umweltbundesamt

AUSTRIA'S NATIONAL INVENTORY REPORT 2006

Submission under the United Nations Framework Convention on Climate Change

Resubmission October 2006

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Project management

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The authors of this report want to express their thanks to all experts at the *Umweltbundesamt* as well as experts from other institutions involved in the preparation of the Austrian Greenhouse Gas Inventory for their contribution to the continuous improvement of the inventory.

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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 2004.

By taking decision 18/CP.8 (see document FCCC/CP/2002/7/Add.2) the Conference of the Parties (COP) has undertaken to implement 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 sixth version of the National Inventory Report (NIR) submitted by Austria, it is an update of the NIR submitted in 2005[1]. This report is based on data submitted to the UNFCCC in the common reporting format (CRF submission 2006). 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 2006 and as submitted to the UNFCCC in the data submission 2006 replaces all previous versions of data submissions.

This Resubmission is an updated edition of the report submitted on April, 15th 2006. The following updates are included:

- Data and description of the source: 2 B 5 Other – Ethylene Production
- Description of the source: 2 C 2 Ferroalloys Production
- Data update of the source: 2 A 7 Other – Bricks Production
- Data update of the source: 2 B 1 Ammonia Production

The structure of the NIR follows closely 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 centralized reviews.

The underlying emission data for the year 2004 as reported in the tables of the common reporting format of the data submission 2005 to the convention are also included as well as abbreviations and references used. Furthermore detailed results from the key source analysis, detailed information on the methodology of emission estimates for the fuel combustion sector, the CO_2 reference approach as well as the National Energy Balance are presented in the Annexes.

[1] Austria's National Inventory Report 2005 – Submission Under the United Nations Framework Convention of Climate Change. BE-268; Umweltbundesamt, Vienna.

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.

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.

Project leader for the preparation of the NIR is Barbara Muik.

Specific responsibilities for the NIR 2006 have been as follows:

Executive Summary	Barbara Muik
Chapters 1.1 – 1.5, 1.7	Barbara Muik
Chapters 1.6, 1.8	Doris Halper
Chapter 2	Barbara Muik
Chapter 3.1 - 3.4	Stephan Poupa
Chapter 3.2 (Road Transport / Aviation)	Agnes Kurzweil
Chapter 3.5	Barbara Muik
Chapter 4	Barbara Muik
Chapter 5	Traute Köther
Chapter 6	Michael Anderl
Chapter 7	Peter Weiss
Chapter 8.1-8.3, 8.5	Daniela Wappel
Chapter 8.4	Stephan Poupa
Chapter 9	Barbara Muik
Annexes	Stephan Poupa, Barbara Muik

ES.2 Summary of National Emission and Removal Related Trends

The most important GHG in Austria is carbon dioxide (CO_2), it contributed 84.4% of total national GHG emissions expressed in CO_2 equivalents in 2004, followed by CH_4, 8.1% and N_2O, 5.8%. PFCs, HFCs and SF_6 contributed 1.7% of the overall GHG emissions in the country. The energy sector accounted for 77.3% of the total GHG emissions followed by Industrial Processes 10.8%, Agriculture 8.6% and Waste 2.8%.

Total GHG emissions (excluding land-use change and forestry (LULUCF)) amounted to 91 299 Gg CO_2 equivalents and increased by 15.7% from 1990 to 2004. Different from previous reporting, 1990 has been chosen as the base year for all greenhouse gases.

Table 1 provides data on emissions by sector and Table 2 by gas from 1990 to 2004.

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
BY*	[Gg CO_2 equivalent]	66 998.69	**78 959.40**	55 654.51	10 111.56	515.17	9 122.44	-11 960.71	3 555.73
1991		65 107.68	**82 997.57**	59 531.71	10 152.50	469.27	9 296.60	-17 889.88	3 547.49
1992		63 602.16	**76 300.77**	54 617.66	8 998.84	420.24	8 812.64	-12 698.62	3 451.39
1993		59 749.55	**76 270.69**	55 103.30	8 751.45	419.85	8 582.84	-16 521.14	3 413.25
1994		61 686.76	**77 113.09**	55 122.59	9 275.76	404.04	9 048.22	-15 426.33	3 262.48
1995		65 823.21	**80 234.57**	57 827.98	9 730.26	422.38	9 134.47	-14 411.36	3 119.48
1996		73 871.93	**83 567.37**	61 860.80	9 602.19	405.31	8 718.11	-9 695.44	2 980.97
1997		64 363.03	**83 146.28**	60 988.53	10 193.59	422.59	8 687.43	-18 783.25	2 854.14
1998		65 704.93	**82 605.15**	61 053.67	9 675.43	404.74	8 691.32	-16 900.22	2 779.99
1999		59 425.32	**80 800.09**	59 820.92	9 392.02	390.87	8 504.96	-21 374.77	2 691.31
2000		65 253.20	**81 278.83**	59 890.31	10 035.10	413.52	8 333.92	-16 025.63	2 605.97
2001		66 383.15	**85 145.37**	63 999.09	9 908.97	426.10	8 270.44	-18 762.22	2 540.77
2002		71 734.01	**86 858.79**	65 187.51	10 593.70	424.85	8 157.15	-15 124.79	2 495.60
2003		75 929.65	**92 526.59**	70 907.99	10 662.86	423.60	8 006.61	-16 596.94	2 525.53
2004		74 703.02	**91 332.60**	70 582.03	9 913.02	422.34	7 863.19	-16 629.58	2 552.01

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

Over the period 1990-2004 CO_2 emissions increased by 24.5%, mainly due to increased emissions from transport. Methane emissions decreased during the same period by 19.2% mainly due to lower emissions from *Solid Waste Disposal* ; N_2O emissions decreased by 15.4% over the same period due to lower emissions from agricultural soils and from chemical industry.

Emissions from HFCs and SF_6 increased by 3827% and 2%, respectively, whereas PFCs emissions decreased by 89% from the base year (1990) to 2004.

Table 2: Austria's greenhouse gas emissions by gas

GHG		**Total**	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
BY*	[Gg CO_2 equivalent]	78 959.40	61 933.39	9 178.82	6 242.34	23.03	1 079.24	502.58
1991		82 997.57	65 485.82	9 150.38	6 575.71	45.21	1 087.08	653.36
1992		76 300.77	60 043.91	8 857.19	6 190.48	48.68	462.67	697.85
1993		76 270.69	60 415.32	8 829.83	6 021.58	157.34	52.92	793.71
1994		77 113.09	60 766.35	8 636.77	6 458.80	206.83	58.65	985.70
1995		80 234.57	63 664.36	8 520.12	6 574.85	267.34	68.74	1 139.16
1996		83 567.37	67 330.66	8 333.02	6 272.52	346.84	66.27	1 218.05
1997		83 146.28	67 155.39	8 057.19	6 289.29	427.42	96.83	1 120.15
1998		82 605.15	66 837.28	7 936.47	6 383.76	494.89	44.75	907.99
1999		80 800.09	65 444.12	7 759.62	6 305.65	542.20	64.54	683.96
2000		81 278.83	66 185.96	7 598.87	6 192.10	596.26	72.33	633.31
2001		85 145.37	70 179.02	7 477.62	6 074.87	695.10	82.15	636.62
2002		86 858.79	71 943.21	7 336.10	6 069.33	782.44	86.87	640.83
2003		92 526.59	77 561.83	7 364.43	6 039.35	864.92	102.54	593.52
2004		91 332.60	77 103.43	7 414.06	5 283.48	904.39	114.72	512.51

**BY= Base Year: 1990 for CO_2, CH_4 and N_2O, HFCs, PFCs and SF6*

NOTE: Total without emissions from LUCF

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

In 2004, 70 582 Gg CO_2 equivalents, that is 77.3% of total national emissions, arose from the sector *Energy*. In 2004, 98.8% of these emissions arose from fuel combustion activities. The most important *Fuel Comustion* sub-sector in 2004 was *1 A 3 Transport* with a share of 34%. From 1990 to 2004 emissions from the energy sector increased by 26.8%.

Industrial Processes was the second largest sector in Austria with 10.8% of total GHG emissions in 2004 (9 880 Gg CO_2 equivalents). The main source of greenhouse gas emissions in the industrial processes sector was *Metal Production*, which caused 45% of the emissions from this sector in 2004. From the base year to 2004 emissions from industrial processes decreased by 2.1%.

In 2004, 0.5% of total GHG emissions in Austria (422 Gg CO_2 equivalent) arose from the sector *Solvent and Other Product Use*. From 1990-2004 emissions from this category decreased by 18%.

Emissions from *Agriculture* amounted to 7 863 Gg CO_2 equivalent in 2004, which corresponded to 8.6% of total national emissions. In 2004 the most important sub-sector *Enteric Fermentation* contributed 42% of total greenhouse gas emissions from the agricultural sector. In 2004 emissions from this category were 13.8% below the level of the base year.

In 2004 the greenhouse gas emissions from the *Waste* sector amounted to 2 552 Gg CO_2 equivalents which corresponded to 2.8% of total national emissions. The main source of greenhouse gas emissions in this sector was *solid waste disposal on land*, which caused 86.9% of emissions. In 2004 emissions from this category were 28.2% 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 1990-2004

Gas	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
						Gg					
NOx	211.59	192.58	212.46	199.57	212.13	198.98	203.90	213.18	219.73	230.01	226.91
CO	1 221.85	1010.19	1020.84	954.07	914.71	862.92	797.50	781.76	737.74	761.59	742.17
NM-VOC	284.37	220.66	215.53	202.84	189.90	178.76	179.15	182.04	176.09	175.38	172.20
SO_2	74.23	46.82	44.67	40.34	35.54	33.57	31.50	32.86	32.83	33.38	28.89

Emissions of indirect greenhouse gases except NOx decreased in the period from 1990 to 2004: for NMVOCs and CO by 39% and for SO_2 emissions by 61%. NOx emissions increased by 7% over the considered period.

The most important emission source for indirect greenhouse gases and SO_2 are fuel combustion activities.

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 0.6-0.7°C in the past 100 years and, according to the IPCC, will rise by another 1.4-5.8°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

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

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 2004. 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.

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].

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).

  - 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).

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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/program/mis/ghg/countrep/autrep03.pdf and http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2004_irr_centralized_review_austria.pdf

- Obligation under the Austrian Ambient Air Quality Law[4] 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). Article 15 of the IPPC Directive can be 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.

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 identified 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.

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

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 relevant and up to date under the responsibility of the Quality Manager. The Quality Manager within the "Inspection body for GHG inventory" has irrespective of other duties the defined authority and responsibility for quality assurance within the inspection body. 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 be a basis for policies to reduce emissions.

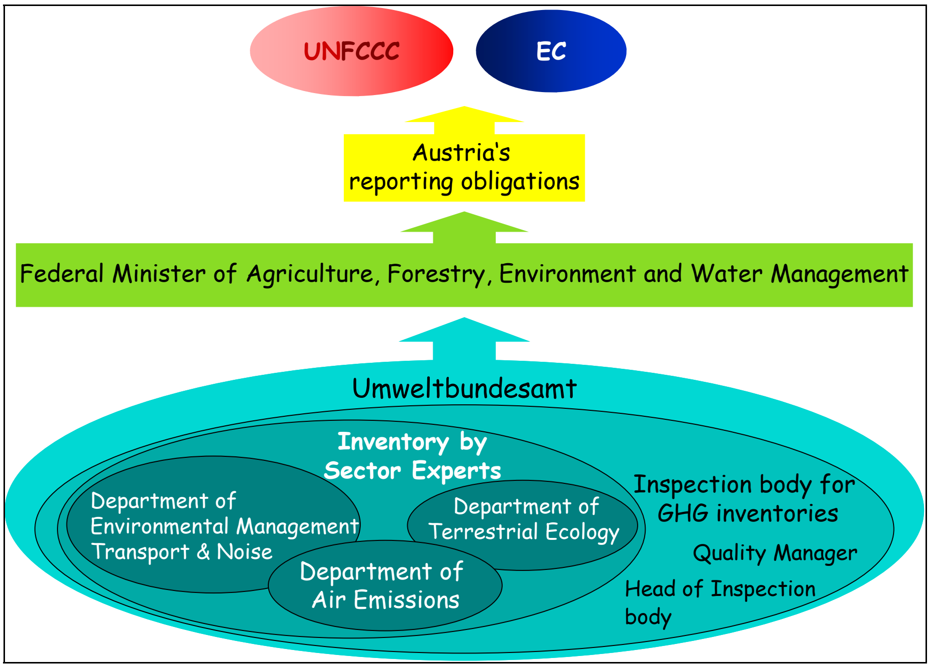

Figure 1: Responsibilities in the Austrian National System for Greenhouse Gas Inventories

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:

- The ordinance pertaining to the Austrian Emissions Certificate Trading Act[5] that regulates monitoring and reporting in the context of the EU Emissions Trading scheme in Austria; it is outlined below.
- **Ordinance regarding Monitoring and Reporting of Greenhouse Gas Emissions**[6]

5 "*Emissionszertifikate-Gesetz*", Federal Law Gazette 46/2004

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 Emissions Trading scheme will be available for the year 2005; these data will be considered in the National Inventory Report 2007.

- 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[7]), 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"[7] (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)[8] 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.
- According to the Landfill Ordinance (Deponieverordnung)[9], 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*). These data provide the main data basis for calculating emissions from the sector *Waste*.
- Since 2004 there has also been a reporting obligation under the Austrian Fluorinated Compounds (FC) Ordinance[10] to the BMLFUW for users of FCs for the following

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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 458/2004

7 *"Bundesstatistikgesetz"*, Federal Law Gazette 163/1999

8 „Emissionsschutzgesetz für Kesselanlagen", Federal Law Gazette 150/2004

9 „*Deponieverordnung",* Federal Law Gazette 164/1996

10 *„Industriegas-Verordnung (HFKW-FKW-SF6-VO)";* Federal Law Gazette 447/2002

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 has 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 is 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, which is currently being finalized, has a structure as illustrated in Figure 1.

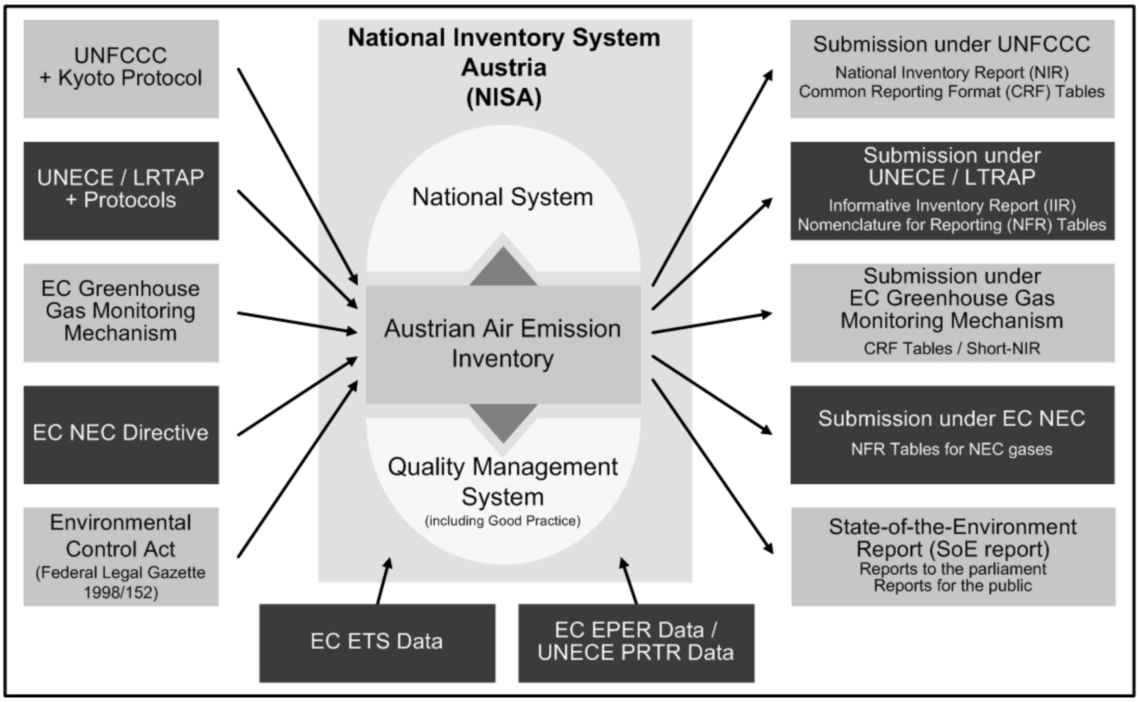

Figure 2: Structure of the emission inventory system in Austria (NISA)

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 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 and Uncertainty Management of Greenhouse Gas Inventories.
- 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 pertain 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.

1.3 Inventory Preparation Process

The present Austrian greenhouse gas inventory for the period 1990 to 2004 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)[11] (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).

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 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.

Like the IPCC Sectors of the CRF format the CORINAIR system has its own nomenclature, called SNAP (Selected Nomenclature for sources of Air Pollution), which may be expanded by so-called SPLIT codes and additionally each SNAP/SPLIT category can be extended using a fuel code, a four digit alphanumeric code. The first three digits are based on the NAPFUE code (further information about fuel codes can be found in Chapter 3, the source analysis of the sector Energy).

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.

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

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.

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, Steam boiler database;	*Umweltbundesamt*, plant operators
Industry	National production statistics, import/export statistics, direct information from industry or associations of industry;	*Umweltbundesamt*, plant operators
Waste	Database on landfills	*Umweltbundesamt*
LULUCF	National forest inventory obtained from the Austrian Federal Office and Research Centre for Forest (BFW)	*Umweltbundesamt*
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

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

A complete list of data sources for activity and emission data or emission factors used by sector can be found from page 318 onwards.

If emission data are reported (e.g. by the plant owner) these data are entered into the inventory. This method is mainly used for large point sources.

If no such information is available an emission factor is multiplied by the activity data to obtain the emission data for a specific source. This method is mainly used for area sources.

For the preparation of the greenhouse gas inventory, the *Umweltbundesamt* prefers 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 are not available, national emission factors are used or, if there are no national emission factors, international emission factors are used to estimate the emissions.

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[12]. 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 1998-2004 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.

Data from EPER

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[13.]

It 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.

The Austrian industrial facilities had to report their annual emissions of 2001 or 2002. There were about 400 facilities in Austria that had to report to EPER. As the thresholds for reporting

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[12] "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 2004.

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

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, which is why for example 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, as the only information included is whether emissions are estimated, measured or calculated. What is also included is one activity value that is often not useful in the context of emissions.

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.

1.5 Key Source Analysis

The identification of key source categories is described in the IPCC Good Practice Guidance (IPCC-GPG, 2000), Chapter 7. It stipulates that a key source 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, the trend in emissions, or both.

All notations, descriptions of identification and results for source and key source 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 source categories, except LULUCF. Emissions and removals from LULUCF have not been considered in this key source analysis, but the results of a key category analysis including emissions and removals from LULUCF are included in Annex 6: CFR for 2004 (Table 7).

The presented key source analysis was performed by the *Umweltbundesamt* with data for greenhouse gas emissions of the submission 2006 to the UNFCCC and comprises a level assessment for all years between 1990 and 2004 and a trend assessment for the trend of the years 1997 to 2004 with respect to base year emissions. Different from previous reporting, 1990 has been chosen as the base year for all greenhouse gases.

1.5.1 Austria's Key Source Categories

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

The identified key source categories are listed in Table 5. They comprise 88 555.7 Gg CO_2e in the year 2004, which is a share of 97% of Austria's total greenhouse gas emissions (without LULUCF).

Table 5: Austrian key source categories based on emission data submitted to the UNFCCC in 2006

IPCC Category Description		Gas	Emissions 2004 [Gg CO_2e]	Share in National Total Emissions 2004
1 A gaseous	Fuel Combustion (stationary)	CO_2	16 962.0	18.6%
1 A 3 b diesel oil	Road Transportation	CO_2	15 805.8	17.3%
1 A 4 stat-liquid	Other Sectors	CO_2	7 097.5	7.8%
1 A 1 a solid	Public Electricity and Heat Production	CO_2	6 676.4	7.3%
1 A 3 b gasoline	Road Transportation	CO_2	6 586.8	7.2%
1 A 2 solid	Manufacturing Industries and Construction	CO_2	4 992.1	5.5%
2 C 1	Iron and Steel Production	CO_2	4 414.8	4.8%
4 A 1	Cattle	CH_4	3 072.1	3.4%
6 A	SOLID WASTE DISPOSAL ON LAND	CH_4	2 218.8	2.4%
1 A 1 b liquid	Petroleum refining	CO_2	2 164.6	2.4%
1 A 2 stat-liquid	Manufacturing Industries and Construction	CO_2	1 847.9	2.0%

IPCC Category Description		Gas	Emissions 2004 [Gg CO_2e]	Share in National Total Emissions 2004
2 A 1	Cement Production	CO_2	1 754.5	1.9%
4 D 1	Direct Soil Emissions	N_2O	1 496.4	1.6%
1 A 4 mobile-diesel	Other Sectors	CO_2	1 460.8	1.6%
1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO_2	1 144.4	1.3%
4 D 3	Indirect Emissions	N_2O	1 085.6	1.2%
1 A 1 a liquid	Public Electricity and Heat Production	CO_2	1 061.0	1.2%
2 F1/2/3/4/5	ODS Substitutes	HFCs	900.5	1.0%
4 B 1	Cattle	N_2O	800.7	0.9%
1 A 2 other	Manufacturing Industries and Construction	CO_2	760.6	0.8%
1 A 4 solid	Other Sectors	CO_2	618.4	0.7%
2 A 2	Lime Production	CO_2	599.5	0.7%
1 B 2 b	Natural gas	CH_4	539.1	0.6%
1 A 1 a other	Public Electricity and Heat Production	CO_2	537.1	0.6%
2 F 7	Semiconductor Manufacture	FCs	497.3	0.5%
4 B 1	Cattle	CH_4	468.8	0.5%
2 B 1	Ammonia Production	CO_2	468.5	0.5%
4 B 8	Swine	CH_4	385.3	0.4%
2 A 7 b	Sinter Production	CO_2	328.5	0.4%
2 A 3	Limestone and Dolomite Use	CO_2	297.5	0.3%
2 B 2	Nitric Acid Production	N_2O	280.9	0.3%
1 A 4 biomass	Other Sectors	CH_4	239.8	0.3%
6 B	WASTEWATER HANDLING	N_2O	201.0	0.2%
3	SOLVENT AND OTHER PRODUCT USE	CO_2	189.8	0.2%
1 A 3 a jet kerosene	Civil Aviation	CO_2	184.6	0.2%
1 A 3 b gasoline	Road Transportation	N_2O	167.4	0.2%
1 A 4 other	Other Sectors	CO_2	148.7	0.2%
2 F 9	Other Sources of SF_6	SF6	100.1	0.1%
2 C 3	Aluminium production	PFCs	0.0	0.0%
2 C 4	SF6 Used in Al and Mg Foundries	SF_6	0.0	0.0%

The key source 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 source analysis because the same emission factor is used for all sub categories. The contribution to national total emissions in the base year was 14.1% compared to 18.6% in 2004. It ranked number one in all level assessments, and number two in all trend assessments.

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 1995 and *1 A 3 b Road Transportation – gasoline (CO_2)* for the years before 1995. 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 2004, it was 17.3% (7.2%). 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 increased by 294% since the base year (this source ranked number one in all trend assessments).

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 source in all trend assessments (ranks: 6-11). In the year 2004 it contributed 7.8% of national total greenhouse gas emissions, emissions from this source decreased by 5% from 1990 to 2004.

Comparison to last year's submission

There is a difference in the identified key source 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 source analysis, four sources have been identified as additional key sources:

- *1 A 3a jet kerosene - Civil aviation* (CO_2)
- *1 A 4 Other – Other sectors* (CO_2)
- *1 B 2 b Natural gas* (CH_4)
- *2 A 3 Limestone and Dolomite Use* (CO_2)

Recalculations and newly added source categories influence the result.

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*.

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

The identification of key source categories consists of three steps:

- Identifying source categories
- Level Assessment
- Trend Assessment

Level of disaggregation and identification of key source categories

To identify key source categories total emissions have been split into those source categories that have been estimated using the same methodology and the same emission factor.

Table A1.3 of Annex 1 presents the 152 defined source categories and their greenhouse gas emissions expressed in CO_2 equivalent emissions for the years 1990 to 2004.

Further details and a list of the source categories and key source categories for each category are given in the corresponding subchapter of the chapter analysis chapters *3 Energy – 8 Waste*.

Level Assessment

For the Level Assessment the contribution of GHG emissions (expressed in CO_2 equivalent emissions) of each source category to national total emissions was calculated. The calculation was performed for the years 1990 to 2004 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 years 2003 and 2004, 29 source categories comprised > 95% of the cumulative total and were thus rated as key sources. For the years 1991 and 2002 30 source categories were identified as key sources in the level assessment and for all other years 31-32 categories were identified as key sources. The results of each level assessment is presented in Annex 1.

Trend Assessment

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 source's level assessment.

For the Trend Assessment, emissions of the years 1997 to 2004 were compared with base year emissions (1990 for all gases), resulting in eight calculations.

The calculation was performed according to Equation 7.2 of the GPG. 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 source categories. Between 24 and 31 sources were identified as key source categories for the different trend assessments. Results are presented in Annex 1.

Identification of key source categories

Any source category meeting the 95% threshold in any year of the Level or the Trend Assessment is considered a key source. The key sources are presented in Table 5 in descending order of magnitude of contribution to total national GHG emissions in the year 2004. In Annex 1 they are presented together with their ranking of all assessments where they are within the 95% threshold.

Consequences of key source category selection

Whenever a method used for the estimation of emissions of a key source 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)

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.

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, valid from 23 December 2005. The requirements of EN ISO/IEC (Type A) are fulfilled. When compiling emission inventories according to the standard, the methodologies applied have to be officially approved by the accreditation body. For some sources (LULUCF forest land, solid waste disposal on land and waste water) new methodologies have been applied which have not yet been approved by the accreditation body – however, the approval is scheduled for early 2007.

The International Standard ISO 17020 and the Compilation of the National Greenhouse Gas Inventory

Inspection bodies carry out assessments on behalf of private clients, their parent organisations, and/or official authorities with the objective of providing information to these parties relative to conformity with regulations, standards, or specifications. 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.*

The QMS was drawn up to meet requirements of the International Standard ISO 17020. The International Standard ISO 17020 superseded the European Standard EN 45004. 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. 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.

According to ISO 17020, *accreditation* is the procedure by which an authorized body - in Austria this is the Federal Ministry of Economic Affairs and Labour - formally recognizes that an organisation has the competence to perform a stipulated conformity assessment activity.

A Type A inspection body provides “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.

The International Standard ISO 17020 has been drawn up with the objective of promoting confidence in those bodies performing inspections which conform to it. The ISO 17020 takes into account requirements and recommendations of European and international documents such as the ISO 9000 (EN/ISO 9000) series of standards and Guide EA-5/01 (Guidance on the Application of EN 45004 which is identical with ISO 17020, European Co-operation for Accreditation, 2003).

ISO 17020 forms part of the following series of standards covering testing, inspection and certification.

- ISO 17000 (Conformity assessment – vocabulary and general principles)
- ISO 17011 (General requirements for bodies providing assessment and accreditation)
- ISO 17020 (General criteria for the operation of various types of bodies performing inspection) replacing EN 45004
- ISO 17021 (Conformity assessment: Requirements of bodies providing audit and certification of management systems) replacing EN 45012 (General criteria for certification bodies operating quality system certification)
- ISO 17024 (Conformity assessment - General requirements for bodies operating certification of persons) replacing EN 45013 (General criteria for certification bodies operating certification of personnel)
- ISO/IEC 17025 (General requirements for the competence of testing and calibration laboratories) replacing EN 45001 (General criteria for the operation of testing laboratories)
- EN 45002 (General criteria for the assessment of testing laboratories)
- EN 45003 (General criteria for the laboratory accreditation bodies)
- EN 45010 (General Criteria for the assessment and accreditation of certification bodies)
- EN 45011 (General criteria for certification bodies operating product certification)
- EN 45020 (General terms and their definitions concerning standardisation and related activities)

Quality Management System (QMS)

The Quality Assurance and Quality Control (QA/QC) procedures within the QMS correspond to the QA/QC system outlined in IPCC-GPG Chapter 8 "Quality Assurance and Quality Control".

The implementation of QA/QC procedures as required by IPCC-GPG support the development of national greenhouse gas inventories that can be readily assessed in terms of quality and completeness. A QMS goes beyond QA/QC activities and comprises supporting and management processes in addition to the QA/QC procedures in inventory compilation. A system of standard operating procedures (SOPs) ensures agreed standards as well as transparency within (i) the inventory compilation process (ii) supporting processes (e.g. achieving) and (iii) management processes (e.g. annual management reviews, internal audits, recruitment of personnel and continuing professional development, error prevention).

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.

This process-based approach of the QMS within the Inspection Body for Greenhouse Gas Inventories at the Umweltbundesamt is illustrated in Figure 3.

