands, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land and grassland conversion should be provided in table 5 as an information item.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5.E SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Settlements

(Sheet 1 of 1)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED CARBON-STOCK-CHANGE FACTORS					CHANGES IN CARBON STOCK					
Land-Use Category	Sub-division [1]	Area[2] (kha)	Carbon stock change in living biomass per area [3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]	Carbon stock change in living biomass[3], [4], [5]			Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils [4]	Net CO_2 emissions/ removals [6] [7]
			Gains	Losses	Net change			Gains	Losses	Net change			
			(Mg C/ha)					(Gg C)					(Gg)
E. Total Settlements		655.25	0.52	-0.13	0.39	NO	-0.29	341.62	-84.64	256.98	NO	-193.22	-233.79
1. Settlements remaining Settlements [8]		483.95	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE	NE,NO
	Total	483.95	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE	NE,NO
2. Land converted to Settlements [9]		171.29	1.99	-0.49	1.50	NO	-1.13	341.62	-84.64	256.98	NO	-193.22	-233.79
2.1 Forest Land converted to Settlements		17.02	0.64	-0.85	-0.21	NO	-4.45	10.91	-14.44	-3.53	NO	-75.77	290.76
	Total	17.02	0.64	-0.85	-0.21	NO	-4.45	10.91	-14.44	-3.53	NO	-75.77	290.76
2.2 Cropland converted to Settlements		39.85	2.14	NO	2.14	NO	NO	85.42	NO	85.42	NO	NO	-313.21
	Total	39.85	2.14	NO	2.14	NO	NO	85.42	NO	85.42	NO	NO	-313.21
2.3 Grassland converted to Settlements		65.62	2.14	NO	2.14	NO	-1.00	140.66	NO	140.66	NO	-65.62	-275.16
	Total	65.62	2.14	NO	2.14	NO	-1.00	140.66	NO	140.66	NO	-65.62	-275.16
2.4 Wetlands converted to Settlements		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Settlements		48.81	2.14	-1.44	0.71	NO	-1.06	104.63	-70.20	34.43	NO	-51.84	63.82
	Total	48.81	2.14	-1.44	0.71	NO	-1.06	104.63	-70.20	34.43	NO	-51.84	63.82

[1] Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

[2] The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Settlements report the cumulative area remaining in the category in the reporting year.

[3] Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

[4] The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

[5] For category 5.E.1 Settlements remaining Settlements this column only includes changes in perennial woody biomass.

[6] According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

[7] Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change columns.

[8] Parties may decide not to prepare estimates for this category contained in appendix 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

[9] A Party may report aggregate estimates for all land conversions to settlements, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land and grassland conversion should be provided in table 5 as an information item.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5.F SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Other land
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED CARBON-STOCK-CHANGE FACTORS					CHANGES IN CARBON STOCK					Net CO_2 emissions/ removals [5] [6]
Land-Use Category	Sub-division [1]	Area[2] (kha)	Carbon stock change in living biomass per area [3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]	Carbon stock change in living biomass[3] [4]			Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils [4]	
			Gains	Losses	Net change			Gains	Losses	Net change			
			(Mg C/ha)					(Gg C)					(Gg)
F. Total Other Land		27.23	IE,NO	-0.85	-0.85	NO	-4.00	IE,NO	-23.10	-23.10	NO	-108.94	484.15
1. Other Land remaining Other Land [7]		NE											
2. Land converted to Other Land [8]		27.23	IE,NO	-0.85	-0.85	NO	-4.00	IE,NO	-23.10	-23.10	NO	-108.94	484.15
2.1 Forest Land converted to Other Land		27.23	IE	-0.85	-0.85	NO	-4.00	IE	-23.10	-23.10	NO	-108.94	484.15
	Total	27.23	IE	-0.85	-0.85	NO	-4.00	IE	-23.10	-23.10	NO	-108.94	484.15
2.2 Cropland converted to Other Land		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.3 Grassland converted to Other Land		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.4 Wetlands converted to Other Land		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Settlements converted to Other Land		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

(2) The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Other Land report the cumulative area remaining in the category in the reporting year.

(3) Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

(4) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

(5) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

(6) Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change columns.

(7) This land-use category is to allow the total of identified land area to match the national area.

(8) A Party may report aggregate estimates for all land conversions to other land, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land and grassland conversion should be provided in table 5 as an information item.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (I) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Direct N_2O emissions from N fertilization[1] of Forest Land and Other

(Sheet 1 of 1)

Inventory 2006

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS [4]
Land-Use Category [2]	Total amount of fertilizer applied	N_2O-N emissions per unit of fertilizer	N_2O
	(Gg N/yr)	(kg N_2O-N/kg N)[3]	(Gg)
Total for all Land Use Categories	**NO**	**NO**	**NO**
A. Forest Land [5] [6]	**NO**	**NO**	**NO**
1. Forest Land remaining Forest Land	NO	NO	NO
2. Land converted to Forest Land	NO	NO	NO
G. Other *(please specify)*			

(1) Direct N_2O emissions from fertilization are estimated using equations 3.2.17 and 3.2.18 of the IPCC good practice guidance for LULUCF based on the amounts of fertilizers applied to forest land.

(2) N_2O emissions from N fertilization of cropland and grassland are reported in the Agriculture sector; therefore only Forest Land is included in this table.

(3) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

(4) Emissions are reported with a positive sign.

(5) If a Party is not able to separate the fertilizer applied to forest land from that applied to agriculture, it may report all N_2O emissions from fertilization in the Agriculture sector. This should be explicitly indicated in the documentation box.

(6) A Party may report aggregate estimates for all N fertilization on forest land in the category Forest Land remaining Forest Land when data are not available to report Forest Land remaining Forest Land and Land converted to Forest Land separately.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (II) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Inventory 2006

Non-CO_2 emissions from drainage of soils and wetlands[1]

Submission 2008 v1.1

(Sheet 1 of 1)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS		EMISSIONS [5]	
Land-Use Category [2]	Sub-division [3]	Area (kha)	N_2O-N per area [4] (kg N_2O-N/ha)	CH_4 per area (kg CH_4/ha)	N_2O (Gg)	CH_4 (Gg)
Total all Land-Use Categories					**NO**	**NO**
A. Forest Land [6]			**NO**	**NO**	**NO**	**NO**
Organic Soil		NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO
Mineral Soil		NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO
D. Wetlands			**NO**	**NO**	**NO**	**NO**
Peatland [7]		NO	NO	NO	NO	NO
Flooded Lands [7]		NO	NO	NO	NO	NO
G. Other (please specify)						

[1] Parties may decide not to prepare estimates for these categories contained in appendices 3a.2 and 3a.3 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

[2] N_2O emissions from drained cropland and grassland soils are covered in the Agriculture tables of the CRF under Cultivation of Histosols.

[3] A Party should report further disaggregations of drained soils corresponding to the methods used. Tier 1 disaggregates soils into "nutrient rich" and "nutrient poor" areas, whereas higher-tier methods can further disaggregate into different peatland types, soil

[4] In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

[5] Emissions are reported with a positive sign.

[6] In table 5, these emissions will be added to 5.A.1 Forest Land remaining Forest Land.

[7] In table 5, these emissions will be added to 5.D.2 Land converted to Wetlands.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (III) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Inventory 2006

N_2O emissions from disturbance associated with land-use conversion to cropland [(1)]

Submission 2008 v1.1

(Sheet 1 of 1)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS [(4)]
Land-Use Category [(2)]	Land area converted	N_2O-N emissions per area converted[(3)]	N_2O
	(kha)	(kg N_2O-N/ha)	(Gg)
Total all Land-Use Categories [(5)]	**527.99**	**1.04**	**0.86**
B. Cropland	**527.99**	**1.04**	**0.86**
2. Lands converted to Cropland [(6)]	527.99	1.04	0.86
Organic Soils	NO	NO	NO
Mineral Soils	527.99	1.04	0.86
2.1 Forest Land converted to Cropland	NE,NO	NE,NO	NE,NO
Organic Soils	NO	NO	NO
Mineral Soils	NE	NE	NE
2.2 Grassland converted to Cropland	527.99	1.04	0.86
Organic Soils	NO	NO	NO
Mineral Soils	527.99	1.04	0.86
2.3 Wetlands converted to Cropland [(7)]	NO	NO	NO
Organic Soils	NO	NO	NO
Mineral Soils	NO	NO	NO
2.5 Other Land converted to Cropland	NO	NO	NO
Organic Soils	NO	NO	NO
Mineral Soils	NO	NO	NO
G. Other *(please specify)*			

(1) Methodologies for N_2O emissions from disturbance associated with land-use conversion are based on equations 3.3.14 and 3.3.15 of the IPCC good practice guidance for LULUCF. N_2O emissions from fertilization in the preceding land use and new land use should not be reported.

(2) According to the IPCC good practice guidance for LULUCF, N_2O emissions from disturbance of soils are only relevant for land conversions to cropland. N_2O emissions from Cropland remaining Cropland are included in the Agriculture sector of the good practice guidance. The good practice guidance provides methodologies only for mineral soils.

(3) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

(4) Emissions are reported with a positive sign.

(5) Parties can separate between organic and mineral soils, if they have data available.

(6) If activity data cannot be disaggregated to all initial land uses, Parties may report some initial land uses aggregated under Other Land converted to Cropland (indicate in the documentation box what this category includes).

(7) Parties should avoid double counting with N_2O emissions from drainage and from cultivation of organic soils reported in Agriculture under Cultivation of Histosols.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF Sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (IV) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Inventory 2006

CO_2 emissions from agricultural lime application [1]

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(Sheet 1 of 1)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS [3]
Land-Use Category	Total amount of lime applied (Mg/yr)	CO_2-C per unit of lime [2] (Mg CO_2-C /Mg)	CO_2 (Gg)
Total all Land-Use Categories [4], [5], [6]	**204 749.89**	**0.12**	**90.09**
B. Cropland [6] [7]	**204 749.89**	**0.12**	**90.09**
Limestone $CaCO_3$	204 749.89	0.12	90.09
Dolomite $CaMg(CO_3)_2$	IE	IE	IE
C. Grassland [6] [8]	**IE**	**IE**	**IE**
Limestone $CaCO_3$	IE	IE	IE
Dolomite $CaMg(CO_3)_2$	IE	IE	IE
G. Other *(please specify)* [6] [9]			

[1] CO_2 emissions from agricultural lime application are addressed in equations 3.3.6 and 3.4.11 of the IPCC good practice guidance for LULUCF.
[2] The implied emission factor is expressed in unit of carbon to faciliate comparison with published emission factors.
[3] Emissions are reported with a positive sign.
[4] If Parties are not able to separate liming application for different land-use categories, they should include liming for all land-use categories in the category 5.G Other.
[5] Parties that are able to provide data for lime application to forest land should provide this information under 5.G Other and specify in the documentation box that forest land application is included in this category.
[6] A Party may report aggregate estimates for total lime applications when data are not available for limestone and dolomite.
[7] In table 5, these CO_2 emissions will be added to 5.B.1 Cropland remaining Cropland.
[8] In table 5, these CO_2 emissions will be added to 5.C.1 Grassland remaining Grassland.
[9] If a Party has data broken down to limestone and dolomite at national level, it can report these data under 5.G Other.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (V) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Inventory 2006

Biomass Burning [1]

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(Sheet 1 of 1)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA			IMPLIED EMISSION FACTOR			EMISSIONS [5]		
	Description[3]	Unit	Values	CO_2	CH_4	N_2O	CO_2 [4]	CH_4	N_2O
Land-Use Category[2]		**(ha or kg dm)**		**(Mg/activity data unit)**			**(Gg)**		
Total for Land-Use Categories	**Area burned**		**NA**	**IE,NA,NO**	**NA**	**NA**	**IE,NA,NO**	**0.00**	**0.00**
A. Forest Land	**Area burned**	**ha**	**67.00**	**IE,NO**	**0.06**	**0.00**	**IE,NO**	**0.00**	**0.00**
1. Forest land remaining Forest Land	Area burned	ha	67.00	IE,NO	0.06	0.00	IE,NO	0.00	0.00
Controlled Burning	(specify)	ha	NO	NO	NO	NO	NO	NO	NO
Wildfires	Area burned	ha	67.00	IE	0.06	0.00	IE	0.00	0.00
2. Land converted to Forest Land			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)	ha	NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)	ha	NO	NO	NO	NO	NO	NO	NO
B. Cropland			**NA**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**
1. Cropland remaining Cropland[6]			NA	NA	NA	NA	NA	NA	NA
Controlled Burning	(specify)		NA	NA	NA	NA	NA	NA	NA
Wildfires	(specify)		NA	NA	NA	NA	NA	NA	NA
2. Land converted to Cropland			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2.1. Forest Land converted to Cropland	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Controlled Burning	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Wildfires	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
C. Grassland			**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1. Grassland remaining grassland[7]			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2. Land converted to Grassland			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2.1. Forest Land converted to Grassland	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Controlled Burning	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Wildfires	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
D. Wetlands			**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1. Wetlands remaining Wetlands[8]			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2. Land converted to Wetlands			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2.1. Forest Land converted to Wetlands	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Controlled Burning	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Wildfires	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
E. Settlements [8]	(specify)	ha	NO	**NO**	**NO**	**NO**	NO	NO	NO
F. Other Land [9]	Area burned	ha	NO	**NO**	**NO**	**NO**	NO	NO	NO
G. Other (please specify)									

[1] Methodological guidance on burning can be found in sections 3.2.1.4 and 3.4.1.3 of the IPCC good practice guidance for LULUCF.

[2] Parties should report both controlled/prescribed burning and wildfires emissions, where appropriate, in a separate manner.

[3] For each category activity data should be selected between area burned or biomass burned. Units for area will be ha and for biomass burned kg dm. The implied emission factor will refer to the selected activity data with an automatic change in the units.

[4] If CO_2 emissions from biomass burning are not already included in tables 5.A - 5.F, they should be reported here. This should be clearly documented in the documentation box and in the NIR. Double counting should be avoided. Parties that include all carbon stock changes in the carbon stock tables (5.A, 5.B, 5.C, 5.D, 5.E and 5.F), should report IE (included elsewhere) in this column.

[5] Emissions are reported with a positive sign.

[6] In-situ above-ground woody biomass burning is reported here. Agricultural residue burning is reported in the Agriculture sector.

[7] Includes only emissions from controlled biomass burning on grasslands outside the tropics (prescribed savanna burning is reported under the Agriculture sector).

[8] Parties may decide not to prepare estimates for these categories contained in appendices 3a.2, 3a.3 and 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

[9] This land-use category is to allow the total of identified land area to match the national area.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 6 SECTORAL REPORT FOR WASTE
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [(1)]	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
	(Gg)						
Total Waste	**12.26**	**87.39**	**1.13**	**0.05**	**5.91**	**0.08**	**0.06**
A. Solid Waste Disposal on Land	**NA,NO**	**83.79**		**NA,NO**	**5.90**	**0.08**	
1. Managed Waste Disposal on Land	NA	83.79		NA	5.90	0.08	
2. Unmanaged Waste Disposal Sites	NO	NO		NO	NO	NO	
3. Other *(as specified in table 6.A)*	NA	NA		NA	NA	NA	
B. Waste Water Handling		**1.97**	**0.90**	**NA**	**NA**	**NA**	
1. Industrial Wastewater		IE,NA	0.18	NA	NA	NA	
2. Domestic and Commercial Waste Water		1.97	0.71	NA	NA	NA	
3. Other *(as specified in table 6.B)*		NA	NA	NA	NA	NA	
C. Waste Incineration	**12.26**	**0.00**	**0.00**	**0.05**	**0.01**	**0.00**	**0.06**
D. Other *(please specify)*	**NA**	**1.63**	**0.23**	**NA**	**NA**	**NA**	**NA**
Compost production	NA	1.63	0.23	NA	NA	NA	NA

(1) CO_2 emissions from source categories Solid waste disposal on land and Waste incineration should only be included if they derive from non-biological or inorganic waste sources.

Documentation box:
- Parties should provide detailed explanations on the waste sector in Chapter 8: Waste (CRF sector 6) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
- If estimates are reported under "6.D Other", use this documentation box to provide information regarding activities covered under this category and to provide reference to the section in the NIR where background information can be found.

TABLE 6.A SECTORAL BACKGROUND DATA FOR WASTE
Solid Waste Disposal
(Sheet 1 of 1)

Inventory 2006
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTOR		EMISSIONS		
	Annual MSW at the SWDS	MCF	DOC degraded	CH_4 (1)	CO_2	CH_4		CO_2 (4)
						Emissions (2)	Recovery (3)	
	(Gg)		%	(t /t MSW)		(Gg)		
1 Managed Waste Disposal on Land	596.52	1.00	109.66	0.18	NA	83.79	21.73	NA
2 Unmanaged Waste Disposal Sites	NO	NO	NO	NO	NO	NO	NO	NO
a. Deep (>5 m)	NO	NO	NO	NO	NO	NO	NO	NO
b. Shallow (<5 m)	NO	NO	NO	NO	NO	NO	NO	NO
3 Other *(please specify)*						NA	NA	NA

Additional information

Description	Value
Total population (1000s)[a]	**8 281.95**
Urban population (1000s)[a]	5 417.52
Waste generation rate (kg/capita/day)	0.20
Fraction of MSW disposed to SWDS	0.15
Fraction of DOC in MSW	0.17
CH_4 oxidation factor [b]	0.10
CH_4 fraction in landfill gas	0.55
CH_4 generation rate constant (k)[c]	0.10
Time lag considered (yr)[c]	57.00

Note: MSW - Municipal Solid Waste, SWDS - Solid Waste Disposal Site, MCF - Methane Correction Factor, DOC - Degradable Organic Carbon (IPCC Guidelines (Volume 3. Reference Manual, section 6.2.4)).
MSW includes household waste, yard/garden waste, commercial/market waste and organic industrial solid waste. MSW should not include inorganic industrial waste such as construction or demolition materials.

(1) The CH_4 implied emission factor (IEF) is calculated on the basis of gross CH_4 emissions, as follows: IEF = (CH_4 emissions + CH_4 recovered)/annual MSW at the SWDS.
(2) Actual emissions (after recovery)
(3) CH_4 recovered and flared or utilized.
(4) Under Solid Waste Disposal, CO_2 emissions should be reported only when the disposed waste is combusted at the disposal site as a management practice. CO_2 emissions from non-biogenic wastes are included in the total emissions, whereas the CO_2 emissions from biogenic wastes are not included in the total emissions.

(a) Specify whether total or urban population is used and the rationale for doing so.
(b) See IPCC Guidelines (Volume 3. Reference Manual, p. 6.9).
(c) Only for Parties using Tier 2 methods

TABLE 6.C SECTORAL BACKGROUND DATA FOR WASTE
Waste Incineration
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTOR			EMISSIONS		
	Amount of incinerated wastes	CO_2	CH_4	N_2O	CO_2 (1)	CH_4	N_2O
	(Gg)	(kg/t waste)			(Gg)		
Waste Incineration	6.10				12.26	0.00	0.00
a. Biogenic (1)	NA	NA	NA	NA	NA	NA	NA
b. Other (non-biogenic - *please specify*) (1), (2)	6.10				12.26	0.00	0.00
Municipal waste burning	NO	NO	NO	NO	NO	NO	NO
Waste oil	3.00	3 224.00	0.00	0.02	9.67	0.00	0.00
Hospital waste	3.10	836.00	0.10	0.01	2.59	0.00	0.00

(1) Under Solid Waste Disposal, CO_2 emissions should be reported only when the disposed waste is combusted at the disposal site as a management practice. CO_2 emissions from non-biogenic wastes are included in the total emissions, while the CO_2 emissions from biogenic wastes are not included in the total emissions.
(2) Enter under this source category all types of non-biogenic wastes, such as plastics

Note: Only emissions from waste incineration without energy recovery are to be reported in the Waste sector. Emissions from incineration with energy recovery are to be reported in the Energy sector, as Other Fuels (see IPCC good practice guidance, page 5.23).

Documentation box:
- Parties should provide detailed explanations on the waste sector in Chapter 8: Waste (CRF sector 6) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details
- Parties that use country-specific models should provide a reference in the documentation box to the relevant section in the NIR where these models are described, and fill in only the relevant cells of tables 6.A and 6.C.
- Provide a reference to the relevant section in the NIR, in particular with regard to:
  - (a) A population size (total or urban population) used in the calculations and the rationale for doing so;
  - (b) The composition of landfilled waste;
  - (c) In relation to the amount of incinerated wastes (specify whether the reported data relate to wet or dry matter).