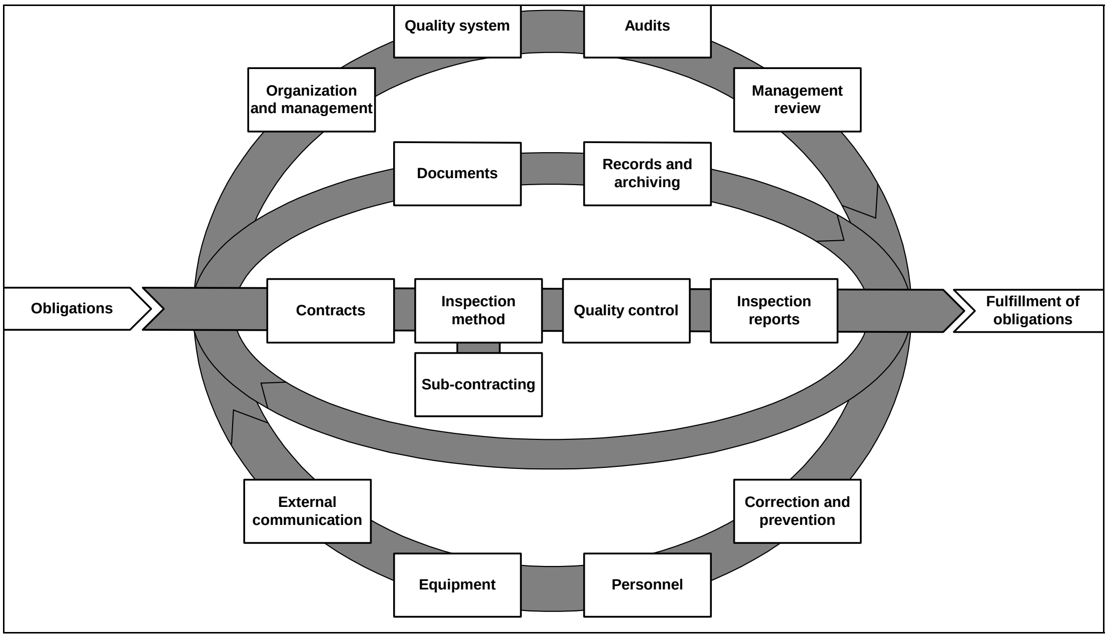

Figure 3: Process-based QMS (the outer circle corresponds to management processes, the straight line to realisation processes and the inner circle to supporting processes)

The QMS is characterized by a *process based approach*, referring to the application of three processes within its organisation, along with the identification and interactions of these processes and their management.

1) **Management processes** (outer circle)

Management Processes comprise all activities necessary for management and control of an organisation, e.g. 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 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.

2) 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. The 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.

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.

Accreditation Act

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, partially or in total for all or part of the testing, inspection or certification body's scope of accreditation. It requires re-assessment in the event of changes affecting the activity and operation of the testing, inspection or certification body, such as changes in personnel or equipment, or if analysis of a complaint or any other information indicates that the testing, inspection or certification body no longer complies with the requirements of the accreditation body.

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

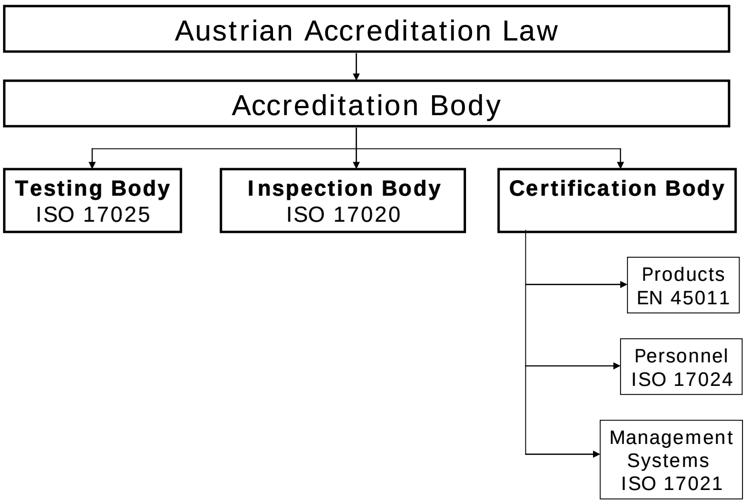

Figure 4: Inter-relationship between the Austrian Accreditation Act, the EN 45000/ISO 17000 and the ISO 9000 series.

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.

Reports issued by an accredited body may carry the federal emblem in addition to the accreditation logo. These reports are official documents. Figure 3 presents the official emblem of accredited Austrian Inspection Bodies.

Figure 5: official emblem of an Austrian accredited inspection body

QA/QC Activities

During the year 2005 QA/QC activities were focused on finalizing and updating the QMS system and preparing for the accreditation audit. QA/QC procedures comply with the recommendations of IPCC-GPG chapter 8 on *Quality Assurance and Quality Control*. Priority is given to key sources. For all sources, fundamental checks such as completeness of estimates, time series consistencies, data transcription and documentation are performed. For key sources, activity data, emission factors, emissions and uncertainty analysis are assessed using the Tier 1 checklist. In addition, where applicable, Tier 2 QC procedures are employed. Special attention is given to documentation, archiving and reporting as outlined in chapter 8.10 of IPCC-GPG. Table 6 presents the timetable for the implementation of the quality management system:

Table 6: Timetable for steps

Step		Date
1.	Development of a quality management system including quality manual	1999 – 2002
2.	Development of the quality management system	2003 – 2005
3.	Implementation of the quality management system	
4.	Accreditation Audit	September 2005
5.	Accreditation as Inspection Body for Greenhouse Gas Inventories	December 2005

1.7 Uncertainty Assessment

In this submission uncertainty estimates for all key sources are presented. They are mainly based on results from the first comprehensive uncertainty analysis that was performed in 2001 based on data from the submission of 1999 (WINIWARTER & RYPDAL 2001).

However, the methodologies for some sectors have been improved. In these cases the uncertainty was estimated for the new methodology. Furthermore, the first uncertainty analysis did not cover fluorinated compounds. Thus for key sources regarding FC emissions uncertainty estimates are presented here.

The following table presents uncertainties for activity data and emission factors (or a combined uncertainty) for all key sources[14]. For information on the uncertainty estimates of the different sources, please refer to the respective chapters of this report.

Table 7: Uncertainty estimates for key sources

IPCC Category	Description	Gas	AD	EF	Combined
			Uncertainty[15] [%]		
1 A gaseous	Fuel Combustion (stationary)	CO_2	3.0	0.5	3.0
1 A 1 a liquid	Public Electricity and Heat Production	CO_2	2.0	0.5	2.1
1 A 1 a other	Public Electricity and Heat Production	CO_2	15.0	20.0	25.0
1 A 1 a solid	Public Electricity and Heat Production	CO_2	2.0	0.5	2.1
1 A 1 b liquid	Petroleum refining	CO_2	3.0	0.5	3.0
1 A 2 mob-liquid	Manufacturing Industries and Constr.	CO_2	1.0	0.5	1.1
1 A 2 other	Manufacturing Industries and Constr.	CO_2	20.0	20.0	28.3
1 A 2 solid	Manufacturing Industries and Constr.	CO_2	3.0	0.5	3.0
1 A 2 stat-liquid	Manufacturing Industries and Constr.	CO_2	3.0	0.5	3.0
1 A 3 a jet kerosene	Civil Aviation	CO_2	5.0	5.0	7.1
1 A 3 b diesel oil	Road Transportation	CO_2	0.5	0.5	0.7
1 A 3 b gasoline	Road Transportation	CO_2	0.5	0.5	0.7
1 A 3 b gasoline	Road Transportation	N_2O	10.0	40.0	41.2
1 A 4 biomass	Other Sectors	CH_4	10.0	50.0	51.0
1 A 4 mob-diesel	Other Sectors	CO_2	1.0	0.5	1.1
1 A 4 other	Other Sectors	CO_2	30.0	30.0	42.4
1 A 4 solid	Other Sectors	CO_2	3.0	0.5	3.0

[14] values refer to random uncertainty only (in the comprehensive uncertainty estimate described in Chapter 1.7.1 both random and systematic uncertainties are considered)

[15] referring to 2 standard deviations (95% confidence interval)

IPCC Category	Description	Gas	AD	EF	Combined
			Uncertainty[15] [%]		
1 A 4 stat-liquid	Other Sectors	CO_2	2.0	0.5	2.1
1 B 2 b	Natural gas	CH_4	4.2	14.1	14.7
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 Production	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	3.0	0.0	3.0
2 C 1	Iron and Steel Production	CO_2	2.0	5.0	5.4
2 C 3	Aluminium production	PFCs	2.0	50.0	50.0
2 C 4	SF6 used in Al and Mg Foundries	SF_6	5.0	0.0	5.0
2 F 1/2/3/4/5	ODS Substitutes	HFCs	20.0	50.0	53.9
2 F 6	Semiconductor Manufacture	FCs	5.0	10.0	11.2
2 F 8	Other Sources of SF6	SF_6	25.0	50.0	55.9
3	Solvent and Other Product Use	CO_2	15.0	10.0	18.0
4 A 1	Cattle	CH_4	0.0	8.0	8.0
4 B 1	Cattle	N_2O	10.0	75.0	75.7
4 B 1	Cattle	CH_4	10.0	69.0	69.7
4 B 8	Swine	CH_4	10.0	70.0	70.7
4 D 1	Direct Soil Emissions	N_2O	0.0	48.0	48.0
4 D 3	Indirect Emissions	N_2O	0.0	48.0	48.0
6 A	Solid Waste disposal on land	CH_4	12.0	25.0	27.7
6 B	Wastewater handling	N_2O	20.0	50.0	53.9

<u>Note:</u> *Uncertainties for activity data on stationary combustion of IPCC Category* 1 A Fuel Combustion *estimated for gross inland consumption, only random uncertainty considered.*

A Tier 1 Uncertainty analysis was made for sources that amount to 97.0% and 96.5% of total national GHG emissions in the years 2004 and 1990, respectively. The Tier 1 uncertainty analysis is presented in Annex 6. The following Table presents results from this analysis, for total emissions and the gas-specific uncertainties. For the gas-specific Tier 1 uncertainty analysis the sources have been grouped by gas. In 2004, the analyzed sources contributed 98.7% of total CO_2 emissions, 93.4% of total CH_4 emissions, 76.3% of total N_2O emissions and 97.8% of total F-gas emissions.

Table 8: Uncertainties for CO_2, CH_4, N_2O, F-gases (HFC, PFC and SF6) and for total GHG emissions of key sources calculated with the Tier 1 approach

	CO_2	CH_4	N_2O	F-gases	Total GHG emissions
Base Year (1990)	0.9%	13.1%	24.6%	33.5%	2.42%
2004	0.9%	11.6%	26.8%	32.8%	1.81%

According to the Tier 1 Uncertainty Analysis (see Annex 6), the uncertainty calculated for the trend in total national emissions is 2.97%. Uncertainties of non-key sources have not been estimated due to a lack of resources. We are aiming at assessing them for the next submission.

1.7.1 First Comprehensive Uncertainty Analysis

IPCC-GPG requires uncertainty estimates as an essential part of a complete emission inventory. Uncertainty information is not intended to dispute the validity of the inventory as a whole but to help prioritise efforts to improve the accuracy of inventories in the future and provide guidance for decisions on methodological choice.

The starting point for any prioritisation of efforts aimed at improving the accuracy of inventories is the identification of key source categories. Based on these categories, the uncertainty is estimated (providing in itself an input for a possible second step in the identification of key source categories) and as a next step, if required, the methods for emission estimation are adapted.

A first comprehensive uncertainty analysis was performed as a pilot study (WINIWARTER & RYPDAL 2001) on the greenhouse gases CO_2, CH_4 and N_2O for the years 1990 and 1997. The work was carried out by the *Austrian Research Centres Seibersdorf* to ensure an independent assessment.

In Table 9 the most important emission sources with respect to uncertainty are listed.

Table 9: Most important emission sources with respect to uncertainty

Emission Source	CO_2	CH_4	N_2O
Energy Conversion	×		×
Industry	×		
Transport	×		×
Energy – Other Sources	×		
Fugitive Emissions – Gas and Liquid Fuels	×		
Industrial Processes – Cement	×		
Metal Industry Processes – Iron and Steel	×		
Enteric Fermentation – Cattle		×	
Agricultural Soils		×	×
Abandonment of Managed Lands	×		

Emission Source	CO_2	CH_4	N_2O
Solid Waste Disposal		×	

As regards uncertainty, two aspects were considered: systematic uncertainty and random uncertainty. Random uncertainty covers the fluctuation of a large set of measurements, which may include both the random uncertainty of the measurements and the natural variability of a parameter. A systematic error is the deviation of a result from "reality", a deviation that may be caused by a systematically flawed estimate as well as by the omission or false interpretation of certain data or statistics. The main difficulty in dealing with the systematic error is that it is normally by definition not apparent. Once a systematic error becomes apparent, it can be accounted for and eliminated.

The total uncertainty comprises both systematic and random uncertainty and reflects the current situation, whereas the random uncertainty can be established under ideal conditions with the inventory techniques currently available.

Table 10 shows the estimates for total uncertainty including systematic uncertainty and random uncertainty and Table 11 presents random uncertainty.

Table 10: Total uncertainty of emission data (emissions given in Tg CO_2 equivalents per year, uncertainties given as a percentage of the mean value)

Total uncertainty		CO_2	CH_4	N_2O	Total GHG emissions
1990	Mean value	63.20	9.48	6.59	79.27
	Standard deviation	0.73	2.29	2.95	3.89
	2σ	**2.3%**	**48.3%**	**89.6%**	**9.8%**
1997	Mean value	67.76	8.34	6.81	82.91
	Standard deviation	0.71	1.98	2.93	3.67
	2σ	**2.1%**	**47.4%**	**85.9%**	**8.9%**

Table 11: Random uncertainty of emission data (emissions given in Tg CO_2 equivalents per year, uncertainties given as a percentage of the mean value)

Random uncertainty		CO_2	CH_4	N_2O	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%**

Regarding the individual greenhouse gases, the emissions of CO_2 have a low uncertainty whereas the uncertainty for N_2O is high. The overall relative uncertainty calculated for the year 1990 was 9.8%, for the year 1997 it was 8.9%. The reduction is due to the increase in CO_2 emissions caused by the use of fossil fuels. These CO_2 emissions have a very low uncertainty in comparison to other greenhouse gas emissions and as they dominate the total greenhouse gas emissions their uncertainty dominates the overall uncertainty. The random uncertainty calculated for the year 1990 was 4.5%, for the year 1997 it was 3.8%.

Procedure

The uncertainty was determined in four steps:

- Step 1: Compilation of emission sources
- Step 2: Prioritisation and first estimate of uncertainty
- Step 3: Uncertainty assessment for input parameters
- Step 4: Monte Carlo analysis

Step 1: Compilation of emission sources

The emission sources had to be compiled so that it was possible to describe emissions in terms of statistically independent parameters. As the Austrian Air Emission Inventory is based on the CORINAIR SNAP Code, these source categories had to be first transformed into IPCC source categories. Emission source categories that are based on common assumptions and use the same emission factors have been aggregated.

Step 2: Prioritisation and first estimate of uncertainty

A prioritisation of input parameters (emission factors and activities or emission data) was performed using three different approaches in order to determine the emission sources with the highest uncertainty and to provide a focus for further assessment. One approach was based on the results for the UK as described by (CHARLES et al. 1998), another approach was based on the results for Norway as described by (RYPDAL 1999). In case of qualitative estimates of uncertainty (such as low, medium and high) as in the Norwegian study, these categories were transformed into quantitative values (low = 5%, medium = 30%, high = 80%). Based on the method for the UK and Norway a first estimate of uncertainty was made. The third approach was taken according to the IPCC-GPG 2000, Chapter 7 (Methodological Choice and Recalculation).

Step 3: Uncertainty assessment for input parameters

Any emission source category that was relevant in at least one of the approaches described in step 2 was analysed more thoroughly with regard to its uncertainty. A detailed uncertainty analysis was performed by quantitative estimation, by literature research or by expert judgement. In the latter case the experts were asked to provide references from the literature so that their uncertainty estimates could be taken into account.

As already mentioned, two aspects were considered regarding uncertainty: systematic uncertainty and random uncertainty.

Step 4: Monte Carlo analysis

The uncertainty data determined in Step 3 were fed into a Monte Carlo analysis. All input parameters were varied to obtain overall uncertainties for each of the greenhouse gases CO_2, CH_4 and N_2O and for their combination as CO_2 equivalents (using values for greenhouse gas warming potentials). The uncertainties for the underlying data (activities and emission factors) were calculated as well.

1.8 Completeness

CRF–Table 9 (Completeness) has been used in order to describe 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".

Due to the change of the reporting format, the number of notations keys NE and IE have increased in some sectors which, however, does not mean that the overall transparency and completeness have decreased since the submission of 2005. Figures from the NIR 2006 should therefore not be compared with figures from previous submissions.

Table 12: Transparency and completeness in the submission of 2006.

Sector	Submission 2006		Submission 2006	
	IE	NE	Transparency	Completeness
1 Energy	30	0	92%	100%
2 Industrial processes	38	30	93%	94%
3 Solvents	0	0	100%	100%
4 Agriculture	4	2	91%	95%
5 LULUCF	18	31	92%	87%
6 Waste	4	0	89%	100%
Total	**94**	**63**	**92%**	**95%**
Total number of estimates*	**1217**			

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

*Transparency was calculated as: [1 - (number of IE / number of estimates)]*100*

*Completeness was calculated as: [1 - (number of NE / number of estimates)]*100*

2 TREND IN TOTAL EMISSIONS

According to the Kyoto Protocol, Austria's greenhouse gas emissions will have to be 8% 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"[17] 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. Different from previous reporting, 1990 has been chosen as the base year for all greenhouse gases.

For Austria, there is also a CO_2 stabilization target 2000 according to the UNFCCC, which means that by 2000 CO_2 emissions should have been reduced to 1990 levels. However, the member states of the EC agreed to jointly implement this stabilization target and the EC was successful in achieving this goal.

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 13 gives a summary of Austria's anthropogenic greenhouse gas emissions 1990-2004.

Different from previous reporting, 1990 has been chosen as the base year for all greenhouse gases.

Table 13: Summary of Austria's anthropogenic greenhouse gas emissions from 1990-2004

	Greenhouse gas emissions [Gg CO_2 equivalent]											Trend
	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	BY*-2004
Total	**78 959**	**80 235**	**83 567**	**83 146**	**82 605**	**80 800**	**81 279**	**85 145**	**86 859**	**92 527**	**91 333**	***15.7%***
CO_2	61 933	63 664	67 331	67 155	66 837	65 444	66 186	70 179	71 943	77 562	77 103	*24.5%*
CH_4	9 179	8 520	8 333	8 057	7 936	7 760	7 599	7 478	7 336	7 364	7 414	*-19.2%*
N_2O	6 242	6 575	6 273	6 289	6 384	6 306	6 192	6 075	6 069	6 039	5 283	*-15.4%*
HFCs	23	267	347	427	495	542	596	695	782	865	904	*3827%*
PFCs	1 079	69	66	97	45	65	72	82	87	103	115	*-89.4%*
SF_6	503	1 139	1 218	1 120	908	684	633	637	641	594	513	*2.0%*

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

[17] 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 15.7% from the base year to 2004 (CO_2: +24.5%).

In the period from 2003 to 2004 Austria's total greenhouse gases decreased by 1.3%, CO_2 emissions decreased by 0.6%. The following figure presents the trend in total GHG emissions 1990-2004 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).

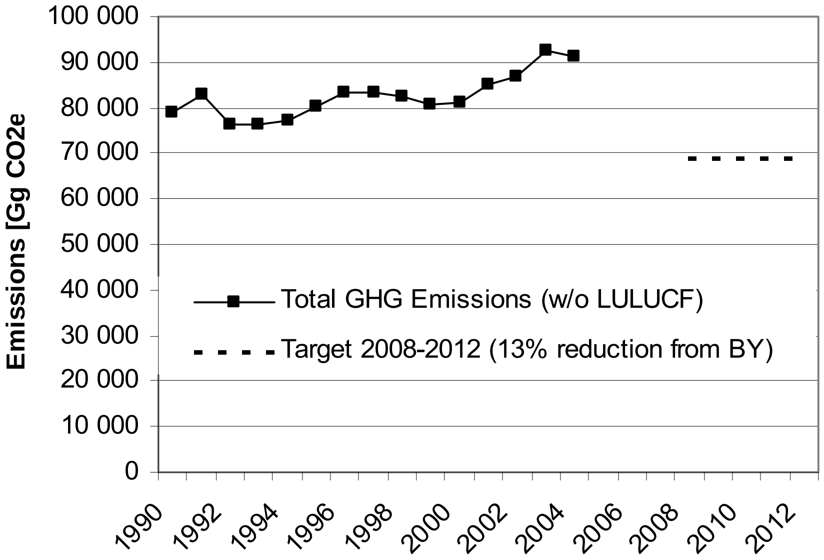

Figure 6: Trend in total GHG emissions 1990-2004

2.2 Emission Trends by Gas

Table 14 presents greenhouse gas emissions of the base year and 2004 as well as their share in total greenhouse gas emissions.

Table 14: Austria's greenhouse gas emissions by gas in the base year and in 2004.

GHG	Base year*	2004	Base year*	2004
	CO_2 equivalent [Gg]		[%]	
Total	**78 959**	**91 333**	**100.0%**	**100.0%**
CO_2	61 933	77 103	78.4%	84.4%
CH_4	9 179	7 414	11.6%	8.1%
N_2O	6 242	5 283	7.9%	5.8%
F-Gases	1 605	1 532	2.0%	1.7%

Emissions without LULUCF

**1990 for CO_2, CH_4, N_2O and F-Gases*

The greenhouse gas most emitted in Austria is CO_2, which represented 84.4% of total greenhouse gas emissions in 2004 compared to 78.4% in the base year, followed by CH_4 (8.1%

in 2004 and 11.6% in the base year), N_2O (5.8% in 2004 and 7.9% in the base year) and finally fluorinated hydrocarbons with a share of 1.7%.

The trend in Austrian greenhouse gas emissions, compared to emissions in the base year (1990), is presented in Figure 7.

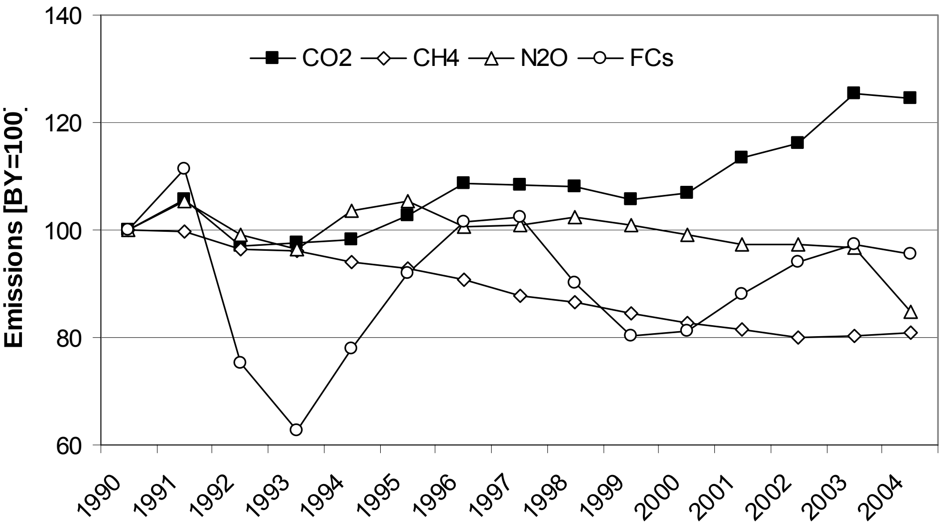

Figure 7: Trend in greenhouse gas emissions 1990-2004 by gas in index form (base year = 100)

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 been strongly increasing, from 2000 to 2003 by 17%. From 2003 to 2004 there was a slight decrease of emissions by 0.6%.

This results in a total increase of 24.5% from 1990 to 2004. In absolute figures, CO_2 emissions increased from 61 933 to 77 103 Gg (see Table 13) during the period from 1990 to 2004 mainly due to higher emissions from transport, which increased by 89%.

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 2002. From 2002 to 2004 there was a slight increase of 1.1%, mainly due to increasing emissions from solid waste disposal on land and increasing fugitive emissions from natural gas. This resulted in a total decrease from 9 179 to 7 414 Gg CO_2 equivalents between 1990 and 2004 (see Table 13). In 2004 CH_4 emissions were 19.2% 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 and manure management).

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 5 283 Gg CO_2 equivalents in 2004 compared to 6 242 in the base year (minus 15.4%). 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 53% in national total N_2O emissions. Manure management has a share of 17% 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 2004 from 23 to 904 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 with HFC emissions. PFC emissions decreased remarkably during the period from 1990 to 2004, from 1079 to 115 Gg CO_2 equivalents. PFCs are side-products of aluminium production, which closed down in Austria in 1992; in 2004 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 2004 SF_6 emissions amounted to 512 Gg CO_2 equivalents, which was 2% above the level of the base year (1990).

The main sources of SF_6 emissions in 2004 were semiconductor manufacture and filling of noise insulating windows.

2.3 Emission Trends by Source

Table 15 presents a summary of Austria's anthropogenic greenhouse gas emissions by sector for the period from 1990 to 2004:

- Sector 1: Energy
- Sector 2: Industrial Processes
- Sector 3: Solvent and Other Product Use
- Sector 4: Agriculture

- Sector 5: Land Use, Land-Use Change and Forestry
- Sector 6: Waste

Table 15: Summary of Austria's anthropogenic greenhouse gas emissions from 1990-2004

	Greenhouse gas emissions [Gg CO_2 equivalents]										
	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total	78 959	80 235	83 567	83 146	82 605	80 800	81 279	85 145	86 859	92 527	91 333
1	55 655	57 828	61 861	60 989	61 054	59 821	59 890	63 999	65 188	70 908	70 582
2	10 112	9 730	9 602	10 194	9 675	9 392	10 035	9 909	10 594	10 663	9 913
3	515	422	405	423	405	391	414	426	425	424	422
4	9 122	9 134	8 718	8 687	8 691	8 505	8 334	8 270	8 157	8 007	7 863
5	-11 961	-14 411	-9 695	-18 783	-16 900	-21 375	-16 026	-18 762	-15 125	-16 597	-16 630
6	3 556	3 119	2 981	2 854	2 780	2 691	2 606	2 541	2 496	2 526	2 552

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 2004 as well as their share and trends are presented in the following table.

Table 16: Austria's greenhouse gas emissions by sector in the base year and in 2004 as well as their share and trends.

GHG	Base year*	2004	Trend BY*-2004	Base year*	2004
	Emissions [Gg CO_2e]			Share [%]	
Total	**78 959**	**91 333**	**15.7%**	**100.0%**	**100.0%**
1 Energy	55 655	70 582	26.8%	70%	77%
2 Industry	10 112	9 913	-2.0%	13%	11%
3 Solvent	515	422	-18.0%	1%	0%
4 Agriculture	9 122	7 863	-13.8%	12%	9%
5 LULUCF	-11 961	-16 630	39.0%	-15%	-18%
6 Waste	3 556	2 552	-28.2%	5%	3%

Total emissions without LUCF

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

The dominant sectors are the energy sector, which caused 77% of total greenhouse gas emissions in Austria in 2004 (70% in 1990), followed by the Sector Industrial Processes, which caused 11% of greenhouse gas emissions in 2004 (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 8.

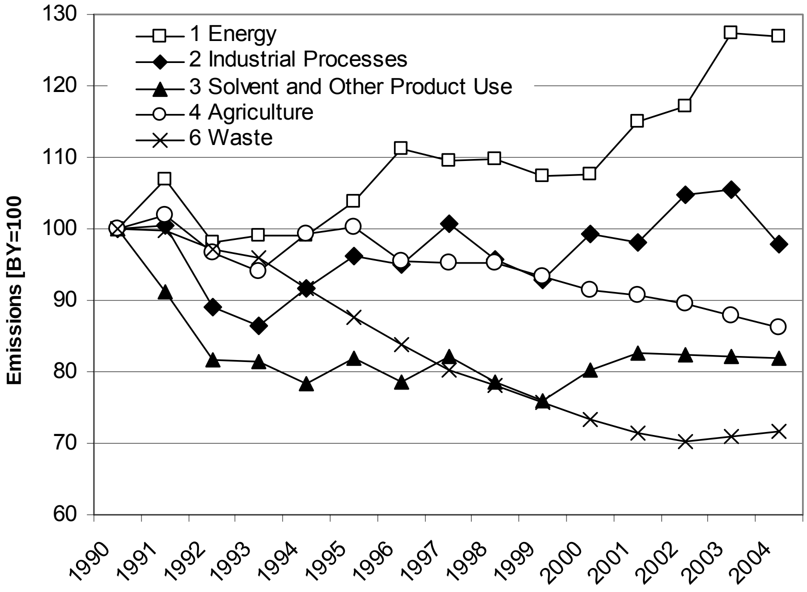

Figure 8: Trend in emissions 1990-2004 by Sector in index form (base year = 100)

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 stabilized between 1996 and 2000. The strong increase between 2000 and 2003 was followed by a slight decrease of emissions in 2004 compared to 2003 (-0.5%). In 2004 greenhouse gas emissions from Category *1 Energy* amounted to 70 582 Gg CO_2 equivalents, which corresponds to 77.3% of total national emissions.

In 2004, 98.8% 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 97.5% to total GHG emissions from *Energy*, CH_4 1.3% and N_2O 1.2%.

The most important energy sub-sectors in 2004 were *1 A 3 Transport* with a share of 34%, followed by *1 A 1 Energy Industries* (22%), *1 A 2 Manufacturing Industries and Construction* (22%) and *1 A 4 Other Sectors* (21%).

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 2004 with 87%. Apart from an increase of road performance (miles driven) in Austria, another main reason for this strong increase is the so-called 'tank tourism'. At the beginning of the 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 sub-sector *1 A 1 Energy Industries* show an increase of 14% from the base year to 2004. The main drivers for emissions from this sector are total electricity production (which increased by about 30% from 1990 to 2004; while final electricity consumption increased by 34% over this period) and an increase in heat production, which doubled over this period due to an increase of the demand for district heating in the residential and commercial sector. Furthermore, the share of biomass used as fuel in this sector and the contribution of hydro plants to total electricity production, which is generally about 73% and varied from 65% to 78% in the observation period (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.

Emissions from *1 A 2 Manufacturing Industries and Construction* increased by 14% from 1990 to 2004, mainly due to an increase of natural gas and fuel waste consumption, whereas consumption of liquid fossil fuels decreased.

The increase of heating space, water heating demand, climatic circumstances and changes of fuel mix are the most important drivers for emissions from *1 A 4 Other Sectors*. Emissions in 2004 were 2% lower than in the base year, and 7% lower than in 2003, mainly due to changes in the fuel mix.

2.3.2 Industrial Processes (IPCC Category 2)

Greenhouse gas emissions from the industrial processes sector fluctuated during the period 1990-2004 and were at a minimum level in 1993. In 2004 they were 2% below the level of the base year. In 2004 greenhouse gas emissions from Category *2 Industrial Processes* amounted to 9 913 Gg CO_2 equivalents, which corresponds to 10.9% of total national emissions.

The main sources of greenhouse gas emissions in the industrial processes sector are *Metal Production* and *Mineral Products*, which caused 45% and 32%, respectively, of the emissions from this sector in 2004. The emission trend in this sector follows to a large extent production figures.

The most important GHG of the industry sector is carbon dioxide with 81.6% of emissions from this category, followed by HFCs with 8.7%, SF6 with 6%, N_2O with 2.8%, PFCs with 1% and finally CH_4 with 0.1%.

2.3.3 Solvent and Other Product Use (IPCC Category 3)

In the year 2004, 0.5% of total GHG emissions in Austria (422 Gg CO_2 equivalents) originated from *Solvent and Other Product Use*.

Greenhouse gas emissions in this sector decreased by almost 20% from 1990 to 1992 and then remained at the same level. In 2004 greenhouse gas emissions from *Solvent and Other product Use* were 18% below the level of the base year.

55% of these emissions were N_2O emissions, CO_2 emissions contributed 45%.

2.3.4 Agriculture (IPCC Category 4)

Greenhouse gas emissions from the agricultural sector fluctuated at the beginning of the 1990s, since 1995 they have shown a steady downward trend. In the year 2004 emissions from this category were 13.8% below the base year. This decrease was mainly due to decreasing livestock numbers. The fluctuations result from variations of mineral fertilizer sales used as activity data for calculating N_2O emissions from agricultural soils, which is an important sub-source.

Emissions from Agriculture amounted to 7 863 Gg CO_2 equivalents in 2004, which corresponds to 8.6% of total national emissions. In 2004 the most important sub-sector *Enteric Fermentation* contributed 42% of total greenhouse gas emissions from the agricultural sector, the second largest sub-source *Agricultural Soils* had a share of 36%.

Agriculture is the largest source for both N_2O and CH_4 emissions: in 2004 70% of total N_2O emissions and 56% (198.3 Gg) of total CH_4 emissions in Austria originated from this sector. N_2O emissions from *Agriculture* amounted to 11.9 Gg in 2004 (3 698 Gg CO_2 equivalents), which corresponds to 47% of the GHG emissions from this sector, methane contributed 53%.

2.3.5 LULUCF (IPCC Category 5)

Land use change and forestry is a net sink in Austria. CO_2 removals from that category amounted to 11 961 Gg CO_2 in the base year, which corresponds to 15% of national total GHG emissions (without LULUCF) compared to 18% in the year 2004. The trend in net removals from LULUCF is plus 39% over the observed period.

The main sink is sub-category *5 A Forest Land* with net removals of 16 641 Gg CO_2 in 2004. This category and category *5 B Cropland* are net sinks for CO_2. The categories 5 C Grassland, 5 D Wetlands, 5 E Settlements and 5 F Other Land are sources amounting together to 538 Gg CO_2 in 2004.

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 decreased as well as methane recovery. From 2002 to 2004 emissions increased slightly mainly due to increasing amounts of landfilled waste. In the year 2004 emissions from this category were 28.2% below the base year.

In 2004 the greenhouse gas emissions from the waste sector amounted to 2 552 Gg CO_2 equivalents, which corresponds to 2.8% of total national emissions

The main source of greenhouse gas emissions in the waste sector is *solid waste disposal on land*, which caused 86.9% of the emissions from this sector in 2004; the second largest source was *waste water handling* with 9.5%.

In 2004 the most important GHG of the *Waste* sector was CH_4 with 89.5% of emissions from this category, followed by N_2O with 10%, and CO_2 with 0.5%.

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. The following 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) 2006, Submission under the UNECE/CLRTAP Convention*, which will be published by the end of 2006.

Table 17 presents a summary of emission estimates for indirect greenhouse gases and SO_2 for the period from 1990 to 2004. 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 17. These reduction targets should be met by 2010 by parties to the UNECE/CLRTAP convention who signed this protocol.

Table 17: Emissions of indirect GHGs and SO_2 1990-2004

Gas	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	NEC
						[Gg]						
NO_X	211.6	192.6	212.5	199.6	212.1	199.0	203.9	213.2	219.7	230.0	226.9	107
CO	1 221.8	1 010.2	1 020.8	954.1	914.7	862.9	797.5	781.8	737.7	761.6	742.2	---
NM-VOC	284.4	220.7	215.5	202.8	189.9	178.8	179.1	182.0	176.1	175.4	172.2	159
SO_2	74.2	46.8	44.7	40.3	35.5	33.6	31.5	32.9	32.8	33.4	28.9	39

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

Emissions of NMVOCs and CO decreased over the period from 1990 to 2004 by 39%. SO_2 emissions showed a significant negative trend, emissions decreased by 61% compared to 1990 levels. NO_X emissions increased by 7% over this period.

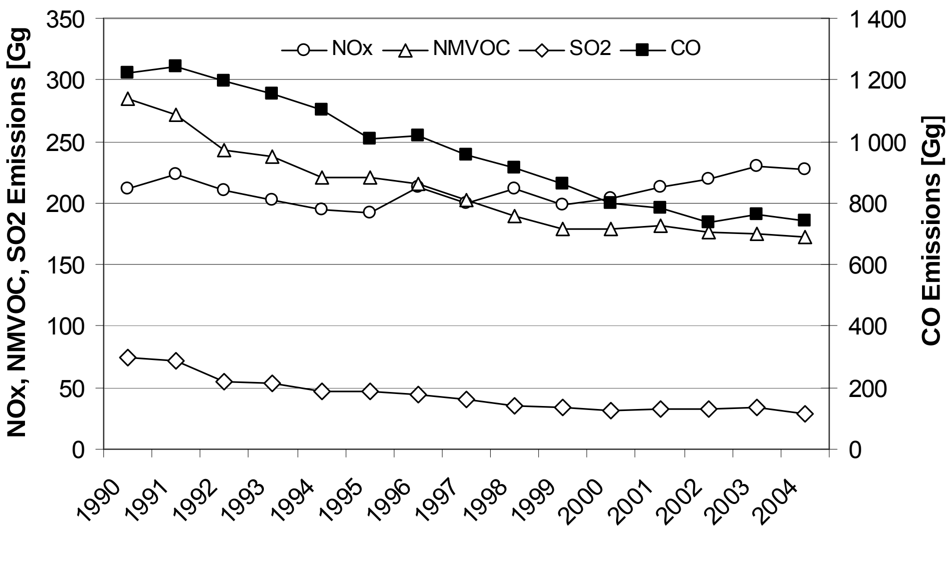

Figure 9: Emissions of indirect GHGs and SO_2 1990-2004

NO_X

NO_X emissions increased from 212 to 227 Gg during the period from 1990 to 2004. In 2004 the NO_X emissions were 7% above the level of 1990.

Over 97% of NO_X emissions in Austria originate from fossil fuel combustion, with the major part originating from mobile combustion.

CO

CO emissions decreased from 1 222 to 742 Gg during the period from 1990 to 2004. In 2004 CO emissions were 39% below the level of 1990.

In the year 2004, 96% of total CO emissions in Austria originated from fuel combustion activities, with the most important sub-source regarding CO emissions being the residential sector.

NMVOC

NMVOC emissions decreased from 284 to 172 g Gg during the period from 1990 to 2004. In 2004 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 47% and 41% respectively of national total emissions in 2004.

SO_2

SO_2 emissions decreased from 74 to 29 Gg during the period from 1990 to 2004. In 2004 SO_2 emissions were 61% below the level of 1990.

The decrease is mainly due to lower emissions from residential plants and manufacturing industries and construction. In the year 2004, 95% of total SO_2 emissions in Austria originated from fuel combustion activities.

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 2004 about 76.4% of national total GHGs emissions and 89.3% 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 house holding sector.

3.1.1 Emission Trends

Figure 10 presents the trend for emission from IPCC Sector *1 Energy* in Gg CO_2 equivalent. The trend shows an increase by 26.8% from 55.65 Tg CO_2 equivalents in 1990 to 70.58 Tg CO_2 equivalents in 2004, which is mainly caused by increasing emissions from the transport sector.

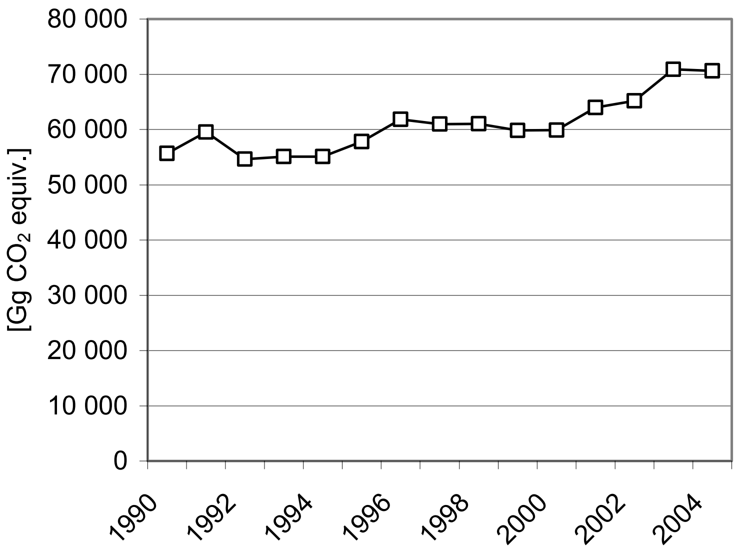

Figure 10: Trend of GHG emissions from 1990-2004 for Sector 1 Energy.

Table 18 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 1998 onwards has been due to increasing fugitive emissions from natural gas distribution networks.

Table 18: Emissions of greenhouse gases and their trend from 1990-2004 from category 1 Energy

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1990	54 044	40.28	2.47
1991	57 801	42.46	2.71
1992	52 907	41.23	2.72
1993	53 363	41.58	2.80
1994	53 400	40.39	2.82
1995	56 080	41.94	2.80
1996	60 064	44.07	2.81
1997	59 282	40.49	2.76
1998	59 337	40.44	2.80
1999	58 110	41.36	2.72
2000	58 226	41.07	2.59
2001	62 279	42.28	2.69
2002	63 477	41.96	2.68
2003	69 155	43.17	2.73
2004	68 816	45.23	2.63
Trend 1990-2004	27.3%	12.3%	6.8%

Emission trends by sectors

Table 19 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 19: Total GHG emissions in [Gg CO_2 equivalent] from 1990–2004 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	55 655	55 168	13 712	13 622	12 725	15 072	36	487	11	476
1991	59 532	59 022	14 513	13 899	14 376	16 196	38	510	9	500
1992	54 618	54 081	11 363	12 759	14 337	15 588	35	537	8	529
1993	55 103	54 556	11 403	13 134	14 529	15 450	40	547	8	540
1994	55 123	54 546	11 662	14 146	14 490	14 204	43	577	6	571
1995	57 828	57 229	12 692	14 327	14 858	15 318	33	599	6	593
1996	61 861	61 291	13 790	14 385	16 413	16 663	40	570	5	565
1997	60 989	60 351	13 886	16 196	15 321	14 911	38	638	5	633
1998	61 054	60 384	12 910	15 136	17 532	14 762	43	670	5	665
1999	59 821	59 101	12 534	14 164	16 924	15 437	43	720	5	715
2000	59 890	59 160	12 459	14 708	18 050	13 897	46	730	6	724
2001	63 999	63 243	13 725	14 271	19 353	15 769	125	756	5	751
2002	65 188	64 424	13 505	14 931	21 314	14 632	42	764	6	757
2003	70 908	70 066	16 243	14 737	23 178	15 817	91	842	5	836
2004	70 582	69 719	15 615	15 491	23 766	14 738	109	863	1	862
Trend 1990-2004	26.8%	26.4%	13.9%	13.7%	86.8%	-2.2%	203.3%	77.3%	-90.4%	81.2%

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 2004 the most important source of GHGs was the transport sector (sub-category *1 A 3 Transport*), with a share of 26% in national total GHG emissions. 14.1% of national GHG emissions were released by passenger cars, 1.9% by light duty vehicles, 8.7% 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 0.2% of national GHG arise from domestic air transport.

The second largest GHG source of the energy sector in 2004 was category *1 A 1 Energy Industries*, where fossil fuels are combusted to produce electrical power or district heating. In the year 2004 overall gross public electricity production was 56 458[18] GWh of which 37 700 GWh (66.8%) were generated by hydro plants, 17 821 GWh (31.6%) by thermal power plants and 937 GWh (1.7%) by solar, geothermal and wind power plants. Industrial auto producers generated 7 667 GWh of electricity in the year 2004. There are no operating nuclear plants in Austria. Thus, the seasonal water situation in Austria has an important 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*).

Combustion in Industry (sub-category *1 A 2 Manufacturing Industries and Construction*) was the third largest sub-category with a share of 17% in 2004 total GHG emissions. This sector also includes mobile off-road machinery mainly used in the construction sector.

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 16.1% in 2004 total GHG emissions. Emissions of this category are very dependent on the climatic circumstances and on the economic trend (for example a "cold winter" combined with an economic uptrend may influence emissions from this sector significantly). The main share of biomass in Austria is used in the small combustion sector. This sector also includes emissions from off-road mobile machinery mainly used in agriculture and forestry.

[18] Source: IEA Questionnaire dec/2005 by STATISTICS AUSTRIA.

3.2.1.1 Key Sources

The methodology and results of the key source analysis is presented in Chapter 1.5. Table 20 presents the key source categories of category *1 A Fuel Combustion Activities*.

Table 20: Key sources of Category 1 Energy

IPCC Category	Source Categories	Key Sources	
		GHG	KS-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 1997-1999,2002-2004
1 A 1 a other	Public Electricity and Heat Production	CO_2	LA 2001-2004; 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; TA 1997,1998,2003
1 A 2 mob-liquid	Manufacturing Industries and Constr.	CO_2	LA
1 A 2 other	Manufacturing Industries and Constr.	CO_2	LA; TA 1997,1999-2004
1 A 2 solid	Manufacturing Industries and Constr.	CO_2	LA; TA
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 3 b gasoline	Road Transportation	N_2O	LA 1991-1995
1 A 4 biomass	Other Sectors	CH_4	LA 1990-1996; TA 2003
1 A 4 mob-diesel	Other Sectors	CO_2	LA; TA 2003
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 1997, 1999; TA 2000-2003

LA = Level Assessment 1990-2004

TA = Trend Assessment 1997-2004

3.2.1.2 Completeness

Table 21 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 21: 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)** **030301 Sinter and palletising plants** **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
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		✓	✓	✓

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
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** **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		✓	✓	✓
1 A 3 a Civil Aviation	**080501 Domestic airport traffic (LTO cycles - <1000 m)** **080503 Domestic cruise traffic (>1000 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

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
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** **0810 Other Mobile Sources and Machinery-Other off-road**			
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
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**			

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
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 - <1000 m)** **080504 International cruise traffic (>1000 m)**			
Jet Kerosene		✓	✓	✓
Gasoline		NO	NO	NO
Multilateral Operations		**IE**(2)	**IE**(2)	**IE**(2)

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

(2) Energy consumption and emissions from Multilateral Operations are included in 1 A 4 a Commercial / Institutional.

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 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.

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), (BMWA-EB 1996), (BMWA-EB 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 compared to the value of 55.0 in the previous submission (see chapter 9 Recalculations and Improvements.

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[19] 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 2005). 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) 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 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:

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 1641.8 t CO_2/t Waste. By selecting

[19] 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 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).

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, 2005) 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 Source: Yes (CO_2: gaseous/ liquid/ solid/ other)

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 18.5% for the year 2004. The increase of CH_4 emissions was caused by the increase of natural gas combustion in plants smaller 50 MW_{th} (see tables in Annex 2).

Methodology

The CORINAIR simple methodology is applied.

Emission factors

National emission factors for CO_2 and CH_4 are taken from (BMWA-EB, 1990), (BMWA-EB, 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 2004 are listed in the following table. The CO_2 emission factor for municipal solid waste is taken from (ABFALLWIRTSCHAFT, 2003).

Table 22: Emission factors of Category 1 A 1 a for 2004.

Fuel	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	(1)100.00	21.00	3.00
Wood Waste	(1)110.00	2.00	4.00
Sewage Sludge	(1)110.00	12.00	1.40
Biogas, Sewage Sludge Gas, Landfill Gas	(1)112.00	1.50	1.00
Municipal Solid $Waste_{wet}$	(2)48.88	12.00	1.40
Industrial Waste	(2)104.17	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 2005) prepared by STATISTIK AUSTRIA (see Annex 4).

In a first step large point sources are considered. The *Umweltbundesamt* operates a database to store plant 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 42 plants are considered in this approach.

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

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 23 shows the gross electricity and heat production of public power and district heating plants.

Table 23: Public gross electricity and heat production.

	Gross electricity production [GWh]						Heat Production [TJ] by Combustible Fuels
	Total	Hydro	Combustib le Fuels	Geotherm al	Solar	Wind	
1990	43 404	30 111	13 293	0	0	0	24 427
1991	43 497	30 268	13 229	0	0	0	29 038
1992	42 838	33 530	9 308	0	0	0	27 601
1993	45 063	35 334	9 728	0	1	0	30 429
1994	44 981	34 243	10 737	0	1	0	30 730
1995	47 944	35 794	12 148	0	1	1	34 426
1996	46 011	32 950	13 055	0	1	5	44 484
1997	47 695	34 701	12 972	0	2	20	40 597
1998	48 250	36 058	12 145	0	2	45	43 414
1999	51 610	39 593	11 964	0	2	51	45 479
2000	53 157	41 410	11 677	0	3	67	43 023
2001	53 655	39 681	13 798	0	4	172	49 233
2002	54 854	40 581	14 060	3	7	203	47 147
2003	52 904	34 230	18 294	3	11	366	52 115
2004	56 458	37 700	17 821	2	11	924	51 808

Source: STATISTIK AUSTRIA.

Recalculations

The CO_2 emission factor for industrial waste has been revised from 10 t/TJ to 104.17 t/TJ. Due to last years' revisions of the energy balance the definition of "industrial waste" has become more accurate regarding the fact that pure biomass fuels such as sludges, black liquor, waste paper and animal/vegetable waste are reported as biomass wheras in earlier versions of the energy balance a high share in biomass fuels was reported as industrial waste. Thus carbon included in industrial waste is now mainly fossil. Assumptions of emission factor derivation are given in chapter 3.2.2.

Double counting of hazardous waste (formerly included in NAPFUE 114C) NAPFUE 114C) with industrial waste (NAPFUE 115A) has been eliminated.

Due to additional information of STAT.AT double counting of sewage sludge (NAPFUE 118A) and carcass meal (formerly included in NAPFUE 114C) with other biomass (NAPFUE 116B) has been eliminated. Gap filling of hazardous waste activity data 1999 by means of reported 2000 data. Gap filling of non-GHG 1990 to 1991 for single plants >= 50 MW_{th}.

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

3.2.2.2 1 A 1 b Petroleum Refining

Key Source: Yes (CO_2: gaseous/ liquid)

Category *1 A 1 b Petroleum Refining* enfolds CO_2 and N_2O emissions from fuel combustion 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*.

The share in total GHG emissions from sector *1 A* is 4.5% for the year 1990 and 3.6% for the year 2004. Crude oil input which was 8 Mio t in 1990 and 8.4 Mio t in 2004.

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 24: 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

CO_2 emissions are calculated by multiplying activity data from the energy balance by the emission factors in Table 24.

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 26, 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 25.

Table 25: Implied emission factors for refinery gas.

	t CO_2/ TJ
1990	51.7
1991	50.9
1992	51.0
1993	49.2
1994	50.4
1995	52.3
1996	51.8

	t CO_2/ TJ
1997	51.0
1998	51.2
1999	55.4
2000	50.9
2001	50.8
2002	48.6
2003	47.3
2004	49.5

N_2O emissions are calculated by multiplying fuel consumption by the emission factors presented in Table 26 (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 26: Emission factors of Category 1 A 1 b for 2004.

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

Revision of other oil products according to the revised energy balance for the whole timeseries (1990: + 1%).

Fuel consumption is taken from (IEA JQ 2005) as presented in Annex 4 except for the years 1999 to 2004, 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 2005).

Recalculations

Update of activity data for the years 1999 to 2001 according to reported activity data from (DKDB 2005) for improved consistency with reported CO_2 emissions. The methodology is now consistent over the whole time series.

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

Key Source: Yes (CO_2: gaseous)

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 and for 1990 to 1995 transformation losses/own use in gas works. The share in sector *1 A* overall GHG emissions is 0.6% for the year 1990 and 0.2% for the year 2004.

Methodology

The CORINAIR simple methodology is applied.

Emission factors

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

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

The emission factors are presented in Table 27.

Table 27: 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 2005) 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 2005) 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 2005).

Recalculations

Revision of natural gas consumption for single years from 1991 onwards according to the revised energy balance as described in Annex 2.

Changes in allocation of emissions

- Transformation losses of gas works from 1990 (+ 4 Gg CO_2) to 1995 are additionally estimated in this category.

3.2.2.4 1 A 2 a Iron and Steel

Key Source: Yes (CO_2: 1 A 2 gaseous/ solid/ liquid-stationary)

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 8.4% for the year 2004.

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 2005). The complex carbon fluxes in iron and steel plants can not be well modelled within the energy balance. Thus the resulting implied CO_2 emission factors for solid fuels in CRF-table 1.A(a) for category *1 A 2 a* vary quite strongly over time.

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 2004 this ratio is 90/374; the plant reported 90 t NMVOC and by applying the ratio obtained from the CORINAIR simple methodology, total CH_4 emissions were estimated to be 27 t. In a last step CH_4 emissions were allocated to the different fuel types.

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

Since 2003 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: 284 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 28: 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	185	0.005	0.001	4 753	0.020	0.044
1991	244	0.006	0.001	4 366	0.016	0.043
1992	197	0.005	0.001	3 731	0.014	0.037
1993	218	0.006	0.002	3 969	0.016	0.037
1994	231	0.006	0.002	4 207	0.020	0.040
1995	287	0.007	0.002	4 483	0.018	0.045
1996	442	0.012	0.003	4 221	0.019	0.041

	area sources			point sources		
	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1997	468	0.012	0.002	4 822	0.022	0.046
1998	427	0.011	0.002	4 499	0.021	0.051
1999	332	0.009	0.001	4 521	0.021	0.050
2000	409	0.011	0.002	4 903	0.027	0.057
2001	278	0.007	0.001	4 889	0.027	0.056
2002	380	0.010	0.001	5 118	0.027	0.057
2003	366	0.010	0.001	5 146	0.027	0.059
2004	376	0.010	0.001	5 482	0.027	0.062

Emission factors

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

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

The selected and calculated emission factors for 2004 are presented in Table 29 and Table 30.

Table 29: Emission factors of Category 1 A 2 a for 2004, 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	(1)110.00	2.00	4.00

(1) Reported as CO_2 emissions from biomass.

Table 30: Emission factors of Category 1 A 2 a for 2004, point sources

Fuel	CO_2 [t / TJ]	CH_4 [kg / TJ]	N_2O [kg / TJ]
Heavy Fuel Oil	78.00	0.48	1.00
Coke	104.00	0.48	1.40
Coke Oven Gas	94.60	0.00	0.00
Natural Gas	55.40	0.36	0.10

Activity data

Total fuel consumption is taken from (IEA JQ 2005) as presented in Annex 4.

Point source activity data are reported by plant operators which are widely consistent with (IEA JQ 2005).

Recalculations

Update of activity data according to the revised energy balance as described in Annex 2.

Point Sources 2003: Activity data reported by plant operators are used. CO_2 emissions from coke oven transformation losses are now estimated by means of a default emission factor instead of using an implied emission factor derived from historical data.

Changes in allocation of emissions

While 1990 to 2002 total emissions from integrated iron and steel plants were not recalculated a revised estimate of process CO_2 emissions from blast furnaces which are reported in category *2 C 1 Iron and Steel Production* leads to the following shifts from or to category *1 A 2 a* :

Table 31: Shift of CO_2 emissions from category 2 C 1 to category 1 A 2 a.

	CO_2 [Gg]
1993	22.3
1994	34.2
1995	34.1
1996	27.9
1997	36.5
1998	33.1
1999	29.0
2000	36.0
2001	34.2
2002	-11.2
2003	10.0

3.2.2.5 1 A 2 b Non-Ferrous Metals

Key Source: Yes (CO_2: 1 A 2 gaseous/ solid/ liquid-stationary)

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 2004.

Methodology

CORINAIR simple methodology is applied. Fuel consumption is taken from (IEA JQ 2005) as described in Annex 4.

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

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

The emission factors for 2004 are presented in Table 32.

Table 32: Emission factors of Category 1 A 2 b for 2004.

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 2005] as presented in Annex 4.

Recalculations

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

3.2.2.6 1 A 2 c Chemicals

Key Source: Yes (CO_2: 1 A 2 gaseous/ solid/ liquid-stationary)

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 1.3% for the year 1990 and 1.8% for the year 2004.

Methodology

CORINAIR simple methodology is applied.

Emission factors

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

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

Emission factors for 2004 are presented in Table 33.

Table 33: Emission factors of Category 1 A 2 c for 2004.

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	(1)100.00	2.00	4.00
Wood Waste	(1)110.00	2.00	4.00
Black Liquor	(1)110.00	2.00	1.40
Biogas	(1)112.00	1.50	1.00
Industrial Waste	(2) 104.17	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 2005) as presented in Annex 4.

Recalculations

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

3.2.2.7 1 A 2 d Pulp, Paper and Print

Key Source: Yes (CO_2: 1 A 2 gaseous/ solid/ liquid-stationary)

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 4.1% for the year 1990 and 2.7% for the year 2004.

Methodology

The CORINAIR simple methodology is applied.

Emission factors

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

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

Emission factors for 2004 are presented in Table 34.

Table 34: Emission factors of Category 1 A 2 d for 2004.

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	(1)100.00	2.00	4.00
Wood Waste(2)	(1)110.00	2.00	4.00
Black Liquor	(1)110.00	2.00	1.40
Biogas	(1)112.00	1.50	1.00
Landfill Gas	(1)112.00	1.50	1.00
Industrial Waste	(3)104.17	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 2005) as presented in Annex 4.

Recalculations

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

3.2.2.8 1 A 2 e Food Processing, Beverages and Tobacco

Key Source: Yes (CO_2: 1 A 2 gaseous/ solid/ liquid-stationary)

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 1.5% for the year 1990 and 1.7% for the year 2004.

Methodology

CORINAIR simple methodology is applied.

Emission factors

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

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

Emission factors for 2004 are presented in Table 35.

Table 35: Emission factors of Category 1 A 2 e for 2004.

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	(1)100.00	2.00	4.00
Wood Waste	(1)110.00	2.00	4.00
Biogas	(1)112.00	1.50	1.00
Industrial Waste	(2)104.17	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 2005) as presented in Annex 4.

Recalculations

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

3.2.2.9 1 A 2 f Manufacturing Industries and Construction – Other

Key Source: Yes (CO_2: 1 A 2 gaseous/ solid/ liquid-stationary)

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 8.1% for the year 1990 and 6.8% for the year 2004. N_2O emissions mainly arise from mobile machinery.

1 A 2 f Manufacturing Industries and Construction - Other - stationary sources

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% for the year 1990 and 5% for the year 2004.

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 capacity of the 10 Austrian plants is about 4 mio t cement clinker / year. 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) 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 2003.

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) 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

For the year 2004 CO_2 emissions from coal, fuel oil and natural gas are calculated by multiplying activity data by 2003 emission factors. Activity data 2004 is taken from (IEA JQ 2005) according to the historical share of cement industry on total *Non-metallic Mineral Products* final energy consumption of (IEA JQ 2005): 100% of coal, petrol coke and industrial waste. 150% of 2003 fuel oil consumption. Natural gas consumption was selected to reach an accurate total fuel consumption in relation to cement clinker production 2003 (about 3.5 TJ / kt clinker).

CH_4 and N_2O emissions

Are calculated with the simple CORINAIR methodology.