TABLE 6.B SECTORAL BACKGROUND DATA FOR WASTE
Waste Water Handling
(Sheet 1 of 2)

Inventory 2006
Submission 2008 v1.1
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND RELATED INFORMATION[1]	IMPLIED EMISSION FACTOR		EMISSIONS		
	Total organic product	CH_4 [2]	N_2O [3]	CH_4 Emissions [4]	CH_4 Recovery [5]	N_2O [3]
	(Gg DC[1]/yr)	(kg/kg DC)		(Gg)		
1. Industrial Waste Water				IE,NA	NA	0.18
a. Waste Water	510.00	NA	0.00	NA	NA	0.18
b. Sludge	NA	IE	NA	IE	NA	IE
2. Domestic and Commercial Wastewater				1.97	NA	0.71
a. Waste Water	332.52	0.01	NA	1.97	NA	NA
b. Sludge	NA	IE	NA	IE	NA	IE
3. Other *(please specify)* [6]				NA	NA	NA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTOR	EMISSIONS
	Population (1000s)	Protein consumption (kg/person/yr)	N fraction (kg N/kg protein)	N_2O (kg N_2O-N/kg sewage N produced)	N_2O (Gg)
N_2O from human sewage [3]	8 281.95	43.07	0.16	0.01	0.71

(1) DC - degradable organic component. DC indicators are COD (Chemical Oxygen Demand) for industrial waste water and BOD (Biochemical Oxygen Demand) for Domestic/Commercial waste water/sludge (IPCC Guidelines (Volume 3. Reference Manual, pp. 6.14, 6.18)).

(2) The CH_4 implied emission factor (IEF) is calculated on the basis of gross CH_4 emissions, as follows: IEF = (CH_4 emissions + CH_4 recovered or flared) / total organic product.

(3) Parties using methods other than those from the IPCC for estimating N_2O emissions from human sewage or waste-water treatment should provide aggregate data in this table.

(4) Actual emissions (after recovery).

(5) CH_4 recovered and flared or utilized.

(6) Use the cells below to specify each activity covered under "6.B.3 Other". Note that under each reported activity, data for waste water and sludge are to be reported separately.

Documentation box:
- Parties should provide detailed explanations on the Waste sector in Chapter 8: Waste (CRF sector 6) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
- Regarding the estimates for N_2O from human sewage, specify whether total or urban population is used in the calculations and the rationale for doing so. Provide explanation in the documentation box.
- Parties using methods other than those from the IPCC for estimating N_2O emissions from human sewage or waste-water treatment should provide, in the NIR, corresponding information on methods, activity data and emission factors used, and should provide a reference to the relevant section of the NIR in this documentation box.

TABLE 6.B SECTORAL BACKGROUND DATA FOR WASTE
Waste Water Handling
(Sheet 2 of 2)

Inventory 2006
Submission 2008 v1.1
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Additional information

	Domestic	Industrial
Total waste water (m^3):	1 064 674.52	1 050 000.00
Treated waste water (%):	100.00	100.00

Waste-water streams:	Waste-water output (m^3)	DC (kg COD/m^3)
Industrial waste water	NA	NA
Iron and steel	NA	NA
Non-ferrous	NE	NE
Fertilizers	NE	NE
Food and beverage	NE	NE
Paper and pulp	NE	NE
Organic chemicals	NE	NE
Other (please specify)	NE	NE
Textile		
Rubber		
Poultry		
Wood and wood production		
Wool Scouring		
Other agricultural		
Chemical		
Dairy Processing		
Electricity, steam, water production		
Leather industry		
Leather and Skins		
Iron and steel		
Meat industry		
Fuels		
Machinery and equipment		
Mining and quarrying		
	DC (kg BOD/1000 person/yr)	
Domestic and Commercial	NE	
Other (please specify)		

Handling systems:	Industrial waste water treated (%)	Industrial sludge treated (%)	Domestic waste water treated (%)	Domestic sludge treated (%)
Aerobic	NE	NA	NA	NE
Anaerobic	NE	NA	NA	NE
Other (please specify)	NE	NA	NA	NE

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 1 of 3)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs(1)		PFCs(1)		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals	**58 860.72**	**330.32**	**18.27**	**1 336.59**	**857.80**	**380.99**	**135.67**	**0.02**	**0.02**	**225.16**	**785.35**	**171.63**	**28.46**
1. Energy	**68 049.56**	**47.01**	**2.61**							**218.27**	**754.06**	**70.12**	**27.18**
A. Fuel Combustion — Reference Approach (2)	72 105.69												
Sectoral Approach (2)	67 817.52	13.73	2.61							218.27	754.06	66.99	27.01
1. Energy Industries	15 426.28	0.30	0.24							15.37	4.67	0.71	7.85
2. Manufacturing Industries and Construction	15 812.24	0.62	0.51							35.37	168.71	3.06	10.29
3. Transport	22 807.93	1.11	0.93							133.71	241.93	22.32	0.28
4. Other Sectors	13 645.61	11.70	0.92							33.62	338.00	40.86	8.55
5. Other	125.46	0.00	0.01							0.21	0.75	0.05	0.04
B. Fugitive Emissions from Fuels	232.04	33.28	IE,NA							IE,NA	IE,NA	3.12	0.17
1. Solid Fuels	IE,NA,NO	0.00	IE,NA							IE,NA	IE,NA	IE,NA	IE,NA
2. Oil and Natural Gas	232.04	33.28	IE,NA							IE,NA	IE,NA	3.12	0.17
2. Industrial Processes	**8 999.94**	**0.92**	**0.90**	**1 336.59**	**857.80**	**380.99**	**135.67**	**0.02**	**0.02**	**1.63**	**24.37**	**4.73**	**1.22**
A. Mineral Products	3 294.35	IE,NA	IE,NA							IE,NA	9.78	IE,NA	IE,NA
B. Chemical Industry	599.25	0.92	0.90	NO	NO	NO	NO	NO	NO	0.45	11.14	1.32	0.77
C. Metal Production	5 106.34	0.00	NA				NO		NO	0.11	2.67	0.47	0.45
D. Other Production (3)	NA									1.07	0.78	2.94	NA
E. Production of Halocarbons and SF_6					NA		NA		NA				
F. Consumption of Halocarbons and SF_6				1 336.59	857.80	380.99	135.67	0.02	0.02				
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: **A** = Actual emissions based on Tier 2 approach of the IPCC Guidelines.
P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

Note: All footnotes for this table are given at the end of the table on sheet 3.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A) (Sheet 2 of 3)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
3. Solvent and Other Product Use	**220.99**		**0.53**							**NA**	**NA**	**94.92**	**NA**
4. Agriculture		**194.99**	**12.24**							**5.21**	**1.01**	**1.79**	**0.00**
A. Enteric Fermentation		152.85											
B. Manure Management		41.68	2.82									NE,NO	
C. Rice Cultivation		NO										NO	
D. Agricultural Soils(4)		0.41	9.42									1.67	
E. Prescribed Burning of Savannas		NO	NO							NO	NO	NO	
F. Field Burning of Agricultural Residues		0.06	0.00							0.03	1.01	0.11	
G. Other		NA	NA							5.18	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	(5) **-18 422.04**	**0.00**	**0.86**							**IE,NA,NE**	**IE,NA,NE**	**NA,NE**	**NA**
A. Forest Land	(5) -19 729.23	0.00	0.00							NE	NE	NE	
B. Cropland	(5) 1 876.76	NA,NO	0.86							IE	IE	NE	
C. Grassland	(5) -1 148.69	NO	NO							IE	IE	NE	
D. Wetlands	(5) 328.77	NO	NO							NA	NA	NA	
E. Settlements	(5) -233.79	NA,NO	NA,NO							NA	NA	NA	
F. Other Land	(5) 484.15	NA,NO	NA,NO							NA	NA	NA	
G. Other	(5) NE	NA	NA							NA	NA	NA	NA
6. Waste	**12.26**	**87.39**	**1.13**							**0.05**	**5.91**	**0.08**	**0.06**
A. Solid Waste Disposal on Land	(6) NA,NO	83.79								NA,NO	5.90	0.08	
B. Waste-water Handling		1.97	0.90							NA	NA	NA	
C. Waste Incineration	(6) 12.26	0.00	0.00							0.05	0.01	0.00	0.06
D. Other	NA	1.63	0.23							NA	NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Note: All footnotes for this table are given at the end of the table on sheet 3.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A) (Sheet 3 of 3)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Memo Items: [8]													
International Bunkers	**1 810.00**	**0.03**	**0.06**							**5.79**	**1.79**	**0.75**	**0.57**
Aviation	1 810.00	0.03	0.06							5.79	1.79	0.75	0.57
Marine	NA,NO	NA,NO	NA,NO							NO	NO	NO	NO
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**16 481.89**												

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II) of this common reporting format.

(2) For verification purposes, countries are asked to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach in the documentation box to Table 1.A.(c). For estimating national total emissions, the results from the Sectoral approach should be used, where possible.

(3) Other Production includes Pulp and Paper and Food and Drink Production.

(4) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(5) For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(6) CO_2 from source categories Solid Waste Disposal on Land and Waste Incineration should only be included if it stems from non-biogenic or inorganic waste streams. Only emissions from Waste Incineration Without Energy Recovery are to be reported in the Waste sector, whereas emissions from Incineration With Energy Recovery are to be reported in the Energy sector.

(7) If reporting any country-specific source category under sector "7. Other", detailed explanations should be provided in Chapter 9: Other (CRF sector 7) of the NIR

(8) Countries are asked to report emissions from international aviation and marine bunkers and multilateral operations, as well as CO_2 emissions from biomass, under Memo Items. These emissions should not be included in the national total emissions from the energy sector. Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO_2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO_2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector.

SUMMARY 1.B SHORT SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7B)
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emisions/removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals	**58 860.72**	**330.32**	**18.27**	**1 336.59**	**857.80**	**380.99**	**135.67**	**0.02**	**0.02**	**225.16**	**785.35**	**171.63**	**28.46**
1. Energy	**68 049.56**	**47.01**	**2.61**							**218.27**	**754.06**	**70.12**	**27.18**
A. Fuel Combustion — Reference Approach[2]	72 105.69												
Sectoral Approach[2]	67 817.52	13.73	2.61							218.27	754.06	66.99	27.01
B. Fugitive Emissions from Fuels	232.04	33.28	IE,NA							IE,NA	IE,NA	3.12	0.17
2. Industrial Processes	**8 999.94**	**0.92**	**0.90**	**1 336.59**	**857.80**	**380.99**	**135.67**	**0.02**	**0.02**	**1.63**	**24.37**	**4.73**	**1.22**
3. Solvent and Other Product Use	**220.99**		**0.53**							**NA**	**NA**	**94.92**	**NA**
4. Agriculture [3]		**194.99**	**12.24**							**5.21**	**1.01**	**1.79**	**0.00**
5. Land Use, Land-Use Change and Forestry	[4] **-18 422.04**	**0.00**	**0.86**							**IE,NA,NE**	**IE,NA,NE**	**NA,NE**	**NA**
6. Waste	**12.26**	**87.39**	**1.13**							**0.05**	**5.91**	**0.08**	**0.06**
7. Other	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items: [5]													
International Bunkers	**1 810.00**	**0.03**	**0.06**							**5.79**	**1.79**	**0.75**	**0.57**
Aviation	1 810.00	0.03	0.06							5.79	1.79	0.75	0.57
Marine	NA,NO	NA,NO	NA,NO							NO	NO	NO	NO
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**16 481.89**												

Note: A = Actual emissions based on Tier 2 approach of the IPCC Guidelines.
P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II) of this common reporting format.

(2) For verification purposes, countries are asked to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach in the documentation box to Table 1.A.(c). For estimating national total emissions, the result from the Sectoral approach should be used, where possible.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(5) Countries are asked to report emissions from international aviation and marine bunkers and multilateral operations, as well as CO_2 emissions from biomass, under Memo Items. These emissions should not be included in the national total emissions from the energy sector. Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO_2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO_2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**58 860.72**	**6 936.68**	**5 664.83**	**857.80**	**135.67**	**480.24**	**72 935.93**
1. Energy	**68 049.56**	**987.13**	**808.81**				**69 845.50**
A. Fuel Combustion (Sectoral Approach)	67 817.52	288.27	808.81				68 914.60
1. Energy Industries	15 426.28	6.26	75.51				15 508.05
2. Manufacturing Industries and Construction	15 812.24	13.03	158.32				15 983.59
3. Transport	22 807.93	23.27	288.09				23 119.30
4. Other Sectors	13 645.61	245.62	284.56				14 175.79
5. Other	125.46	0.09	2.33				127.87
B. Fugitive Emissions from Fuels	232.04	698.85	IE,NA				930.89
1. Solid Fuels	IE,NA,NO	0.03	IE,NA				0.03
2. Oil and Natural Gas	232.04	698.82	IE,NA				930.86
2. Industrial Processes	**8 999.94**	**19.33**	**280.12**	**857.80**	**135.67**	**480.24**	**10 773.09**
A. Mineral Products	3 294.35	IE,NA	IE,NA				3 294.35
B. Chemical Industry	599.25	19.25	280.12	NO	NO	NO	898.61
C. Metal Production	5 106.34	0.08	NA	NO	NO	NA,NO	5 106.43
D. Other Production	NA						NA
E. Production of Halocarbons and SF_6				NA	NA	NA	NA
F. Consumption of Halocarbons and SF_6 [2]				857.80	135.67	480.24	1 473.71
G. Other	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	**220.99**		**164.30**				**385.29**
4. Agriculture		**4 094.87**	**3 794.46**				**7 889.33**
A. Enteric Fermentation		3 209.78					3 209.78
B. Manure Management		875.29	874.64				1 749.93
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		8.63	2 919.53				2 928.16
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		1.17	0.29				1.46
G. Other		NA	NA				NA
5. Land Use, Land-Use Change and Forestry [1]	**-18 422.04**	**0.09**	**267.63**				**-18 154.32**
A. Forest Land	-19 729.23	0.09	0.02				-19 729.12
B. Cropland	1 876.76	NA,NO	267.61				2 144.37
C. Grassland	-1 148.69	NO	NO				-1 148.69
D. Wetlands	328.77	NO	NO				328.77
E. Settlements	-233.79	NA,NO	NA,NO				-233.79
F. Other Land	484.15	NA,NO	NA,NO				484.15
G. Other	NE	NA	NA				NA,NE
6. Waste	**12.26**	**1 835.26**	**349.52**				**2 197.05**
A. Solid Waste Disposal on Land	NA,NO	1 759.56					1 759.56
B. Waste-water Handling		41.44	278.27				319.71
C. Waste Incineration	12.26	0.01	0.03				12.30
D. Other	NA	34.25	71.22				105.47
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: [4]							
International Bunkers	1 810.00	0.65	19.47				1 830.12
Aviation	1 810.00	0.65	19.47				1 830.12
Marine	NA,NO	NA,NO	NA,NO				NA,NO
Multilateral Operations	**NO**	**NO**	**NO**				**NO**
CO_2 Emissions from Biomass	**16 481.89**						**16 481.89**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	91 090.25
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	72 935.93

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED
(Sheet 1 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
1. Energy	**CS,M,T1,T2**	**CS,PS**	**CS,M,T1,T2**	**CR,CS,D**	**CS,M,T2**	**CS**						
A. Fuel Combustion	CS,M,T2	CS,PS	CS,M,T2	CS	CS,M,T2	CS						
1. Energy Industries	T2	CS,PS	T2	CS	T2	CS						
2. Manufacturing Industries and Construction	T2	CS,PS	T2	CS	T2	CS						
3. Transport	CS,M	CS	CS,M	CS	CS,M	CS						
4. Other Sectors	T2	CS	T2	CS	T2	CS						
5. Other	CS,M	CS	CS,M	CS	CS,M	CS						
B. Fugitive Emissions from Fuels	CS,T1	CS,PS	T1	CR,CS,D	NA	NA						
1. Solid Fuels	NA	NA	T1	CR	NA	NA						
2. Oil and Natural Gas	CS,T1	CS,PS	T1	CS,D	NA	NA						
2. Industrial Processes	**CS,T1,T2**	**CS,D,PS**	**CR,CS**	**CS,PS**	**CS**	**PS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**
A. Mineral Products	CS,T1	CS,D	NA	NA	NA	NA						
B. Chemical Industry	CS	CS,PS	CS	PS	CS	PS					NA	NA
C. Metal Production	CS,T2	D,PS	CR	CS	NA	NA	NA	NA	NA	NA	NA	NA
D. Other Production	NA	NA										
E. Production of Halocarbons and SF_6							NA	NA	NA	NA	NA	NA
F. Consumption of Halocarbons and SF_6							CS	CS	CS	CS	CS	CS
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Use the following notation keys to specify the method applied:

D (IPCC default) **T1a, T1b, T1c** (IPCC Tier 1a, Tier 1b and Tier 1c, respectively) **CR** (CORINAIR)
RA (Reference Approach) **T2** (IPCC Tier 2) **CS** (Country Specific)
T1 (IPCC Tier 1) **T3** (IPCC Tier 3) **OTH** (Other)

If using more than one method within one source category, list all the relevant methods. Explanations regarding country-specific methods, other methods or any modifications to the default IPCC methods, as well as informatic

Use the following notation keys to specify the emission factor used:

D (IPCC default) **CS** (Country Specific) **OTH** (Other)
CR (CORINAIR) **PS** (Plant Specific)

Where a mix of emission factors has been used, list all the methods in the relevant cells and give further explanations in the documentation box. Also use the documentation box to explain the use of notation OTH.

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED
(Sheet 2 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
3. Solvent and Other Product Use	**CR,CS**	**CS**			**CS**	**D**						
4. Agriculture			**CS,D,T1,T2**	**CS,D**	**D,T1**	**CS,D**						
A. Enteric Fermentation			T1,T2	CS,D								
B. Manure Management			T1,T2	CS,D	T1	CS						
C. Rice Cultivation			NA	NA								
D. Agricultural Soils			CS	CS	T1	D						
E. Prescribed Burning of Savannas			NA	NA	NA	NA						
F. Field Burning of Agricultural Residues			D	D	D	D						
G. Other			NA	NA	NA	NA						
5. Land Use, Land-Use Change and Forestry	**T1,T3**	**CS,D**	**T1**	**CS,D**	**T1**	**CS,D**						
A. Forest Land	T1,T3	CS	T1	CS,D	T1	CS,D						
B. Cropland			NA	NA	T1	CS,D						
C. Grassland	T1,T3	CS,D	NA	NA	NA	NA						
D. Wetlands	T1,T3	CS	NA	NA	NA	NA						
E. Settlements	T1,T3	CS	NA	NA	NA	NA						
F. Other Land	T1,T3	CS	NA	NA	NA	NA						
G. Other	NA	NA	NA	NA	NA	NA						
6. Waste	**D**	**CS,D**	**CR,D,T2**	**CS,D**	**CR,CS,D**	**CS,D**						
A. Solid Waste Disposal on Land	NA	NA	T2	CS,D								
B. Waste-water Handling			D	CS,D	CS,D	CS,D						
C. Waste Incineration	D	CS,D	D	CS	D	CS						
D. Other	NA	NA	CR	CS	CR	CS						
7. Other (as specified in Summary 1.A)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Use the following notation keys to specify the method applied:

D (IPCC default) | **T1a, T1b, T1c** (IPCC Tier 1a, Tier 1b and Tier 1c, respectively) | **CR** (CORINAIR)
RA (Reference Approach) | **T2** (IPCC Tier 2) | **CS** (Country Specific)
T1 (IPCC Tier 1) | **T3** (IPCC Tier 3) | **OTH** (Other)

If using more than one method within one source category, list all the relevant methods. Explanations regarding country-specific methods, other methods or any modifications to the default IPCC methods, as well as information regarding the use of different methods per

Use the following notation keys to specify the emission factor used:

D (IPCC default) | **CS** (Country Specific) | **OTH** (Other)
CR (CORINAIR) | **PS** (Plant Specific)

Where a mix of emission factors has been used, list all the methods in the relevant cells and give further explanations in the documentation box. Also use the documentation box to explain the use of notation OTH.

Documentation box:

• Parties should provide the full information on methodological issues, such as methods and emission factors used, in the relevant sections of Chapters 3 to 9 (see section 2.2 of each of Chapters 3 - 9) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.

• Where a mix of methods/emission factors has been used within one source category, use this documentation box to specify those methods/emission factors for the various sub-sources where they have been applied.
• Where the notation OTH (Other) has been entered in this table, use this documentation box to specify those other methods/emission factors.