Activity data

Hard Coal, Brown Coal, Petrol Coke and Industrial Waste

In (IEA JQ 2005) 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, petrol coke and industrial waste for fuel combustion, 100% of those fuels are allocated to the cement industry. It has to be noted that for industrial waste (IEA JQ 2005) uses about 25% lower calorific values than (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003) and (MAUSCHITZ 2004). By keeping activity data consistent with (IEA JQ 2005) this leads to a rather high implied emission factor for CO_2.

Natural Gas

For the period 1990 to 2003 natural gas consumption is taken from (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003) and (MAUSCHITZ 2004) and converted into the unit TJ by applying the calorific values reported in (IEA JQ 2005).

Fuel Oil

For the period 1990 to 2003 fuel oil consumption is taken from (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003) and (MAUSCHITZ 2004) and converted into the unit TJ by applying the calorific values reported in (IEA JQ 2005).

Emission factors

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

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

Recalculations

CO_2 emissions 2003: Emission factors and activity data are now taken from (MAUSCHITZ 2004) whereas in the previous submission CO_2 emissions were estimated by means of a similar methodology as described above under "CO_2 emissions 2004".

From 1990 on the energy balance is updated according to coal consumption reported in (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003) and (MAUSCHITZ 2004).

In the previous submission non fossil CO_2 emissions where accounted as fossil CO_2. The share in non fossil CO_2 is taken from (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003) and (MAUSCHITZ 2004).

Table 36: Recalculations of cement industry CO_2 emissions.

	CO_2 [Gg]		
	CO_2 from Biomass	Previous Submision	Actual Submission
1990	0.00	1 054.66	1 054.66
1991	0.00	1 037.78	1 037.78
1992	0.00	1 107.18	1 107.18
1993	0.00	1 038.29	1 038.29
1994	0.00	1 088.89	1 088.89
1995	0.00	867.07	867.07
1996	13.40	861.30	847.90
1997	25.68	957.82	932.14
1998	35.49	888.38	852.89
1999	44.58	870.93	826.35
2000	72.05	938.22	866.17
2001	147.04	953.66	806.62
2002	146.69	976.43	829.74
2003	167.97	877.74	820.99
2004	-	-	774.17

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.

Activity data

Fuel consumption is taken from (IEA JQ 2005) as presented in Annex 4, fuel consumption of cement industry is subtracted as it is considered separately (see above).

Since the enrgy balance (IEA JQ 2005) 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 2005).

Emission factors

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

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

The emission factors for 2004 are presented in Table 37.

Table 37: Emission factors of Category 1 A 2 f stationary sources for 2004.

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	(1)100.00	2.00	4.00
Wood Waste	(1)110.00	2.00	4.00
Black Liquor	(1)110.00	2.00	1.40
Biogas	(1)112.00	1.50	1.00
Sewage Sludge Gas	(1)112.00	1.50	1.00
Landfill Gas	(1)112.00	1.50	1.00
Industrial Waste-unspecified	(2)10.00	12.00	1.40
Industrial Waste-Cement industry	(3)64.70	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 81

Recalculations

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

For 1990 to 1995 emissions from final energy use of gas works gas are additionally estimated.

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% for the year 1990 and 1.8% for the year 2004. All GHGs emissions originate from liquid fossil fuel combustion.

Table 38: 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	1 018.41	0.07	0.35	1 129.85
1991	1 059.26	0.08	0.37	1 175.16
1992	1 070.59	0.08	0.37	1 187.70
1993	1 036.25	0.08	0.36	1 149.60
1994	1 063.40	0.08	0.38	1 183.38
1995	1 038.50	0.07	0.37	1 155.69
1996	1 010.09	0.07	0.37	1 125.12
1997	1 026.11	0.07	0.38	1 145.82
1998	1 041.21	0.07	0.39	1 164.50
1999	1 047.88	0.06	0.37	1 164.13
2000	1 061.52	0.06	0.36	1 174.87
2001	1 076.51	0.06	0.35	1 187.51
2002	1 081.83	0.06	0.35	1 190.31
2003	1 086.86	0.05	0.31	1 184.82
2004	1 144.37	0.05	0.29	1 234.68
Trend 1990 - 2004	12%	-33%	-19%	9%

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 39 to Table 42. 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 39: Emission Factors for diesel engines > 80 kW

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

Table 40: Emission Factors for diesel engines < 80 kW

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

Table 41: Emission Factors for 4-stroke-petrol engines

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

Table 42: Emission Factors for 2-stroke-petrol engines

Year	CO_2 [t/TJ]	CH_4 [kg/TJ]	N_2O

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 43: Implied emission factors and activities for industrial off-road traffic 1990–2004

	Activity	Implied Emission Factors		
	TJ	CO_2 T/TJ	CH_4 kg/TJ	N_2O kg/TJ
1990	13 724	74.20	5.44	25.82
1991	14 277	74.19	5.46	25.82
1992	14 429	74.20	5.48	25.81
1993	13 971	74.17	5.50	25.80
1994	14 339	74.16	5.30	26.63
1995	14 033	74.00	5.27	26.58
1996	13 650	74.00	5.21	26.83
1997	13 880	73.93	5.05	27.48
1998	14 086	73.92	4.94	27.90
1999	14 210	73.74	4.44	26.09
2000	14 396	73.74	4.18	25.11
2001	14 600	73.73	3.95	24.26
2002	14 673	73.73	3.77	23.59
2003	14 742	73.73	3.53	21.20
2004	15 704	72.87	3.20	18.34

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 2004. 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 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 44: CO_2 and N_2O emissions from 1 A 3 a Civil Aviation by subcategories 1990-2004

Year	CO_2			N_2O		Activity		
	dom. LTO Kerosene [Gg]	dom. LTO Gasoline [Gg]	dom. cruise Kerosene [Gg]	dom. LTO Kerosene [Gg]	dom. cruise Kerosene [Gg]	dom. LTO Kerosene [TJ]	dom. LTO Gasoline [TJ]	dom. cruise 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	61.0	6.4	152.3	0.0035	0.0048	838	79	2 094
2002	19.7	6.4	49.1	0.0013	0.0016	270	102	676
2003	44.0	6.4	110.0	0.0031	0.0035	605	110	1 513
2004	52.8	6.4	131.9	0.0035	0.0042	725	102	1 812

Methodological Issues

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[20] (flight distance and destination per aircraft type), aircraft/ engine performance data and emission factors.

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

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

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 (assuming equal fuel consumption for domestic and international LTO).

The study only delivers values until 2000. the splitting of the energy data of 2001 to 2004 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 2004 has done according to the shares for 2000 of the study.

Table 45: Number of national LTO cycles and fuel consumptions as obtained from the MEET model 1990-2004

	Activity			national
	nat. LTO Kerosene [Mg]	VFR Gasoline [Mg]	nat. cruise Kerosene [Mg]	LTO [-]
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	19 352	1 868	48 353	13 045
2002	6 243	2 389	15 600	13 084
2003	13 982	2 596	34 936	13 652
2004	16 753	2 405	41 861	17 212
Trend 1990 - 2004	429%	-3%	829%	177%

CO_2

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), was taken from the study (KALIVODA et al. 2002).

N_2O

CORINAIR simple methodology was used.

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.

The applied emission factors for national/international cruse 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).

CH_4

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.

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

The splitting of the energy data into national and international aviation of 2003 has been updated according to the energy balance.

Planned improvements

The discrepancy between the development of fuel consumption and number of flights (both national) will be proofed.

3.2.2.11 1 A 3 b Road Transport

Key Source: Yes (CO_2: diesel/ gasoline; N_2O: gasoline)

Emissions from road transportation are covered in this category.

Table 46: Greenhouse gas emissions from Category 1 A3 b Road Transport

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	Gg CO_2 equivalent
1990	11 924	2.88	0.82	12 237
1991	13 509	2.84	1.00	13 880
1992	13 454	2.58	1.08	13 842
1993	13 636	2.37	1.14	14 039
1994	13 588	2.16	1.14	13 988
1995	13 965	1.97	1.11	14 349
1996	15 544	1.78	1.05	15 908
1997	14 466	1.59	0.97	14 800
1998	16 537	1.52	1.03	16 886
1999	15 843	1.36	0.92	16 157
2000	16 877	1.24	0.89	17 180
2001	18 112	1.15	0.89	18 412
2002	20 148	1.10	0.94	20 462
2003	21 884	1.04	0.94	22 198
2004	22 393	0.95	0.89	22 688
Trend 1990 - 2004	88%	-67%	9%	85%

Table 47: GHG emissions from Road Transport, differentiated by means of transportation

	Passenger cars petrol [Gg CO_2e]	Passenger cars diesel [Gg CO_2e]	light duty vehicles [Gg CO_2e]	heavy duty vehicles [Gg CO_2e]	moped [Gg CO_2e]	motorcycle [Gg CO_2e]
1990	7 560.31	1 465.72	1 304.90	1 851.60	30.73	23.97
1991	8 411.42	1 683.72	1 347.91	2 382.42	28.69	25.57
1992	8 077.13	1 797.58	1 389.69	2 522.34	27.20	28.46
1993	7 782.36	1 941.10	1 411.68	2 846.70	25.79	31.44
1994	7 514.11	2 194.13	1 466.63	2 753.17	24.67	35.14
1995	7 263.47	2 419.24	1 487.88	3 115.18	23.73	39.87
1996	6 701.08	2 664.59	1 505.78	4 969.40	22.91	44.23
1997	6 342.90	2 925.38	1 541.42	3 919.23	22.20	48.60
1998	6 670.25	3 380.17	1 585.76	5 174.35	21.67	54.30
1999	6 175.51	3 585.13	1 637.11	4 678.34	21.06	60.15
2000	5 966.45	3 934.67	1 685.62	5 509.49	20.33	63.90
2001	6 025.55	4 424.98	1 697.98	6 176.62	19.65	67.39
2002	6 524.49	5 246.30	1 694.44	6 906.58	19.01	71.09
2003	6 686.05	5 932.03	1 713.01	7 773.98	18.52	74.29
2004	6 498.72	6 413.34	1 738.41	7 943.18	17.96	76.81
Trend 1990 - 2004	-14%	338%	33%	329%	-42%	220%

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 tripled.

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).

For road transportation, energy consumption and emissions of the different categories are calculated by multiplying the yearly road performance (km/vehicle and year) and the specific energy use by emission factors. The emissions from cold starts are calculated separately – taking into account temperature, interception periods and driving distances.

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 48: Implied emission factors of passenger cars 1990 - 2004

	Activity	Implied Emission Factors CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	115 884	75.49	18.81	6.45
1991	129 329	75.48	16.84	7.16
1992	126 228	75.45	15.52	7.90
1993	126 227	74.15	14.12	8.33
1994	126 043	74.15	12.78	8.41
1995	126 008	74.10	11.45	8.07
1996	122 172	74.09	10.33	7.60
1997	121 180	74.08	9.27	7.14
1998	131 632	74.07	8.08	6.82
1999	128 284	73.99	7.26	6.26
2000	130 414	73.98	6.34	5.83
2001	137 965	73.95	5.47	5.43
2002	155 629	73.96	4.60	5.08
2003	167 153	73.95	3.96	4.69
2004	172 436	73.49	3.44	4.25

The catalytic converter of former generation (EURO 1) had an 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 49: Implied emission factors of light duty vehicles 1990 – 2004

	Activity	Implied Emission Factors CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	17 306	74.73	7.85	1.64
1991	17 897	74.67	6.98	1.61
1992	18 473	74.61	6.12	1.59
1993	18 908	74.07	5.36	1.55
1994	19 651	74.06	4.70	1.53
1995	19 975	73.93	4.10	1.52
1996	20 221	73.92	3.60	1.51
1997	20 705	73.92	3.11	1.51
1998	21 305	73.91	2.68	1.51
1999	22 042	73.76	2.30	1.50
2000	22 700	73.75	1.99	1.50
2001	22 877	73.74	1.73	1.46
2002	22 835	73.73	1.51	1.41

	Activity	Implied Emission Factors CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
2003	23 093	73.73	1.30	1.36
2004	23 694	72.94	1.11	1.30

Table 50: Implied emission factors of heavy duty vehicles 1990 – 2004

	Activity	Implied Emission Factors CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	24 827	74.05	2.49	1.55
1991	31 951	74.04	2.21	1.54
1992	33 832	74.04	2.09	1.52
1993	38 197	74.02	1.96	1.51
1994	36 950	74.02	1.92	1.46
1995	41 915	73.84	1.82	1.42
1996	66 872	73.84	1.58	1.41
1997	52 746	73.84	1.52	1.38
1998	69 647	73.84	1.36	1.37
1999	63 123	73.67	1.29	1.35
2000	74 342	73.67	1.19	1.34
2001	83 361	73.67	1.13	1.29
2002	93 234	73.67	1.08	1.25
2003	104 965	73.67	1.03	1.20
2004	108 530	72.81	1.00	1.15

Table 51: Implied emission factors of Mopeds 1990 – 2004

	Activity	Implied Emission Factors CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	271	75.75	1 791	0.37
1991	253	75.87	1 774	0.39
1992	243	75.78	1 717	0.41
1993	237	74.29	1 635	0.42
1994	230	74.15	1 571	0.43
1995	224	74.29	1 510	0.45
1996	219	74.21	1 444	0.46
1997	215	74.29	1 381	0.47
1998	213	74.18	1 308	0.47
1999	210	74.12	1 249	0.48
2000	204	74.23	1 204	0.49
2001	199	74.09	1 157	0.50

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
2002	194	74.34	1 115	0.51
2003	192	74.22	1 062	0.52
2004	188	74.13	1 015	0.53

Table 52: Implied emission factors of Motorcycles 1990 – 2004

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	310	75.83	67.2	0.001
1991	330	75.83	66.3	0.001
1992	368	75.82	62.5	0.001
1993	416	74.21	57.7	0.001
1994	465	74.16	54.4	0.001
1995	528	74.17	50.7	0.001
1996	587	74.19	47.9	0.001
1997	645	74.18	45.8	0.001
1998	721	74.20	43.3	0.001
1999	799	74.18	41.3	0.001
2000	849	74.19	40.0	0.001
2001	896	74.15	38.3	0.001
2002	945	74.19	36.7	0.001
2003	988	74.22	35.3	0.001
2004	1 022	74.18	34.1	0.001

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.

This year the first time biodiesel was considered. For the year 2004 a consumption of 70.000 t Biodiesel is assumed (HAUSBERGER 2005).

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 (0.5%), and also the uncertainty of CO_2 emission factors is estimated to be 0.5%.
- N_2O emissions are calculated not only on the basis of the amount of total fuel sold but also on vehicle km per vehicle type, that's why the uncertainty of activity data for N_2O emissions is estimated to be higher than for CO_2 (10%).
- 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 50%.

Recalculation

Recalculation were necessary because the activity data of the statistic Austria changed concerning the light duty vehicle stock. Up to the year 2003, the light duty vehicles stock contained vehicles with less than 3.500 kg, excluding vehicles with 3.500 kg. Up to the year 2004 vehicles with 3.500 kg are allocated to the light duty vehicle stock.

For the years 1990 – 2003 the emissions of vehicles with 3.500 kg were relocated from heavy to light duty vehicles.

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

	CO_2 Gg	CH_4 Gg	N_2O Gg
1990	168	0.01	0.02
1991	175	0.01	0.02
1992	174	0.01	0.02
1993	170	0.01	0.02
1994	172	0.01	0.02
1995	160	0.01	0.02
1996	144	0.01	0.02
1997	145	0.01	0.02
1998	143	0.01	0.02
1999	177	0.01	0.02

	CO_2 Gg	CH_4 Gg	N_2O Gg
2000	177	0.01	0.02
2001	177	0.01	0.02
2002	174	0.01	0.02
2003	178	0.01	0.02
2004	170	0.01	0.02
Trend 1990 - 2004	1.5%	-24.7%	-11.8%

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 54: Emission factors and activity data for railway 1990–2004

		Implied Emission Factors		
	Activity	CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	2 330	72.0	3.1	9.3
1991	2 417	72.2	3.1	9.3
1992	2 411	72.2	3.0	9.2
1993	2 351	72.3	3.0	9.1
1994	2 372	72.3	2.9	8.9
1995	2 217	72.0	2.8	8.8
1996	2 004	71.8	2.8	8.6
1997	1 998	72.6	2.7	8.5
1998	1 968	72.8	2.6	8.4
1999	2 433	72.8	2.5	8.3
2000	2 428	72.9	2.4	8.1
2001	2 421	73.0	2.4	8.0
2002	2 389	73.0	2.3	7.9
2003	2 443	73.0	2.3	7.8
2004	2 359	72.1	2.3	8.1

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 55: 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

	CO_2 Gg	CH_4 Gg	N_2O Gg
1992	46	0.01	0.01
1993	47	0.01	0.01
1994	56	0.01	0.01
1995	54	0.01	0.01
1996	54	0.01	0.01
1997	62	0.01	0.01
1998	62	0.01	0.01
1999	63	0.01	0.01
2000	64	0.01	0.01
2001	73	0.01	0.02
2002	80	0.01	0.02
2003	84	0.01	0.02
2004	87	0.01	0.02
Trend 1990 - 2004	66%	-6%	47%

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 56: Emission factors and activity data for the sector Navigation 1990–2004

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	2 383	21.90	5.42	5.22
1991	2 476	19.13	5.16	4.50
1992	2 468	18.80	5.16	4.33
1993	2 416	19.34	5.26	4.40
1994	2 438	22.83	5.28	5.29
1995	2 282	23.68	5.58	5.38
1996	2 068	26.15	6.11	5.86
1997	2 087	29.64	6.09	6.69
1998	2 061	30.32	6.11	6.76
1999	2 527	24.96	4.93	5.49
2000	2 525	25.23	4.87	5.47
2001	2 517	28.92	4.90	6.28
2002	2 486	32.04	4.96	6.92
2003	2 539	33.20	4.84	7.10
2004	2 455	35.26	4.97	7.44

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 0.9% for the year 2004. 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 2005) 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 for 2004 are presented in Table 57.

Table 57: 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 2003 activity data are based on energy balance recalculation as described in Annex 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 21.1% for the year 2004.

1 A 4 Other sectors - stationary sources

Key Source: Yes (CO_2: gaseous/ liquid/ solid; CH_4: biomass)

Category *1 A 4 Other sectors stationary* enfolds emissions from stationary fuel combustion in the small combustion sector.

The share in total GHG emissions from sector *1 A* is 24.3% for the year 1990 and 18.6% for the year 2004.

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 2005) is combusted in devices similar to central heatings.

1 A 4 b Residential

For category *1 A 4 b Residential* the disaggregation of the fuel consumption to each of the heating types is performed by the means of building- and habitation-statistics which were surveyed for the years 1991 and 2000 by STATISTIK AUSTRIA.

Emission factors

CO_2, CH_4 and VOC emission factors are taken from studies (BMWA-EB 1990), (BMWA-EB 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 58. 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 58: 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 2004 are presented in Table 59.

Table 59: Emission factors of Category 1 A 4 conventional boilers for the year 2004.

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	-	0.10	-
Gas Works Gas	64.00	0.20	-	1.00	-
Natural Gas	55.40	0.80	0.80	1.00	1.00
Fuel Wood	(1)100.00	150.00	220.00	3.00	7.00
Wood Waste	(1)110.00	150.00	220.00	3.00	7.00
Landfill Gas	(1)112.00	1.50	-	1.00	-
Industrial Waste	(2)104.17	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.

Table 60: Emission factors of Category 1 A 4 new biomass boilers for the year 2004.

Fuel	CO_2 [t / TJ]	CH_4 [kg / TJ]		N_2O [kg / TJ]	
		CH / AH	Stove	CH and AH	Stove
Fuel Wood	(1)100.00	108.2 / 112.7	115.60	3.00	7.00
Wood Chips	(1)110.00	27.06	-	2.00	-
Pellets	(1)110.00	12.14	-	2.00	-

(1) Reported as CO_2 emissions from biomass.

Activity data

Fuel consumption is taken from (IEA JQ 2005) as presented in Annex 4.

Since (IEA JQ 2005) 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 2005).

Table 61 shows the selected share of each heating type for category *1 A 4 b.*

Table 61: Share of 1 A 4 b heating type on fuel category for the year 2004.

	Central Heating	Appartement Heating	Stove
Hard Coal	59.7%	8.7%	31.6%
Brown Coal	47.2%	18.7%	34.1%
Brown Coal Briquettes	26.2%	10.1%	63.7%
Coke	75.6%	7.5%	16.9%
Gas oil	84.2%	5.4%	10.4%
Residual Fuel Oil, Gas Works Gas, LPG, Petroleum	100%	-	-
Natural Gas	47.1%	47.7%	5.1%
Fuel Wood	67.7%	8.0%	24.3%
Wood Chips, Pellets, other solid biomass	89.4%	3.3%	7.3%

Recalculations

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

For 1990 to 1995 emissions from final energy use of gas works gas are additionally estimated.

New pellets, wood chips and wood gasifiers stoves and boilers are considered from 2001 on. This new biomass heatings have lower VOC emissions and thus lower CH_4 emissions than conventional boiler types.

<u>1 A 4 Other sectors - mobile sources</u>

<u>1 A 4 b Household and Gardening</u>

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 the following table.

Table 62: Greenhouse gas emissions from mobile sources of household and gardening 1990–2004

	CO_2 Gg	CH_4 Gg	N_2O Gg
1990	142.15	0.11	0.02
1991	142.56	0.11	0.02
1992	143.97	0.11	0.02
1993	144.82	0.11	0.02
1994	143.76	0.11	0.03
1995	144.58	0.10	0.03
1996	143.61	0.10	0.03
1997	142.46	0.10	0.03
1998	141.55	0.10	0.03
1999	140.76	0.10	0.02
2000	140.58	0.09	0.02

	CO_2 Gg	CH_4 Gg	N_2O Gg
2001	140.54	0.08	0.02
2002	140.60	0.07	0.02
2003	140.33	0.06	0.02
2004	140.16	0.05	0.02
Trend 1990 - 2004	-1%	-49%	-24%

Table 63: Emission factors and activity data for mobile sources of household and gardening 1990–2004

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	1 891.2	75.16	0.056	0.013
1991	1 896.8	75.16	0.056	0.013
1992	1 915.6	75.15	0.055	0.013
1993	1 950.0	74.27	0.055	0.013
1994	1 935.9	74.26	0.055	0.013
1995	1 948.7	74.19	0.054	0.013
1996	1 935.8	74.19	0.053	0.013
1997	1 922.1	74.12	0.053	0.013
1998	1 910.0	74.11	0.053	0.013
1999	1 901.5	74.03	0.051	0.012
2000	1 899.1	74.02	0.046	0.012
2001	1 899.1	74.00	0.042	0.012
2002	1 899.3	74.02	0.037	0.011
2003	1 895.6	74.03	0.033	0.010
2004	1 903.7	73.62	0.028	0.009

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 64: 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	823	0.12	0.27	537	0.08	0.18
1991	825	0.12	0.27	395	0.06	0.13

	Agriculture			Forestry		
	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1992	835	0.12	0.27	427	0.06	0.14
1993	841	0.12	0.28	432	0.06	0.14
1994	846	0.12	0.28	511	0.07	0.17
1995	770	0.11	0.26	494	0.07	0.17
1996	838	0.11	0.28	546	0.07	0.19
1997	934	0.12	0.32	543	0.07	0.19
1998	899	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	918	0.10	0.29	509	0.06	0.17
2002	903	0.10	0.28	564	0.06	0.18
2003	814	0.09	0.24	649	0.06	0.21
2004	869	0.09	0.25	638	0.06	0.19
Trend 1990 - 2004	5%	-25%	-9%	19%	-23%	11%

Table 65: Emission factors and activity data for mobile sources of Agriculture and Forestry 1990–2003

	Agriculture				Forestry			
		Implied Emission Factors				Implied Emission Factors		
	Activity	CO_2	CH_4	N_2O	Activity	CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ	TJ	T/TJ	kg/TJ	kg/TJ
1990	11 088	74.3	10.5	24.3	7 234	74.2	10.4	24.3
1991	11 108	74.2	10.5	24.3	5 318	74.2	10.4	24.3
1992	11 243	74.2	10.5	24.3	5 758	74.2	10.3	24.3
1993	11 338	74.2	10.5	24.3	5 826	74.2	10.3	24.3
1994	11 401	74.2	10.4	24.4	6 883	74.2	10.2	24.6
1995	10 398	74.0	10.5	24.5	6 678	74.0	10.0	24.8
1996	11 327	74.0	10.1	24.9	7 371	74.0	9.7	25.1
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	73.8	9.0	24.7	7 174	73.8	8.9	25.3
2000	11 639	73.8	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	11 913	72.9	7.3	20.6	8 751	72.9	6.6	22.2

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 66: Greenhouse gas emissions from military aviation

	CO_2 [t] military Kerosene	CH_4 [t] military Kerosene	N_2O [t] military Kerosene
1990	32 883	2.05	14.51
1991	34 971	2.16	15.54
1992	31 560	2.03	16.58
1993	37 294	2.40	17.63
1994	39 461	2.47	18.66
1995	30 467	1.95	19.71
1996	36 822	2.33	23.11
1997	35 024	2.10	26.50
1998	40 348	2.36	29.89
1999	39 534	2.29	29.34
2000	42 880	2.69	28.78
2001	120 822	7.01	24.21
2002	38 980	2.59	26.22
2003	87 296	6.10	22.42
2004	104 600	6.88	26.32

Methodological Issues

Fuel consumption for military flights were 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 > 80kW was used (see Table 39; for these vehicles an power of 300kW 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 67: 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	2.09	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	2.04	0.0001	0.0006	27.6
2003	2.01	0.0001	0.0006	27.3
2004	1.99	0.0001	0.0005	27.3
Trend 1990-2004	-7%	-33%	-30%	-5%

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 68: Emissions and Activity from International Aviation 1990-2004

	CO_2 [Gg]		N_2O [Gg]		CH_4 [Gg]	Activity [TJ]
	int. LTO Kerosene	int. cruise Kerosene	int. LTO Kerosene	int. cruise Kerosene	int. LTO Kerosene	int. cruise Kerosene
1990	90.3	795.7	0.006	0.025	0.001	11 014
1991	103.0	890.8	0.006	0.028	0.001	12 330
1992	115.8	961.6	0.007	0.031	0.001	13 310
1993	128.6	1 011.4	0.008	0.032	0.001	13 998
1994	141.4	1 044.2	0.009	0.033	0.001	14 453
1995	154.2	1 173.2	0.010	0.037	0.001	16 127
1996	164.8	1 301.6	0.010	0.041	0.001	17 927
1997	175.4	1 350.2	0.011	0.043	0.001	18 605

	CO_2 [Gg]		N_2O [Gg]		CH_4 [Gg]	Activity [TJ]
	int. LTO Kerosene	int. cruise Kerosene	int. LTO Kerosene	int. cruise Kerosene	int. LTO Kerosene	int. cruise Kerosene
1998	186.0	1 392.3	0.011	0.044	0.001	19 187
1999	190.1	1 351.6	0.011	0.043	0.001	18 583
2000	194.2	1 480.8	0.012	0.047	0.001	20 356
2001	163.3	1 245.7	0.009	0.040	0.004	17 124
2002	176.9	1 349.2	0.012	0.043	0.001	18 547
2003	151.3	1 153.7	0.011	0.037	0.003	15 858
2004	177.6	1 354.2	0.012	0.043	0.003	18 614

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 and 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 2006.

Concerning activity data for sectors *1 A 1* and *1 A 2* there are specific regulations in the Austrian legislation:

- BGBl II 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 6.