TABLE 7 SUMMARY OVERVIEW FOR KEY CATEGORIES
(Sheet 1 of 1)

KEY CATEGORIES OF EMISSIONS AND REMOVALS	Gas	Criteria used for key source identification			Key category excluding LULUCF [1]	Key category including LULUCF [1]	Comments [1]
		L	T	Q			
Specify key categories according to the national level of disaggregation used:							
1 A 1 a liquid	CO2	x	x		x	x	
1 A 1 a other	CO2	x	x		x	x	
1 A 1 a solid	CO2	x	x		x	x	
1 A 1 b liquid	CO2	x			x	x	
1 A 2 mobile, liquid	CO2	x			x	x	
1 A 2 other	CO2	x	x		x	x	
1 A 2 solid	CO2		x		x	x	
1 A 2 stationary, liquid	CO2	x	x		x	x	
1 A 3 a jet kerosene	CO2		x		x	x	
1 A 3 b diesel oil	CO2	x	x		x	x	
1 A 3 b gasoline	CO2	x	x		x	x	
1 A 3 b gasoline	N2O						
1 A 4 biomass	CH4		x		x		
1 A 4 mobile, diesel	CO2	x	x		x	x	
1 A 4 other	CO2		x		x	x	
1 A 4 solid	CO2	x	x		x	x	
1 A 4 stationary, liquid	CO2	x	x		x	x	
1 A gaseous	CO2	x	x		x	x	
1 B 2 b natural gas	CH4	x	x		x	x	
2 A 1 Cement Production	CO2	x	x		x	x	
2 A 2 Lime Production	CO2	x	x		x	x	
2 A 3 Limestone and Dolomite Use	CO2	x			x		
2 A 7 b Sinter Production	CO2	x	x		x	x	
2 B 1 Ammonia Production	CO2	x			x	x	
2 B 2 Nitric Acid Production	N2O		x		x	x	
2 C 1 Iron and Steel Production	CO2	x	x		x	x	
2 C 3 Aluminium production	CO2		x		x	x	
2 C 3 Aluminium production	PFCs		x		x	x	
2 C 4 SF6 Used in Al and Mg Foundries	CO2		x		x	x	
2 F 1 to 2 F 5: ODS Substitutes	HFCs	x	x		x	x	
2 F 7 Semiconductor Manufacture	HFC, PFC, SF6		x			x	
2 F 9 Other Sources of SF6	SF6						
3 SOLVENT AND OTHER PRODUCT USE	CO2		x		x	x	
4 A 1 Cattle	CH4	x	x		x	x	
4 B 1 Cattle	CH4	x	x		x	x	
4 B 1 Cattle	N2O	x	x		x	x	
4 B 8 Swine	CH4	x	x		x	x	
4 D 1 Direct Soil Emissions	N2O	x	x		x	x	
4 D 2 Pasture, Range and Paddock Manure	N2O						
4 D 3 Indirect Emissions	N2O	x	x		x	x	
5 A 1 Forest land remaining forest land	CO2	x	x			x	
5 A 2 Land converted to forest land	CO2	x	x			x	
5 B 1 Cropland remaining cropland	CO2		x			x	
5 B 2 Land converted to cropland	CO2	x	x			x	
5 C 2 Land converted to grassland	CO2	x				x	
5 D 2 Land converted to wetland	CO2	x				x	
5 E 2 Land converted to settlements	CO2						
5 F 2 Land converted to other land	CO2	x	x			x	
6 A SOLID WASTE DISPOSAL ON LAND	CH4	x	x		x	x	
6 B Wastewater Handling	N2O		x		x	x	

Note: L = Level assessment; T = Trend assessment; Q = Qualitative assessment.
[1] The term “key categories” refers to both the key source categories as addressed in the IPCC good practice guidance and the key categories as addressed in the IPCC good practice guidance for LULUCF.

[2] For estimating key categories Parties may chose the disaggregation level presented as an example in table 7.1 of the IPCC good practice guidance (page 7.6) and table 5.4.1 (page 5.31) of the IPCC good practice guidance for LULUCF, the level used in ta

Documentation box:

Parties should provide the full information on methodologies used for identifying key categories and the quantitative results from the level and trend assessments (according to tables 7.1–7.3 of the IPCC good practice guidance and tables 5.4.1–5.4.3 of th

TABLE 8(a) RECALCULATION - RECALCULATED DATA
(Sheet 1 of 2)

Recalculated year: Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2						CH_4						N_2O					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**58 860.72**						6 936.68						5 664.83				
1. Energy		**68 049.56**						987.13						808.81				
1.A. Fuel Combustion Activities		67 817.52						288.27						808.81				
1.A.1. Energy Industries		15 426.28						6.26						75.51				
1.A.2. Manufacturing Industries and Construction		15 812.24						13.03						158.32				
1.A.3. Transport		22 807.93						23.27						288.09				
1.A.4. Other Sectors		13 645.61						245.62						284.56				
1.A.5. Other		125.46						0.09						2.33				
1.B. Fugitive Emissions from Fuels		232.04						698.85						IE,NA				
1.B.1. Solid fuel		IE,NA,NO						0.03						IE,NA				
1.B.2. Oil and Natural Gas		232.04						698.82						IE,NA				
2. Industrial Processes		**8 999.94**						**19.33**						**280.12**				
2.A. Mineral Products		3 294.35						IE,NA						IE,NA				
2.B. Chemical Industry		599.25						19.25						280.12				
2.C. Metal Production		5 106.34						0.08						NA				
2.D. Other Production		NA																
2.G. Other		NA						NA						NA				
3. Solvent and Other Product Use		**220.99**												**164.30**				
4. Agriculture								**4 094.87**						**3 794.46**				
4.A. Enteric Fermentation								3 209.78										
4.B. Manure Management								875.29						874.64				
4.C. Rice Cultivation								NO										
4.D. Agricultural Soils [(4)]								8.63						2 919.53				
4.E. Prescribed Burning of Savannas								NO						NO				
4.F. Field Burning of Agricultural Residues								1.17						0.29				
4.G. Other								NA						NA				
5. Land Use, Land-Use Change and Forestry (net) [(5)]		**-18 422.04**						0.09						267.63				
5.A. Forest Land		-19 729.23						0.09						0.02				
5.B. Cropland		1 876.76						NA,NO						267.61				
5.C. Grassland		-1 148.69						NO						NO				
5.D. Wetlands		328.77						NO						NO				
5.E. Settlements		-233.79						NA,NO						NA,NO				
5.F. Other Land		484.15						NA,NO						NA,NO				
5.G. Other		NE						NA						NA				

Note: All footnotes for this table are given at the end of the table on sheet 2.

TABLE 8(a) RECALCULATION - RECALCULATED DATA
(Sheet 2 of 2)

Recalculated year: Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)		
6. Waste		**12.26**				
6.A. Solid Waste Disposal on Land		NA,NO				
6.B. Waste-water Handling						
6.C. Waste Incineration		12.26				
6.D. Other		NA				
7. Other *(as specified in Summary 1.A)*		NA				
Memo Items:						
International Bunkers		**1 810.00**				
Multilateral Operations		**NO**				
CO_2 Emissions from Biomass		**16 481.89**				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)		
6. Waste		1 835.26				
6.A. Solid Waste Disposal on Land		1 759.56				
6.B. Waste-water Handling		41.44				
6.C. Waste Incineration		0.01				
6.D. Other		34.25				
7. Other *(as specified in Summary 1.A)*		NA				
Memo Items:						
International Bunkers		**0.65**				
Multilateral Operations		**NO**				
CO_2 Emissions from Biomass						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	N_2O					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)		
6. Waste		349.52				
6.A. Solid Waste Disposal on Land						
6.B. Waste-water Handling		278.27				
6.C. Waste Incineration		0.03				
6.D. Other		71.22				
7. Other *(as specified in Summary 1.A)*		NA				
Memo Items:						
International Bunkers		**19.47**				
Multilateral Operations		**NO**				
CO_2 Emissions from Biomass						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**857.80**				
2.C.3. Aluminium Production						
2.E. Production of Halocarbons and SF_6		NA				
2.F. Consumption of Halocarbons and SF_6		857.80				
2.G. Other		NA				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**1 336.59**				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	PFCs					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**135.67**				
2.C.3. Aluminium Production		NO				
2.E. Production of Halocarbons and SF_6		NA				
2.F. Consumption of Halocarbons and SF_6		135.67				
2.G. Other		NA				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**380.99**				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	SF_6					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**480.24**				
2.C.3. Aluminium Production						
2.E. Production of Halocarbons and SF_6		NA				
2.F. Consumption of Halocarbons and SF_6		480.24				
2.G. Other		NA				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**414.22**				

	Previous submission	Latest submission	Difference	Difference[(1)]
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry		72 935.93		
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry		91 090.25		

(1) Estimate the percentage change due to recalculation with respect to the previous submission (percentage change = 100 x [(LS-PS)/PS], where LS = latest submission and PS = previous submission. All cases of recalculation of the estimate of the source/sink category should be addressed and explained in table 8(b).

(2) Total emissions refer to total aggregate GHG emissions expressed in terms of CO_2 equivalent, excluding GHGs from the LULUCF sector. The impact of the recalculation on the total emissions is calculated as follows: impact of recalculation (%) = 100 x [(source (LS) - source (PS))/total emissions (LS)], where LS = latest submission, PS = previous submission.

(3) Total emissions refer to total aggregate GHG emissions expressed in terms of CO_2 equivalent, including GHGs from the LULUCF sector. The impact of the recalculation on the total emissions is calculated as follows: impact of recalculation (%) = 100 x [(source (LS) - source (PS))/total emissions (LS)], where LS = latest submission, PS = previous submission.

(4) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(5) Net CO_2 emissions/removals to be reported.

Documentation box:

Parties should provide detailed information on recalculations in Chapter 10: Recalculations and Improvements, and in the relevant sections of Chapters 3 to 9 (see section 2.5 of each of Chapters 3 - 9) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.

TABLE 8(b) RECALCULATION - EXPLANATORY INFORMATION
(Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

Specify the sector and source/sink category[1] where changes in estimates have occurred:		GHG	RECALCULATION DUE TO				
			CHANGES IN:			Addition/removal/ reallocation of source/sink categories	Other changes in data (e.g. statistical or editorial changes, correction of errors)
			Methods [2]	Emission factors [2]	Activity data [2]		

[1] Enter the identification code of the source/sink category (e.g. 1.B.1) in the first column and the name of the category (e.g. Fugitive Emissions from Solid Fuels) in the second column of the table. Note that the source categories entered in this table should match those used in table 8(a).
[2] Explain changes in methods, emission factors and activity data that have resulted in recalculation of the estimate of the source/sink as indicated in table 8(a). Include changes in the assumptions and coefficients in the Methods column.

Documentation box:

Parties should provide the full information on recalculations in Chapter 10: Recalculations and Improvements, and in the relevant sections of Chapters 3 to 9 (see section 2.5 of each of Chapters 3 to 9) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table. References should point particularly to the sections of the NIR in which justifications of the changes as to improvements in the accuracy, completeness and consistency of the inventory are reported.

TABLE 9(a) COMPLETENESS - INFORMATION ON NOTATION KEYS
(Sheet 1 of 1)

Sources and sinks not estimated (NE)(1)

GHG	Sector(2)	Source/sink category (2)	Explanation
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
CH4	5 LULUCF	Grassland converted to Other Land-Use Categories	No information available
CO2	5 LULUCF	Harvested Wood Products	Parties do not have to prepare estimates for this category contained in appendix 3a.1 of the IPCC good practice guidance for LULUCF.
N2O	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	no sufficient data for estimates.
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.P4 Destroyed amount	No information available
SF6	2 Industrial Processes	Research and other use	No information available
SF6	2 Industrial Processes	Research and other use	No information available

Sources and sinks reported elsewhere (IE)(3)

GHG	Source/sink category	Allocation as per IPCC Guidelines	Allocation used by the Party	Explanation
Carbon	Perennial converted to annual	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Annual remaining annual	Increase	Decrease	only net figures are reported.
Carbon	Annual converted to perennial	Increase	Decrease	only net figures are reported.
Carbon	Total	5 A 2 1 Cropland converted to Forest Land -Total - Decrease	d converted to Forest Land -Total - Increase	only net figures are reported.
Carbon	Total	5 A 2 2 Grassland converted to Forest Land -Total - Decrease	d converted to Forest Land -Total - Increase	only net figures are reported.
Carbon	Total	5 A 2 3 Wetlands converted to Forest Land -Total - Decrease	s converted to Forest Land -Total - Increase	only net figures are reported.
Carbon	Total	5 A 2 5 Other Land converted to Forest Land -Total - Decrease	d converted to Forest Land -Total - Increase	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Total	Organic Soils	Included in Mineral Soils	Included in Mineral Soils
CH4	3.1.A.2.2 Post-Mining Activities	1 B 1 A 2 Coal Surface Mines/ Post Mining Activities	A 2 Coal Surface Mines/ Mining Activities	Emissions from mining and post-mining activities are reported together.
CH4	3.1.B Solid Fuel Transformation	1 B 1 B Solid Fuel Transformation	1 A 2 a Iron and Steel	Emissions from coke ovens are included in 1 A 2 a Iron and Steel
CH4	1.B.2.A.1 Exploration	1 B 2 A 1 Oil Exploration	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CH4	1.B.2.A.3 Transport	1 B 2 A 3 Oil Transport	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CH4	1.B.2.B.1 Exploration	1 B 2 A 3 Oil Transport	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CH4	B.2.B.2 Production / Processing	1 B 2 A 3 Oil Transport	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CH4	1.B.2.C.1 Venting	1.B.2.C.1	1 B 2 b iv Refining Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.1.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.1.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.1.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.2 Flaring	1.B.2.C.1	1 B 2 b iv Refining Storage	The emission declaration of the refinery includes all emissions from all sources.
CH4	1.B.2.C.2.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.2.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.2.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	4.A Enteric Fermentation	4 A Enteric Fermentation / Mules and Asses	4 A Enteric Fermentation / Horses	In the national statistics mules, asses and horses are published together.
CH4	4.B Manure Management	4 A Manure Managment / Mules and Asses	4 A Manure Managment / Horses	In the national statistics mules, asses and horses are published together.
CH4	2.A.7.1 Glass Production	2.A.7.1 Glass Production	2A3 Limestone Use, 2A4 Soda ash use	emissions are reported under 2A3 Limestone and dolomite use and under 2A4 Soda ash use
CH4	2.C.1.1 Steel	2 C 1 1 Steel	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CH4	2.C.1.2 Pig Iron	2 C 1 2 Pig Iron	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CH4	2.C.1.3 Sinter	2 C 1 3 Sinter	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CH4	2.C.1.4 Coke	2 C 1 4 Coke	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CH4	4.F.1.2 Barley	4 F 1 2 Barlay	4 F 1 1 Wheat	Wheat includes cereals total
CH4	4.F.1.3 Maize	4 F 1 3 Maize	4 F 1 1 Wheat	Wheat includes cereals total
CH4	4.F.1.4 Oats	4 F 1 4 Oats	4 F 1 1 Wheat	Wheat includes cereals total
CH4	4.F.1.5 Rye	4 F 1 5 Rye	4 F 1 1 Wheat	Wheat includes cereals total
CH4	6.B.1 Industrial Wastewater	6 B 1 Industrial Wastewater / Sludge	6 B 1 Industrial Wastewater / Wastewater	Emissions from sludge are reported together with emissions from wastewater
CH4	ommercial (w/o human sewage)	6 B 2 Dometic and Commercial Wastewater / Sludge	: and Commercial Wastewater / Wastewater	Emissions from sludge are reported together with emissions from wastewater
CH4	1.AA.1.B Petroleum Refining	1 A 1 b Petroleum Refining / Liquid Fuels.	1 B 2 fugitive Emissions from fuels.	ed. CH4 emissions from fuel combustion are a minor source of total CH4 emisions from refinery.
CH4	1.AA.1.B Petroleum Refining	1 A 1 b Petroleum Refining / Gaseous Fuels.	1 B 2 fugitive Emissions from fuels.	ed. CH4 emissions from fuel combustion are a minor source of total CH4 emisions from refinery.
CO2	3.1.A.2.2 Post-Mining Activities	1 B 1 A 2 Coal Surface Mines/ Post Mining Activities	A 2 Coal Surface Mines/ Mining Activities	Emissions from mining and post-mining activities are reported together.
CO2	3.1.B Solid Fuel Transformation	1 B 1 B Solid Fuel Transformation	1 A 2 a Iron and Steel	Emissions from coke ovens are included in 1 A 2 a Iron and Steel
CO2	1.B.2.A.1 Exploration	1 B 2 A 1 Oil Exploration	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CO2	1.B.2.A.3 Transport	1 B 2 A 3 Oil Transport	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CO2	1.B.2.C.1 Venting	1.B.2.C.1	1 A 1 b Petroleum Refining	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.1.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.1.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.1.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.2 Flaring	1.B.2.C.1	1 A 1 b Petroleum Refining	The emission declaration of the refinery includes all emissions from all sources.
CO2	1.B.2.C.2.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.2.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.2.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	2.A.4.1 Soda Ash Production	2 A 4 1 Soda Ash Production	1 A 2 c Chemicals	sector (subcategory 1 A 2 c), that's why CO2 emissions of soda ash production is reported as "IE".
CO2	2.A.4.1 Soda Ash Production	2 A 4 1 Soda Ash Production	1 A 2 c Chemicals	sector (subcategory 1 A 2 c), that's why CO2 emissions of soda ash production is reported as "IE".
CO2	2.A.5 Asphalt Roofing	2 A 5 Asphalt Roofing	3 Solvent Use	from 2A5 Asphalt Roofing and 2A6 Road Paving with Asphalt are included in the Solvent Sector.
CO2	2.A.6 Road Paving with Asphalt	2 A 6 Road Paving	3 Solvent Use	from 2A5 Asphalt Roofing and 2A6 Road Paving with Asphalt are included in the Solvent Sector.
CO2	2.A.7.1 Glass Production	2.A.7.1 Glass Production	2A3 Limestone Use, 2A4 Soda ash use	emissions are reported under 2A3 Limestone and dolomite use and under 2A4 Soda ash use
CO2	2.C.1.3 Sinter	2 C 1 3 Sinter	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CO2	2.C.1.4 Coke	2 C 1 4 Coke	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CO2	est Land remaining Forest Land	5 A 1 Widfires	Forest Land remaining Forest land	arbon stock change due to wildfires at forest land is included in figures of table 5.A Sektor 5.A.1.
CO2	1 Cropland remaining Cropland	5 B Cropland / lime application / Dolomite	5 B Cropland / lime application / Limestone	Emissions from dolomite liming include emissions from limestone liming
CO2	Grassland remaining Grassland	5 C Grassland / lime application	5 B Cropland / lime application / Limestone	Emissions from cropland dolomite liming include emissions from grassland liming.
CO2	Grassland remaining Grassland	5 C Grassland / lime application	5 B Cropland / lime application / Limestone	Emissions from cropland dolomite liming include emissions from grassland liming.
N2O	3.1.B Solid Fuel Transformation	1 B 1 B Solid Fuel Transformation	1 A 2 a Iron and Steel	Emissions from coke ovens are included in 1 A 2 a Iron and Steel
N2O	1.B.2.A.1 Exploration	1 B 2 A 1 Oil Exploration	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
N2O	1.B.2.C.2 Flaring	1.B.2.C.1	1 A 1 b Petroleum Refining	The emission declaration of the refinery includes all emissions from all sources.
N2O	1.B.2.C.2.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
N2O	1.B.2.C.2.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
N2O	1.B.2.C.2.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
N2O	2.A.7.1 Glass Production	2.A.7.1 Glass Production	2A3 Limestone Use, 2A4 Soda ash use	emissions are reported under 2A3 Limestone and dolomite use and under 2A4 Soda ash use
N2O	4.F.1.2 Barley	4 F 1 2 Barlay	4 F 1 1 Wheat	Wheat includes cereals total
N2O	4.F.1.3 Maize	4 F 1 3 Maize	4 F 1 1 Wheat	Wheat includes cereals total
N2O	4.F.1.4 Oats	4 F 1 4 Oats	4 F 1 1 Wheat	Wheat includes cereals total
N2O	4.F.1.5 Rye	4 F 1 5 Rye	4 F 1 1 Wheat	Wheat includes cereals total
N2O	6.B.1 Industrial Wastewater	6 B 1 Industrial Wastewater / Sludge	6 B 1 Industrial Wastewater / Wastewater	Emissions from sludge are reported together with emissions from wastewater
N2O	ommercial (w/o human sewage)	6 B 2 Dometic and Commercial Wastewater / Sludge	: and Commercial Wastewater / Wastewater	Emissions from sludge are reported together with emissions from wastewater
SF6	2.F.P2.2 In products	2 F P 2 2 Import in Products	2 F P 2 1 Import in Bulk	calculation is based on consumption data of halocarbons and SF6 or products (net import/export).
SF6	2.F.P3.1 In bulk	2 F P 3 1 Export in Bulk	2 F P 2 1 Import in Bulk	calculation is based on consumption data of halocarbons and SF6 or products (net import/export).
SF6	2.F.P3.2 In products	2 F P 3 2 Export in Products	2 F P 2 1 Import in Bulk	calculation is based on consumption data of halocarbons and SF6 or products (net import/export).