3.2.4 Recalculations of Category 1 A

The revision of the national energy statistics for the time series 1990-2003 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 69 shows the recalculations of CO_2 emissions for the subcategories of sector *1 A Fuel Combustion.*

Table 69: 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	516.89	40.37	481.84	-4.54	-0.79	0.01
1991	563.74	39.64	342.46	-3.86	185.50	0.00
1992	481.36	-28.18	309.00	-4.18	204.72	0.00
1993	325.45	-28.26	145.50	-3.64	211.85	0.00
1994	371.90	-30.03	145.26	-3.60	260.28	0.00
1995	413.03	-37.40	241.32	-3.71	212.81	0.00
1996	634.00	-23.12	429.88	-3.66	230.89	0.00
1997	483.98	465.03	-117.98	-1.33	138.26	0.00
1998	529.88	-42.76	358.49	-11.95	226.09	0.00
1999	710.38	220.87	416.41	0.50	72.60	0.00
2000	609.18	126.07	227.21	-0.75	256.65	0.00
2001	803.54	237.14	25.71	151.40	302.65	86.65
2002	890.10	93.11	355.41	12.65	428.91	0.01
2003	1 297.32	134.83	395.46	157.33	556.58	53.12

CH_4 emissions

Table 70 shows the recalculations of CH_4 emissions for the subcategories of sector *1 A Fuel Combustion.*

Table 70: 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	-0.38	0.01	0.01	0.00	-0.40	0.00
1991	-0.23	0.01	0.01	-0.01	-0.23	0.00
1992	-0.26	-0.01	0.01	0.00	-0.25	0.00
1993	-0.14	-0.01	0.00	0.00	-0.13	0.00
1994	-0.01	-0.01	0.00	0.00	0.00	0.00
1995	-0.05	-0.01	0.00	0.00	-0.04	0.00
1996	-0.10	-0.01	0.00	-0.01	-0.08	0.00
1997	-0.07	0.00	-0.01	-0.01	-0.06	0.00
1998	-0.07	-0.01	0.00	-0.01	-0.05	0.00
1999	-0.13	0.00	0.00	-0.01	-0.13	0.00
2000	-0.17	-0.01	0.00	-0.01	-0.16	0.00
2001	-0.58	-0.02	0.00	0.01	-0.57	0.00
2002	-1.28	-0.01	0.00	0.00	-1.26	0.00
2003	-1.63	-0.06	0.02	0.01	-1.61	0.00

N_2O emissions

Table 71 shows the recalculations of N_2O emissions for the subcategories of sector *1 A Fuel Combustion.*

Table 71: 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	0.30	0.00	0.01	0.30	-0.01	0.00
1991	0.28	0.00	0.00	0.28	0.00	0.00
1992	0.23	0.00	0.00	0.23	0.00	0.00
1993	0.19	0.00	0.00	0.19	0.00	0.00
1994	0.15	0.00	0.00	0.15	0.00	0.00
1995	0.12	0.00	0.00	0.12	0.00	0.00
1996	0.08	0.00	0.00	0.08	0.00	0.00
1997	0.05	0.00	0.00	0.06	0.00	0.00
1998	0.07	0.00	0.00	0.07	0.00	0.00
1999	0.04	0.00	0.01	0.05	0.00	0.00
2000	0.03	0.00	0.00	0.04	0.00	0.00
2001	0.05	-0.01	0.00	0.06	-0.01	0.00
2002	0.05	-0.01	0.00	0.07	-0.01	0.00
2003	0.09	0.01	0.01	0.08	-0.02	0.00

Emissions in Gg CO_2 equivalent

Table 72 shows the recalculations in [Gg CO_2 equivalent] for the subcategories of sector *1 A Fuel Combustion.*

Table 72: Recalculation difference of GHG emissions in [Gg CO_2 equivalent] for Category 1 Energy *with respect to previous submission.*

	1 A	1 A 1	1 A 2	1 A 3	1 A 4	1 A 5
1990	601.56	40.01	484.16	88.39	-11.01	0.01
1991	644.84	39.28	343.75	81.41	180.40	0.00
1992	548.24	-29.56	309.98	68.40	199.41	0.00
1993	381.94	-29.66	145.96	56.19	209.44	0.00
1994	418.26	-31.44	145.22	43.54	260.93	0.00
1995	448.24	-38.77	241.58	33.24	212.18	0.00
1996	656.33	-24.53	430.44	21.76	228.66	0.00
1997	499.41	463.95	-118.09	17.27	136.27	0.00
1998	548.86	-44.37	358.70	9.29	225.24	0.00
1999	721.20	220.54	418.05	14.32	68.29	0.00
2000	616.29	124.85	227.66	11.44	252.33	0.00
2001	807.23	235.23	26.07	169.09	288.63	88.22
2002	877.26	90.40	354.98	34.00	397.86	0.01
2003	1 289.92	137.49	398.85	182.42	516.89	54.27

3.2.5 Planned Improvements

An update for energy consumption and the emissions of off-road is planned for the next submission.

3.3 Comparison of the Sectoral Approach with the Reference Approach

3.3.1 Comparison of CO_2 emissions

CO_2 emissions from the sectoral and reference approach are compared and explanations for the differences are provided.

Table 73 compares the results of the two approaches.

Table 73: Comparison of CO_2 emissions of the two approaches

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	28 569	15 914	12 238	56 722	28 119	13 922	11 169	732	53 942
1991	30 989	16 771	12 939	60 699	30 596	14 517	11 771	805	57 690
1992	30 068	12 953	12 705	55 725	29 331	10 666	11 834	956	52 787
1993	31 105	11 649	13 399	56 154	30 744	9 493	12 340	675	53 251
1994	30 350	11 808	13 782	55 941	30 113	9 377	12 962	820	53 272
1995	30 915	13 496	15 048	59 459	30 315	10 740	14 059	839	55 953
1996	33 385	13 665	16 017	63 067	32 941	10 759	15 219	1 073	59 993
1997	32 862	14 446	15 437	62 745	32 147	11 319	14 679	1 017	59 161
1998	35 117	12 634	15 848	63 599	34 269	9 113	14 995	818	59 196
1999	33 160	12 678	16 125	61 963	32 521	9 166	15 147	1 105	57 940
2000	32 295	14 240	15 388	61 924	31 829	10 724	14 566	942	58 061
2001	34 927	14 763	16 309	65 999	34 424	11 272	15 483	917	62 096
2002	35 837	15 048	16 494	67 379	35 319	11 400	15 451	1 140	63 310
2003	38 770	16 277	17 833	72 881	38 315	12 680	16 689	1 237	68 922
2004	38 436	15 408	17 988	71 832	37 908	12 289	16 962	1 446	68 605

Table 74 presents the percentual difference of the two approaches.

Table 74: Deviation between CO_2 emissions from the two approaches.

Year	Liquid	Solid	Gaseous	Total
1990	1.60%	14.31%	9.57%	5.15%
1991	1.28%	15.52%	9.92%	5.22%
1992	2.51%	21.44%	7.36%	5.57%
1993	1.18%	22.71%	8.59%	5.45%
1994	0.79%	25.93%	6.33%	5.01%
1995	1.98%	25.67%	7.03%	6.27%
1996	1.35%	27.00%	5.24%	5.12%
1997	2.22%	27.63%	5.16%	6.06%
1998	2.47%	38.63%	5.69%	7.44%
1999	1.96%	38.32%	6.46%	6.94%
2000	1.46%	32.79%	5.65%	6.65%
2001	1.46%	30.97%	5.33%	6.29%

Year	Liquid	Solid	Gaseous	Total
2002	1.47%	32.00%	6.75%	6.43%
2003	1.19%	28.37%	6.85%	5.74%
2004	1.39%	25.38%	6.05%	4.70%

Reasons for deviations between CO_2 emissions:

- 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.
- 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 feed stocks 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 solvents 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 and1991.
- 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*.
- Gaseous fuels: The National Approach uses sector 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 an additional fuel type (e.g. municipal solid waste, hazardous waste and industrial fuel waste)

Simple approach to quantifying the deviation:

By quantifying the deviation between the two approaches with a simple approach it can be seen that the remaining difference of total CO_2 emissions is less than -1.7% for all years (see Table 75).

Currently it is not possible to quantify the amount of solvents and plastic products which are imported or exported by products, bulk or waste. Furthermore it is known that petrol coke is imported and used for carbide production but not considered in the energy balance.

Table 75: Quantification of deviation between the two approaches

Year	Natural Gas(1) [Gg CO_2]	2 B 1 Ammonia Production(3) [Gg CO_2]	Coke Oven Coke(4) [Gg CO_2]	3 Solvent Use [Gg CO_2]	Total [Gg CO_2]	Remaining total deviation(2)
1990	296	513	2 429	283	3 521	-1.3%
1991	337	542	2 523	237	3 639	-1.0%
1992	332	549	2 260	188	3 329	-0.7%
1993	285	535	2 422	187	3 430	-0.9%
1994	327	504	2 640	172	3 642	-1.7%
1995	475	534	2 993	190	4 191	-1.2%
1996	274	535	2 734	173	3 715	-1.0%
1997	237	529	3 135	190	4 091	-0.8%
1998	341	522	2 769	172	3 804	0.9%
1999	462	527	2 853	158	4 000	0.0%
2000	311	515	3 128	181	4 134	-0.4%
2001	350	469	3 091	194	4 104	-0.3%
2002	546	483	3 364	192	4 585	-0.8%
2003	601	523	3 191	191	4 505	-0.7%
2004	542	464	2 908	190	4 104	-1.2%

(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 under 2 C 1 Iron and Steel Production.

3.3.2 Comparison of energy consumption

Table 76 compares the energy consumption of the two approaches.

Table 76: Comparison of Energy Consumption of the two approaches

Year	Reference Approach				Sectoral Approach				
	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Total [TJ]	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Other [TJ]	Total [TJ]
1990	432 880	168 733	219 239	820 853	377 834	139 683	201 600	8 990	728 108
1991	467 037	177 293	231 794	876 124	410 146	146 041	212 477	10 079	778 743
1992	457 275	137 560	227 610	822 445	393 785	108 198	213 616	12 010	727 609
1993	465 569	123 581	240 044	829 194	414 645	96 243	222 735	9 775	743 397
1994	457 132	125 301	246 908	829 341	406 724	95 007	233 968	10 527	746 227
1995	462 169	142 849	269 583	874 601	409 140	108 446	253 772	10 916	782 273
1996	501 056	145 218	286 941	933 215	445 358	109 159	274 712	14 015	843 242
1997	500 287	153 621	276 551	930 460	433 885	114 940	264 963	13 122	826 910
1998	529 646	134 632	283 920	948 198	462 309	92 248	270 664	12 284	837 506

Year	Reference Approach				Sectoral Approach				
	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Total [TJ]	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Other [TJ]	Total [TJ]
1999	502 234	134 660	288 876	925 769	438 033	91 757	273 414	14 117	817 321
2000	490 844	150 904	275 681	917 429	430 915	108 229	262 921	12 974	815 039
2001	529 825	156 567	292 169	978 560	465 727	113 855	279 473	13 517	872 572
2002	541 449	159 232	295 485	996 166	478 056	114 703	278 905	15 741	887 405
2003	582 487	172 512	319 481	1 074 480	517 980	128 135	301 251	17 637	965 004
2004	580 087	163 565	322 260	1 065 912	516 057	124 517	306 174	20 050	966 798

Energy consumptions are 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: CO_2 emissions from the use of bitumen for road paving and roofing are currently not estimated (categories *2 A 5*, *2 A 6*). However, VOC emissions are estimated.

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 2005] 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 2004 0.9% 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 77presents GHG emissions arising from this category, their share and trend from 1990 to 2004.

Table 77: Greenhouse gas emissions from Category 1 B Fugitive Emissions

Gas	GHG emissions [Gg CO_2 equivalent]											Share 2004	Trend 1990-2004
	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004		
TOTAL	486.75	599.16	569.60	637.63	670.08	720.15	730.01	756.49	763.78	841.67	863.08	*100%*	*+77.3%*
CO_2	102.03	127.03	71.03	120.51	141.83	170.53	164.53	182.73	167.03	233.04	210.04	*24%*	*106%*
CH_4	384.72	472.14	498.57	517.12	528.25	549.62	565.48	573.76	596.75	608.63	653.05	*76%*	*70%*

3.5.1.2 Completeness

Table 78 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 78: 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	✓

IPCC Category	SNAP	Status	
		CO_2	CH_4
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	✓	✓
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 CO2 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*

Following the recommendation of the ERT during the review 2005 the sector was surveyed and the following changes in notation keys were made: Oil-Transport (NE → IE), Oil-Other (NE → NO) and Natural Gas-Other Leakage (NE → NO).

3.5.2 Methodological issues

3.5.2.1 1 B 1 a Fugitive Emissions from Fuels – Coal Mining

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 79). The overall trend from the base year to 2004 is minus 90%.

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[21]). Activity data are taken from the national energy balance.

Table 79: Activity data (brown coal produced) and CH_4 emissions for Fugitive Emissions from Fuels- Coal Mining 1990-2003

Year	Coal Mined [Mg]	CH_4 emissions [Gg]
1990	2 447 710	0.52
1991	2 080 726	0.52
1992	1 746 756	0.45
1993	1 691 675	0.37
1994	1 369 217	0.36
1995	1 297 919	0.29
1996	1 108 558	0.28
1997	1 130 839	0.24
1998	1 140 651	0.24
1999	1 137 888	0.24
2000	1 254 605	0.27
2001	1 193 970	0.26
2002	1 411 819	0.30
2003	1 152 383	0.25
2004	235 397	0.05

3.5.2.2 1 B 2 a Fugitive Emissions from Fuels – Oil

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).

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 80).

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 80).

[21] http://www.ipcc-nggip.iges.or.jp/EFDB/main.php

Methane emissions for the years 1992 to 2004 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 80: Activity data (Crude Oil Refined and Gas Produced, respectively) and emissions for Fugitive Emissions from Fuels- Oil Refining and Production 1990-2004

Refining			Production				
Year	Crude Oil Refined [Gg]	CH_4 [Gg]	Gas Produced [Mio m³]	CH_4 [Gg]	IEF CH_4 [kg/ 1000m³]	CO_2 [Gg]	IEF CO_2 [kg/ 1000m³]
1990	7 952	0.25	1 288	4.56	3.54	43	33.39
1991	8 273	0.26	1 326	4.56	3.44	43	32.43
1992	8 732	0.28	1 437	4.56	3.17	40	27.84
1993	8 522	0.27	1 488	4.54	3.05	37	24.87
1994	8 898	0.28	1 355	4.50	3.32	48	35.06
1995	8 619	0.27	1 482	4.41	2.97	38	25.64
1996	8 754	0.28	1 492	4.47	3.00	41	27.48
1997	9 374	0.30	1 428	4.55	3.18	31	21.76
1998	9 190	0.29	1 568	4.39	2.80	61	38.90
1999	8 635	0.27	1 741	4.15	2.38	90	51.69
2000	8 240	0.26	1 805	4.03	2.23	72	39.89
2001	8 799	0.28	1 954	4.10	2.10	88	45.04
2002	8 946	0.28	2 014	4.18	2.08	84	41.71
2003	8 819	0.28	2 030	3.92	1.93	133	65.52
2004	8 442	0.27	1 963	5.11	2.60	122	62.15

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 are a key source because of the contribution both to the level of all years of the greenhouse gas inventory and to the trend from the base year to all years. In 2004 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 81) 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 81).

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*.

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 81: Activity data and emissions for Fugitive Emissions from Fuels – Natural Gas Distribution and Sour Gas Processing 1990-2004

Year	Natural Gas Distribution		Sour Gas Processing	
	Gas network [km]	CH_4 Emissions [Gg]	Sour Gas Prod. [1000m³]	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
1995	22 358	13.75	405 638	89
1996	23 391	14.39	136 737	30
1997	24 661	15.17	406 177	89

Year	Natural Gas Distribution		Sour Gas Processing	
	Gas network [km]	CH_4 Emissions [Gg]	Sour Gas Prod. [1000m³]	CO_2 Emissions [Gg]
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

Table 82: Activity data and emissions for Fugitive Emissions from Fuels – Natural Gas Transmission and Storage 1990-2004

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

3.5.3 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 4.2% for AD, 14% for EF, resulting in a total uncertainty of emissions of 14.7%.

3.5.4 Recalculations

Activity data for *1 B 1 a Coal Mining* for 2002 and 2003 have been updated.

For *1 B 2 a Refining/Storage* activity data have been updated for the years 2002 and 2003 with data from the national energy balance.

Activity data for 1 B 2 b Natural gas storage have been updated for 2003.

1 B 2 b *Gas Distribution:* The method to calculate CH_4 emissions was changed to the IPCC Tier 1 methodology. The relevant activity data are now the km of distribution mains. The EF is the mean IPCC default EF (0.615 Mg CH_4/km).

Table 83: Recalculation difference of emissions in [Gg] for Category 1 B Fugitive Emissions with respect to the previous submission.

	CH_4
1990	5.10
1991	5.59
1992	6.52
1993	7.06
1994	7.97
1995	8.52
1996	8.82
1997	9.81
1998	10.36
1999	11.17
2000	12.35
2001	12.58
2002	13.54
2003	13.69

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 2004.

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 92.

4.1.1 Emission Trends

In the year 2004, 10.9% 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. From 2003 to 2004 emissions decrease again due to a strong decrease of N_2O emissions from Chemical Industry.

In 2004, greenhouse gas emissions from Category *2 Industrial Processes* amount to 9 913 Gg CO_2 equivalent compared to 10 112 Gg in the base year. Figure 11 shows the trend of GHG emissions from this category for 1990-2004.

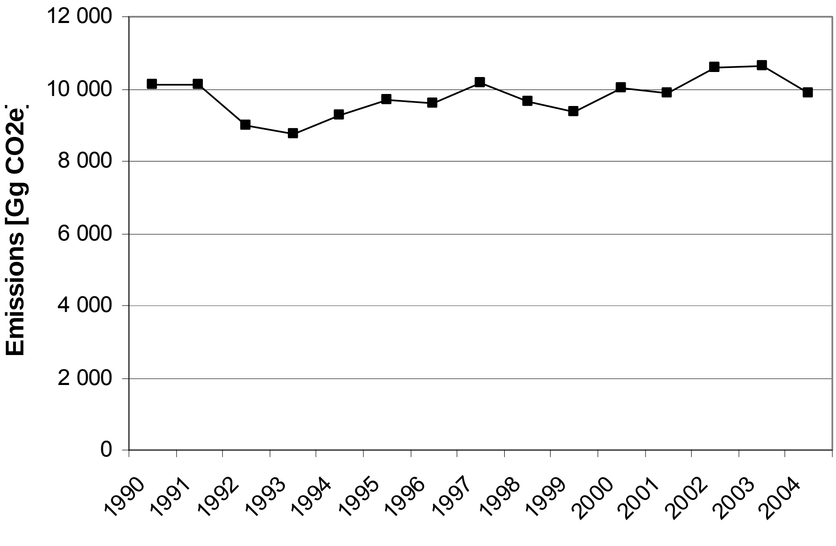

Figure 11: GHG emissions from IPCC Sector 2 Industrial Processes 1990-2004

Emission trends by gas

Table 84 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 2004.

Table 84: Greenhouse gas emissions from 2 Industrial Processes by gas in the base year and in 2004.

GHG	Base year*	2004	Base year*	2004
	CO_2 equivalent [Gg CO_2e]		[%]	
Total	**10 111.56**	**9 913.02**	***100.0%***	***100.0%***
CO_2	7 579.85	8 085.80	*75.0%*	*81.6%*
CH_4	14.83	14.74	*0.1%*	*0.1%*
N_2O	912.02	280.86	*9.0%*	*2.8%*
HFCs	23.03	864.92	*0.2%*	*8.7%*
PFCs	1 079.24	102.54	*10.7%*	*1.0%*
SF_6	502.58	593.52	*5.0%*	*6.0%*

**1990 for all gases*

The most important GHG of the industrial processes sector is carbon dioxide with 81.6% of emissions from this category in 2004, followed by HFCs with 8.7%, SF_6 with 6%, N_2O with 2.8%, PFCs with 1% and finally CH_4 with 0.1%. Emissions by gas and their trends are presented in Table 85.

Table 85: Emissions from IPCC Category 2 Industrial Processes by gas from 1990-2004 and their trend

Gas	GHG emissions [Gg CO_2e]											Trend BY*-2004
	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
Total	**10 112**	**9 730**	**9 602**	**10 194**	**9 675**	**9 392**	**10 035**	**9 909**	**10 594**	**10 663**	**9 913**	*-2.0%*
CO_2	7 580	7 383	7 082	7 672	7 316	7 163	7 767	7 695	8 262	8 204	8 086	*6.7%*
CH_4	15	14	15	15	15	15	15	14	15	15	15	*-0.6%*
N_2O	912	857	874	863	897	923	952	786	807	883	281	*-69.2%*
HFCs	23	267	347	427	495	542	596	695	782	865	904	*3827%*
PFCs	1 079	69	66	97	45	65	72	82	87	103	115	*-89.4%*
SF_6	503	1 139	1 218	1 120	908	684	633	637	641	594	513	*2.0%*

** BY: 1990 for all gases*

CO_2 emissions

As can be seen in Figure 12, CO_2 emissions from the industrial processes sector fluctuate during the period from 1990 to 2004, showing no clear trend. In 2004 CO_2 emissions from

Industrial Processes amount to 8 086 Gg CO_2 equivalent, which corresponds to an increase of 6.7% compared to base year emissions (7 580 Gg).

About 50% of CO_2 emissions originate from *Metal Production (mainly Iron and Steel Production)* and about 40% from *Mineral Products*. The rest originates from *Chemical Industry (mainly Ammonia Production)*.

CH_4 emissions

As can be seen in Figure 12, CH_4 emissions from Industrial Processes fluctuate over the period from 1990 to 2004, they reach a maximum in 1998 and are 0.6% below the level of the base year in 2004.

CH_4 emissions from this sector mainly arise from *Chemical Industry (Production of Urea and Fertilizers and Ammonia Production);* 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 12, 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 2004, N_2O emissions from *Industrial Processes* are 69% below the level of the base year.

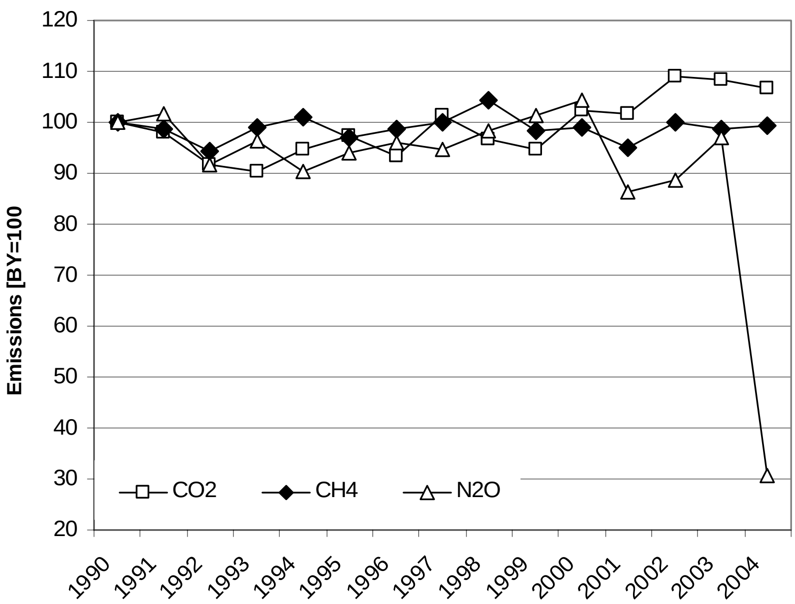

Figure 12: CO_2, CH_4 and N_2O emissions from Industrial Processes 1990-2004 in index form (base year = 100)

HFC emissions

As can be seen in Figure 13, HFC emissions increase remarkably during the period from 1990 to 2004. In 2004 HFC emissions amount to 904 Gg CO_2 equivalent, 3827% above 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 13, PFC emissions decrease remarkably during the period from 1990 to 2004. 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 1993 which was the major source for PFC emissions. Since then PFC emissions increased, and in the year 2004 they amounted to 115 Gg CO_2 equivalent, which is 89.4% below the level of the base year (1990).

In 2004 PFC emissions only arise from semiconductor manufacture.

SF6 emissions

As can be seen in Figure 13, SF_6 emissions increase at the beginning of the period and reach a maximum in 1996, since then SF_6 emissions are decreasing again. In 2004 SF_6 emissions amount to 513 Gg CO_2 equivalent, 2% above the level of the base year (1990).

In 2004 SF_6 emissions arise mainly from semiconductor manufacture, electric equipment and noise insulating windows.

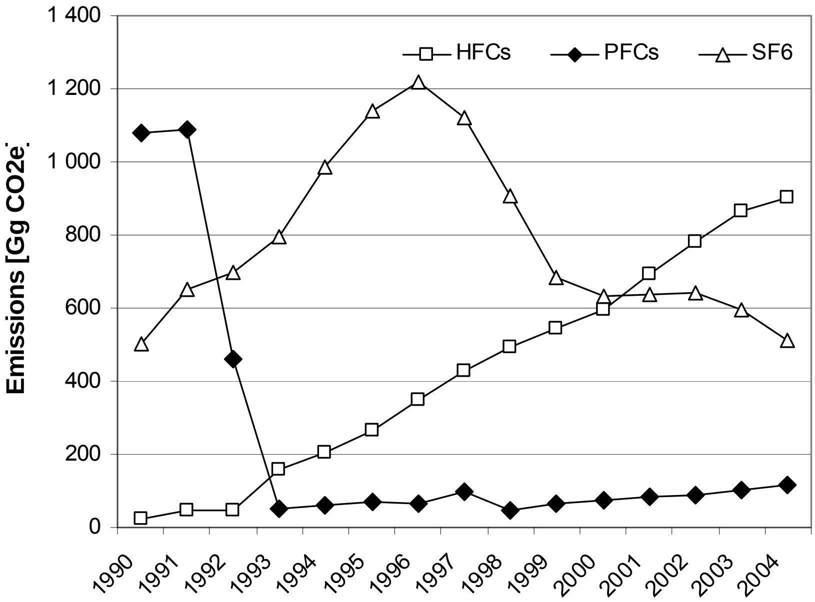

Figure 13: HFC, PFC and SF_6 emissions from Industrial Processes 1990-2004

Emission trends by sources

The main sources of greenhouse gas emissions in the industrial processes sector are *Metal Production* and *Mineral Products*, which cause 45% and 31%, respectively, of the emissions from this sector in 2004 (see Table 86).

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 86: Greenhouse gas emissions from IPCC Category 2 Industrial Processes by sector, their share and trend for the base year and 2004.

	Emissions [Gg CO_2e]		Share [%]		Trend
	BY*	2004	BY*	2004	BY - 2004
2 Industrial Processes	**10 111.56**	**9 913.02**	***100.0%***	***100.0%***	***-2.0%***
A Mineral Products	3 269.05	3 125.45	*32.3%*	*31.5%*	*-4.4%*
B Chemical Industry	1 512.65	824.37	*15.0%*	*8.3%*	*-45.5%*
C Metal Production	5 028.53	4 431.59	*49.7%*	*44.7%*	*-11.9%*
F Consumption of Halocarbons and SF_6	301.33	1 531.62	*3.0%*	*15.5%*	*408.3%*

**1990 for all gases*

Figure 14 and Table 87 present greenhouse gas emissions from IPCC Category *2 Industrial Processes* by sub category for the years 1990 to 2004.

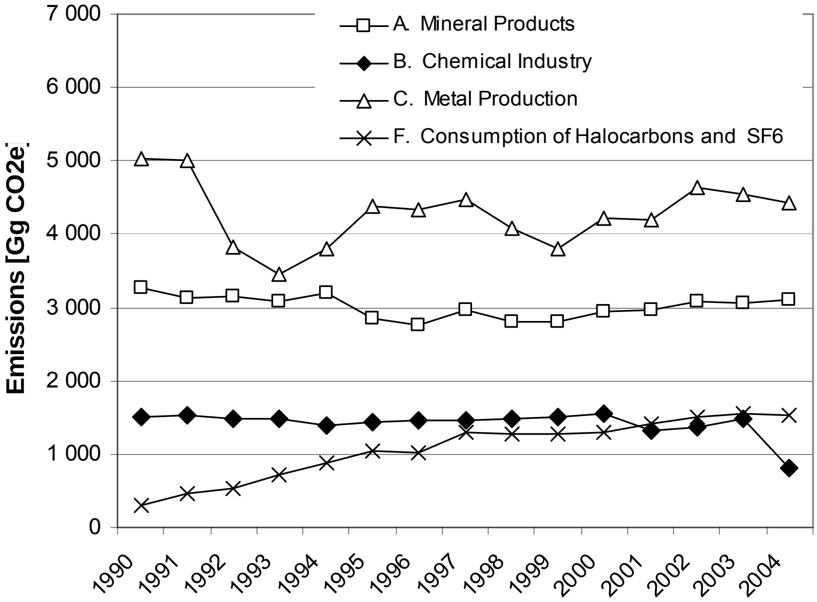

Figure 14: Emissions from IPCC Category 2 Industrial Processes per sub sector 1990-2004

Table 87: Total greenhouse gas emissions from 1990–2004 by subcategories of Category 2 Industrial Processes

	GHG emissions [Gg CO_2 equivalent]										
	BY*	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2	**10 112**	**9 730**	**9 602**	**10 194**	**9 675**	**9 392**	**10 035**	**9 909**	**10 594**	**10 663**	**9 913**
2 A	3 269	2 857	2 769	2 969	2 815	2 801	2 958	2 977	3 085	3 071	3 125
2 B	1 513	1 456	1 480	1 461	1 493	1 522	1 554	1 341	1 374	1 491	824
2 C	5 029	4 385	4 332	4 468	4 084	3 801	4 228	4 185	4 632	4 540	4 432
2 F	301	1 032	1 021	1 295	1 283	1 268	1 294	1 406	1 502	1 561	1 532

**1990 for all gases*

2 A Mineral Products

Greenhouse gas emissions decrease by 4.4% from 1990 to 2004 in this sub-category. This is mainly due to decreasing CO_2 emissions from cement production due to a decrease in cement production.

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 a decrease of N_2O emissions. In 2004 emissions are 45.5% below the level of the base year.

The main sources of this sub sector 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 1993 and an increase in CO_2 emissions from *Iron and Steel Production.* The overall trend is a decrease by 11.9% related to emissions of the base year (1990).

The main source of this sector are CO_2 emissions from pig iron production.

2 F Consumption of Halocarbons and SF_6

In 2004 greenhouse gas emissions are 408.3% higher than base year emissions for the sub-category *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 Sources

The methodology and results of the key source analysis is presented in Chapter 1.5. Table 88 summarizes the key sources in the IPCC Sector *2 Industrial Processes*.

Table 88: 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 LA, TA04
2 A 3	Limestone and Dolomite Use	CO_2	LA98-01, LA04
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, TA97, TA01-04
2 C 1	Iron and Steel Production	CO_2	All
2 C 3	Aluminium production	PFCs	LA90-92
2 C 4	SF_6 used in Al and Mg Foundries	SF_6	LA90-97, TA98-02
2 F 1/2/3/4/5	ODS Substitutes	HFCs	LA95-04, TA97-04
2 F 7	Semiconductor Manufacture	FCs	LA92-04, TA97-04
2 F 9	Other Sources of SF6	SF_6	LA97-98, LA00, TA97-02

LA90 = Level Assessment 1990
LA04 = Level Assessment 2004
TA91 = Trend Assessment BY-1991
TA04 = Trend Assessment BY-2004

In the base year (1990), 12.3% of total greenhouse gas emissions in Austria originate from the 12 key sources of the industrial processes sector compared to 10.6% in 2004. The most important key source is *Iron and Steel Production* which has a share of 4.8% in total emissions in 2004. Emissions from *Cement Production* contribute with 1.9% to total emissions 2004 and 1.0% 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 2004 (see Table 89).

Table 89: Level Assessment for the base year and 2004 for the key sources of Category 2 Industrial Processes

IPCC Category	Source Categories	GHG	Level Assessment	
			BY	2004
2 A 1	Cement Production	CO_2	2.6%	1.9%
2 A 2	Lime Production	CO_2	0.5%	0.7%
2 A 3	Limestone and Dolomite Use	CO_2	0.3%*	0.3%
2 A 7 b	Magnesia Sinter Plants	CO_2	0.6%	0.4%
2 B 1	Ammonia Production	CO_2	0.7%	0.5%
2 B 2	Nitric Acid Production	N_2O	1.2%	0.3%*
2 C 1	Iron and Steel Production	CO_2	4.5%	4.8%
2 C 3	Aluminium production	PFCs	1.3%	NO
2 C 4	SF_6 used in Al and Mg Foundries	SF_6	0.3%	NO

IPCC Category	Source Categories	GHG	Level Assessment	
			BY	2004
2 F 1/2/3/4/5	ODS Substitutes	HFCs	0.0%*	1.0%
2 F 7	Semiconductor Manufacture	FCs	0.2%*	0.5%
2 F 9	Other Sources of SF_6	SF_6	0.2%*	0.1%*

**Level 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. For IPCC key source categories, methodologies are described in more detail.

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 (Verweis auf Unsicherheitskapitel) and on expert judgement by Umweltbundesamt are provided (see Table 90, explanations see respective subchapters).

Table 90: 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	5.0	2.0	5.4
2 A 2	Lime Production	20.0	5.0	20.6
2 A 3	Limestone and Dolomite Use	19.6	2.0	19.7
2 A 7 b	Magnesia Sinter Plants	2.0	5.0	5.4
2 B 1	Ammonia Production	2.0	4.6	5.0
2 B 2	Nitric Acid Production	3.0	0.0	3.0
2 C 1	Iron and Steel Production	2.0	5.0	5.4
2 C 3	Aluminium production	2.0	50.0	50.0
2 C 4	SF6 used in Al and Mg Foundries	5.0	0.0	5.0
2 F 1/2/3/4/5	ODS Substitutes	20	50	53.9
2 F 7	Semiconductor Manufacture	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, for further information see Chapter 1.6.

Concerning measurement and documentation of emission data there are also specific regulations in the Austrian legislation as presented in Table 91. This legislation also addresses verification. Some plants that are reporting emission data have quality management systems according to the ISO 9000–series or according similar systems.

Table 91: Austrian legislation with specific regulations concerning measurement and documentation of emission data

IPCC Source Category	Austrian legislation
2 A 1	BGBl 1993/ 63 Verordnung für Anlagen zur Zementerzeugung
2 A 7	BGBl 1994/ 498 Verordnung für Anlagen zur Glaserzeugung
2 C 1	BGBl 1994/ 447 Verordnung für Gießereien
2 C 1	BGBl II 1997/ 160 Verordnung für Anlagen zur Erzeugung von Eisen und Stahl
2 C 1	BGBl II 1997/ 163 Verordnung für Anlagen zum Sintern von Eisenerzen
2 A / 2 B /2 C / 2 D	BGBl II 1997/ 331 Feuerungsanlagen-Verordnung
2 C 2 / 2 C 3 / 2 C 5	BGBl II 1998/ 1 Verordnung zur Erzeugung von Nichteisenmetallen
2 A / 2 B /2 C / 2 D	BGBl 1988/ 380 Luftreinhaltegesetz für Kesselanlagen
2 A / 2 B /2 C / 2 D	BGBl 1989/ 19 Luftreinhalteverordnung für Kesselanlagen

Extracts of the applicable paragraphs are provided in Annex 6.

4.1.6 Recalculations

Compared to last year's inventory one sub-source has been added and data for several sources have been updated. A summary of the changes made since the last submission is presented below:

Addition of source categories:

The sub-source *Limestone used for desulphurization in 2 A 3 Limestone and Dolomite Use* has been added to the inventory.

CH_4 emissions from the source 2 B 5 Other – Ethylene have been estimated. In previous submissions the notation key NE was used for emissions from this source.

2 F Consumption of Halocarbons and SF_6: HFC emissions from the sub-categories 4 Aerosols/Metered dose inhalers and 5 Solvents have been added to the inventory.

Update of activity data:

2 A 1 Cement Production: Activity and emission data for CO_2 emissions from *Cement Production* 2003 has been updated using data from a study based on plant specific data.

2 A 2 Lime: Activity data for 2003 has been updated.

2 A 7a Bricks: Activity data for 2003 has been updated.

2 A 7b Magnesia Sinter: Activity data for the whole time series has been changed to Magnesia used for Magnesia sinter production using information from industry. CO_2 emissions have been updated for 2003.

2 B 4 Calcium Carbide: Activity data for 2003 has been updated.

2 C 2 Ferroalloys: Activity data for the years 1999-2003 have been updated.

Improvements of methodologies and emission factors:

2 A 3 Dolomite Use: During QC checks an error in the emission factor was found that was corrected. CO_2 emissions from dolomite use are now calculated with the IPCC default emission factor for the whole time series.

2 A 7a Bricks: Emissions 1998 to 2001 were updated with validated data. This lead to a recalculation of the whole time series, because emissions of the years before 1998 were calculated with the IEF for 1998; and the IEF from 2001 was used to calculate emissions after 2001.

2 B 1 Ammonia: During QC checks it was found that CO_2 emissions as reported by the plant operator were not determined in accordance with the IPCC guidelines. Consequently, CO_2 emissions have been recalculated from the natural gas input (from the national energy balance) with a standard emission factor. 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 plant melamine is produced, a product in which carbon can be considered to stored for a long time. Thus, account was taken for the carbon bound in the melamine production, and it was subtracted from the total CO_2 emissions.

2 C 1 Iron and Steel: Process specific CO_2 emissions from pig iron production have been recalculated as the underlying activity data used for the calculation (non-energy use of coke) has been updated in the national energy balance.

2 F Consumption of Halocarbons and SF_6:

HFC emissions from the sub-category 2 Foam Blowing have been recalculated incorporating the results from a new study on HFC used in foam blowing (OBERNOSTERER et al. 2004).

HFC emissions from disposal have been estimated for the sub-category 2 F 1 Refrigeration and Air conditioning equipment.

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 92 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 92: Overview of subcategories of Category 2 Industrial Processes: transformation into SNAP Codes and status of estimation

	IPCC Category		SNAP	Status CO_2	Status CH_4	Status N_2O
2 A	**MINERAL PRODUCTS**					
2 A 1	Cement Production	040612	Cement (decarbonising)	✓		
2 A 2	Lime Production	040614	Lime (decarbonising)	✓		
2 A 3	Limestone and Dolomite Use	040618	Limestone and Dolomite Use	✓		
2 A 4	Soda Ash Production and Use	040619	Soda Ash Production and Use	✓		
2 A 5	Asphalt Roofing	040610	Roof covering with asphalt materials	IE(1)		
2 A 6	Road Paving with Asphalt	040611	Road paving with asphalt	IE(1)		
2 A 7	*Other*					
	2 A 7 a Bricks	040613	Bricks (decarbonising)	✓		
	2 A 7 b Magnesit Sinter	040617	Other - Magnesia Sinter Plants	✓		
2 B	**CHEMICAL INDUSTRY**					
2 B 1	Ammonia Production	040403	Ammonia	✓	✓	
2 B 2	Nitric Acid Production	040402	Nitric acid	✓		✓
2 B 3	Adipic Acid Production	040521	Adipic acid			NO(2)
2 B 4	Carbide Production	040412	Calcium carbide production	✓		
2 B 5	Other	040407 040408	NPK fertilisers Urea	✓	✓	
2 B 5	Other	040501	Ethylene production		✓	
2 C	**METAL PRODUCTION**					
2 C 1	Iron and Steel Production(3)	040202 040206 040207 040208	Blast furnace charging Basic oxygen furnace steel plant Electric furnace steel plant Rolling mills	✓	✓	
2 C 2	Ferroalloys Production	040302	Ferro alloys	✓		
2 C 3	Aluminium Production	040301	Aluminium production (electrolysis) – except SF_6	✓ / NO(3)	✓ / NO(3)	
2 C 4	SF_6 Used in Aluminium and Magnesium Foundries	030310 040301 040304	Secondary Aluminium Production 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(4)		
	IPCC Category		SNAP		HFCs, PFCs, SF_6	
2 E	**PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE**	0408	Production of halocarbons and sulphur hexaflouride		NO(5)	
2 F	**CONSUMPTION OF HALOCARBONS AND**	0605	Use of HFC, PFC and SF_6			

	SULPHUR HEXAFLUORIDE [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) *Primary aluminium production was terminated in 1992.*

(4) CO_2 *emissions from this source are of biogenic origin.*

(5) *There is no production of halocarbons or* SF_6 *in Austria.*

(6) *No corresponding SNAP category is presented here as the actual estimation is based on IPCC Categories.*

4.1.8 Planned Improvements

For the last year of the inventory, no data was available for some important sub-categories of this Sector. One reason is that national statistical data are not available in time to be considered in the inventory. On the other hand, industry is not obliged to report data for the national inventory.

The data availability problem will be solved for most key sources of this Sector from the years 2005 onwards, because 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).

This ensures data availability for the following key sources:

- 2 A 1 Cement Production
- 2 A 2 Lime Production
- 2 A 7 b Magnesia Sinter Plants
- 2 C 1 Iron and Steel,

and the non-key sources

- 2 A 3 Limestone and Dolomite Use
- 2 A 4 Soda Ash Use
- 2 A 7 a Bricks production
- 2 B 4 Carbide Production.

Until data is available from the EU Emissions Trading scheme[22], mainly national statistical data will be used to estimate emissions where data from plant operators are not available.

For the sub-category 2 A 7 a Bricks and Tiles it is planned to revise the time series for the next submission as it was recommended by the ERT during the Review 2005.

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 production of cement are a key source because of the contribution both to the level of all years of the greenhouse gas inventory and to the trend from the base year to all years. In 2004 CO_2 emissions from cement production contributed 1.9% to total greenhouse gas emissions in Austria (see Table 89).

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 93 presents the process-related CO_2 emissions from the production of cement for the period from 1990 to 2004.

Table 93: CO_2 emissions from decarbonising from cement production 1990–2004

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

[22] the first year for which data will be available is 2005, this data will be reported in the submission 2007

Year	Process specific CO_2 emissions [Gg]	Clinker [t/a]	IEF [kg/t_{Cl}]
2003	1 754	3 119 808	562
2004	1 754	3 119 808	562

CO_2 emissions (see Table 93) are quite constant from 1990 to 1994; 1995 they drop by 21.7% compared to the previous year, due to a drop in cement production of almost 20%. Since 1995 emissions as well as production of cement remain on this lower level with only minor fluctuations. The overall trend from 1990 to 2004 is minus 14%. For the year 2004 the value of 2003 was used, as no up to date value was available.

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. As data for 2004 was not available in time, and clinker production remain quite stable over the last years the value of 2003 was used for 2004 as a first estimate.

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.

CO_2 emissions from the raw meal calcination (decarbonising) were calculated from the raw meal composition:

$$M_{(CO2\ calc)} = \sum_k (m_{(raw\ meal)})_k \bullet x_{(CaCO3)k} \bullet (44.0088/100.0892)$$

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. Based on this data and plant specific production data total emissions from this source were calculated.

No cement kiln dust (CKD) correction factor was considered because cement kiln dust is returned back into the raw material.

Table 93 presents activity data and implied emission factors for process-specific CO_2 emissions from cement production as reported in the studies (HACKL, MAUSCHITZ, 1995, 1997, 2001, 2003 and MAUSCHITZ 2004).

4.2.1.3 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%).

4.2.1.4 Recalculations

Activity data and emission data for 2003 have been updated (previously the estimate of 2002 was used for 2003). The recalculation difference resulting from the update of data is presented in the following table.

Table 94: Recalculation difference for CO_2 emissions from Cement Production with respect to submission 2005

	2003
Recalculation Difference [Gg]	18.82

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 2004. In the year 2004 emissions from this category contributed 0.7% to the total amount of greenhouse gas emissions in Austria (see Table 89).

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 95 presents activity data for this category (lime produced) as well as CO_2 emissions from lime production for the period from 1990 to 2004.

Table 95: Activity data and CO_2 emissions for Lime production 1990–2004

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

Year	Lime Produced [t/a]	CO_2 emissions [Gg]	CO_2 IEF [kg/Mg]
1999	595 978	453	760
2000	654 437	498	760
2001	666 633	507	760
2002	719 246	547	760
2003	756 140	575	760
2004	788 790	599	760

The overall trend for CO_2 emissions from this category is increasing emissions, in the year 2004 emissions were 51% higher than 1990 (see Table 95).

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*, except the emissions for 2002 to 2004, which were calculated using the IEF of 2001.

The reported CO_2 emission data is based on data of each lime production plant in Austria, considering the CaO and MgO content of limestone used at the different plants and calculating CO_2 emissions from the stoichiometric ratios (using IPCC default emission factors).

Activity data for lime production for the period from 1990 to 2004 is presented in Table 95.

4.2.2.3 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 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).

4.2.3 Limestone and Dolomite Use (2 A 3)

4.2.3.1 Source Category Description

Emissions: CO_2

Key Source: *Yes*

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 1998 to 2001. In the year 2004 emissions from this category contributed 0.3% to the total amount of greenhouse gas emissions in Austria (see Table 89).

In this category CO_2 emissions from decarbonising of limestone and dolomite in the glass industry, in the iron and steel industry and the limestone use for desulphurization are considered.

Emissions from this category increase by 34% between 1990 and 2004 mainly due to increased limestone use in iron and steel industries.

Table 96: Activity data and CO_2 emissions for Limestone and Dolomite Use 1990–2004

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

4.2.3.2 Methodological Issues

Emissions were estimated using the methodology and the default emission factor of the IPCC guidelines.

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.

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 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.

4.2.3.3 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%.

4.2.3.4 Recalculations

CO_2 emissions from *Limestone used for desulphurization* have been included for the whole time series.

During QC checks an error in the emission factor was found that was corrected. CO_2 emissions from dolomite use are now calculated with the IPCC default emission factor (477 kg CO_2/ t dolomite) instead of 447 kg CO_2/ t dolomite for the whole time series.

Table 97: Recalculation difference for CO_2 emissions from Limestone and dolomite use with respect to submission 2005

	Recalculation difference [Gg]
1990	22.13
1991	22.23
1992	24.16
1993	24.16
1994	24.57
1995	25.76
1996	25.76
1997	25.71
1998	25.71
1999	25.78
2000	25.66
2001	25.77
2002	25.68
2003	25.89

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 2004 emissions from this category contributed 0.01% to total emissions in Austria. The following table presents CO_2 emissions from this category.

Table 98: Activity data and CO_2 emissions for Soda Use 1990–2004

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

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). Activity data is presented in Table 98.

For calculation of CO_2 emissions the IPCC default emission factor of 415 kg CO_2/ t soda was used.

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 now reported as "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 99 presents CO_2 emissions from bricks production for the period from 1990 to 2004. CO_2 emissions from bricks production had a maximum in 1995/1996, following brick production. In 2004 emissions from this category were 0.6% below the level of 1990.

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).

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. For 2004 the value of 2003 was used. 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 99 presents activity data for production of bricks and CO_2 emissions for this category for the period from 1990 to 2004.

Table 99: Activity data and CO_2 emissions for Bricks Production 1990-2004

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
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

Recalculations

Activity data for 2003 has been updated with national statistical data.

During QC checks it was found that the emissions 1998 to 2001 were not published data. Consequently validated data published by the Federal Ministry of Agriculture, Forestry, Environment and Water Management were used in this submission. This lead to a recalculation of the whole time series, because emissions of the years before 1998 were calculated with the IEF for 1998; and the IEF from 2001 was used to calculate emissions after 2001 (see Table 100 for recalculation differences).

Table 100: Recalculation difference for CO_2 emissions from Bricks production with respect to submission 2005

	Recalculation difference [Gg]
1990	4.19
1991	4.38
1992	4.53
1993	4.87
1994	5.03
1995	5.35
1996	5.35
1997	4.93
1998	4.81
1999	4.80
2000	4.19
2001	4.46
2002	4.34
2003	-0.12

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 all trend assessments. In 2004 it contributed 0.4% to the total amount of greenhouse gas emissions in Austria (see Table 89).

During production of magnesia sinter CO_2 is generated during the calcination step, when magnesite ($MgCO_3$) is roasted 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 2004. CO_2 emissions from magnesia sinter plants vary over the period from 1990 to 2004 with an overall decreasing trend. In 2004 emissions are 32% 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. Emissions have been calculated based on the carbonate content of the raw material.

In previous submissions Magnesia Sinter Production was reported as activity data, but no effective values were obtainable since 1995. Thus, the activity data "Raw magnesite" used for magnesia sinter production is reported for the whole time-series in this submission for the first time. This does not affect the reported CO_2 emissions.

Table 101 presents CO_2 emissions from this category for the period from 1990 to 2004.

Table 101: CO_2 emissions from Magnesia Sinter Production 1990-2004

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

Uncertainty Assessment

Emissions were calculated based on stochiometric 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

Activity and emission data for 2003 has been updated with data reported from the company, resulting in a recalculation difference of -62 Gg CO_2.

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 2004. In 2004 it contributed 0.5% to the total amount of greenhouse gas emissions in Austria (see Table 89).

Ammonia (NH_3) is produced by catalytic steam reforming of natural gas or other light hydrocarbons (e.g. liquefied petroleum gas, naphtha). 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 2004.

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 2004 CO_2 emissions are 9.5% lower than in the base year, CH_4 emissions 9.4%.

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. Emissions are measured regularly at the only ammonia producer in Austria, using spot sampling and extrapolation to annual loads. The measurements are performed 2 to 12 times per year for CH_4. 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.

The methodology for CO_2 emission estimates was changed with respect to previous submissions. During QC checks it was found that CO_2 emissions as reported by the plant operator were not determined in accordance with the IPCC guidelines. Two problems were encountered:

First, the reported CO_2 emissions included emissions that result from heating the reformers. These emissions from combustion are already accounted for in IPCC Category *1 A 2 Manufacturing Industries and Construction* thus leading to a double counting of emissions.

Second, as the reported emissions were measurement based, account was taken for intermediate binding of CO_2 in downstream manufacturing processes (Urea production). This lead to an underestimation of emissions.

Consequently, CO_2 emissions have been recalculated from the natural gas input (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.

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 plant melamine is produced from urea, a product in which carbon can be considered to be stored for a long time. Thus, account was taken for the carbon bound in the melamine production. Carbon stored was calculated stoichiometric from urea input for melamine production, and was subtracted from the total CO_2 emissions.

The resulting CO_2 IEF (with respect to ammonia) is decreasing over the time-series, 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 1990–2004

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 [Gg]
1990	461 000	10 239	14	517	1 122	0.062
1991	475 000	10 550	10	546	1 150	0.064
1992	432 000	10 735	11	554	1 281	0.058
1993	469 000	10 417	10	540	1 150	0.063
1994	444 000	10 036	13	508	1 143	0.060
1995	473 000	10 518	12	538	1 137	0.061
1996	484 772	10 781	16	540	1 113	0.059
1997	479 698	10 669	16	533	1 111	0.081
1998	484 449	10 554	16	526	1 086	0.102
1999	490 493	10 644	16	531	1 082	0.055
2000	482 333	10 504	17	519	1 075	0.060
2001	448 176	9 945	21	473	1 055	0.051
2002	464 028	10 336	23	487	1 049	0.069
2003	510 887	11 278	27	527	1 031	0.047
2004	510 024	10 253	27	468	918	0.056

4.3.1.3 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).

Recalculations

CO_2 emissions have been recalculated for the whole time-series (see Table 103 for recalculation differences). For further information on the recalculations see sub-chapter Methodological Issues.

Table 103: Recalculation difference for CO_2 emissions from Ammonia production with respect to submission 2005

	Recalculation difference [Gg]
1990	121.38
1991	138.41
1992	182.44
1993	136.75
1994	126.46
1995	69.78
1996	74.26
1997	76.03
1998	25.05
1999	59.08
2000	55.78
2001	31.24
2002	41.92
2003	33.54

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 are 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 1997 and 2001-2004. In 2004 it contributed 0.3% to the total amount of greenhouse gas emissions in Austria (see Table 89).

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 104 presents N_2O and CO_2 emissions from production of nitric acid for the period from 1990 to 2004.

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.

CO_2 emissions also varied over the period from 1990-2004 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 104). In 2004 emissions were 1% lower than in 1990.

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 where closed since 1990, two are still in operation). With these (conservative) estimate of 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 104: Activity data, emissions and implied emission factors for N_2O and CO_2 emissions from Nitric Acid Production 1990-2004

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

Year	Nitric Acid Produced [t]	N_2O Emissions [Mg]	CO_2 Emissions [Gg]	IEF N_2O [kg/t]	IEF CO_2 [kg/t]
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
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

4.3.2.3 Uncertainty assessment

As data was obtained from the only nitric acid plant in Austria where emissions are measured continuously the quality of emission estimates was rated as "high" (3% uncertainty).

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 2004, emissions from this source contribute 0.04% 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 105: Activity data and emissions for CO_2 emissions from Calcium Carbide Production 1990-2004

Year	Calcium Carbide [t]	CO_2 Emissions [Gg]
1990	28 951	38
1991	27 159	35
1992	31 896	41

Year	Calcium Carbide [t]	CO_2 Emissions [Gg]
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

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 2004, total emissions from this source contribute 0.03% to national total emissions.

CO_2 emissions from the production of fertilizers varied over the period following closely the trend of fertilizer production. They first decreased, reaching a minimum in 1997 and since then increased again. In 2004 emissions from this category were 21% lower than in 1990 (see Table 106).

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.

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 2003 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 and urea were reported for the years 2002, 2003 and 2004; 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, which is why the implied emission factor for the year 2002 was used for all years.

Table 106 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 2004.

Table 106: Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from NPK-fertilizer Production and Urea Production 1990-2004

Year	Urea Production			Fertilizer Production			
	Urea Production [t]	CO_2 [Gg]	CH_4 [Gg]	Fertilizer Production [t]	CO_2 [Gg]	IEF CO_2 [kg/t]	CH_4 [Gg]
1990	282 000	0.27	0.11	1 388 621	30.26	21.79	0.18
1991	295 000	0.29	0.11	1 273 467	27.75	21.79	0.17
1992	259 000	0.25	0.10	1 182 595	37.75	31.92	0.16
1993	305 000	0.30	0.12	1 250 804	33.53	26.81	0.17
1994	360 000	0.35	0.14	1 222 578	22.27	18.22	0.16
1995	393 000	0.40	0.15	916 265	19.55	21.34	0.12
1996	417 705	0.30	0.16	940 313	18.07	19.22	0.12
1997	392 017	0.35	0.15	924 856	17.22	18.62	0.12
1998	395 288	0.29	0.15	977 212	18.68	19.12	0.13
1999	408 386	0.24	0.16	988 662	19.65	19.88	0.13
2000	390 185	0.22	0.15	1 022 983	20.59	20.13	0.14
2001	367 218	0.26	0.14	959 698	19.75	20.58	0.13
2002	389 574	0.35	0.15	1 013 767	23.61	23.29	0.13
2003	447 450	0.18	0.16	1 073 940	24.07	22.41	0.13
2004	442 252	0.14	0.17	1 090 069	24.03	22.05	0.13

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.

4.3.5 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.

4.3.5.2 Methodological Issues

Emissions were estimated using the IPCC default methodology.

Activity data for all years are the capacity of the only ethylene producing plant in Austria and amount to 350 000 t Ethylene per year. The IPCC default emission factor of 1g CH_4 / kg Ethylene production was used to calculate the emissions that amount to 350 tonnes CH_4 per year.

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 all years.

In the year 2004, CO_2 emissions from production of iron and steel contributed 4.8% 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 2004 was 0.0001%.

Table 107 presents total CO_2 and CH_4 emissions from the production of iron and steel for the period from 1990 to 2004. 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 2004 emissions were 25% above the level of 1990.

Table 107: Total CO_2 and CH_4 emissions from iron and steel 1990–2004

Year	CO_2 [Gg]	CH_4 [Gg CO_2 eq]
1990	3 546	0.047
1991	3 508	0.039
1992	3 074	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	4 415	0.077

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[23] 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*).

[23] 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.

CO_2 emissions from 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[24].

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.

Only carbonatious ore was considered for the calculation as no statistical data was available for the amount of other ore[25] (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 and 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. These data will be verified with data from industry (survey to the national allocation plan) as soon as available.

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, 2003 and 2004 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.

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 108. 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

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[24] 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.

[25] Carbonatious ore is mined in Austria, thus it is reported in the statistical yearbook.

use in the national energy balance and the use of other reducing agents that are not directly allocated.

Table 108: Activity data, emissions and implied emission factors for CO_2 emissions from pig iron production 1990–2004

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	3 010	874
1992	792	1 629	3 074	2 624	854
1993	815	1 627	3 070	2 693	877
1994	893	1 695	3 320	2 923	880
1995	1012	2 071	3 888	3 352	862
1996	941	2 071	3 432	3 201	933
1997	1070	2 071	3 972	3 519	886
1998	1037	1 810	4 032	3 309	821
1999	1001	1 734	3 912	3 186	814
2000	1125	1 879	4 320	3 568	826
2001	1113	1 875	4 380	3 518	803
2002	1251	1 925	4 669	3 925	841
2003	1200	2 119	4 677	3 838	821
2004	1167	2 100	4 861	3 702	762

CO_2 emissions from steel production

CO_2 emissions from steel production (which corresponds to steel production at the two integrated sites operating basic oxygen furnaces) 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, 2003 and 2004 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 steel production

Emissions were estimated using a country specific methodology.

CO_2 emissions for the years 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 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 109 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 109: Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from Steel Production 1990–2004

Year	Steel Production				Electric Steel Production			Total CH_4 [Gg]	Total CO_2 [Gg]
	Steel [kt]	CO_2 [Gg]	IEF CO_2 [t/kt]	CH_4 [Gg]	Electric Steel [kt]	CO_2 [Gg]	CH_4 [Gg]		
1990	3 921	484	123	0.0004	370	20	0.002	0.0022	503
1991	3 896	483	124	0.0004	290	15	0.001	0.0018	499
1992	3 592	431	120	0.0004	361	19	0.002	0.0022	450
1993	3 738	430	115	0.0004	411	22	0.002	0.0024	451
1994	3 968	465	117	0.0004	431	23	0.002	0.0026	488
1995	4 538	545	120	0.0005	454	24	0.002	0.0027	569
1996	4 032	481	119	0.0004	396	21	0.002	0.0024	502
1997	4 718	557	118	0.0005	466	25	0.002	0.0028	581
1998	4 801	565	118	0.0005	503	27	0.003	0.003	592
1999	4 722	548	116	0.0005	486	26	0.002	0.0029	573
2000	5 183	605	117	0.0005	541	29	0.003	0.0032	634
2001	5 346	613	115	0.0005	546	29	0.003	0.0033	642
2002	5 647	654	116	0.0006	538	28	0.003	0.0033	682
2003	5 707	655	115	0.0006	568	30	0.003	0.0034	685
2004	5 901	680	115	0.0006	614	32	0.003	0.0036	713

4.4.1.3 Uncertainty Assessment

According to the IPCC GPG the uncertainty of the CO_2 emission factor for coke and the carbon content of iron and steel is 5%.

The uncertainty of activity data is assumed to be low (5%) because there are only five production sites with two sites dominating.

However, in the case of CO_2 emissions from iron and steel production (not including electric steel production) the uncertainty of total emissions from the two production sites is relevant (see general remark in Chapter 4.4.1.2). According to the Monitoring and Reporting Guidelines[26], uncertainty of emission estimates for process emissions from solid raw materials is 5%.

4.4.1.4 Recalculation

Process specific CO_2 emissions from pig iron production have been recalculated as the underlying activity data used for the calculation (non-energy use of coke) has been updated in the national energy balance. The iron ore value 2003 was updated with data from the Steel statistical yearbook (see Table 110).

Table 110: Recalculation difference of CO_2 emissions from pig iron production 1990–2003

Year	CO_2 emissions [Gg]
1990	-0.01
1991	0.03
1992	-0.04
1993	22.34
1994	34.24
1995	34.09
1996	27.93
1997	36.52
1998	33.08
1999	29.00
2000	36.05
2001	34.16
2002	-11.24
2003	10.00

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.

4.4.2.2 Methodological Issues

Emissions were estimated using the IPCC Tier 1b methodology.

26 COMMISSION DECISION of 29/01/2004 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

According to publications from the *British Geological Survey* (BRITISH GEOLOGICAL SURVEY 2001, 2005) Austria produce ferro-molybdenum, ferro-vanadium and ferro-nickel. Activity data from 1995 to 2003 were directly taken from these publications. As no data were available for 1990-1994 the value from 1995 was taken for these years. For 2004 the production from 2003 was used.

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 111 presents activity data and CO_2 emissions from ferroalloy production.