(1) Clearly indicate sources and sinks which are considered in the IPCC Guidelines but are not considered in the submitted inventory. Explain the reason for excluding these sources and sinks, in order to avoid arbitrary interpretations. An entry should be made for each source/sink
(2) Indicate omitted source/sink following the IPCC source/sink category structure (e.g. sector: Waste, source category: Waste-Water Handling)
(3) Clearly indicate sources and sinks in the submitted inventory that are allocated to a sector other than that indicated by the IPCC Guidelines. Show the sector indicated in the IPCC Guidelines and the sector to which the source or sink is allocated in the submitted inventory. Explain

TABLE 9(b) COMPLETENESS - INFORMATION ON ADDITIONAL GREENHOUSE GASES (Sheet 1 of 1)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

Additional GHG emissions reported[1]						
GHG	Source category	Emissions (Gg)	Estimated GWP value (100-year horizon)	Emissions CO_2 equivalent (Gg)	Reference to the source of GWP value	Explanation
HFC-245fa	Hard Foam	0.00	950.00	1.92	l Panel on Climate Chang	CHF2CH2CF3
HFC-365mfc	Hard Foam	0.00	890.00	1.80	l Panel on Climate Chang	CF3CH2CF2CH3

(1) Parties are encouraged to provide information on emissions of greenhouse gases whose GWP values have not yet been agreed upon by the COP. Include such gases in this table if they are considered in the submitted inventory. Provide additional information on the estimation methods used.

Documentation box:

Parties should provide detailed information regarding completeness of the inventory in the NIR (Chapter 1.8: General Assessment of the Completeness, and Annex 5). Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.

TABLE 10 EMISSION TRENDS
CO_2
(Part 1 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**54 196.26**	**57 989.02**	**53 091.68**	**53 492.91**	**53 564.71**	**56 381.94**	**60 141.37**	**59 326.00**	**59 274.41**	**58 207.44**
A. Fuel Combustion (Sectoral Approach)	54 094.24	57 878.00	52 971.65	53 380.89	53 437.19	56 254.91	60 070.34	59 205.49	59 132.58	58 036.91
1. Energy Industries	13 792.26	14 622.47	11 481.05	11 466.02	11 761.36	12 918.65	13 804.57	13 885.36	12 993.69	12 841.59
2. Manufacturing Industries and Construction	13 445.48	13 842.03	12 543.84	12 959.77	13 960.54	14 167.55	14 266.28	15 835.17	14 537.72	13 882.13
3. Transport	12 425.58	14 018.76	13 962.28	14 137.74	14 098.95	14 484.10	16 058.61	14 986.10	17 180.73	16 607.25
4. Other Sectors	14 395.90	15 357.64	14 950.80	14 777.93	13 574.74	14 652.02	15 901.93	14 461.72	14 377.99	14 664.31
5. Other	35.02	37.11	33.70	39.43	41.60	32.59	38.94	37.13	42.45	41.62
B. Fugitive Emissions from Fuels	102.03	111.03	120.03	112.03	127.53	127.03	71.03	120.51	141.83	170.53
1. Solid Fuels	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
2. Oil and Natural Gas	102.03	111.03	120.03	112.03	127.53	127.03	71.03	120.51	141.83	170.53
2. Industrial Processes	**7 579.11**	**7 425.25**	**6 938.52**	**6 853.28**	**7 183.49**	**7 382.43**	**7 081.29**	**7 670.77**	**7 314.65**	**7 162.44**
A. Mineral Products	3 269.05	3 127.22	3 147.24	3 081.86	3 196.46	2 856.93	2 769.36	2 968.65	2 815.30	2 801.11
B. Chemical Industry	585.10	609.31	632.54	605.93	555.09	583.65	590.28	582.88	579.72	583.12
C. Metal Production	3 724.96	3 688.72	3 158.74	3 165.49	3 431.94	3 941.84	3 721.65	4 119.24	3 919.62	3 778.22
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	282.67	236.77	187.74	187.35	171.54	189.88	172.81	190.09	172.24	158.37
4. Agriculture										
A. Enteric Fermentation										
B. Manure Management										
C. Rice Cultivation										
D. Agricultural Soils										
E. Prescribed Burning of Savannas										
F. Field Burning of Agricultural Residues										
G. Other										
5. Land Use, Land-Use Change and Forestry[(2)]	**-14 592.98**	**-20 509.63**	**-15 488.86**	**-19 376.08**	**-18 003.34**	**-17 369.48**	**-12 387.65**	**-21 132.33**	**-19 330.48**	**-23 665.91**
A. Forest Land	-16 154.02	-22 195.48	-17 131.41	-21 105.01	-19 785.58	-18 764.87	-13 795.94	-22 648.51	-20 548.49	-24 940.41
B. Cropland	1 564.17	1 563.89	1 571.95	1 603.11	1 612.76	1 616.00	1 687.39	1 708.33	1 725.34	1 757.15
C. Grassland	-841.71	-829.88	-821.31	-815.50	-832.68	-957.62	-980.01	-1 002.36	-1 024.47	-1 034.65
D. Wetlands	188.67	204.83	220.98	237.13	243.07	243.70	281.84	287.56	260.62	270.96
E. Settlements	-160.04	-82.22	-177.59	-163.62	-73.93	-250.63	-281.44	-134.45	-357.15	-314.97
F. Other Land	809.95	829.23	848.52	867.80	833.03	743.93	700.51	657.10	613.68	596.00
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**26.89**	**23.40**	**10.86**	**10.60**	**10.65**	**10.97**	**11.30**	**11.62**	**11.94**	**12.26**
A. Solid Waste Disposal on Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
B. Waste-water Handling										
C. Waste Incineration	26.89	23.40	10.86	10.60	10.65	10.97	11.30	11.62	11.94	12.26
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CO_2 emissions including net CO_2 from LULUCF	**47 491.96**	**45 164.81**	**44 739.94**	**41 168.06**	**42 927.05**	**46 595.74**	**55 019.11**	**46 066.15**	**47 442.76**	**41 874.60**
Total CO_2 emissions excluding net CO_2 from LULUCF	**62 084.94**	**65 674.44**	**60 228.81**	**60 544.14**	**60 930.40**	**63 965.22**	**67 406.76**	**67 198.47**	**66 773.24**	**65 540.51**
Memo Items:										
International Bunkers	**885.97**	**993.88**	**1 077.44**	**1 139.98**	**1 185.65**	**1 327.42**	**1 466.42**	**1 525.57**	**1 578.21**	**1 541.67**
Aviation	885.97	993.88	1 077.44	1 139.98	1 185.65	1 327.42	1 466.42	1 525.57	1 578.21	1 541.67
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	9 770.31	10 634.72	10 368.75	10 919.87	10 536.87	11 218.88	11 915.66	11 713.66	11 409.22	13 199.32

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CO_2
(Part 2 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	**57 968.98**	**62 278.91**	**63 616.64**	**69 836.06**	**69 147.11**	**70 622.12**	**68 049.56**	**25.56**
A. Fuel Combustion (Sectoral Approach)	57 804.44	62 096.17	63 449.60	69 603.02	68 937.08	70 417.09	67 817.52	25.37
1. Energy Industries	12 352.81	14 127.97	13 670.35	16 116.27	16 351.11	16 095.94	15 426.28	11.85
2. Manufacturing Industries and Construction	14 491.12	14 413.51	14 776.25	15 190.16	15 275.23	15 907.97	15 812.24	17.60
3. Transport	17 745.11	18 903.08	20 761.41	22 683.80	23 289.61	24 013.77	22 807.93	83.56
4. Other Sectors	13 170.45	14 608.55	14 199.69	15 523.49	13 914.54	14 279.29	13 645.61	-5.21
5. Other	44.95	43.07	41.90	89.31	106.59	120.13	125.46	258.26
B. Fugitive Emissions from Fuels	164.53	182.73	167.03	233.04	210.04	205.04	232.04	127.43
1. Solid Fuels	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00
2. Oil and Natural Gas	164.53	182.73	167.03	233.04	210.04	205.04	232.04	127.43
2. Industrial Processes	**7 766.11**	**7 693.74**	**8 260.57**	**8 205.30**	**8 155.93**	**8 690.90**	**8 999.94**	**18.75**
A. Mineral Products	2 958.13	2 976.77	3 085.41	3 072.98	3 162.59	3 119.86	3 294.35	0.77
B. Chemical Industry	587.27	539.50	551.22	592.50	530.27	557.38	599.25	2.42
C. Metal Production	4 220.70	4 177.48	4 623.93	4 539.83	4 463.06	5 013.66	5 106.34	37.08
D. Other Production	NA	NA	NA	NA	NA	NA	NA	0.00
E. Production of Halocarbons and SF_6								
F. Consumption of Halocarbons and SF_6								
G. Other	NA	NA	NA	NA	NA	NA	NA	0.00
3. Solvent and Other Product Use	181.02	215.09	225.62	217.76	213.72	190.14	220.99	-21.82
4. Agriculture								
A. Enteric Fermentation								
B. Manure Management								
C. Rice Cultivation								
D. Agricultural Soils								
E. Prescribed Burning of Savannas								
F. Field Burning of Agricultural Residues								
G. Other								
5. Land Use, Land-Use Change and Forestry[(2)]	**-18 285.53**	**-21 010.61**	**-17 236.98**	**-18 593.72**	**-18 754.62**	**-18 388.02**	**-18 422.04**	**26.24**
A. Forest Land	-19 499.81	-22 174.09	-18 355.42	-19 807.51	-19 780.45	-19 753.40	-19 729.23	22.13
B. Cropland	1 770.76	1 741.42	1 822.73	1 892.49	1 788.96	1 851.32	1 876.76	19.98
C. Grassland	-1 045.90	-1 007.25	-1 112.01	-1 091.64	-1 174.06	-1 081.37	-1 148.69	36.47
D. Wetlands	281.30	289.53	297.77	306.00	314.55	307.34	328.77	74.25
E. Settlements	-370.20	-420.86	-432.99	-418.32	-415.17	-209.76	-233.79	46.08
F. Other Land	578.31	560.63	542.95	525.26	511.56	497.85	484.15	-40.22
G. Other	NE	NE	NE	NE	NE	NE	NE	0.00
6. Waste	**12.26**	**12.26**	**12.26**	**12.26**	**12.26**	**12.26**	**12.26**	**-54.39**
A. Solid Waste Disposal on Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
B. Waste-water Handling								
C. Waste Incineration	12.26	12.26	12.26	12.26	12.26	12.26	12.26	-54.39
D. Other	NA	NA	NA	NA	NA	NA	NA	0.00
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total CO_2 emissions including net CO_2 from LULUCF	**47 642.84**	**49 189.39**	**54 878.11**	**59 677.67**	**58 774.41**	**61 127.40**	**58 860.72**	**23.94**
Total CO_2 emissions excluding net CO_2 from LULUCF	**65 928.38**	**70 200.00**	**72 115.08**	**78 271.39**	**77 529.03**	**79 515.42**	**77 282.75**	**24.48**
Memo Items:								
International Bunkers	**1 674.93**	**1 628.55**	**1 526.13**	**1 305.01**	**1 531.80**	**1 730.71**	**1 810.00**	**104.29**
Aviation	1 674.93	1 628.55	1 526.13	1 305.01	1 531.80	1 730.71	1 810.00	104.29
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	0.00
CO_2 Emissions from Biomass	12 478.52	13 252.15	13 431.49	13 626.13	13 935.52	15 084.46	16 481.89	68.69

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CH_4
(Part 1 of 2)

Inventory 2006
Submission 2008 v1.1
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	40.45	42.96	42.00	42.56	41.41	42.94	44.97	41.34	41.24	42.29
A. Fuel Combustion (Sectoral Approach)	22.13	23.97	22.17	21.83	20.02	20.46	21.23	16.71	16.08	16.12
1. Energy Industries	0.16	0.19	0.16	0.16	0.15	0.16	0.18	0.19	0.18	0.17
2. Manufacturing Industries and Construction	0.40	0.43	0.43	0.42	0.44	0.45	0.46	0.48	0.47	0.46
3. Transport	3.07	3.37	3.37	3.37	3.20	2.99	2.71	2.43	2.35	2.07
4. Other Sectors	18.50	19.99	18.21	17.88	16.22	16.87	17.89	13.61	13.08	13.42
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	18.32	18.99	19.84	20.73	21.39	22.48	23.74	24.62	25.15	26.17
1. Solid Fuels	0.52	0.45	0.37	0.36	0.29	0.28	0.24	0.24	0.24	0.24
2. Oil and Natural Gas	17.80	18.54	19.46	20.37	21.10	22.21	23.50	24.38	24.91	25.93
2. Industrial Processes	**0.71**	**0.70**	**0.67**	**0.70**	**0.71**	**0.69**	**0.70**	**0.71**	**0.74**	**0.70**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
B. Chemical Industry	0.70	0.70	0.66	0.70	0.71	0.68	0.69	0.70	0.73	0.69
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use										
4. Agriculture	**230.02**	**226.80**	**218.33**	**218.81**	**219.12**	**220.14**	**216.81**	**213.78**	**212.92**	**208.82**
A. Enteric Fermentation	179.13	176.62	168.94	168.88	169.79	171.16	168.75	165.79	164.47	162.83
B. Manure Management	50.49	49.78	49.02	49.39	48.86	48.48	47.55	47.48	47.94	45.47
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	0.33	0.33	0.31	0.47	0.40	0.44	0.45	0.45	0.45	0.45
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.07	0.07	0.06	0.06	0.06	0.07	0.06	0.07	0.07	0.07
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.01**	**0.00**	**0.01**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**
A. Forest Land	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00
B. Cropland	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Waste	**166.16**	**165.86**	**161.63**	**159.46**	**151.13**	**143.04**	**135.32**	**128.78**	**123.91**	**118.71**
A. Solid Waste Disposal on Land	160.79	160.48	156.27	154.09	145.77	137.79	130.36	124.17	119.61	114.61
B. Waste-water Handling	4.85	4.84	4.70	4.56	4.39	4.21	3.87	3.53	3.19	2.93
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.52	0.54	0.65	0.82	0.98	1.04	1.09	1.08	1.12	1.18
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**437.35**	**436.32**	**422.63**	**421.54**	**412.38**	**406.81**	**397.80**	**384.61**	**378.82**	**370.53**
Total CH_4 emissions excluding CH_4 from LULUCF	**437.34**	**436.32**	**422.62**	**421.53**	**412.38**	**406.81**	**397.80**	**384.61**	**378.81**	**370.53**
Memo Items:										
International Bunkers	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03
Aviation	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CH_4
(Part 2 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	42.06	43.07	43.34	44.03	45.36	46.37	47.01	16.20
A. Fuel Combustion (Sectoral Approach)	15.13	15.75	14.93	15.05	14.26	14.42	13.73	-37.98
1. Energy Industries	0.16	0.20	0.21	0.24	0.27	0.23	0.30	83.22
2. Manufacturing Industries and Construction	0.48	0.49	0.50	0.54	0.57	0.59	0.62	56.16
3. Transport	1.89	1.75	1.68	1.57	1.41	1.27	1.11	-63.91
4. Other Sectors	12.60	13.31	12.54	12.70	12.00	12.32	11.70	-36.78
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	244.05
B. Fugitive Emissions from Fuels	26.93	27.32	28.42	28.98	31.10	31.96	33.28	81.65
1. Solid Fuels	0.27	0.26	0.30	0.25	0.05	0.00	0.00	-99.73
2. Oil and Natural Gas	26.66	27.07	28.11	28.74	31.05	31.96	33.28	86.99
2. Industrial Processes	**0.70**	**0.67**	**0.71**	**0.70**	**0.70**	**0.75**	**0.92**	**30.30**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
B. Chemical Industry	0.70	0.67	0.70	0.69	0.70	0.75	0.92	30.17
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.58
D. Other Production								
E. Production of Halocarbons and SF_6								
F. Consumption of Halocarbons and SF_6								
G. Other	NA	NA	NA	NA	NA	NA	NA	0.00
3. Solvent and Other Product Use								
4. Agriculture	**206.62**	**204.44**	**200.09**	**198.54**	**196.89**	**195.70**	**194.99**	**-15.23**
A. Enteric Fermentation	161.87	159.48	156.59	154.92	154.61	153.34	152.85	-14.67
B. Manure Management	44.23	44.46	43.05	43.15	41.82	41.93	41.68	-17.46
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	0.00
D. Agricultural Soils	0.45	0.43	0.38	0.41	0.37	0.37	0.41	25.13
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	0.00
F. Field Burning of Agricultural Residues	0.06	0.07	0.07	0.06	0.09	0.06	0.06	-16.13
G. Other	NA	NA	NA	NA	NA	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**-64.94**
A. Forest Land	0.00	0.00	0.01	0.00	0.00	0.00	0.00	-64.94
B. Cropland	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
C. Grassland	NO	NO	NO	NO	NO	NO	NO	0.00
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	0.00
E. Settlements	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
G. Other	NA	NA	NA	NA	NA	NA	NA	0.00
6. Waste	**113.57**	**109.29**	**107.33**	**108.29**	**101.06**	**93.90**	**87.39**	**-47.40**
A. Solid Waste Disposal on Land	109.68	105.62	103.87	105.04	97.59	90.31	83.79	-47.89
B. Waste-water Handling	2.68	2.42	2.18	1.93	1.95	1.96	1.97	-59.31
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-90.13
D. Other	1.21	1.25	1.29	1.32	1.53	1.63	1.63	215.57
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total CH_4 emissions including CH_4 from LULUCF	**362.94**	**357.48**	**351.49**	**351.56**	**344.02**	**336.74**	**330.32**	**-24.47**
Total CH_4 emissions excluding CH_4 from LULUCF	**362.94**	**357.48**	**351.47**	**351.56**	**344.02**	**336.73**	**330.31**	**-24.47**
Memo Items:								
International Bunkers	0.03	0.03	0.03	0.02	0.03	0.03	0.03	114.34
Aviation	0.03	0.03	0.03	0.02	0.03	0.03	0.03	114.34
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	0.00
CO_2 Emissions from Biomass								

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
N_2O
(Part 1 of 2)

Inventory 2006
Submission 2008 v1.1
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**2.20**	**2.38**	**2.35**	**2.39**	**2.44**	**2.47**	**2.56**	**2.57**	**2.66**	**2.66**
A. Fuel Combustion (Sectoral Approach)	2.20	2.38	2.35	2.39	2.44	2.47	2.56	2.57	2.66	2.66
1. Energy Industries	0.15	0.18	0.14	0.15	0.15	0.16	0.16	0.15	0.17	0.17
2. Manufacturing Industries and Construction	0.52	0.54	0.54	0.54	0.56	0.55	0.54	0.57	0.57	0.59
3. Transport	0.58	0.71	0.73	0.76	0.79	0.81	0.83	0.81	0.92	0.89
4. Other Sectors	0.95	0.95	0.94	0.95	0.93	0.94	1.03	1.03	1.00	1.00
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
1. Solid Fuels	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
2. Oil and Natural Gas	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
2. Industrial Processes	**2.94**	**2.99**	**2.70**	**2.83**	**2.66**	**2.77**	**2.82**	**2.78**	**2.89**	**2.98**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
B. Chemical Industry	2.94	2.99	2.70	2.83	2.66	2.77	2.82	2.78	2.89	2.98
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
4. Agriculture	**13.99**	**14.80**	**13.81**	**13.03**	**14.62**	**14.89**	**13.60**	**13.72**	**13.79**	**13.54**
A. Enteric Fermentation										
B. Manure Management	3.24	3.20	3.08	3.09	3.09	3.16	3.10	3.07	3.06	3.02
C. Rice Cultivation										
D. Agricultural Soils	10.75	11.60	10.73	9.94	11.53	11.74	10.50	10.65	10.73	10.52
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.81**	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**	**0.83**	**0.83**	**0.83**	**0.84**
A. Forest Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Cropland	0.81	0.82	0.82	0.82	0.82	0.82	0.83	0.83	0.83	0.84
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Waste	**0.43**	**0.43**	**0.42**	**0.43**	**0.49**	**0.54**	**0.60**	**0.63**	**0.68**	**0.73**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0.35	0.35	0.33	0.31	0.35	0.40	0.45	0.48	0.52	0.57
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.08	0.08	0.09	0.12	0.14	0.14	0.15	0.15	0.15	0.16
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total N_2O emissions including N_2O from LULUCF	**21.13**	**22.17**	**20.86**	**20.26**	**21.78**	**22.25**	**21.16**	**21.28**	**21.60**	**21.50**
Total N_2O emissions excluding N_2O from LULUCF	**20.32**	**21.36**	**20.04**	**19.44**	**20.96**	**21.42**	**20.33**	**20.45**	**20.77**	**20.66**
Memo Items:										
International Bunkers	**0.03**	**0.03**	**0.04**	**0.04**	**0.04**	**0.05**	**0.05**	**0.05**	**0.06**	**0.05**
Aviation	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.05
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
N_2O
(Part 2 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	**2.58**	**2.69**	**2.75**	**2.80**	**2.75**	**2.67**	**2.61**	**18.48**
A. Fuel Combustion (Sectoral Approach)	2.58	2.69	2.75	2.80	2.75	2.67	2.61	18.48
1. Energy Industries	0.17	0.20	0.20	0.23	0.25	0.22	0.24	57.55
2. Manufacturing Industries and Construction	0.57	0.56	0.55	0.52	0.50	0.49	0.51	-1.89
3. Transport	0.91	0.94	1.02	1.06	1.03	1.00	0.93	60.78
4. Other Sectors	0.93	0.99	0.97	0.99	0.96	0.95	0.92	-2.99
5. Other	0.00	0.00	0.00	0.01	0.01	0.01	0.01	167.11
B. Fugitive Emissions from Fuels	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
1. Solid Fuels	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
2. Oil and Natural Gas	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
2. Industrial Processes	**3.07**	**2.54**	**2.60**	**2.85**	**0.91**	**0.88**	**0.90**	**-69.29**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
B. Chemical Industry	3.07	2.54	2.60	2.85	0.91	0.88	0.90	-69.29
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	0.00
D. Other Production								
E. Production of Halocarbons and SF_6								
F. Consumption of Halocarbons and SF_6								
G. Other	NA	NA	NA	NA	NA	NA	NA	0.00
3. Solvent and Other Product Use	0.75	0.71	0.67	0.64	0.60	0.56	0.53	-29.33
4. Agriculture	**13.05**	**13.02**	**12.93**	**12.43**	**12.07**	**12.08**	**12.24**	**-12.54**
A. Enteric Fermentation								
B. Manure Management	2.98	2.95	2.89	2.87	2.86	2.83	2.82	-12.97
C. Rice Cultivation								
D. Agricultural Soils	10.07	10.07	10.03	9.56	9.21	9.25	9.42	-12.41
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	0.00
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-16.49
G. Other	NA	NA	NA	NA	NA	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**0.84**	**0.85**	**0.85**	**0.85**	**0.86**	**0.87**	**0.86**	**6.15**
A. Forest Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-66.27
B. Cropland	0.84	0.85	0.85	0.85	0.86	0.87	0.86	6.16
C. Grassland	NO	NO	NO	NO	NO	NO	NO	0.00
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	0.00
E. Settlements	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
G. Other	NA	NA	NA	NA	NA	NA	NA	0.00
6. Waste	**0.82**	**0.91**	**0.92**	**0.92**	**1.01**	**1.08**	**1.13**	**164.64**
A. Solid Waste Disposal on Land								
B. Waste-water Handling	0.65	0.74	0.74	0.74	0.79	0.85	0.90	156.62
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-74.43
D. Other	0.17	0.17	0.18	0.18	0.21	0.23	0.23	203.01
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total N_2O emissions including N_2O from LULUCF	**21.11**	**20.72**	**20.73**	**20.49**	**18.20**	**18.14**	**18.27**	**-13.51**
Total N_2O emissions excluding N_2O from LULUCF	**20.27**	**19.87**	**19.88**	**19.64**	**17.33**	**17.27**	**17.41**	**-14.30**
Memo Items:								
International Bunkers	**0.06**	**0.06**	**0.05**	**0.05**	**0.05**	**0.06**	**0.06**	**103.29**
Aviation	0.06	0.06	0.05	0.05	0.05	0.06	0.06	103.29
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	0.00
CO_2 Emissions from Biomass								

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
HFCs, PFCs and SF_6
(Part 1 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990) (Gg)	1991 (Gg)	1992 (Gg)	1993 (Gg)	1994 (Gg)	1995 (Gg)	1996 (Gg)	1997 (Gg)	1998 (Gg)	1999 (Gg)
Emissions of HFCs[3] - (Gg CO_2 equivalent)	**23.03**	**45.21**	**48.68**	**157.34**	**206.83**	**267.34**	**346.84**	**427.42**	**494.89**	**542.20**
HFC-23	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-32	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-43-10mee	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-125	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00	0.00	0.01	0.01	0.01	0.02
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-134a	0.00	0.00	0.00	0.08	0.11	0.15	0.19	0.23	0.27	0.30
HFC-152a	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.04	0.05	0.06	0.07	0.08	0.09	0.10
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-143a	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00	0.00	0.01	0.01	0.01
HFC-227ea	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00	0.00	0.00	0.00
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed HFCs[4] - (Gg CO_2 equivalent)	20.81	41.52	44.02	45.92	47.89	50.17	52.32	52.97	47.67	49.48
Emissions of PFCs[3] - (Gg CO_2 equivalent)	**1 079.24**	**1 087.08**	**462.67**	**52.90**	**58.61**	**68.69**	**66.20**	**96.75**	**44.65**	**64.44**
CF_4	0.14	0.14	0.05	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_2F_6	0.02	0.02	0.01	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_3F_8	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_4F_{10}	NA,NE,NO	NA,NE,NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-C_4F_8	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
C_5F_{12}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed PFCs[4] - (Gg CO_2 equivalent)	29.05	36.89	44.73	52.57	58.30	68.39	65.92	96.48	44.40	64.19
Emissions of SF6[3] - (Gg CO_2 equivalent)	**502.58**	**653.36**	**697.85**	**793.71**	**985.70**	**1 139.16**	**1 218.05**	**1 120.15**	**907.99**	**683.96**
SF_6	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.04	0.03

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
HFCs, PFCs and SF_6
(Part 2 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
Emissions of HFCs[(3)] - (Gg CO_2 equivalent)	**596.26**	**694.45**	**781.07**	**862.75**	**896.56**	**907.68**	**857.80**	**3 624.50**
HFC-23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-32	0.00	0.00	0.00	0.00	0.00	0.01	0.01	100.00
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-43-10mee	0.00	0.00	0.00	0.00	0.00	0.00	0.00	318.01
HFC-125	0.02	0.03	0.03	0.04	0.05	0.05	0.06	100.00
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-134a	0.31	0.33	0.35	0.37	0.35	0.33	0.29	21 517.74
HFC-152a	0.11	0.24	0.35	0.43	0.53	0.57	0.42	100.00
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-143a	0.01	0.02	0.03	0.03	0.04	0.04	0.05	100.00
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Unspecified mix of listed HFCs[(4)] - (Gg CO_2 equivalent)	51.57	53.04	54.34	54.29	51.24	47.55	31.70	52.37
Emissions of PFCs[(3)] - (Gg CO_2 equivalent)	**72.21**	**82.02**	**86.73**	**102.39**	**125.68**	**125.22**	**135.67**	**-87.43**
CF_4	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	-100.00
C_2F_6	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	-100.00
C_3F_8	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00
C_4F_{10}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00
$c\text{-}C_4F_8$	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00
C_5F_{12}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Unspecified mix of listed PFCs[(4)] - (Gg CO_2 equivalent)	71.98	81.80	86.52	102.20	125.49	125.04	135.50	366.42
Emissions of SF6[(3)] - (Gg CO_2 equivalent)	**633.31**	**636.62**	**640.83**	**593.52**	**513.12**	**286.50**	**480.24**	**-4.45**
SF_6	0.03	0.03	0.03	0.02	0.02	0.01	0.02	-4.45

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
SUMMARY
(Part 1 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	47 491.96	45 164.81	44 739.94	41 168.06	42 927.05	46 595.74	55 019.11	46 066.15	47 442.76	41 874.60
CO_2 emissions excluding net CO_2 from LULUCF	62 084.94	65 674.44	60 228.81	60 544.14	60 930.40	63 965.22	67 406.76	67 198.47	66 773.24	65 540.51
CH_4 emissions including CH_4 from LULUCF	9 184.30	9 162.71	8 875.21	8 852.26	8 659.99	8 543.08	8 353.73	8 076.76	7 955.15	7 781.05
CH_4 emissions excluding CH_4 from LULUCF	9 184.05	9 162.64	8 875.04	8 852.11	8 659.92	8 543.04	8 353.70	8 076.73	7 955.03	7 781.04
N_2O emissions including N_2O from LULUCF	6 549.81	6 872.84	6 465.19	6 279.47	6 753.07	6 896.15	6 559.87	6 597.16	6 696.88	6 664.87
N_2O emissions excluding N_2O from LULUCF	6 297.68	6 620.09	6 211.79	6 025.27	6 498.06	6 640.48	6 303.29	6 339.64	6 438.58	6 405.50
HFCs	23.03	45.21	48.68	157.34	206.83	267.34	346.84	427.42	494.89	542.20
PFCs	1 079.24	1 087.08	462.67	52.90	58.61	68.69	66.20	96.75	44.65	64.44
SF_6	502.58	653.36	697.85	793.71	985.70	1 139.16	1 218.05	1 120.15	907.99	683.96
Total (including LULUCF)	**64 830.93**	**62 986.02**	**61 289.54**	**57 303.74**	**59 591.25**	**63 510.16**	**71 563.82**	**62 384.39**	**63 542.32**	**57 611.11**
Total (excluding LULUCF)	**79 171.53**	**83 242.82**	**76 524.83**	**76 425.47**	**77 339.51**	**80 623.93**	**83 694.84**	**83 259.18**	**82 614.39**	**81 017.65**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	55 728.43	59 630.11	54 702.86	55 128.13	55 189.72	58 049.17	61 879.09	60 989.53	60 964.54	59 919.80
2. Industrial Processes	10 110.82	10 152.82	8 999.19	8 750.64	9 274.83	9 729.22	9 601.24	10 192.53	9 674.37	9 391.10
3. Solvent and Other Product Use	515.17	469.27	420.24	419.85	404.04	422.38	405.31	422.59	404.74	390.87
4. Agriculture	9 168.74	9 351.60	8 866.42	8 634.39	9 134.50	9 240.12	8 769.95	8 743.21	8 746.55	8 583.14
5. Land Use, Land-Use Change and Forestry[(5)]	-14 340.60	-20 256.80	-15 235.29	-19 121.73	-17 748.26	-17 113.77	-12 131.03	-20 874.78	-19 072.06	-23 406.53
6. Waste	3 648.36	3 639.02	3 536.13	3 492.46	3 336.42	3 183.04	3 039.25	2 911.33	2 824.18	2 732.74
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[(5)]	**64 830.93**	**62 986.02**	**61 289.54**	**57 303.74**	**59 591.25**	**63 510.16**	**71 563.82**	**62 384.39**	**63 542.32**	**57 611.11**

(1) The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

(2) Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(3) Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

(4) In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is Gg of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

(5) Includes net CO_2, CH_4 and N_2O from LULUCF.

TABLE 10 EMISSION TRENDS SUMMARY (Part 2 of 2)

Inventory 2006
Submission 2008 v1.1
AUSTRIA

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	2006	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	47 642.84	49 189.39	54 878.11	59 677.67	58 774.41	61 127.40	58 860.72	23.94
CO_2 emissions excluding net CO_2 from LULUCF	65 928.38	70 200.00	72 115.08	78 271.39	77 529.03	79 515.42	77 282.75	24.48
CH_4 emissions including CH_4 from LULUCF	7 621.80	7 507.05	7 381.19	7 382.85	7 224.49	7 071.51	6 936.68	-24.47
CH_4 emissions excluding CH_4 from LULUCF	7 621.74	7 507.02	7 380.94	7 382.76	7 224.40	7 071.42	6 936.59	-24.47
N_2O emissions including N_2O from LULUCF	6 544.29	6 423.39	6 426.02	6 351.30	5 641.19	5 621.86	5 664.83	-13.51
N_2O emissions excluding N_2O from LULUCF	6 284.00	6 159.04	6 161.31	6 086.95	5 373.74	5 353.37	5 397.21	-14.30
HFCs	596.26	694.45	781.07	862.75	896.56	907.68	857.80	3 624.50
PFCs	72.21	82.02	86.73	102.39	125.68	125.22	135.67	-87.43
SF_6	633.31	636.62	640.83	593.52	513.12	286.50	480.24	-4.45
Total (including LULUCF)	**63 110.71**	**64 532.92**	**70 193.95**	**74 970.49**	**73 175.46**	**75 140.17**	**72 935.93**	**12.50**
Total (excluding LULUCF)	**81 135.90**	**85 279.15**	**87 165.97**	**93 299.76**	**91 662.54**	**93 259.62**	**91 090.25**	**15.05**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	2006	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	59 652.70	64 016.84	65 380.59	71 629.77	70 953.20	72 423.61	69 845.50	25.33
2. Industrial Processes	10 034.18	9 907.41	10 591.23	10 662.00	9 986.89	10 300.26	10 773.09	6.55
3. Solvent and Other Product Use	413.52	435.81	434.56	414.92	399.10	363.74	385.29	-25.21
4. Agriculture	8 384.71	8 329.98	8 209.37	8 021.07	7 876.41	7 854.41	7 889.33	-13.95
5. Land Use, Land-Use Change and Forestry[(5)]	-18 025.19	-20 746.23	-16 972.02	-18 329.27	-18 487.08	-18 119.45	-18 154.32	26.59
6. Waste	2 650.78	2 589.10	2 550.22	2 572.01	2 446.93	2 317.61	2 197.05	-39.78
7. Other	NA	NA	NA	NA	NA	NA	NA	0.00
Total (including LULUCF)[(5)]	**63 110.71**	**64 532.92**	**70 193.95**	**74 970.49**	**73 175.46**	**75 140.17**	**72 935.93**	**12.50**

[(1)] The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

[(2)] Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

[(3)] Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

[(4)] In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is Gg of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

[(5)] Includes net CO_2, CH_4 and N_2O from LULUCF.

Documentation box:
• Parties should provide detailed explanations on emissions trends in Chapter 2: Trends in Greenhouse Gas Emissions and, as appropriate, in the corresponding Chapters 3 - 9 of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.
• Use the documentation box to provide explanations if potential emissions are reported.

ANNEX 8 - VOLUNTARY SUPPLEMENTARY INFORMATION FOR ARTICLE 3.3 OF THE KYOTO PROTOCOL

1.1 General information

The supplementary information in this Annex is provided in accordance with Decision 15/CP.10 (FCCC/CP/2004/10/Add.2). Austria has decided to account for each activity under Article 3.3 for the entire commitment period (FCCC/IRR/2007/AUT)[1].

1.1.1 Definition of forest

The National Forest Inventory (NFI) of Austria is the main data provider for the greenhouse gas reporting related to Art. 3.3. Consequently and for reason of consistency, the applied forest definition follows the definition used within the NFI. The selected parameters are presented in Table 1 (see also FCCC/IRR/2007/AUT).

Table 1: Parameters defining forest in Austria according to the NFI of Austria (FBVA, 2001)

Parameter	Range	Selected value
Minimum land area	0.05 - 1 ha	0.05 ha
Minimum crown cover	10 - 30 %	30%
Minimum height	2 - 5 m	2 m

1.1.2 Elected activities under Article 3.4

As reported in the Initial Report[2] Austria has decided not to elect any of the activities under Article 3.4 of the Kyoto Protocol (FCCC/IRR/2007/AUT).

1.1.3 Description of how the definitions of each activity under Article 3.3 have been implemented and applied consistently over time

The area of forest land reported for Afforestation/Reforestation under the Kyoto Protocol is equal to the area reported for Land use changes to forests and for Deforestation equal to the area reported for Land use changes from forest in the UNFCCC greenhouse gas inventory taking the different time frame into account (see chapter 7.2.2 Land Use Changes to Forest Land – 5.A.2). All LUC from and to forests are considered to be human induced and AR activities will be reported together.

The information about ARD (Afforestation/Reforestation/Deforestation) areas is based on the NFI, which was carried out in the periods 1961-70, 1971-80, 1981-85, 1986-90, 1992-96 and 2000-02. The next inventory period will be from 2007-09.

[1] http://unfccc.int/resource/docs/2007/irr/aut.pdf

[2] Austria's Initial Report under the Kyoto Protocol, Report to facilitate the calculation of the assigned amount pursuant to Article 3, paragraphs 7 and 8, of the Kyoto Protocol, Federal Ministry of Agriculture and Forestry, Environment and Water Management, Vienna, November 2006

1.2 Land-related information

1.2.1 Spatial assessment unit used for determining the area of the units of land under Article 3.3

The spatial assessment unit for the voluntary submission of the Kyoto Protocol LULUCF tables 2008 covers the entire territory of Austria. The methodology for reporting is based on the National Forest Inventory which uses a permanently below ground marked 4 x 4 km grid across all of Austria with four permanent sample plots of 300 m^2 size at each grid point. At each plot the ARD area is measured. ARD activities are accounted as long as the forest definition is met (minimum area 0.05 ha). At plots with ARD adjacent to existing forests any ARD area is accounted, even at ARD areas smaller than 0.05 ha.

However, areas were land use changes to and from forests take place are generally very small in Austria thus the number of grid points with observed land use change is rather small. A statistical approach will be used to estimate the total area of ARD units following Reporting Method 1 of the GPG-LULUCF (2003).

1.2.2 Methodology used to develop the land transition matrix in Kyoto reporting table NIR 2

The land transition matrix is based on the results of land use changes from and to forest derived from the NFI of the periods 1986/90, 1992/96 and 2000/02. In the period from 1990-1995 the annual increase of AR (Afforestation/Reforestation) area was on average 14 700 ha, between 1995 and 2001 on average 9 700 ha. In the same time periods the annual deforestation areas amounted to 7 000 ha and 4 500 ha on average. Further data will become available when the next NFI will have been finished in 2009.

1.3 Activity-specific information

1.3.1 Methods for carbon stock changes and GHG emission and removal estimates

1.3.1.1 Description of the methodologies and the underlying assumptions used

The methodologies and assumptions used for the reporting under the Kyoto Protocol Art. 3.3. are described in detail in Austria's National Inventory Report, see chapter 7.2.2 Land Use Changes to Forest Land – 5.A.2.

1.3.1.2 Justification when omitting any carbon pool or GHG emissions/removals from activities under Article 3.3

No carbon pool will be omitted although net carbon stock changes in litter are not reported separately but are included in the soil carbon pools. With regard to deadwood it is currently estimated not to occur on AR area and to become part of the soil/litter pool at D (Deforestation) area.

There is no practice of biomass burning at ARD areas in Austria.

1.3.1.3 Information on whether or not indirect and natural GHG emissions and removals have been factored out

Indirect and natural GHG emissions/removals have **not** been factored out.

1.3.1.4 Changes in data and methods since the previous submission (recalculations)

Not applicable in this instance.

1.3.1.5 Uncertainty assessments

A model based approach to assess the uncertainties of emissions/removals of the ARD units is planned. Uncertainty estimates are expected to be available by 2009 or 2010.

1.3.1.6 Information on other methodological issues

The methods used to estimate emissions/removals from ARD activities are of the same tier method as those used for the UNFCCC reporting.

1.3.1.7 For the purpose of accounting as required in paragraph 18 of the annex to CMP.1 (Land use, land-use change and forestry) attached to decision 11/CP.7, an indication of the year of the onset of an activity, if after 2008.

Not applicable for this submission.

1.3.2 Article 3.3

1.3.2.1 Information that demonstrates that activities under Article 3.3 began on or after 1 January 1990 and before 31 December 2012 and are direct human-induced.

Austria uses a statistical approach to detect ARD. The NFIs covered the period which is under consideration. Therefore, the NFIs provide a good estimate for the ARD activities before and after 1st January 1990.

The NFI data in Austria provide for each period between two consecutive NFIs information on the average annual increase and loss of forest area. All land use changes from and to forests since 1990 are considered to be human induced.

1.3.2.2 Information on how harvesting or forest disturbance that is followed by the re-establishment of forest is distinguished from deforestation

In Austria temporarily unstocked areas (e.g. harvested area, disturbances) remain forests and are not accounted as deforestation. The NFI teams have criteria that are defined in a handbook[3] and are trained to distinguish between forest management operations and land use change.

[3] FBVA (2001): Instruktionen für die Feldarbeit. Österreichische Waldinventur 2000/02. Forstliche Bundesversuchsanstalt Wien.

ARD activities are only accounted if a LUC is visible and the forest definition is met (e.g. abandonment of managed lands covered by trees which will meet in future the forest definition). In doubt, no LUC is assumed and it may take further NFIs to identify clearly the LUC.

1.3.2.3 Information on the size and geographical location of forest areas that have lost forest cover but which are not yet classified as deforested

The Austrian NFI uses a grid of permanent plots. Information from these plots is extrapolated to the entire forest area according to the methodology described in "Methods of the Austrian Forest Inventory 2000/02: Origins, approaches, design, sampling, data models, evaluation and calculation of standard error"[4]. Therefore, geographical information would be only available for the permanent plots which – as each statistical approach – are only a low percentage of the Austrian forests.