Table 111: Activity data and emissions from ferroalloy production 1990–2004

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
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	12.3	16.7

4.4.2.3 Recalculations

Activity data for the years 2000-2003 have 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)

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.

Table 112 presents PFC and CO_2 emissions from primary aluminium production for the period from 1990 to 1992.

Table 112: PFC emissions from primary aluminium production from 1990 to 1992

	1990	1991	1992
PFC emission [Gg CO_2-equivalent]	1050	1050	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):

$$\text{kg } CF_4/t_{Al} = (1.7 \times AE/pot/day \times F \times AE_{min})/CE$$

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 Uncertainty Assessment

The uncertainty for the PFC emission factors ("Søderberg" process) lies between 30-80% according to the IPCC GPG (p.3.43). The uncertainty of activity data is assumed to be low, because they are data from national statistics (2%). Assuming a mean value for the emission factor, the uncertainty of PFC emissions is 50%.

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 1990 to 1997 and to the trend of emissions in the trend assessment of the years 1998 to 2002.

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 2004 no emissions arose from this category (see Table 89).

Table 113 presents SF_6 emissions from magnesium and aluminium foundries for the period from 1990 to 2004.

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 113: SF_6 emissions from magnesium and aluminium foundries 1990–2004

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

Year	SF_6 emissions [Gg]
2003	0
2004	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 represent 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.

During the review process of the submission 2005 the ERT noted that the SF_6 IEF for Magnesium foundries is unusual high. Following this finding this source has been reinvestigated and it was found that the amount of SF_6 used is reliable, because these data are plant-specific and cross-checked with data from SF_6 suppliers. The error was found in the amount of Magnesium cast for the years 1990-1994. In comparison with data from national industry statistics, they were found to be highly underestimated. Thus the amount of Magnesium cast was updated for these years and is presented in Table 114 (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 114 also presents SF_6 emissions and the calculated IEFs. 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).

Table 114: Magnesium cast, SF_6 emissions and IEF 1990–1999

Year	Magnesium cast [t]	SF_6 emissions [t]	IEF SF_6 [kg/t]
1990	3080	10.0	3.2
1991	2814	11.0	3.9
1992	2693	10.0	3.7
1993	2491	11.0	4.4
1994	3281	15.0	4.6
1995	3377	17.9	5.3
1996	3377	25.0	7.4
1997	3377	14.0	4.1
1998	3377	6.1	1.8
1999	3600	0.2	0.1

4.4.4.3 Uncertainty Assessment

According to the IPCC GPG (p 3.49) the uncertainty associated with plant SF_6 use data is low (5%).

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, semiconductor manufacture, electrical equipment and other sources (noise insulation windows, tyres and research). Also the subcategories aerosols and solvents have been estimated for the first time in this submission.

There is no production of Halocarbons in Austria.

Different to previous submissions 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 increase by 408% between 2004 and 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 115, emissions by sub sector and gas are presented in Table 116.

Table 115: Potential and actual emissions of IPCC Category 2 F per substance group [Gg CO_2e] 1990-2004

	HFCs		PFCs		SF_6		Total	
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	52.92	966.86	516.47	1 372.67	726.72
1994	371.24	206.83	64.77	58.65	1 127.73	612.86	1 563.74	878.33
1995	727.58	267.34	75.99	68.74	1 216.26	696.06	2 019.82	1 032.14
1996	982.72	346.84	73.24	66.27	942.80	607.41	1 998.77	1 020.52
1997	1 122.46	427.42	107.20	96.83	1 098.77	770.98	2 328.43	1 295.23
1998	1 181.44	494.89	110.71	44.75	1 268.99	743.80	2 561.14	1 283.44
1999	1 302.90	542.20	191.14	64.54	1 027.51	661.74	2 521.55	1 268.48
2000	1 567.21	596.26	243.28	72.33	983.99	625.67	2 794.48	1 294.25
2001	1 901.03	695.10	285.95	82.15	1 025.89	628.97	3 212.87	1 406.21
2002	1 932.79	782.44	316.48	86.87	1 030.86	633.19	3 280.13	1 502.50
2003	1 960.49	864.92	380.59	102.54	812.96	593.52	3 154.03	1 560.98
2004	1 927.01	904.39	320.26	114.72	655.98	512.51	2 903.25	1 531.62

Key Sources

For the key source analysis emission data of this category were aggregated as suggested in the IPCC GPG:

2 F 1/2/3/5 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.

Three of these sources have been identified as key sources: *2 F 1/2/3/4/5 ODS (Ozone Depleting Substances) Substitutes* (HFCs), *2 F 7 Semiconductor Manufacture* (HFCs, PFCs and SF_6) and *2 F 9 Other Sources of SF_6* (for further information on key sources 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 2001-2004 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 (results from this study also lead to recalculations in the whole time-series). The sub-categories *2 F 4 Aerosols* and *2 F 5 Solvents* have been estimated for the first time in this submission for the whole time-series.

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[27] 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 have 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

27 „Industriegas-Verordnung (HFKW-FKW-SF6-VO)" federal law gazette 447/2002

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.

The total consumption of HFC and PFC (potential emissions) since 1995 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 15 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.

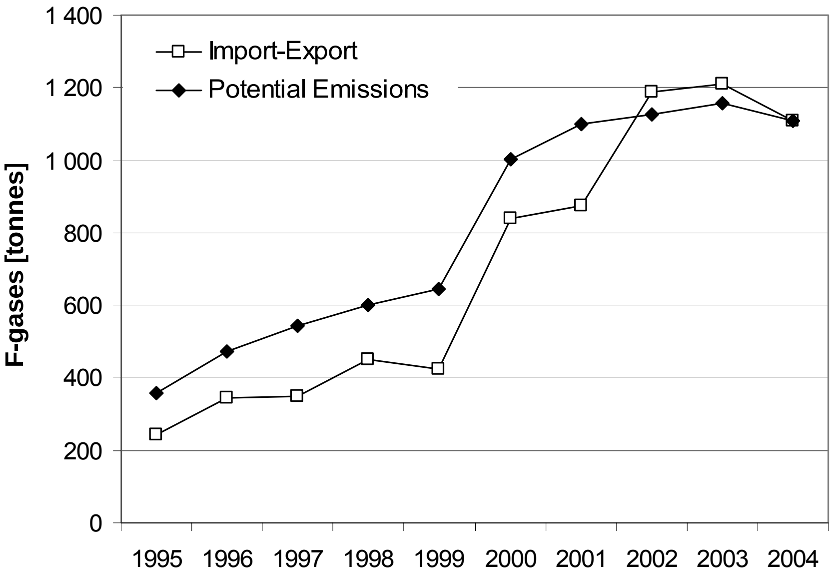

Figure 15: Comparison of potential emissions and Import/Export statistics

Emissions for all subcategories were estimated using a country specific methodology, emission factors are based on information of experts from the respective industries.

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 116: Emissions of IPCC Category 2 F by subsector 1990-2004

GHG	GWP	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	1.86	2.64	3.40	4.11	4.84
HFC-125	2800	t	0.00	0.00	0.00	0.00	0.03	1.47	5.73	10.96	14.26	15.07	19.81	27.62	34.85	41.51	47.78
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	119.00	136.73	151.46	168.53	184.45
HFC-152a	140	t	0.00	0.00	0.00	0.00	0.00	0.06	0.33	0.57	0.72	0.61	0.66	0.70	0.74	0.78	0.81
HFC-143a	3800	t	0.00	0.00	0.00	0.00	0.00	0.39	2.52	5.59	7.92	8.94	12.49	19.98	26.87	33.21	39.11
		Gg CO2e	**1.76**	**2.75**	**3.68**	**5.38**	**8.03**	**33.95**	**79.78**	**131.30**	**177.16**	**206.45**	**258.94**	**332.81**	**398.89**	**464.30**	**525.43**
2 F 2 Foam Blowing																	
HFC-134a	1300	t	0.00	0.00	0.00	75.88	107.41	129.82	151.24	170.37	188.06	197.97	193.95	194.63	195.55	196.64	166.95
HFC-152a	140	t	0.00	0.00	0.00	37.37	52.90	63.94	73.85	82.61	90.64	94.82	108.26	244.25	349.19	430.92	526.17
HFC-unspecified *	1	Gg CO2e	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.65	1.34	2.08	2.89
		Gg CO2e	**0.00**	**0.00**	**0.00**	**103.88**	**147.04**	**177.72**	**206.95**	**233.05**	**257.17**	**270.64**	**267.30**	**287.86**	**304.44**	**318.04**	**293.59**
2 F 3 Fire Extinguishers																	
HFC-23	11700	t	0.00	0.00	0.00	0.10	0.25	0.38	0.56	0.74	0.95	1.15	1.34	1.53	1.72	1.90	1.90
HFC-227ea	2900	t	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.15	0.24	0.35	0.54	0.78	1.08	1.43	1.76
C4F10	7000	t	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
		Gg CO2e	**0.00**	**0.00**	**0.35**	**1.52**	**3.22**	**4.83**	**7.09**	**9.38**	**12.15**	**14.84**	**17.62**	**20.54**	**23.58**	**26.74**	**27.69**
2 F 4 Aerosols																	
HFC-unspecified	1	Gg CO2e	18.88	38.44	39.58	40.11	40.71	41.64	42.58	43.53	44.71	46.25	47.79	49.26	50.19	50.48	51.91
		Gg CO2e	**18.88**	**38.44**	**39.58**	**40.11**	**40.71**	**41.64**	**42.58**	**43.53**	**44.71**	**46.25**	**47.79**	**49.26**	**50.19**	**50.48**	**51.91**
2 F 5 Solvents																	
HFC-43-10mee	1300	t	0.36	0.73	0.75	0.76	0.77	0.79	0.80	0.82	0.85	0.87	0.90	0.92	1.16	1.40	1.43
		Gg CO2e	**0.46**	**0.94**	**0.97**	**0.99**	**1.00**	**1.02**	**1.05**	**1.07**	**1.10**	**1.14**	**1.17**	**1.20**	**1.50**	**1.82**	**1.85**
2 F 7 Semiconductor Manufacture																	
HFC-23	11700	t	0.16	0.26	0.38	0.50	0.61	0.73	0.83	0.81	0.25	0.28	0.32	0.32	0.36	0.33	0.36
CF4	6500	t	3.66	4.11	4.57	5.03	5.17	5.97	5.82	8.52	2.72	4.83	6.33	6.33	6.40	6.90	6.19
C2F6	9200	t	0.57	1.10	1.63	2.16	2.69	3.22	3.05	4.47	2.91	3.56	3.35	4.42	4.08	5.14	6.97
C3F8	7000	t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.05	1.44	1.44
C4F10	7000	t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SF6	23900	t	4.27	7.33	9.98	12.64	15.29	17.94	13.74	20.41	18.01	16.17	13.86	13.86	14.02	15.77	15.85
		Gg CO2e	**133.08**	**215.20**	**287.79**	**360.38**	**430.86**	**505.68**	**403.95**	**593.76**	**477.80**	**453.93**	**407.08**	**416.90**	**425.79**	**483.04**	**497.34**
2 F 8 Electrical Equipment																	
SF6	23900	t	0.86	0.91	0.95	1.00	1.05	1.09	1.13	1.13	1.14	1.21	1.22	1.23	1.26	1.32	1.41
		Gg CO2e	**20.59**	**21.69**	**22.79**	**23.89**	**24.98**	**26.07**	**26.91**	**27.07**	**27.22**	**28.86**	**29.09**	**29.36**	**30.05**	**31.46**	**33.66**
2 F 9 Other sources of SF6																	
SF6	23900	t	5.30	7.50	7.66	7.97	9.31	10.09	10.55	10.71	11.97	10.31	11.10	11.23	11.22	7.74	4.19
		Gg CO2e	**126.56**	**179.20**	**183.10**	**190.58**	**222.49**	**241.23**	**252.21**	**256.06**	**286.13**	**246.36**	**265.25**	**268.28**	**268.04**	**185.09**	**100.14**

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 117. 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 for the first time in this submission. Until 2004 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 first year of HFC usage in the respective sub-category. 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[28]

Generally emissions from disposal can be considered to be low, as cooling devices are recycled in Austria, and the refrigerant is usually recovered[29]. 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 117: 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%

[28] 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 idF BGBl. II Nr. 168/2005)

[29] 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 idF BGBl. II Nr. 440/2001

Sub-category	Description	Used Refrigerants	Emission factors [% of stocks]
Mobile Air-Conditioning	mobile air-conditioning in passenger cars, busses, freight vehicles and rail.	134a	15% 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.

4.5.2.2 2 F 2 Foam Blowing and XPS/PU Plates

HFC emissions from this sub-category have been recalculated incorporating the results from a new study on HFC used in foam blowing (OBERNOSTERER et al 2004).

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.

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 and 2004 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 (HFCs, PFCs, SF_6)

All consumption data and data about actual emissions from semiconductor manufacture were based on direct information from industry. Consumption data is not reported in the CRF as it is treated confidential.

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 and 2004 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/m² – 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 are not yet relevant, because the average life time is estimated to be 25 years and the first SF6 filled windows were introduced in Austria in 1980.

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 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 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%.

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.

4.5.4 Recalculations

HFC emissions from the sub-categories *2 F 4 Aerosols/Metered dose inhalers* and *2 F 5 Solvents* for the whole time-series have been added to the inventory.

HFC emissions from the sub-category *2 F 2 Foam Blowing* have been recalculated incorporating the results from a new study on HFC used in foam blowing.

HFC emissions from disposal have been estimated for the sub-category 2 F 1 Refrigeration and Air conditioning equipment.

The major difference to previously submitted data is due to the recalculation in the sub-sector foam blowing; especially the used blowing agents for soft foam, HFC 134a and HFC 152a – previously it was assumed that only HFC 134a is used – lead to less emissions, expressed as CO_2 equivalent.

Total recalculation differences resulting from the update of data are presented in the following table.

Table 118: Recalculation difference of HFC emissions from consumption of halocarbons and SF_6 1990–2003

Year	HFC emissions [Gg CO_2e]
1990	-196.1
1991	-289.4
1992	-337.9
1993	-286.9
1994	-298.4
1995	-287.9
1996	-290.3
1997	-302.2
1998	-317.6
1999	-324.8
2000	-422.8
2001	-427.3

Year	HFC emissions [Gg CO_2e]
2002	-436.5
2003	-443.3

4.5.5 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.

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 solvent is 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 2004 this category had a contribution of 0.5 % to total greenhouse gas emissions (not considering CO_2 from LUCF). There has been a decrease of 18 % in greenhouse gas emissions from 1990 to 2004 (see Figure 16 and Table 119) due to the positive impact of the enforced laws and regulations in Austria[30] (regulations and directives on solvents, VOC-directive). In emission intensive activity areas such as coating, printing and in the pharmaceutical industry the number of waste air purification plants has grown during the period from 1990 to 1995. From 1995 to 1998 the stock of solvents varied heavily due to the economic development, especially in the last years (1999 - 2004) an increase was observed. In Figure 17 and Table 120 the total greenhouse gas emissions are shown by subcategories.

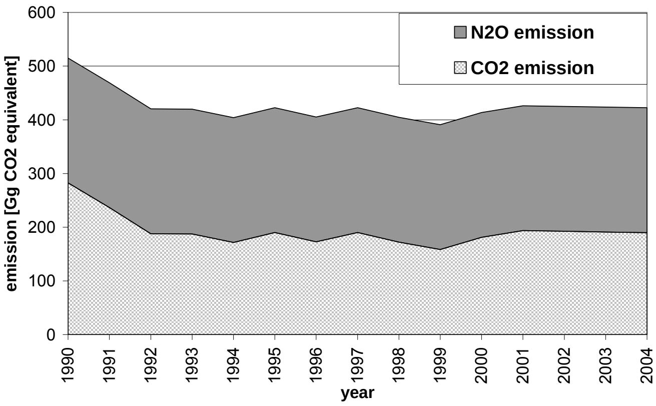

Figure 16: Trend in greenhouse gas emissions of Category 3 Solvent and Other Product Use 1990 – 2004

30 Lösungsmittelverordnung, BGBL 492/1991; Lösungsmittelverordnung 1995, BGBl 872/1995; Lackieranlagen-Verordnung, BGBl. 873/1995; CKW Anlagenverordnung 1994, BGBl. 865/1994.

Table 119: Trend in greenhouse gas emissions of Category 3 Solvent and Other Product Use 1990 – 2004

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	193.60	232.50	426.10
2002	192.35	232.50	424.85
2003	191.10	232.50	423.60
2004	189.84	232.50	422.34
Trend 1990 – 2004	*-32.84%*	*0%*	*-18.02%*

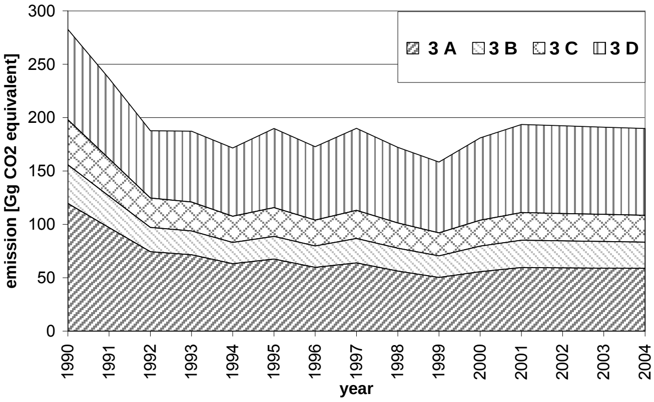

Figure 17: Total greenhouse gas emissions and trend from 1990 – 2004 by subcategories of Category 3 Solvent and Other Product Use

Table 120: Total greenhouse gas emissions and trend from 1990 – 2004 by subcategories of Category 3 Solvent and Other Product Use

GHG	3 A [Gg CO_2 equivalent]	3 B [Gg CO_2 equivalent]	3 C [Gg CO_2 equivalent]	3 D [Gg CO_2 equivalent]	Total [Gg CO_2 equivalent]
1990	119.69	36.11	42.25	317.13	515.17
1991	97.02	29.53	35.02	307.69	469.27
1992	74.37	22.85	27.48	295.54	420.24
1993	71.67	22.23	27.13	298.82	419.85

GHG	3 A [Gg CO_2 equivalent]	3 B [Gg CO_2 equivalent]	3 C [Gg CO_2 equivalent]	3 D [Gg CO_2 equivalent]	Total [Gg CO_2 equivalent]
1994	63.28	19.84	24.58	296.35	404.04
1995	67.46	21.38	26.91	306.62	422.38
1996	59.76	20.15	24.21	301.20	405.31
1997	63.93	22.91	26.31	309.43	422.59
1998	56.29	21.45	23.56	303.45	404.74
1999	50.26	20.34	21.40	298.87	390.87
2000	55.73	23.97	24.16	309.66	413.52
2001	59.60	25.64	25.84	315.02	426.10
2002	59.35	25.28	25.62	314.60	424.85
2003	59.09	24.93	25.40	314.18	423.60
2004	58.84	24.57	25.18	313.75	422.34
Trend 1990 – 2004	*-50.84%*	*-31.94%*	*-40.41%*	*-1.06%*	*-18.02%*

5.1.2 Key Sources

The key source 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 121: 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, 94 TA all years except 02

LA04 = Level Assessment 2004

TA04 = Trend Assessment Base year - 2004

5.1.3 Completeness

Table 122 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 122: 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
3A Paint application	0601	Paint application	✓	NA
3B Degreasing and Dry Cleaning	0602	Degreasing, dry cleaning and electronics	✓	NA
3C Chemical Products, Manufacture and Processing	0603	Chemical products manufacturing and processing	✓	NA

IPCC Category	SNAP		CO_2	N_2O
3D 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

5.2.1 Methodology Overview

CO_2 emissions from solvent use were calculated from NMVOC emissions of this sector. So 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 18 and Figure 19 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.

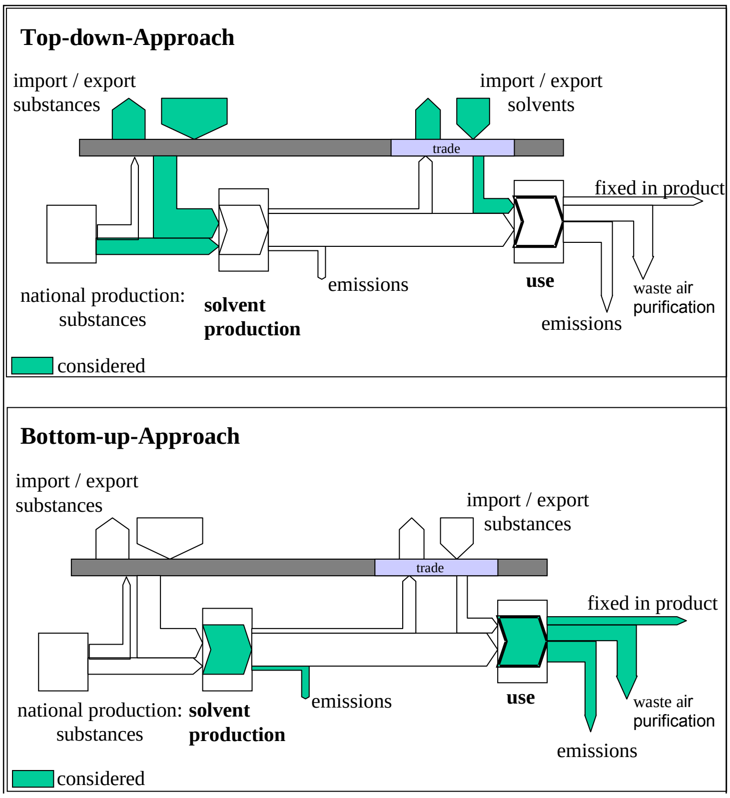

Figure 18: Top-down-Approach compared to Bottom-up-Approach

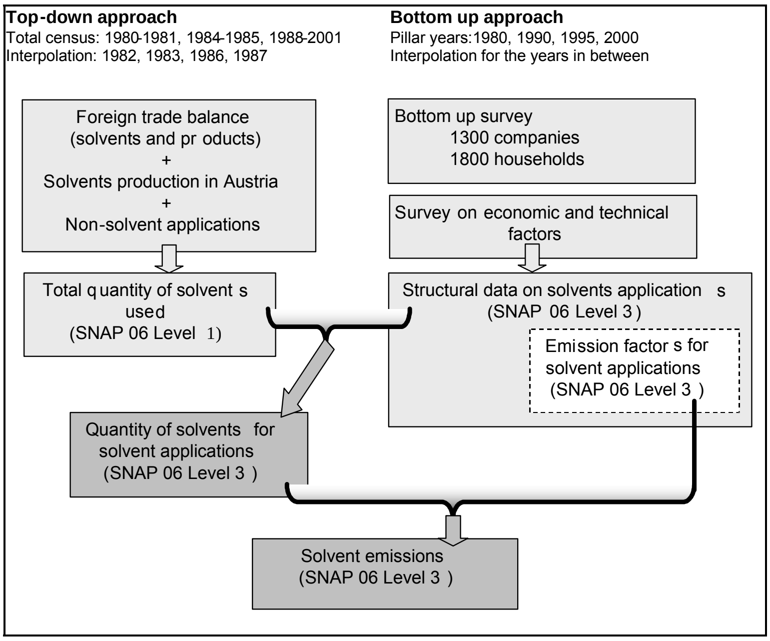

Figure 19: Overview of the methodology for solvent emissions

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. 2002 a)

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. 2002 b). 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 123).

Table 123: 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	1.00
waste gas treatment	0.20

In a second step a survey in 1 800 households was made (WINDSPERGER et al. 2002 a) 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. 2002 a).

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 124: 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 125: 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%
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%

SNAP category	description	year	Distribution of used paints: Solvent based paints	Distribution of used paints: Water based paints	Part of waste gas treatment: application	Part of waste gas treatment: purification
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 126: Specific aspects and their development: changes in the number of employees compared to the year 2000

SNAP97		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%

SNAP97		Changes in the number of employees compared to the year 2000			
		1980	1990	1995	2000
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 2004a).

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 127). The differences between the quantities of solvents from the top down approach and bottom up approach respectively are lower than 10%. Table 127 shows the range of the differences in the considered pillar years broken down to the 15 substance categories.

Table 127: 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 differDifferences [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 present activity data and implied emission factors Table 128 and Table 129 as well as in Figure 20.

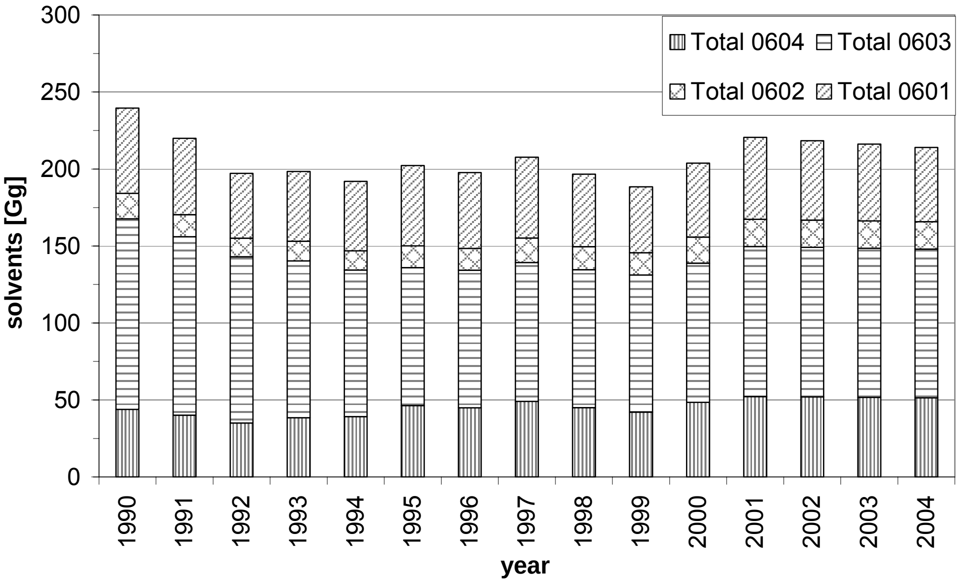

Figure 20: Activity data of Category 3 Solvent and other product use [Gg]

The inventory has been updated with data from (WINDSPERGER et al. 2004 b) since the study (WINDSPERGER et al. 2002) has been published. The data of the Austrian air emission inventory 2005 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 2004 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 128: Activity data of Category 3 Solvent and other product use [Gg]

Activity [Gg]		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
06010	Paint application															
060101	manufacture of automobiles	1.81	1.54	1.24	1.26	1.18	1.28	1.30	1.49	1.43	1.40	1.67	1.73	1.74	1.74	1.74
060102	car repairing	1.01	0.90	0.77	0.83	0.82	0.96	0.91	0.97	0.87	0.79	0.89	0.99	0.98	0.97	0.96
060103	construction and buildings	3.88	3.59	3.16	3.51	3.61	4.32	4.08	4.35	3.90	3.55	3.98	4.41	4.36	4.30	4.25
060104	domestic use	4.60	3.61	2.65	2.40	1.94	1.72	1.67	1.83	1.68	1.58	1.82	1.96	1.95	1.94	1.93
060105	coil coating	5.71	5.12	4.40	4.76	4.78	5.56	5.19	5.45	4.80	4.31	4.74	5.34	5.35	5.35	5.36
060107	wood coating	7.10	6.22	5.20	5.48	5.36	6.08	5.55	5.70	4.90	4.28	4.57	5.30	5.24	5.18	5.12
060108	Other industrial paint application	31.34	28.47	24.72	27.06	27.44	32.31	30.64	32.79	29.46	26.95	30.31	33.43	31.88	30.33	28.79
	Total 0601	*55.45*	*49.44*	*42.14*	*45.30*	*45.12*	*52.22*	*49.33*	*52.59*	*47.04*	*42.85*	*47.99*	*53.16*	*51.49*	*49.83*	*48.16*
0602	Degreasing, dry cleaning and electronics															
060201	Metal degreasing	9.39	7.97	6.45	6.56	6.16	6.70	6.64	7.41	6.94	6.62	7.77	8.21	8.15	8.08	8.02
060202	Dry cleaning	0.47	0.41	0.35	0.38	0.37	0.43	0.42	0.46	0.43	0.40	0.47	0.50	0.50	0.50	0.49
060203	Electronic components manufacturing	2.54	2.15	1.74	1.77	1.66	1.80	1.70	1.81	1.62	1.47	1.64	1.82	1.82	1.82	1.83
060204	Other industrial cleaning	4.08	3.87	3.50	3.98	4.19	5.10	5.26	6.10	5.92	5.83	7.05	7.23	7.30	7.36	7.42
	Total 0602	*16.47*	*14.41*	*12.04*	*12.69*	*12.38*	*14.03*	*14.01*	*15.78*	*14.90*	*14.33*	*16.92*	*17.77*	*17.76*	*17.76*	*17.75*
0603	Chemical products manufacturing and processing															
060305	Rubber processing	0.99	0.86	0.72	0.76	0.73	0.83	0.75	0.76	0.65	0.56	0.59	0.69	0.67	0.64	0.61
060306	Pharmaceutical products manufacturing	8.39	6.98	5.52	5.47	4.99	5.24	5.62	6.74	6.73	6.80	8.39	8.43	8.43	8.43	8.43
060307	Paints manufacturing	59.95	54.97	49.99	45.01	40.03	35.05	34.49	33.92	33.36	32.80	32.24	34.88	34.76	34.64	34.53
060308	Inks manufacturing	7.17	6.93	6.69	6.44	6.20	5.96	5.80	5.63	5.47	5.31	5.14	5.56	5.59	5.62	5.65
060309	Glues manufacturing	4.20	4.17	4.13	4.10	4.06	4.03	4.13	4.23	4.32	4.42	4.52	4.89	4.86	4.84	4.81
060310	Asphalt blowing	1.35	1.17	0.98	1.02	0.99	1.12	0.99	0.98	0.81	0.67	0.67	0.83	0.82	0.81	0.80
060311	Adhesive, magnetic tapes, films and photographs	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	0.01
060312	Textile finishing	0.16	0.13	0.11	0.11	0.10	0.10	0.09	0.09	0.07	0.06	0.06	0.07	0.07	0.07	0.07
060314	Other	41.55	40.70	39.85	39.00	38.15	37.30	37.60	37.91	38.21	38.52	38.83	42.01	41.91	41.81	41.72
	Other - production	*29.89*	*29.20*	*28.52*	*27.83*	*27.14*	*26.45*	*26.63*	*26.81*	*26.99*	*27.18*	*27.36*	*0.00*	*0.00*	*0.00*	*0.00*
	Other – Use	*11.66*	*10.37*	*8.82*	*9.46*	*9.40*	*10.85*	*10.53*	*11.54*	*10.62*	*9.95*	*11.47*	*0.00*	*0.00*	*0.00*	*0.00*
	Total 0603	*123.77*	*115.92*	*107.98*	*101.90*	*95.25*	*89.62*	*89.46*	*90.26*	*89.63*	*89.14*	*90.44*	*97.37*	*97.12*	*96.87*	*96.61*
604	Other use of solvents and related activities															
060403	Printing industry	14.94	13.21	11.17	11.91	11.77	13.51	12.56	13.17	11.58	10.35	11.36	12.84	12.69	12.54	12.39
060404	Fat, edible andnon edible oil extraction	0.54	0.46	0.38	0.39	0.37	0.41	0.37	0.37	0.31	0.26	0.27	0.32	0.32	0.32	0.32
060405	Application of glues and adhesives	0.82	0.71	0.58	0.60	0.58	0.64	0.60	0.64	0.57	0.52	0.58	0.64	0.61	0.58	0.54
060406	Preservation of wood	0.69	0.61	0.52	0.55	0.55	0.63	0.60	0.64	0.57	0.52	0.59	0.65	0.63	0.61	0.59
060407	Under seal treatment and conservation of vehicles	0.22	0.20	0.17	0.19	0.19	0.22	0.20	0.21	0.18	0.16	0.18	0.20	0.19	0.19	0.18