1.3.3 Other information

1.3.4 Information related to Article 6 of the Kyoto Protocol

There are no Article 6 activities concerning the LULUCF sector in Austria.

[4] GABLER K., SCHADAUER K., (2006): Methoden der Österreichischen Waldinventur 2000/02: Grundlagen, Entwicklung, Design, Daten, Modelle, Auswertung und Fehlerrechnung. BFW-Berichte, Wien, (135)

ANNEX 9 – INFORMATION REQUIRED UNDER ARTICLE 7 OF THE KYOTO PROTOCOL

1.1 Changes in the National Inventory System

The national inventory system is unchanged compared to the description given in the Austrian Initial Report under the Kyoto Protocol[5].

1.2 Changes in the National Registry

1.2.1 Introduction

According to Article 7 of the Kyoto Protocol each Party included in Annex I shall incorporate in its annual greenhouse gas inventory the necessary supplementary information for the purposes of ensuring compliance with Article 3 of the Kyoto Protocol. Decision 15/CMP.1 further specifies this supplementary information stating, among other things, that each Party included in Annex I with a commitment inscribed in Annex B shall include in its national inventory report information on any changes that have occurred in its national registry, compared with information reported in its last submission.

This report describes the changes in the Austrian National Registry since the submission of the Initial Report in December 2006 und provides additional information on the Austrian registry.

1.2.2 Registry Administrator

The name and contact information of the registry administrator designated by the Party to maintain the national registry

A new member has joined the team of registry administrators:

Name	Umweltbundesamt Gmbh
Address	Spittelauer Lände 5
City	Vienna
Postcode	1090
Country	Austria
Telephone number	+43 1 31304 5930
Facsimile number	+43 1 31304 5959
E-mail	katrin.seuss@umweltbundesamt.at verena.lorenz-meyer@umweltbundesamt.at johann.weigl@umweltbundesamt.at

[5] http://unfccc.int/files/national_reports/initial_reports_under_the_kyoto_protocol/application/pdf/at-initial-report-200611-corr.pdf

1.2.3 Consolidated System with other Parties

The names of the other Parties with which the Party cooperates by maintaining their national registries in a consolidated system

Austria runs an independent registry and does not cooperate with other Parties by maintaining its national registry in a consolidated system. The information given in Austria's Initial Report that the Austrian registry operates in a consolidated system with the member states of the European Union, the Community Independent Transaction Log (CITL) and the registry of the European Community was based on a misunderstanding concerning the definition of a consolidated system.

1.2.4 Database structure and capacity

A description of the database structure of the national registry

No changes have been implemented in the database structure. The following figure and table serve to provide additional information on the database structure of the Austrian National Registry.

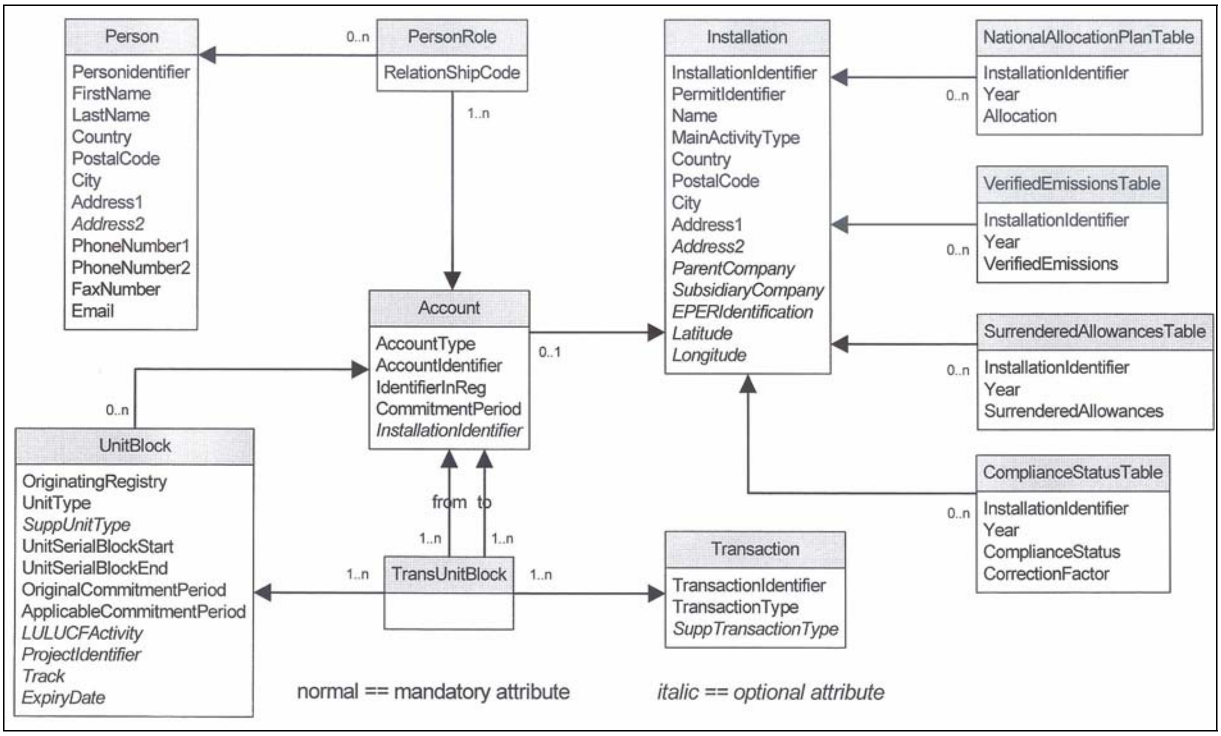

Figure 1: Structure of the Database

Table 1: Structure of the Database

Person	**Personenidentifer**	**Varchar**	**50**
	FirstName	NVarchar	50
	LastName	NVarchar	50
	Country	Varchar	3
	PostalCode	Varchar	10
	City	NVarchar	50
	Address?	NVarchar	50
	Phone?	Varchar	30
	FaxNumber	Varchar	30
	Email	Varchar	100
Installation	**InstallationIdentifer**	**Numeric**	**15/0**
	PermitIdentifer	Varchar	50
	Name	NVarchar	80
	MainActivityType	Numeric	2/0
	Country	Varchar	3
	PostalCode	Varchar	10
	Address?	NVarchar	50
	ParentCompany	NVarchar	80
	SubsidiaryCompany	NVarchar	80
	EPERIdentification	Varchar	50
	Latitude	Varchar	20
	Longitude	Varchar	20
Account	**AccountType**	**Numeric**	**3/0**
	AccountIdentifer	Numeric	15/0
	IdentiferInReg		
	CommitmentPeriod	Numeric	2/0
	InstallationIdentifer	Numeric	15/0
UnitBlock	**OriginatingRegistry**	**Varchar**	**3**
	UnitType	Numeric	2/0
	SupplUnitType	Numeric	2/0
	UnitSerialBlock*	Numeric	15/0
	*CommitmentPeriod	Numeric	2/0
	LULUCFActivity	Numeric	3/0
	Projectidentifer	Numeric	7/0
	Track	Numeric	2/0
	ExpireryDate	Date	
Transaction	**TransactionIdentifer**	**Varchar**	**18**
	TransactionType	Varchar	5
	SupplTransactionType	Varchar	5
PersonRole	**RelationshipType**	**Numeric**	**1/0**
NationalAllocationPlanTable	**InstallationIdentifer**	**Numeric**	**15/0**
	Year	Numeric	4/0
	Allocation	Numeric	38/0
VerifiedEmissionTable	**InstallationIdentifer**	**Numeric**	**15/0**
	Year	Numeric	4/0
	VerifiedEmissions	Numeric	15/0

SurrenderedAllowencesTabl	**InstallationIdentifer**	**Numeric**	**15/0**
	Year	Numeric	4/0
	SurrenderedAllowences	Numeric	15/0
ComplianceStatusTable	**InstallationIdentifer**	**Numeric**	**15/0**
	Year	Numeric	4/0
	ComplianceStatus	Numeric	38/0
	CorrelationFactor	Numeric	10/0

1.2.5 Conformity with data Exchange Standards

A description of how the national registry conforms to the technical standards for data exchange between registry systems for the purpose of ensuring the accurate, transparent and efficient exchange of data between national registries, the clean development mechanism registry and the transaction log (decision 19/CP.7, paragraph 1)

Development of software version 1.1.10.0 of the Austrian national registry, which is programmed according to DES 1.1, has been completed. This software version was used for the interoperability tests according to Annex H of DES 1.1.002 between the Austrian registry and the International Transaction Log (ITL). These tests were successfully completed in July 2007, thus proving that the Austrian registry software is fully compatible with the DES. The interoperability tests formed part of the initialization tests with the Independent Transaction Log (ITL). After having successfully completed initialization, the ITL Administrator issued the Independent Assessment Report (IAR) for Austria on 12 July 2007 including a positive initialization recommendation by the ITL Operator and the ITL Administrator.

See chapter 1.2.7 for a detailed description of the interoperability tests.

1.2.6 Minimization of discrepancies

A description of the procedures employed in the national registry to minimize discrepancies in the issuance, transfer, acquisition, cancellation and retirement of ERUs, CERs, tCERs, lCERs, AAUs and/or RMUs, and replacement of tCERs and lCERs, and of the steps taken to terminate transactions where a discrepancy is notified and to correct problems in the event of a failure in terminating the transactions

The development of software version 1.1.10.0 has been completed. All checks to prevent discrepancies by internal procedures or checks in the national registry of Austria that were listed in table 2 of Annex 2.2 of the report "National Registry Austria" from 2006 have been implemented in this version of the software.

The new checks concern the following areas:

- Checks concerning the handling of tCERs and lCERs (such as replacement, expiry date change, cancellations),
- Checks concerning carry-over procedures,
- Checks concerning the handling of notifications,
- Checks concerning net source cancellations and non-compliance cancellations and other procedures that are performed after notification from the ITL,
- Commitment period reserve checks.

Table 2: Update of the description of discrepancies being prevented by internal procedures or checks in the national registry of Austria

Response code	Description of the discrepancy or technical standard specification	Internal procedure or check in the Austrian national registry to prevent this discrepancy	Comment
3001	Transaction ID for proposedtransactions must not already exist in the ITL.	Yes	Transaction IDs are only used for one transaction and cannot be used again.
3002	Transaction ID for ongoing transactions must already exist in the ITL.	Yes	Transaction IDs are not changed during a transaction.
3003	Previously completed transactions cannot be completed again.	Yes	The completion of a transaction can only be done once for each transaction.
3004	Previously rejected transactions cannot be completed.	Yes	Rejected transactions cannot be completed.
3005	Transactions for which an ITL discrepancy has been previously identified cannot be completed.	Yes	It is not possible to complete a transaction after a discrepancy has been detected by the ITL.
3006	Transactions for which an STL discrepancy has been previously identified cannot be completed.	Yes	It is not possible to complete a transaction after a discrepancy has been detected by the STL.
3007	Previously terminated transactions cannot be completed.	Yes	Terminated transactions cannot be completed.
3008	Previously cancelled transactions cannot be completed.	Yes	Cancelled transactions cannot be completed.
3009	Previously accepted external transactions cannot be terminated.	Yes	The acceptance of a transaction is the final step in the acquiring registry; termination afterwards is not possible.
3010	Transaction status of accepted or rejected is not valid for nonexternal transactions.	Yes	For all internal transactions the status of accepted and rejected is not possible.
3011	Transaction status from initiating registry must indicate status of proposed, completed, or terminated.	Yes	Only these three indicated statuses are allowed when the registry initiates a transaction.
3012	Transaction status from acquiring registry must indicate status of rejected or accepted.	Yes	For the procedure of acquiring units only the transaction statuses rejected or accepted are possible.
3013	Previously completed, cancelled, or terminated transactions cannot have their status changed by subsequent notifications.	Yes	Notifications do not change the status of previously completed, cancelled or terminated transactions.
3014	Previously rejected transactions cannot be	Yes	After a rejection, transactions cannot be accepted.

Response code	Description of the discrepancy or technical standard specification	Internal procedure or check in the Austrian national registry to prevent this discrepancy	Comment
	accepted.		
3015	Transactions for which an ITL discrepancy has been previously identified cannot be accepted.	Yes	After a discrepancy message reaches the registry, the related transactions can only be terminated.
3016	Transactions for which an STL discrepancy has been previously identified cannot be accepted.	Yes	After a discrepancy message reaches the registry, the related transactions can only be terminated.
3502	Transaction ID for ongoing transactions must exist in ITL.	Yes	Transactions cannot be performed without communicating the transaction ID to the ITL.
4003	Units identified in the transaction must be held by Initiating Registry.	Yes	The initiating registry cannot transfer units that are not held in it.
4004	All attributes of all unit blocks must be consistent with ITL unit block attributes except where attributes are changed by the current transaction.	Yes	Inconsistency check
4005	All unit blocks in the transaction must be for a single applicable commitment period.	Yes	Technical standard check
4006	For all transactions except for external transfers, the initiating and acquiring registries must be the same.	Yes	All internal transactions can only be done within same initiating and acquiring registry.
4007	For external transfers, the initiating and acquiring registries must be different.	Yes	External transfers can only be performed between different initiating and acquiring registries.
4010	Units identified in the transaction must not be involved in another transaction.	Yes	Units proposed for transactions are blocked from other transactions.
4011	Cancelled units must not be subject to further transactions.	Yes	Transactions from cancellation accounts are not possible.
4012	Retired units must not be subject to further transactions.	Yes	Transactions from retirement accounts are not possible.
4014	Units previously used to replace tCERs or lCERs must not be subject to further transactions.	Yes	Transactions from replacement accounts are not possible.
4015	lCERs must not be transferred to a holding or retirement account where the CDM Executive Board has notified a replacement requirement for the associated project.	Yes	After a replacement notification has been received, the related lCERs are blocked from transfers to retirement or holding accounts.

Response code	Description of the discrepancy or technical standard specification	Internal procedure or check in the Austrian national registry to prevent this discrepancy	Comment
4016	A transaction proposal must contain at least one unit block	Yes	Transaction proposals always contain at least one unit block
5002	ERUs cannot be issued.	Yes	ERUs can only be created through conversion.
5003	CERs, tCERs and lCERs must be issued by the CDM Registry.	Yes	There is no procedure for issuing CERs, tCERs and lCERs in the national registry.
5005	The original commitment period must be the same for all units issued by the transaction.	Yes	Issuance is only possible with the same original commitment period for all units of the transaction.
5006	The applicable commitment period must be the same as the original commitment period for all units issued by the transaction.	Yes	Issuance can only create units with the same applicable and original commitment period.
5007	Serial numbers for proposed issuance must not already exist in the ITL.	Yes	Only units with new serial numbers can be issued.
5008	The quantity of AAUs issued must not exceed allowed quantity for the commitment period.	Yes	Issuance of AAUs is only possible up to the previously entered allowed quantity for the commitment period
5009	The quantity of RMUs issued for each LULUCF activity type must not exceed the allowed quantity for that LULUCF activity type and commitment period.	Yes	For each LULUCF activity type the maximal allowed quantity of RMU issuance will be enterd into the registry and issuances of RMU will be checked against these numbers
5017	The acquiring account for an issuance transaction involving AAUs or RMUs must be a holding account.	Yes	The issuance of AAUs and RMUs always involves Party holding accounts as acquiring accounts.
5052	The initiating account for a conversion transaction must be a holding account.	Yes	Conversions can be initiated only from holding accounts.
5053	If the unit is a track 1 ERU, the Party of the initiating registry must be determined to meet eligibility criteria 1 through 6.	Yes	The eligiblity status of Parties will be entered into the registry and for initiating the conversion of track 1 ERU, the party of the registry must meet eligiblity criteria 1 through 6.
5054	If the unit is a track 2 ERU, the Party of the initiating registry must be determined to meet eligibility criteria 1,2 and 4.	Yes	The eligiblity status of Parties will be entered into the registry and for initiating the conversion of track 2 ERU, the party of the registry must meet eligiblity criteria 1,2 and 4.
5056	Units for conversion must be AAUs or RMUs.	Yes	Only AAUs and RMUs can be converted to ERUs.

Response code	Description of the discrepancy or technical standard specification	Internal procedure or check in the Austrian national registry to prevent this discrepancy	Comment
5101	The Party of an initiating national registry must be determined to meet eligibility criteria 1 through 6, except for the first external transfer of a track 2 ERU which the registry has converted, or for transfers to the excess issuance cancellation account at the CDM registry.	Yes	External transfers of Kyoto units (except for the first external transfer of a track 2 ERU which the registry has converted or for transfers to the excess issuance cancellation account of the CDM registry) are only allowed if eligibility criteria 1 through 6 are met.
5102	If the transaction is the first external transfer of a track 2 ERU which the registry has converted, the Party of the initiating national registry must be determined to meet eligibitlity criteria 1,2 and 4.	Yes	For the first external transfer of a track 2 ERU which the registry has converted, eligibility criteria 1,2 and 4 must be met by the Party of the transferring registry.
5103	The Party of an acquiring national registry must be determined to meet eligibility criteria 1 through 6, except for transfers initiated by the CMD Registry or for transfers to the excess issuance cancellation account in the CDM registry.	Yes	Acquiring external transfers of Kyoto units in the national registry (except for transfers from the CDM registry) is only allowed if eligibility criteria 1 through 6 are met.
5104	The total quantity of all units held in a national registry, which may be used for compliance for the applicable commitment period of a transaction, must not fall below the CPR level for the Party for that commitment period, except where the transaction is a first transfer of Track 2 ERUs converted by the registry or a transfer to the Excess Issuance Account in the CDM Registry.	Yes	The national registry prevents any external transfers (except first transfer of Track 2 ERUs converted by the registry or transfers to the Excess Issuance Account in the CDM Registry) that do not comply with the CPR.
5105	CDM Registry can only receive external transfers to cancellation accounts for compensating excess issuance of CERs, tCERs and lCERs.	Yes	Any external transfers to the CDM registry (except transfers to the Excess Issuance Account) are blocked.
5106	The Party of an initiating national registry must not have been suspended from making external transfers as a result of not meeting its emission target for the previous commitment period.	Yes	If the Party of the initiating registry is suspended from making external transfers because it has not met its emission target for the previous commitment period, external transfers from the Party's registry will be blocked.
5107	Any unit blocks cancelled by means of an external transfer	Yes	Units can only be transferred to an excess issuance

Response code	Description of the discrepancy or technical standard specification	Internal procedure or check in the Austrian national registry to prevent this discrepancy	Comment
	to the excess issuance cancellation account in the CMD registry must have the same applicable commitment period as the cancellation account.		cancellation account which has the same applicable commitment period as the units.
5108	tCERs and lCERs may only be transferred to the excess issuance cancellation account in the CMD registry in the case that excess issuance is being compensated pursuant to an excess issuance notification.	Yes	The provided notification ID for the transaction will be checked by the registry against existing notification IDs for excess issuance.
5110	If there exists an outstanding expiry date change notification affecting the tCERs or lCERs to be transferred, the units' expiry date must match the target expiry date specified in the notification.	Yes	The expiry date change procedure will change the expiry date to the date indicated in the notification. The units are blocked from transfers until the expiry date is changed.
5152	Cancellation to excess issuance cancellation account must not take place in a national registry.	Yes	Cancellation for excess issuance is designed as external transfer to the excess issuance cancellation account in the CDM registry.
5153	The acquiring account for a cancellation transaction must be a cancellation account.	Yes	Cancellation transactions cannot be performed to other accounts than cancellation accounts.
5154	Account identifiers must be provided for acquiring accounts in cancellation transactions.	Yes	Cancellations are performed including the identifier of an acquiring account.
5155	The unit blocks to be cancelled must have the same applicable commitment period as the cancellation account.	Yes	The system identifies the correct commitment period of the account; the operator cannot change it.
5156	tCERs and lCERs cannot be transferred to net-source cancellation accounts or non-compliance cancellation accounts.	Yes	tCERs and lCERs may not be transferred to net-source cancellation accounts or non-compliance cancellation accounts.
5157	tCERs may only be transferred to the excess issuance cancellation account in the CDM registry in the case that excess tCER issuance is being compensated pursuant to an excess issuance notification. lCERs may only be transferred to the excess issuance cancellation account in the CDM registry in the case where excess lCER issuance is being compensated	Yes	An excess issuance cancellation can only be performed with the number of an excess issuance notification. Excess issuance cancellation in case of lCER excess issuance can only be performed with lCER cancellation if they have the same project number as the lCERs referred to in the excess issuance notification.

Response code	Description of the discrepancy or technical standard specification	Internal procedure or check in the Austrian national registry to prevent this discrepancy	Comment
	pursuant to an excess issuance cancellation notification referencing the same project as the lCERs being cancelled.		
5158	Units may only be transferred to a net-source cancellation account if a notification has been received from the ITL and this ID is reported in the transaction.	Yes	A net-source cancellation can only be performed with a notification ID for this transaction.
5159	Units may only be transferred to a non-compliance cancellation account if a notification has been received from the ITL and this ID is reported in the transaction.	Yes	A non-compliance cancellation can only be performed with a notification ID for this transaction.
5160	A valid notification ID must be provided for cancellation upon reversal of storage for a CDM project.	Yes	A cancellation upon reversal of storage for a CDM project can only be performed with a valid notification ID.
5161	A valid notification ID must be provided for cancellation upon non-submission of certification report for a CDM project.	Yes	A cancellation upon non-submssion of certification report for a CDM project can only be performed with a valid notification ID.
5202	The acquiring account for a replacement transaction involving tCERs must be a tCER replacement account.	Yes	tCER replacements always use tCER replacement accounts as acquiring accounts.
5203	The acquiring account for a replacement transaction involving lCERs must be an lCER replacement account.	Yes	lCER replacements always use lCER replacement accounts as acquiring accounts.
5204	Account identifiers must be provided for acquiring accounts in replacement transactions.	Yes	Replacement transactions always include the numbers of acquiring accounts
5205	The unit blocks used for replacement must have the same applicable commitment period as the replacement account.	Yes	The applicable commitment period of the units will be checked and it must be the same as the replacement account.
5206	Units to be replaced must be tCERs or lCERs.	Yes	Only tCERs and lCERs can be replaced.
5207	A unit may be replaced only once.	Yes	Units that have been replaced will be marked as "replaced" and cannot be replaced again.
5208	The registry holding the units to be replaced and the replacing units must be the same.	Yes	Replacemant is an internal transaction within the registry.

Response code	Description of the discrepancy or technical standard specification	Internal procedure or check in the Austrian national registry to prevent this discrepancy	Comment
5209	The quantity of units replaced must equal the quantity of replacing units.	Yes	In a replacement transaction the same number of replacing units will be used to replace the amount of tCERs and lCERs which need to be replaced.
5211	tCERs to be replaced must be held in a retirement account or a tCER Replacement account.	Yes	tCERs in accounts other than retirement or replacement accounts cannot be replaced.
5212	lCERs to be replaced must not be held in cancellation accounts.	Yes	lCERs in cancellation accounts cannot be replaced.
5213	lCER replacement accounts (upon expiry) cannot acquire tCERs or lCERs.	Yes	tCERs and lCERs cannot be used for replacement of lCERs upon expiry.
5214	tCER replacement accounts (for unit expiry) cannot acquire lCERs.	Yes	lCERs cannot be used for replacement of tCERs upon unit expiry.
5215	lCER replacement accounts (for reversal of storage) may not acquire tCERs and may not acquire lCERs with a project number other than that specified in the replacement notification.	Yes	Only AAUs, RMUs, ERUs, CERs and lCERs of the same project may be used for replacement of lCERs for reversal in storage.
5216	If provided, the replacement notification ID must be valid and must be for replacement upon tCER expiry.	Yes	For replacement transactions the message can only be sent if a valid notification ID of the same type is included.
5217	If provided, the replacement notification ID must be valid and must be for replacement upon lCER expiry.	Yes	For replacement transactions the message can only be sent if a valid notification ID of the same type is included.
5218	A valid replacement notification ID must be provided for replacement upon reversal of storage for a CDM project.	Yes	A replacement transaction can only be started if a valid notification ID of the same type is provided.
5219	A valid replacement notification ID must be provided for replacement upon non-submission of certification report for a CDM project.	Yes	A replacement transaction can only be started if a valid notification ID of the same type is provided.
5220	For lCER replacement transactions upon reversal of storage or lack of a certification report, the project ID for the lCERs to be replaced must be consistent with the project ID contained in the replacement notification.	Yes	Only lCER with the same project ID may be used for replacement of lCER for reversal in storage or lack of certification report.
5252	The acquiring account for a retirement transaction must be	Yes	Retirement transactions can only be performed with

Response code	Description of the discrepancy or technical standard specification	Internal procedure or check in the Austrian national registry to prevent this discrepancy	Comment
	a retirement account.		retirement accounts as acquiring accounts.
5253	Account identifiers must be provided for acquiring accounts in retirement transactions.	Yes	In retirement transactions account identifiers are always provided.
5254	The unit blocks retired must have the same applicable commitment period as the retirement account.	Yes	The system identifies the correct commitment period of the account, the operator cannot change it.
5256	tCER and lCER retirement must not exceed allowed quantity.	Yes	tCER and lCER retirement cannot exceed 1 % of the base year emissions times five, calculated on the basis of the assigned amount.
5302	The initiating account for a carry-over transaction must be a holding account.	Yes	The unit carry-over transaction can only be performed with a holding account as initiating account.
5303	Units may be carried over only to the next subsequent commitment period.	Yes	The unit carry-over procedure can only be performed from one commitment period to the subsequent commitment period.
5304	The quantity of units carried over must not exceed the limit for carry-over established by the Compliance Committee for the Party and reported to the registry in the unit carry-over notification.	Yes	Units can only be carried over up to the quantity indicated in the carry-over notification.
5305	RMUs may not be carried over.	Yes	RMUs cannot be carried over.
5306	ERUs converted from RMUs may not be carried over.	Yes	ERUs converted from RMUs cannot be carried over.
5307	tCERs or lCERs may not be carried over.	Yes	tCERs and lCERs cannot be carried over.
5310	Units may only be carried over if a notification has been received from the ITL and this ID is reported in the transaction.	Yes	A carry-over transaction can only be started if a valid notification ID of a carry-over notification is provided.
5312	The quantity of ERUs (which have not been converted from RMUs) carried over by the Party must not exceed 2.5 % of that Party's allowed quantity of AAU issuance for the commitment period.	Yes	Only 2.5 % of ERUs (which are converted from AAU) of the assigned amount can be carried over.
5313	The quantity of CERs carried over by the Party must not exceed 2.5 % of that Party's allowed quantity of AAU	Yes	Only 2.5 % of CERs of the assigned amount can be carried over.

Response code	Description of the discrepancy or technical standard specification	Internal procedure or check in the Austrian national registry to prevent this discrepancy	Comment
	issuance for the commitment period.		
5453	An expiry date change may only take place if it is pursuant to a valid expiry date change notification from the ITL.	Yes	An expiry date change procedure can only be started if a valid notification ID of an expiry date change notification is provided.
5454	The units for expiry date change must be the units referenced in the ITL expiry date change notification.	Yes	After receiving an expiry date change notification the registry will perform the expiry date change only with the units referred to in the notification.
5902	Acquiring account does not exist.	Yes (for internal transfers)	For internal transfers there is a check that stops a transaction if the acquiring account does not exist.
5903	Acquiring account is not eligible to receive units.	Yes	For acquiring units in external transfers the Party of the acquiring registry needs to meet eligibility criteria 1 through 6.
5904	Transaction inconsistent with Party policy.	Yes	The registry system administrator can mark those Parties that are in a trading system with Austria and other Parties with which trading agreements with Austria exist. Only with these Parties are external transfers possible.
5906	Account has been closed.	Yes (for internal transfers)	For internal transfers there is a check that stops a transaction if the acquiring account is closed.

1.2.7 Test procedures

The results of any test procedures that might be available or developed with the aim of testing the performance, procedures and security measures of the national registry undertaken pursuant to the provisions of decision 19/CP.7 relating to the technical standards for data exchange between registry systems

1.2.7.1 Test steps according to Annex H of DES 1.1.002

The tests steps according to Annex H of DES 1.1.002 were performed with the test environment of the Independent Transaction Log (ITL) in July 2007 according to the ITL test schedule. These tests formed part of the initialization tests with the Independent Transaction Log (ITL). The initialization tests consisted of three phases. The Austrian registry passed phase one, the documentation evaluation, with a score of 87, which means that no significant concerns about the state of registry readiness were identified. Phase two, the connectivity evaluation between the Austrian registry and the ITL, was also passed successfully. Last but not least, the interoperability tests were successfully passed by Austria on 4 July 2007, thus completing the last phase of the initialization tests.

After having successfully completed initialization, the ITL Administrator issued the Independent Assessment Report (IAR) for Austria on 12 July 2007 including a positive initialization recommendation by the ITL Operator and the ITL Administrator.

Additional test cases have been included in the DES 1.1.002 in comparison to the older version 1.0. Table 3 provides the list of the Annex H tests according to DES 1.1.002 that were used for Austria's interoperability tests.

Table 3: Test steps according to Annex H of DES 1.1.002 - Discrete Transaction Tests

Ref:	Case	Transaction	Description
3.1		**Issuance**	
	Issuance-1		Issue 100 AAUs to Holding Account
	Issuance-2a		ITL Request Totals
	Issuance-2b		ITL will request all unit blocks.
3.2		**Conversion**	
	Conversion-1		Issue 100 AAUs to Holding Account
	Conversion-2		Convert 100 AAUs in Holding Account #1 into ERUs.
	Conversion-3a		ITL Request Totals
	Conversion-3b		ITL will request all unit blocks.
3.3		**External Transfer**	
	External Transfer-1		Issue 100 AAUs to Holding Account
	External Transfer-2a		Transfer 50 AAUs to an external third party (holding account of country YY).
	External Transfer-2b		YY agrees to the transaction.
	External Transfer-3a		ITL Request Totals
	External Transfer-3b		ITL will request all unit blocks.
3.4		**Cancellation**	
	Cancellation-1		Issue 100 AAUs to Holding Account
	Cancellation-2		Registry will receive a notification (Type 1) of net source cancellation with instructions to cancel 50 AAUs.
	Cancellation-3a		ITL Request Totals
	Cancellation-3b		ITL will request all unit blocks.
3.5		**Retirement**	
	Retirement-1		Issue 100 AAUs to Holding Account
	Retirement-2		Retire 50 units.
	Retirement-3a		ITL Request Totals
	Retirement-3b		ITL will request all unit blocks.
3.6		**Replacement**	
	Replacement-1		Issue 200 AAUs to Holding Account
	Replacement-2		The CDM registry transfers 200 lCERs from Project 1983.
	Replacement-3a		Registry receives Non-submission of Certification Report for CDM Project notification (Type 5). The registry is directed to replace the affected 200 lCERs which should be in the holding account

Ref:	Case	Transaction	Description
			with 200 AAUs from the holding account.
	Replacement-3b		The registry will fulfil the notification instruction.
	Replacement-4a		ITL Request Totals
	Replacement-4b		ITL will request all unit blocks.
3.7		**Carry-Over**	
	Carry Over-1		Issue 100 AAUs to Holding Account
	Carry Over-2a		Registry receives a Unit Carry-over notification (Type 8) with directions to carry-over 50 AAUs.
	Carry Over-2b		The registry will propose a Carry-over transaction to fulfil the notification direction.
	Carry Over-3a		ITL Request Totals
	Carry Over-3b		ITL will request all unit blocks.
3.8		**Expiry Date Change**	
	Expiry Date Change-1		The CDM transfers 200 lCERs to the registry.
	Expiry Date Change-2		The ITL sends an Expiry Date Change notification (Type 9) to change the expiry date on all lCERs.
	Expiry Date Change-3a		ITL Request Totals
	Expiry Date Change-3b		ITL will request all unit blocks.

Table 4: Test steps according to Annex H of DES 1.1.002 - National Registry Tests

Ref:	Case	Transaction	Description
4.1		**Issuance Transaction**	
	100		Issue 5000 AAUs to Holding Account
	101		Issue 1000 RMUs to Holding Account of registry ZZ
	102		Issue 1000 AAUs to Holding Account to surpass AAU limit reflected by ITL.
	190		ITL will initiate Time Synchronization by calling the ProvideTime Web service.
	191a		ITL Request Totals
	191a		ITL will request all unit blocks.
4.2		**Conversion Transaction**	
	200		Convert 100 AAUs in Holding Account #1 into ERUs.
	201		Convert 100 RMUs in Holding Account #1 into ERUs.
	290		ITL will initiate Time Synchronization by calling the ProvideTime Web service.
	291		ITL Request Totals
	291a		ITL will request all unit blocks.
4.3		**External Transfer Transaction**	
	300		The CDM registry transfers 200 tCERs from Project 12 to Holding Account
	301		The CDM registry transfers 200 lCERs from Project 329 to Holding Account
	302		The CDM registry transfers 200 lCERs from Project 1983. to Holding Account

Ref:	Case	Transaction	Description
	303a		The registry receives a notification (Type 6) of excess issuance for CDM Project (Project ID 329)
	303b		The registry proposes an External Transfer transaction to transfer 50 lCERs generated under Project BO-329 from its Holding Account #1 to the CDM registry.
	304		The CDM registry transfers 150 CERs from Project 1.
	305		The CDM registry transfers 200 lCERs from Project 812.
	306a		Transfer 100 AAUs to an external third party (holding account of country YY).
	306b		YY agrees to the transaction.
	307a		Transfer 100 of Holding Account's AAUs to an external third-party holding account of country YY.
	307b		YY rejects the transaction because it does not contain the specified account.
	308a		Transfer 100 RMUs to an external third party (holding account of country YY).
	308b		Initializing registry ZZ then immediately calls the GetTransactionStatus Web service with the transaction number it specified.
	309a		YY does not respond to the external transfer of 100 RMUs in Test ID 302
	309b		24-Hour Transaction Clean-up is triggered (for the purposes of initialization, in less than 24 hours from initiating transaction).
	310		YY proposes a transaction transferring 100 AAUs originating from YY to the ZZ registry.
	390		ITL will initiate Time Synchronization by calling the ProvideTime Web service.
	391a		ITL Request Totals
	391b		ITL will request all unit blocks.
4.4		**Cancellation Transaction**	
	400a		Registry will receive a notification (Type 1) of net source cancellation with instructions to cancel 100 AAUs.
	400b		Holding Account of ZZ will attempt to cancel 100 AAUs into its voluntary cancellation account.
	490		ITL will initiate Time Synchronization by calling the ProvideTime Web service.
	491a		ITL Request Totals
	491b		ITL will request all unit blocks.
4.5		**Expiry Date Change Transaction**	
	500		The ITL sends an Expiry Date Change notification (Type 9) to change the expiry date on all tCERs.
	501		The ITL sends an Expiry Date Change notification (Type 9) to change the expiry date on all lCERs associated with CDM Project BO-329.
	590		ITL will initiate Time Synchronization by calling the ProvideTime Web service.
	591a		ITL Request Totals
	591b		ITL will request all unit blocks.
4.6		**Retirement Transaction**	

Ref:	Case	Transaction	Description
	600		Retire all units save for 2000 AAUs originating from ZZ and 50 ERUs converted from AAUs.
	690		ITL will initiate Time Synchronization by calling the ProvideTime Web service.
	691a		ITL Request Totals
	691b		ITL will request all unit blocks.
4.7		**Replacement Transaction**	
	700a		Registry receives impending expiry notification for lCERs (Type 3).
	700b		The registry will replace the 200 lCERs which should be in the CP1 Retirement account with 200 AAUs from the holding account.
	701a		Registry receives reversal of storage for CDM Project notification (Type 4).
	701b		The registry will replace the affected 150 lCERs which should be in the CP1 Retirement account with 150 AAUs from the holding account.
	702a		Registry receives Non-submission of Certification Report for CDM Project notification (Type 5). The registry is directed to replace the affected 200 lCERs which should be in the CP1 Retirement account with 200 AAUs from the holding account.
	702b		The registry will partially fulfil the notification direction by transferring only 120 AAUs into the replacement account.
	703a		Registry receives a notification update (Type 10) for the Non-submission of Certification Report for CDM Project notification in test 702.
	703b		The registry will replace the remaining affected 80 lCERs which should be in the CP1 Retirement account with 80 AAUs from the holding account.
	704a		ITL sends a notification (Type 7) that the registry's unit holdings are below the commitment period reserve and it must acquire additional units.
	704b		The registry administrator will call the ITL operator to indicate the notification has been received by explicitly stating the notification identifier.
	704c		Next, the third party registry simulator will transfer the units required to fulfil the notification and additional units to allow transactions in following tests.
	790		ITL will initiate Time Synchronization by calling the ProvideTime Web service.
	791a		ITL Request Totals
	791b		ITL will request all unit blocks.
4.8		**Carry-Over Transaction**	
	800a		Registry receives a Unit Carry-over notification (Type 8) with directions to carry-over 800 AAUs and 50 ERUs converted from AAUs in the Holding Account.
	800b		The registry will propose a Carry-over transaction to fulfil the notification direction.
	801a		The ITL will call the AcceptMessage Web service at the registry to deliver a general message to the registry administrator. The message will inform the registry administrator that the ITL is switching to the second commitment period.

Ref:	Case	Transaction	Description
	801b		The registry will now function as if it were in the second commitment period. The registry administrator will call the ITL operator to indicate receipt of the message before proceeding to the next test.
	802		Issue 5000 AAUs to Holding Account for CP2
	803		Issue 1000 RMUs to Holding Account of registry ZZ for CP2
	804		Issue 1000 AAUs to Holding Account for CP2 to surpass AAU limit reflected by ITL
	805a		Registry will receive a notification (Type 2) of non-compliance with instructions to cancel 100 AAUs.
	805b		The registry will fulfil the request.
	806		Retire all units with Commitment Period = 2 save for 2000 AAUs with originating commitment period = 2.
	890		ITL will initiate Time Synchronization by calling the ProvideTime Web service.
	891a		ITL Request Totals
	891b		ITL will request all unit blocks.
	EU ETS Registries bypass these tests		
	892a		YY proposes a transaction transferring 100 AAUs originating from YY to the ZZ registry.
	892b		Registry ZZ will accept the proposal and finalize the transaction in its database.
	892c		However, registry YY does not complete the transaction before the ITL initializes a reconciliation. The registry will then be directed to roll-back the transaction as part of manual intervention.
	893a		The registry submits its transaction log, reconciliation history log, notification log, and message archive
	893b		ITL Operator verifies random selected transactions from Annex H testing, confirming that they reflect only the registry activity described in Annex H and will conform with Data Logging Specifications described in Section 7 of the Data Exchange Standards.

Table 5: Test steps according to Annex H of DES 1.1.002 - EU ETS Member Registry Specific Tests

Ref:	Case	Transaction	Description
5.1		**Account Management Web Services**	
	1100		The EU registry will call the CreateAccountRequest Web service to create a new Operator Holding Account (Type 120).
	1101		The registry will call the UpdateAccountRequest Web service to update the account contact persons address for the Operator Holding Account created in test 1100.
	1102		The registry calls the CloseAccountRequest to close the Operator Holding Account (Account Identifier 3) created in test 1100.
	1103		The registry calls the UpdateVerifiedEmissionsRequest Web service to report emissions for Installation1.
5.2		**Internal Transfer Transaction**	
	1200		Transfer 1000 AAUs with applicable Commitment Period = 2 from Holding Account (Type 100, Account ID 1) into Operator Holding Account (Type 120, Account ID 3).
	1201a		Transfer 300 AAUs with applicable Commitment Period = 2 from

Ref:	Case	Transaction	Description
			Holding Account (Type 100, Account ID 1) into Operator Holding Account (Type 120, Account ID 3).
	1201b		ITL approves transaction, STL rejects transaction.
	1202a		Transfer 400 AAUs with applicable Commitment Period = 2 from Holding Account (Type 100, Account ID 1) into Operator Holding Account (Type 120, Account ID 3). ITL approves transaction, but STL does not respond to proposal.
	1202b		ITL approves transaction, but STL does not respond to proposal.
	1290		ITL will initiate Time Synchronization by calling the ProvideTime Web service.
	1291a		ITL Request Totals
	1291b		ITL will request all unit blocks.
	1292a		YY proposes a transaction transferring 100 AAUs originating from YY to the ZZ registry.
	1292b		Registry ZZ will accept the proposal and finalize the transaction in its database.
	1292c		However, registry YY does not complete the transaction before the ITL initializes a reconciliation. The registry will then be directed to roll-back the transaction as part of manual intervention.
	1293a		The registry submits its transaction log, reconciliation history log, notification log, and message archive
	1293b		ITL Operator verifies random selected transactions from Annex H testing, confirming that they reflect only the registry activity described in Annex H and will conform with Data Logging Specifications described in Section 7 of the Data Exchange Standards.

1.2.7.2 Test steps according to Registry Administrator Tests

In addition to the standardized tests with the ITL and the CITL, the Austrian registry administrator team carried out additional performance tests in the course of 2007 to ensure the functionality of the Austrian registry software. A list of these tests can be found in Table 4.

Table 6: Registry Administrator Tests

Test ID	Description
U-001	To give an account holder the authorization to hold tCER and lCER in its operator holding account.
U-002	To withdraw the authorization to hold tCER and lCER in an operator holding account.
U-003	To give an account holder the authorization to hold tCER and lCER in its person holding account
U-004	To withdraw the authorization to hold tCER and lCER in a person holding account.
U-005	Kyoto units and EU Allowances on cancellation, retirement and replacement accounts may not be used in any further transaction.
U-006	Expired tCER and lCER can only be cancelled and not be used in any other transaction.
U-007	Generation of a given number of AAUs or RMUs in the national holding account.
U-008	Transfer of a given number of EU Allowances (2005-2007) between accounts in different registries.
U-010	Transfer of allowances to the mandatory cancellation account (type 250) of the respective commitment period.

Test ID	Description
U-011	Cancellation of lCERs on a holding account after notification from the ITL. This transaction can be used for lCER on the holding accounts as an alternative to the respective replacement transaction.
U-012	Retirement through transfer of surrendered EU Allowances (2005-2007) from the national account to the retirement account of CP0 or of CER (not tCER or lCER) to the deletion account of CP1.
U-014	Retirement of a given number of Kyoto units
U-015	Carry over
U-016	Internal transfer Transfer of a given number of EU Allowances and Kyoto units between accounts in different registries.
U-017	Surrender Surrender of EU Allowances or CER/ERU for an installations and a year through transferring the allowances/units to the national account.
U-018	Cancellation and replacement CP=0 Transfer of unsurrendered allowances on operator and person holding accounts to the cancellation account of CP0, issuance of a given amount of EU allowances in CP1 through conversion of AAUs into EUAs type 2008ff to the national holding account and transfer of these EUAs to the respective operator and person holding accounts.
U-019	Cancellation and Replacement CP>0 Transfer of all EU Allowances of the preceding trading period on operator or person holding accounts to the national account, conversion of the number of issued minus surrendered EU Allowances Allowances into AAUs, issuance of the respective number of EU Allowances of Type 2008ff to the national account through the conversion of AAUs into EU Allowances and transfer of these EU Allowances to the respective operator and person holding accounts.
U-020	ETS Issuance CP>0 Conversion of a given number of AAU into EU Allowances (2008ff) on the national holding account.
U-022	Correction to allowances Cancellation of issued and allocated EU Allowances after reducing the number of EU Allowances in the NAP.
U-023	Administration of the country status
U-024	Help menu
U-025	Screen division
U-026	Menu structure
U-027	User authentification test
U-028	Password determination

ANNEX 10: EXTRACTS FROM AUSTRIAN LEGISLATION

Extracts from Austrian legislation, which regulate monitoring, reporting and verification of emissions at plant level

Cement production

BGBl 1993/ 63 Verordnung für Anlagen zur Zementerzeugung

§ 5. Der Betriebsanlageninhaber hat

1. kontinuierliche Messungen der Emissionskonzentrationen an Gesamtstaub, SO_2 und Stickstoffoxiden (berechnet als NO_2) der Ofenanlage entsprechend der Z 1 der Anlage zu dieser Verordnung durchzuführen ...

Zur Durchführung der Messungen gemäß Z 2 und 3 sind Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, welcher

1. bei Messungen gemäß § 5 Z 1 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes und die gemäß § 4 Abs. 1 zu führenden Aufzeichnungen über Grenzwertüberschreitungen, zu enthalten hat. Der Messbericht ist mindestens fünf Jahre in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

<u>Anlage</u>

(§ 5)

Emissionsmessungen

1. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Registrierende Emissionsmessgeräte sind im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 5 letzter Satz angeführten Personenkreis zu kalibrieren.

c) Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige aus dem im § 5 letzter Satz angeführten Personenkreis vorzunehmen.

Foundries

BGBl 1994/ 447 Verordnung für Gießereien

§ 5 (1) Der Betriebsanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 angeführten Stoffe entsprechend der Z 1 lit. A bis c der Anlage 2 dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen durchführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebsanlageninhaber hat kontinuierliche Messungen der Emissionskonzentrationen ... entsprechend der Z2 der Anlage 2 zu dieser Verordnung durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, oder akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992) heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, welcher

1. bei Messungen gemäß § 5 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff, Rohmaterial und Zuschlagstoffen),

2. bei Messungen gemäß § 5 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes und die gemäß § 4 Abs. 2 zu führenden Aufzeichnungen über Grenzwertüberschreitungen, zu enthalten hat. Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 5 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

<u>Anlage 2</u>

(§ 5)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für alle im § 3 Abs. 1 angeführten Stoffe bei jenem Betriebzustand durchzuführen, in dem nachweislich die Anlagen vorwiegende betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

c) Die Abgasmessungen sind an einer repräsentativen Entnahmestelle im Kanalquerschnitt, die vor Aufnahme der Messungen zu bestimmen ist, vorzunehmen. Es sind innerhalb eines Zeitraumes von drei Stunden drei Messwerte als Halbstundenmittelwerte zu bilden, deren einzelne Ergebnisse zu beurteilen sind.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerte unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Registrierende Emissionsmessgeräte sind im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 5 Abs. 3 angeführten Personenkreis zu kalibrieren.

c) Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige aus dem im § 5 Abs. 3 angeführten Personenkreis vorzunehmen.

Glass production

<u>BGBl 1994/ 498 Verordnung für Anlagen zur Glaserzeugung</u>

§ 5 (2) Zur Kontrolle der Einhaltung der im § 3 festgelegten Emissionsgrenzwerte sind unter Beachtung des § 4 jeweils mindestens drei Messwerte als Halbstundenmittelwerte zu bestimmen.

(4) Die Durchführung der Emissionsmessungen hat nach den Regeln der Technik (z.B. nach den vom Verein deutscher Ingenieure herausgegebenen und beim Österreichischen Normungsinstitut, Heinestraße 38, 1021 Wien, erhältlichen Richtlinien VDI 2268, Blätter 1, 2 und 4, VDI 2462, Blätter 1 bis 5 und 8, und VDI 2456, Blätter 1, 2, 8 und 10) zu erfolgen.

§ 7 (1) Der Betriebsanlageninhaber hat in regelmäßigen, ein Jahr, bei Schmelzeinrichtungen gemäß § 3 Z 5 lit. D drei Jahre, nicht übersteigenden Zeitabständen Messungen zur Kontrolle der Einhaltung der im § 3 festgelegten Emissionsgrenzwerte entsprechend den §§ 4 bis 6 durchführen zu lassen.

(2) Zur Durchführung der Messungen sind Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, oder akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992) heranzuziehen.

(3) Die Messwerte für die im § 3 angeführten Stoffe sowie der während der Messung herrschenden Betriebszustände sind zusammen mit den Kriterien, nach denen der Zeitraum für die Messung, der stärksten Emission festgelegt worden ist, in einem Messbericht festzuhalten. Im Messbericht sind auch die verwendeten Messverfahren zu beschreiben. Der Messbericht und sonstige zum Nachweis der Einhaltung der im § 3 festgelegten Emissionsgrenzwerte dienende Unterlagen sind bis zur nächsten Messung in der Betriebsanlage derart aufzubewahren, dass sie den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden können.

Iron and steel production

<u>BGBl II 1997/ 160 Verordnung für Anlagen zur Erzeugung von Eisen und Stahl</u>

§ 6 (1) Der Betriebsanlageninhaber hat, soweit die Absätze 3 und 4 nicht anderes bestimmen, Einzelmessungen der Emissionskonzentrationen der im § 3 Abs. 1 und im § 4 (mit Ausnahme des § 4 Abs. 3 lit. c) angeführten Stoffe entsprechend der Z 1 lit. a bis c der Anlage zu dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen, durchführen zu lassen (wiederkehrende Emissionsmessungen).

(3) Der Betriebsinhaber hat, soweit Abs. 4 oder 5 nicht anderes bestimmt. Entweder kontinuierliche Messungen der Emissionskonzentrationen ... entsprechend der Z 2 der Anlage zu dieser Verordnung durchzuführen oder kontinuierliche Funktionsprüfungen der rauchgas- und bzw. oder Abluftfilteranlagen von Einrichtungen gemäß § 4 durchzuführen, wenn sich durch diese Prüfungen mit hinreichender Sicherheit die Einhaltung der vorgeschriebenen Emissionsgrenzwerte für Staub festgestellt werden kann.

§ 6 (6) Zur Durchführung der Messungen gemäß Abs. 1 und 2 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 3 sind akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBI Nr 468/ 1992), Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 7 Die Ergebnisse der Messungen gemäß § 6 sind in einem Messbericht festzuhalten, der zu enthalten hat:

1. bei Messungen gemäß § 6 Abs. 1 und 2 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch Brennstoff, Rohmaterial und Zuschlagstoffen),

2. bei Messungen gemäß § 6 Abs. 3 und 4 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes,

3. bei Funktionsprüfungen gemäß § 6 Abs. 3 die gemessenen Parameter in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes.

Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 6 Abs. 1 und 2 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen zur Einsicht vorgewiesen werden kann.

<u>Anlage</u>

(§ 6)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für alle im § 3 Abs. 1 und 3 und im § 4 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90% zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 6 Abs. 5 angeführten Personenkreis zu kalibrieren.

c) Jährlich ist eine Funktionskontrolle des registrierenden Messgerätes durch einen Sachverständigen aus dem im § 6 Abs. 5 angeführten Personenkreis vorzunehmen.

Sinter plants

<u>BGBI II 1997/ 163 Verordnung für Anlagen zum Sintern von Eisenerzen</u>

§ 5 (1) Der Betriebanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 Z 2 lit. a und b und Z 3 angeführten Stoffe entsprechend der Z 1 in der Anlage zu dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen, durchzuführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebanlageninhaber hat kontinuierliche Messungen der Emissionskonzentrationen von Staub, Stickstoffoxiden und Schwefeldioxid entsprechend der Z 2 der Anlage dieser Verordnung durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992), Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, der zu enthalten hat:

1. bei Messungen gemäß § 5 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff und Einsatzmaterial),

2. bei Messungen gemäß § 5 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes.

Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 5 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

<u>Anlage</u>
(§ 5)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für die im § 3 Abs. 1 Z 2 lit. a und b und Z 3 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 5 Abs. 3 angeführten Personenkreis zu kalibrieren. Die Kalibrierung hat nach den Regeln der Technik zu erfolgen.

c) Jährlich ist eine Funktionskontrolle des registrierenden Messgerätes durch einen Sachverständigen aus dem im § 5 Abs. 3 angeführten Personenkreis vorzunehmen.

Combustion plants

<u>BGBl II 1997/ 331 Feuerungsanlagen-Verordnung</u>

Emissionsmessungen

§ 4 (1) Der Betriebsanlageninhaber hat Emissionsmessungen sowie die Bestimmung des Abgasverlustes entsprechend der Anlage 1 zu dieser Verordnung durchzuführen bzw. durchführen zu lassen.

(2) Zur Durchführung der Emissionseinzelmessungen sowie zur Bestimmung des Abgasverlustes ist ein Sachverständiger aus dem im § 2 Abs. 2 zweiter Satz genannten Personenkreis heranzuziehen.

§ 5 (1) Der Betriebsanlageninhaber hat, sofern in dieser Verordnung nicht anderes bestimmt ist,

1. kontinuierliche Messungen der Emissionskonzentrationen, abhängig von der jeweiligen Brennstoffwärmeleistung und dem eingesetzten Brennstoff, entsprechende der folgenden Tabelle durchzuführen

Brennstoff	Staub	CO	SO_2	NO_x	
fest	> 10	> 10	> 30	> 30	MW
flüssig	> 10	> 10	> 50	> 30	MW
gasförmig	-	> 10	-	> 30	MW

Prüfungen

Erstmalige Prüfung

§ 23 (1) Feuerungsanlagen sind anlässlich ihrer Inbetriebnahme einer erstmaligen Prüfung zu unterziehen.

(2) Die erstmalige Prüfung hat in der Erbringung des Nachweises zu bestehen, dass die Feuerungsanlage den Anforderungen dieser Verordnung entspricht.

Wiederkehrende Prüfungen

§ 25 (1) Feuerungsanlagen sind jährlich zu prüfen. Bei dieser jährlichen Prüfung sind die Feuerungsanlagen hinsichtlich jener Anlagenteile, die für die Emissionen oder deren Begrenzung von Bedeutung sind, zu besichtigen und auf etwaige Mängel zu kontrollieren... Weiters sind jährlich die Ergebnisse der gemäß § 5 durchgeführten kontinuierlichen Messungen zu beurteilen.

Prüfbescheinigung

§ 27 Das Ergebnis jeder Prüfung muss in einer Prüfbescheinigung festgehalten sein, die insbesondere festgestellte Mängel sowie Vorschläge zu deren Behebung zu enthalten hat. Die Prüfbescheinigung ist im Original in der Betriebsanlage zumindest fünf Jahre so aufzubewahren, dass sie den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage 1

(§§ 4 und 25)

Emissionsmessungen

1. Die Messungen sind

1.3 für gasförmige Emissionen nach den Regeln der Technik, oder nach einem diesen Verfahren gleichwertigen Verfahren durchzuführen.

2. Die Messstellen sind so festzulegen, dass eine repräsentative und messtechnisch einwandfreie Emissionsmessung gewährleistet ist.

3. Einzelmessungen

3.2 Die Einzelmessungen sind an einer repräsentativen Entnahmestelle im Kanalquerschnitt vorzunehmen. Es sind innerhalb eines Zeitraumes von drei Stunden drei messwerte als Halbstundenmittelwerte zu bilden.

4. Kontinuierliche Messungen

4.1 Die Datenaufzeichnung hat durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat. Die Messergebnisse müssen mit dem einzuhaltenden Grenzwert vergleichbar sein.

4.2 Registrierende Emissionsmessgeräte sind im Abnahmeversuch und mindestens alle drei Jahre durch einen Sachverständigen aus dem im § 2 Abs. 2 zweiter Satz angeführten Personenkreis zu kalibrieren. Die Kalibrierung hat nach den Regeln der Technik (z.B. nach den vom Verein Deutscher Ingenieure herausgegebenen und beim Österreichischen Normungsinstitut, Heinestraße 38, 1021 Wien, erhältlichen Richtlinien VDI 2066, Blatt 4 und Blatt 6, und VDI 3950, Blatt 1E) zu erfolgen.

4.3 Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige aus dem im § 2 Abs. 2 zweiter Satz angeführten Personenkreis vorzunehmen.

Non-ferrous metal production

BGBl II 1998/ 1 Verordnung zur Erzeugung von Nichteisenmetallen

§ 6 (1) Der Betriebsanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 und im § 4 angeführten Stoffe entsprechend der Z 1 lit. a bis c der Anlage zu dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen durchführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebsanlageninhaber hat kontinuierliche Messungen ... entsprechend der Z 2 der Anlage zu dieser Verordnung reingasseitig (im Kamin) durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992), Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 7 Die Ergebnisse der Messungen gemäß § 6 sind in einem Messbericht festzuhalten, der zu enthalten hat:

1. bei Messungen gemäß § 6 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff, Rohmaterial und Zuschlagstoffen),

2. bei Messungen gemäß § 6 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes und die gemäß § 5 Abs. 2 zu führenden Aufzeichnungen über Grenzwertüberschreitungen.

Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 6 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage

(§ 6)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für alle im § 3 Abs. 1 und 4 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 6 Abs. 3 angeführten Personenkreis zu kalibrieren.

c) Die Wartung des registrierende Messgerätes ist durch einen Sachverständigen aus dem im § 6 Abs. 3 angeführten Personenkreis mindestens einmal jährlich vornehmen zu lassen.

Steam boilers

BGBl 1988/ 380 idF (BGBl 1993/ 185, BGBl I 1997/ 115, BGBl I 1998/ 158) Luftreinhaltegesetz für Kesselanlagen

Überwachung

§ 7 (1) Die in Betrieb befindlichen Dampfkesselanlagen ... sind einmal jährlich durch einen befugten Sachverständigen auf die Einhaltung der Bestimmungen dieses Bundesgesetzes zu überprüfen. Die Überprüfung umfasst die Besichtigung der Anlage und deren Komponenten, soweit sie für die Emissionen oder deren Begrenzung von Bedeutung sind, verbunden mit der Kontrolle vorhandener Messergebnisse oder Messregistrierungen.

§ 8 (1) Die Behörde hat im Genehmigungsbescheid festzulegen, ob und in welchem Umfange Abnahmemessungen sowie wiederkehrende Emissionsmessungen an der Dampfkesselanlage durchzuführen sind. Emissionsmessungen sind ferner durchzuführen, wenn der befugte Sachverständige anlässlich einer Überprüfung gemäß § 7 Grund zur Annahme hat, dass die einzuhaltenden Emissionsgrenzwerte im Betrieb überschritten werden.

Pflichten des Betreibers

§ 10 (3) Der Betreiber hat der Behörde oder dem hierzu beauftragten Sachverständigen während der Betriebszeit den Zutritt zu der Anlage zu gestatten und Einsicht in alle die Emissionen der Dampfkesselanlage betreffenden Aufzeichnungen zu gewähren, die in einem Dampfkesselanlagenbuch zusammenzufassen sind.

BGBl 1989/ 19 idF (BGBl 1990/ 134, BGBl 1994/ 785, BGBl II 1997/ 324) Luftreinhalteverordnung für Kesselanlagen

Emissionseinzelmessungen

§ 2 a (1) Die Durchführung der Emissionsmessungen hat nach den Regeln der Technik zu erfolgen.

(2) Die in Anlage 7 wiedergegebene ÖNORM M 9415-1, Ausgabe Mai 1991, und die in Anlage 8 wiedergegebene ÖNORM 9415-3, Ausgabe Mai 1991, sind verbindlich anzuwenden.

§ 3 (1) Emissionseinzelmessungen sind für jede Schadstoffkomponente bei jenem feuerungstechnisch stationären Betriebzustand durchzuführen, bei dem nachweislich die Anlage vorwiegend betrieben wird.

(2) Für die Durchführung der Emissionseinzelmessungen ist die in Anlage 9 wiedergegebene ÖNORM M 9415-2, Ausgabe Mai 1991, verbindlich anzuwenden.

Kontinuierliche Emissionsmessungen

§ 4 (3) Kontinuierliche Emissionsmessungen der Massekonzentration einer Emission (§ 8 Abs. 1 LRG-K) haben i der Regel in Halbstundenmittelwerten zu erfolgen.

(5) Die Messstellen sind auf Grund des Gutachtens eines befugten Sachverständigen (§ 7 Abs. 2 LRG-K) von der Behörde derart festzulegen, dass eine repräsentative und messtechnisch einwandfreie Emissionsmessung gewährleistet ist.

§ 5. Für kontinuierliche Emissionsmessungen hat die Datenaufzeichnung zu erfolgen:

1. Durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

3. Die Auswertung der Messdaten aus registrierenden Messgeräten hat mittels Auswertegeräten zu erfolgen, die dafür geeignet sind und die dem Stand der Technik entsprechen.

5. Registrierende Emissionsmessgeräte und Auswertegeräte sind im Abnahmeversuch und danach alle drei Jahre durch einen Sachverständigen zu kalibrieren. Die Kalibrierung hat nach den geltenden einschlägigen technischen Regelwerken zu erfolgen.

6. Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige vorzunehmen.

§ 7 (1) Der Betreiber hat während des Betriebes der Anlage an den Messgeräten mindestens einmal wöchentlich zu kontrollieren, ob der Nullpunkt einjustiert ist und die erforderliche Messfunktion gegeben ist.

(2) Die Messgeräte und alle dazuhörenden Komponenten sind mindestens alle drei Monate zu warten. Hierüber hat der Betreiber Aufzeichnungen zu führen.

(3) Der Sachverständige hat im Rahmen der Überwachung die Aufzeichnungen gemäß Abs. 2 zu kontrollieren und in begründeten Fällen die Richtigkeit der Anzeige der Messgeräte zu überprüfen.

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Der National Inventory Report 2008 (NIR 2008) präsentiert eine genaue Methodikbeschreibung der Österreichischen Luftschadstoff-Inventur für die Treibhausgase Kohlendioxid, Methan und Lachgas sowie der Industriegase (HFKW, FKW, SF_6). Damit erfüllt Österreich die Anforderungen an die transparente und nachvollziehbare Dokumentation, die für die englische Berichterstattung zur Klimarahmenkonvention bzw. zum Kyoto-Protokoll notwendig ist. Der vorliegende Bericht enthält sektorspezifische Emissionen von 1990 bis 2006, Emissionsfaktoren und Basisdaten für Emissionsberechnungen. Erstmals enthält der Report Informationen für die Berichterstattung unter dem Kyoto-Protokoll.

Zudem dokumentiert das Umweltbundesamt im NIR 2008 das Nationale Inventursystem und die Qualitätssicherung im Rahmen der gemäß ISO 17020 akkreditierten Überwachungsstelle Emissionsbilanzen.

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