Table 129: Implied NMVOC emission factors for Solvent Use 1990 – 2004 [Gg]

Emission factor [kg NMVOC/t LM]		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0601	Paint application															
060101	manufacture of automobiles	940	881	822	763	704	645	630	616	602	588	573	559	557	554	551
060102	car repairing	976	973	970	967	965	961	948	935	922	908	895	882	882	882	881
060103	construction and buildings	920	905	889	873	857	841	848	856	864	871	879	887	886	885	885
060104	domestic use	885	886	886	887	887	888	888	887	888	888	887	888	888	888	888
060105	coil coating	841	790	738	686	635	583	572	561	551	540	529	519	520	520	521
060107	wood coating	937	893	848	803	759	714	706	697	689	680	672	663	661	659	656
060108	Other industrial paint application	782	701	619	538	456	374	360	346	332	318	304	290	302	315	329
0602	Degreasing, dry cleaning and electronics															
060201	Metal degreasing	935	860	785	710	635	560	537	515	492	469	447	425	421	417	412
060202	Dry cleaning	951	937	923	907	895	881	873	868	862	856	850	844	844	845	845
060203	Electronic components manufacturing	680	643	606	568	531	494	483	472	461	450	439	428	424	421	418
060204	Other industrial cleaning	723	718	713	708	702	697	694	690	687	683	679	676	676	676	677
0603	Chemical products manufacturing and processing															
060305	Rubber processing	986	981	976	974	969	964	959	953	946	941	935	931	932	933	934
060306	Pharmaceutical products manufacturing	463	420	379	337	295	253	254	255	256	257	258	259	259	259	259
060307	Paints manufacturing	54	53	52	51	50	49	46	43	41	38	35	33	33	33	32
060308	Inks manufacturing	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51
060309	Glues manufacturing	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
060310	Asphalt blowing	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
060311	Adhesive, magnetic tapes, films and photographs	1000	1000	667	1000	1000	750	750	1000	1000	1000	800	1000	986	971	957
060312	Textile finishing	887	880	886	886	885	882	888	885	873	895	893	887	887	887	887
060314	Other	224	219	214	209	203	198	191	183	176	168	161	154	155	156	157
0604	Other use of solvents and related activities															
060403	Printing industry	859	825	790	756	722	688	681	675	669	663	657	651	654	656	658
060404	Fat, edible and non edible oil extraction	192	194	195	196	198	201	201	200	201	199	202	201	201	201	202
060405	Application of glues and adhesives	860	827	792	759	724	690	679	669	660	649	638	629	648	670	694
060406	Preservation of wood	990	990	990	991	991	990	992	992	991	990	991	992	989	986	983
060407	Under seal treatment and conservation of vehicles	846	849	849	850	851	851	852	848	852	846	851	846	846	847	847
060408	Domestic solvent use (other than paint application)	839	839	839	840	840	840	841	841	841	841	842	842	842	842	842
060411	Domestic use of pharm-aceutical products (k)	941	941	941	941	941	941	941	941	941	941	941	941	941	941	941
060412	Other (preservation of seeds,…)	917	819	721	624	526	428	412	395	378	362	345	329	328	327	325

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 130) on the basis of the carbon content and the stoichiometrically formed CO_2.

Table 130: Substance specific carbon dioxide emission factors

Substances	CO_2 factor [kg CO_2/kg substance]
Acetone	2.28
Aldehydes	2.44

Substances	CO_2 factor [kg CO_2/kg substance]
Alcohols	1.91
Alcohols / Propanols	2.20
Aromates	3.33
Cydic Hydrocarbons	3.14
Ester	2.16
Ether	2.38
Glycols	1.82
Ketones	2.45
Methanol	1.38
Paraffins	3.14
Residuals	0.92
Solvent naphta	3.14

The amount of carbon dioxide emissions was disaggregated to SNAP level 3 according to the share of solvents used and solvent emissions respectively, that were calculated in the context of the bottom up approach. In Figure 21 and Table 131 the carbon dioxide emissions of Category 3 Solvent and Other Product Use for the years 1990 to 2004 are shown.

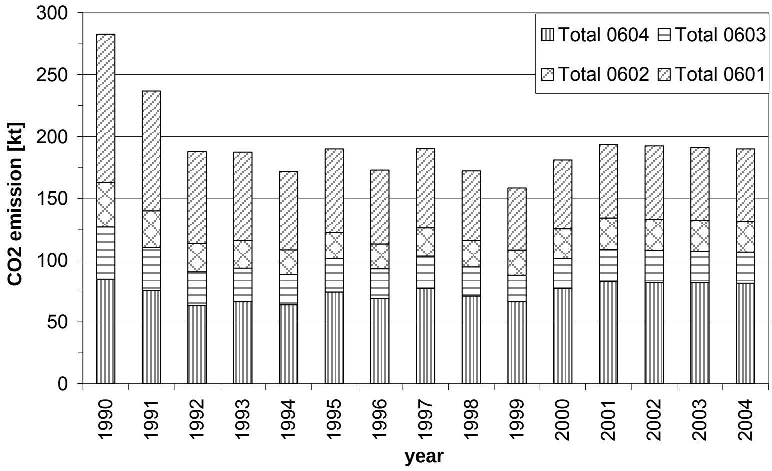

Figure 21: Carbon dioxide emission of Category 3 Solvent and Other Product Use 1990 - 2004

Table 131: Carbon dioxide emission of Category 3 Solvent and Other Product Use 1990 – 2004 [Gg]

Emission [Gg]		**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
060102	car repairing	2.60	2.33	1.97	2.08	2.02	2.36	2.11	2.29	2.05	1.85	2.09	2.23	2.22	2.22	2.21
060103	construction and buildings	10.15	9.28	7.98	8.58	8.42	9.95	9.10	10.07	9.17	8.48	9.75	10.42	10.40	10.38	10.36
060104	domestic use	10.86	8.29	5.93	5.27	4.24	4.04	3.77	4.25	3.95	3.72	4.35	4.65	4.64	4.62	4.61
060105	coil coating	13.65	11.35	8.93	8.85	8.04	8.83	7.76	8.22	7.17	6.33	6.95	7.43	7.51	7.59	7.67
060107	wood coating	17.79	14.71	11.51	11.34	10.24	11.18	9.67	10.07	8.62	7.46	7.99	8.55	8.57	8.59	8.61
060108	Other industrial paint application	59.89	47.34	35.31	33.00	28.18	28.93	25.27	26.64	23.09	20.27	22.06	23.59	23.33	23.06	22.79
	Total 0601	*119.69*	*97.02*	*74.37*	*71.67*	*63.28*	*67.46*	*59.76*	*63.93*	*56.29*	*50.26*	*55.73*	*59.60*	*59.35*	*59.09*	*58.84*
0602	Degreasing, dry cleaning and electronics															
060201	Metal degreasing	23.28	17.99	13.07	11.85	9.76	9.59	8.71	9.56	8.64	7.93	9.04	9.67	9.36	9.06	8.75
060202	Dry cleaning	0.51	0.49	0.44	0.48	0.49	0.59	0.56	0.64	0.61	0.58	0.69	0.74	0.73	0.73	0.72
060203	Electronic components manufacturing	4.33	3.38	2.49	2.30	1.93	1.94	1.71	1.81	1.59	1.41	1.55	1.65	1.65	1.64	1.63
060204	Other industrial cleaning	7.99	7.67	6.85	7.60	7.67	9.26	9.17	10.90	10.61	10.43	12.70	13.58	13.54	13.50	13.47
	Total 0602	*36.11*	*29.53*	*22.85*	*22.23*	*19.84*	*21.38*	*20.15*	*22.91*	*21.45*	*20.34*	*23.97*	*25.64*	*25.28*	*24.93*	*24.57*
0603	Chemical products manufacturing and processing															
060305	Rubber processing	2.87	2.50	2.06	2.13	2.02	2.31	1.99	2.07	1.77	1.53	1.63	1.74	1.71	1.68	1.64
060306	Pharmaceutical products manufacturing	8.35	6.30	4.44	3.88	3.04	2.81	2.92	3.61	3.64	3.68	4.59	4.91	4.83	4.76	4.69
060307	Paints manufacturing	8.94	7.15	5.39	5.11	4.42	4.62	3.95	4.07	3.43	2.92	3.08	3.29	3.21	3.13	3.05
060308	Inks manufacturing	0.65	0.57	0.47	0.49	0.46	0.53	0.48	0.51	0.46	0.41	0.46	0.50	0.50	0.50	0.51
060309	Glues manufacturing	2.26	2.05	1.75	1.86	1.82	2.14	2.02	2.30	2.16	2.05	2.43	2.59	2.59	2.58	2.57
060310	Asphalt blowing	0.05	0.04	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.03
060311	Adhesive, magnetic tapes, films and photographs	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
060312	Textile finishing	0.34	0.28	0.22	0.22	0.20	0.22	0.18	0.18	0.15	0.12	0.12	0.13	0.13	0.14	0.14
060314	Other	18.79	16.15	13.13	13.42	12.58	14.25	12.63	13.52	11.92	10.65	11.82	12.64	12.60	12.57	12.53
	Total 0603	*42.25*	*35.02*	*27.48*	*27.13*	*24.58*	*26.91*	*24.21*	*26.31*	*23.56*	*21.40*	*24.16*	*25.84*	*25.62*	*25.40*	*25.18*
0604	Other use of solvents and related activities															
060403	Printing industry	29.68	24.91	19.80	19.80	18.17	20.16	17.72	18.80	16.41	14.52	15.94	17.04	17.10	17.16	17.21
060404	Fat, edible andnon edible oil extraction	0.34	0.30	0.24	0.25	0.24	0.27	0.23	0.24	0.20	0.17	0.18	0.19	0.20	0.20	0.21
060405	Application of glues and adhesives	2.17	1.76	1.36	1.32	1.17	1.26	1.12	1.20	1.06	0.95	1.06	1.14	1.11	1.09	1.07
060406	Preservation of wood	1.86	1.66	1.39	1.47	1.41	1.64	1.49	1.64	1.48	1.36	1.55	1.66	1.62	1.58	1.54
060407	Under seal treatment and conservation of vehicles	0.42	0.39	0.34	0.37	0.36	0.43	0.38	0.41	0.36	0.32	0.36	0.38	0.37	0.36	0.36
060408	Domestic solvent use (other than paint application)	26.36	25.92	23.59	26.57	27.11	33.08	31.84	36.92	35.18	33.93	40.60	43.42	43.10	42.78	42.45
060411	Domestic use of pharma-ceutical products (k)	10.89	10.17	8.90	9.72	9.66	11.53	10.76	12.12	11.25	10.58	12.37	13.23	13.19	13.16	13.12
060412	Other (preservation of seeds..)	12.91	10.08	7.42	6.82	5.72	5.75	5.16	5.60	5.00	4.54	5.11	5.46	5.40	5.34	5.28
	Total 0604	*84.63*	*75.19*	*63.04*	*66.32*	*63.85*	*74.12*	*68.70*	*76.93*	*70.95*	*66.37*	*77.16*	*82.52*	*82.10*	*81.68*	*81.25*
06	**Total SNAP 06**	**282.67**	**236.77**	**187.74**	**187.35**	**171.54**	**189.88**	**172.81**	**190.09**	**172.24**	**158.37**	**181.02**	**193.60**	**192.35**	**191.10**	**189.84**

Table 132: CO_2 Emission factor for Category 3 Solvent and Other Product Use 1990 – 2004 [Gg]

Emission factor [kg CO_2/t LM]		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0601	Paint application															
060101	manufacture of automobiles	2 620	2 425	2 220	2 023	1 821	1 700	1 591	1 595	1 570	1 540	1 527	1 576	1 546	1 517	1 489
060102	car repairing	2 577	2 588	2 561	2 520	2 449	2 466	2 335	2 366	2 353	2 332	2 335	2 264	2 272	2 281	2 290
060103	construction and buildings	2 614	2 588	2 522	2 441	2 330	2 305	2 231	2 313	2 354	2 386	2 447	2 365	2 388	2 412	2 437
060104	domestic use	2 362	2 297	2 233	2 198	2 187	2 352	2 261	2 325	2 345	2 354	2 387	2 373	2 377	2 381	2 384
060105	coil coating	2 393	2 215	2 031	1 858	1 684	1 587	1 496	1 509	1 493	1 471	1 466	1 391	1 405	1 418	1 432
060107	wood coating	2 505	2 366	2 214	2 067	1 912	1 840	1 742	1 767	1 758	1 745	1 751	1 612	1 634	1 657	1 681
060108	Other industrial paint application	1 911	1 663	1 428	1 220	1 027	895	825	812	784	752	728	706	732	760	792
0602	Degreasing, dry cleaning and electronics															
060201	Metal degreasing	2 479	2 257	2 027	1 806	1 583	1 431	1 313	1 290	1 245	1 197	1 164	1 177	1 149	1 121	1 092
060202	Dry cleaning	1 101	1 186	1 249	1 291	1 313	1 375	1 337	1 395	1 422	1 442	1 474	1 476	1 474	1 471	1 469
060203	Electronic components manufacturing	1 703	1 571	1 432	1 299	1 163	1 078	1 006	1 004	982	956	940	907	902	898	894
060204	Other industrial cleaning	1 961	1 980	1 955	1 909	1 831	1 817	1 744	1 787	1 793	1 789	1 802	1 877	1 856	1 836	1 815
0603	Chemical products manufacturing and processing															
060305	Rubber processing	2 891	2 889	2 854	2 816	2 747	2 787	2 656	2 711	2 722	2 725	2 769	2 513	2 569	2 630	2 697
060306	Pharmaceutical products manufacturing	995	902	804	709	610	536	520	536	540	541	546	582	573	565	556
060307	Paints manufacturing	149	130	108	113	110	132	115	120	103	89	95	94	92	90	88
060308	Inks manufacturing	91	82	70	76	75	89	82	91	84	78	90	89	89	90	90
060309	Glues manufacturing	537	491	422	455	447	530	489	545	500	465	537	530	532	534	535
060310	Asphalt blowing	33	34	34	33	32	33	31	33	32	33	34	29	30	30	31
060311	Adhesive, magnetic tapes, films and photographs	2 333	2 000	2 000	2 000	2 000	2 000	2 000	2 250	2 250	2 250	2 000	2 200	2 239	2 279	2 318
060312	Textile finishing	2 126	2 105	2 095	2 076	2 063	2 127	2 034	2 092	2 099	2 140	2 196	1 845	1 924	2 007	2 092
060314	Other	452	397	329	344	330	382	336	357	312	277	304	301	301	301	300
0604	Other use of solvents and related activities															
060403	Printing industry	1 986	1 885	1 772	1 662	1 544	1 492	1 410	1 427	1 418	1 403	1 403	1 328	1 348	1 369	1 390
060404	Fat, edible and non edible oil extraction	636	642	642	643	636	656	626	641	647	648	663	588	606	624	643
060405	Application of glues and adhesives	2 627	2 488	2 337	2 189	2 035	1 969	1 857	1 877	1 863	1 840	1 837	1 768	1 832	1 903	1 983
060406	Preservation of wood	2 710	2 722	2 698	2 658	2 590	2 614	2 509	2 579	2 599	2 609	2 652	2 569	2 580	2 593	2 606
060407	Under seal treatment and conservation of vehicles	1 891	1 950	1 965	1 963	1 931	1 955	1 887	1 938	1 962	1 975	2 029	1 886	1 916	1 948	1 983
060408	Domestic solvent use (other than paint application)	1 878	1 925	1 921	1 889	1 823	1 816	1 743	1 789	1 798	1 798	1 816	1 855	1 845	1 835	1 826
060411	Domestic use of pharm-aceutical products (k)	2 154	2 196	2 193	2 169	2 111	2 124	2 040	2 097	2 114	2 122	2 150	2 138	2 141	2 144	2 147
060412	Other (preservation of seeds,…)	1 704	1 484	1 274	1 084	908	784	733	734	720	705	696	684	676	668	661

5.2.6 Uncertainty Assessment

The comparison of the results of the top-down approach (import-export statistics, substances and products, production statistics, non solvent application) and these of the bottom-up approach showed a gap of less than 10% (difference between 2 and 14 kt/a) (WINDSPERGER et al. 2004).

Table 133 presents the uncertainties of data sources of the top down approach.

The top-down approach was mainly based on the import-export statistics. The uncertainty of the statistical data was assumed to be negligible compared to the other uncertainties. The method of the import-export statistics between 1980 and 2001 varied and to harmonise the time series it was necessary to adjust data. The current import-export statistics are more detailed in regard of the products and substances. Hence the uncertainty is assumed to be in the order of 0.5 and 10% whereas it is higher in 1990 than in 2000.

An other important data source on top-down level was the survey on “non-solvent-application” in the 20 most relevant companies. The companies reported data in different quality: partly they reported data for all years partly just for the pillar years. Generally due to increasing electronic data storage the data quality is in the last years better than in earlier years. Altogether it was assumed that the uncertainty is between 1.5% and 5%. As for the statistical data, the uncertainty is higher in 1990 than in 2000.

Table 133: Uncertainties of Top down approach

	Data source	1990	1995	2000	Uncertainty source
Substances	national statistics foreign trade balance	+2.5 to - 2.5%	+1.5 to -1.5%	+0.5 to -0.5%	Expert judgement (WINDSPERGER et al. 2004)
Products	national statistics foreign trade balance	+10 to -10%	+5 to - 5%	+2.5 to -2.5%	Expert judgement (WINDSPERGER et al. 2004)]
Solvent Production	National production statistics	0	0	0	Assumed to be negligible (see above)
Non solvent applications	Surveys in relevant companies	+5 to -5%	+2.5 to -2.5%	+1.5 to -1.5%	Expert judgement (WINDSPERGER et al. 2004)

Table 134 presents the uncertainties of the emission factors that were obtained by expert judgement. A sensitivity analysis (WINDSPERGER et al. 2002a) showed a variation of 5% of the emission factors of solvent application in the year 2000.

Table 134: Uncertainties of Bottom- up approach

	1990	1995	2000	Data and uncertainty source
Emissions factor	86%	63%	58%	(WINDSPERGER et al. 2004)]
Uncertainty – emissions factor	+10 to -10%	+7 to -7%	+5 to -5%	Expert judgement (WINDSPERGER et al. 2004)

For calculation of the overall uncertainties of Sector 6 the upper and lower limit of activity data and emission factors was taken into account. Table 135.

Table 135: Uncertainties of Sector 6 Solvent and other product use

	1990	1995	2000	Data source
Uncertainty solvent emissions	-21 to +24%	-18 to +21%	-13 to +14%	(WINDSPERGER et al. 2004)

5.3 N_2O Emissions from Solvent and Other Product Use

Anaesthesia

100% of N_2O used for anaesthesia is released into atmosphere, therefore the emission factor is 1.00 Mg N_2O / Mg product use.

It is assumed that the use of N_2O for anaesthesia is constant at 350 tons per year. This estimation is based upon expert judgement and industry inquiries.

Fire Extinguishers

N_2O emissions from this category are not estimated. It is assumed that emissions from this source are very low in Austria since N_2O driven fire extinguishers are not used widely, the uncertainty of emission estimates would be very high and emissions are not expected to vary widely over time.

Aerosol Cans

100% of N_2O used for aerosol cans is released into atmosphere, that's why the emission factor used is 1.00. 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.

5.4 Recalculation for Emissions from Solvent and Other Product Use

Description of reasons for recalculation is given in the subchapter 5.2.4. The tables below show the recalculation difference of emissions from Sector 6 Solvent and Other Product Use and its subcategories with respect to the previous submission.

Improvements of methodologies and emission factors:

Indirect CO_2 emissions from solvent use have been updated for 2002 and 2003 by means of 2001 data and sector specific technological and economic development; previously the estimate for 2001 was used for these years.

Table 136: Recalculation difference with respect to submission 2005

		Absolute difference [Gg]							Relative difference [Δ%]	
		1990	1995	1999	2000	2001	2002	2003	1990	2003
3	Solvent and other product use	0.00	0.00	0.00	0.00	0.00	-1.25	-2.50	0	-1.29%
3 A	Paint application	0.00	0.00	0.00	0.00	0.00	-0.25	-0.51	0	-0.85%
3 B	Degreasing and dry cleaning	0.00	0.00	0.00	0.00	0.00	-0.35	-0.71	0	-2.76%
3 C	Chemical products. manufacture and processing	0.00	0.00	0.00	0.00	0.00	-0.22	-0.44	0	-1.71%
3 D	Other use of solvents and related products	0.00	0.00	0.00	0.00	0.00	-0.42	-0.85	0	-1.03%
3 D 5	*Other Solvent Use*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*-0.42*	*-0.85*	*0*	*-1.03%*

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 2005):

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 2004 the sector *Agriculture* contributed 8.6% to the total of Austria's greenhouse gas emissions (not considering CO_2 emissions from LUCF). The trend of GHG emissions from 1990 to 2004 shows a decrease of 13.8% for this sector (see Figure 22 and Table 138) due to a decrease in activity data.

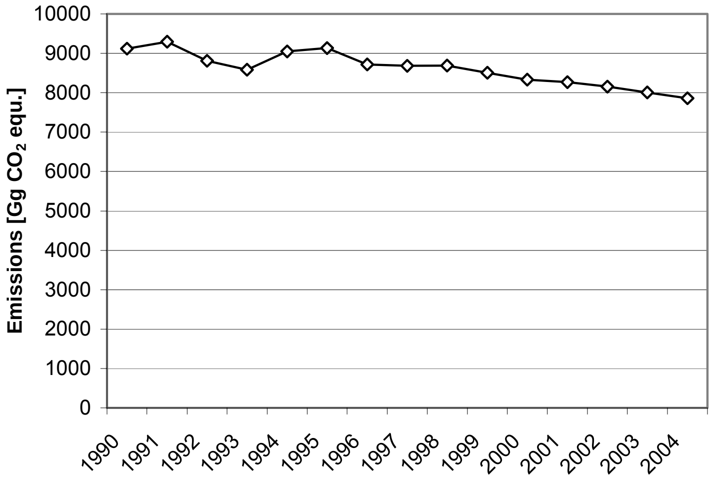

Figure 22: Trend of total GHG emissions from Agriculture

The fluctuations in the time series shown in Figure 22 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 13.8% since the base year mainly due to lower emissions from *Enteric Fermentation* and *Manure Management*. N_2O emissions decreased by 13.8% 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 1990-2004 from Category 4 Agriculture

Year	GHG emissions [Gg]	
	CH_4	N_2O
1990	230.02	13.85
1991	226.80	14.63
1992	218.33	13.64
1993	218.81	12.86
1994	219.12	14.34
1995	220.14	14.55
1996	216.81	13.44

Year	GHG emissions [Gg]	
	CH_4	N_2O
1997	213.78	13.54
1998	212.92	13.61
1999	208.82	13.29
2000	206.62	12.89
2001	204.44	12.83
2002	200.09	12.76
2003	199.20	12.33
2004	198.34	11.93
Trend 90-04	*-13.8%*	*-13.8%*

Emission trends per sector

Table 138 presents total GHG emissions and trend 1990-2004 from *Agriculture* by subcategories as well as the contribution to the overall inventory emissions. Important sub-sectors are *4 A Enteric Fermentation* (3.6%) and *4 D Agricultural Soils* (3.1%) followed by *4 B Manure Management* (1.9%).

Table 138: Total GHG emissions and trend 1990 - 2004 by subcategories of Agriculture

Year	GHG emissions [Gg CO_2 equivalent] by sub categories				
	4	4 A	4 B	4 D	4 F
1990	9 122.44	3 761.66	2 065.40	3 293.64	1.74
1991	9 296.60	3 709.12	2 038.44	3 547.33	1.72
1992	8 812.64	3 547.67	1 985.45	3 277.87	1.65
1993	8 582.84	3 546.57	1 995.68	3 038.96	1.63
1994	9 048.22	3 565.63	1 983.77	3 497.12	1.69
1995	9 134.47	3 594.33	1 996.91	3 541.53	1.71
1996	8 718.11	3 543.72	1 960.11	3 212.59	1.68
1997	8 687.43	3 481.66	1 947.38	3 256.62	1.77
1998	8 691.32	3 453.80	1 955.31	3 280.50	1.72
1999	8 504.96	3 419.54	1 891.11	3 192.56	1.76
2000	8 333.92	3 399.28	1 852.83	3 080.16	1.65
2001	8 270.44	3 349.16	1 849.44	3 070.09	1.74
2002	8 157.15	3 288.47	1 800.89	3 066.05	1.74
2003	8 006.61	3 266.60	1 796.18	2 942.22	1.61
2004	7 863.19	3 274.66	1 765.65	2 820.47	2.41
Share in Austrian Total 2004	8.6%	3.6%	1.9%	3.1%	0.0%
Trend 1990-2004	-13.8%	-12.9%	-14.5%	-14.4%	38.3%

As can be seen in Figure 23 and Table 138 the trend concerning emissions from all categories is decreasing. The reason for the nearly linear 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).

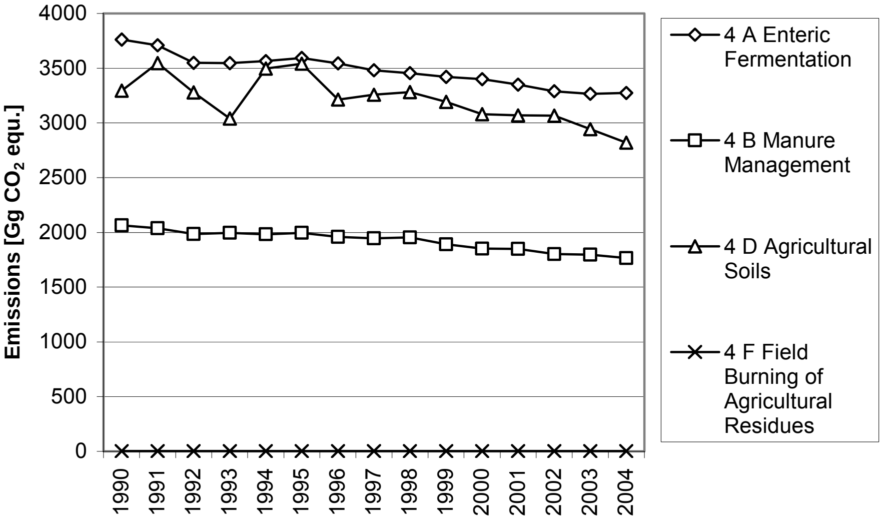

Figure 23: Emission trends of sub- sectors of Agriculture

As can be seen in Table 139, in 2004 about 42% of emissions from sector *Agriculture* originate from source category *4 A Enteric Fermentation*. Source category *4 D Agricultural Soils* contributes around 36%, source category *4 B Manure Management* contributes another 23%. Source category *2 F Field Burning of Agricultural Wastes* contributes only a negligible part (0.003% in 2004).

Table 139: Total greenhouse gas emissions and share of subcategories of Agriculture, 1990 and 2004

Year	GHG emissions [%] by sub categories				
	4	4 A	4 B	4 D	4 F
1990	100.0%	41.2%	22.6%	36.1%	0.0%
2004	100.0%	41.6%	22.5%	35.9%	0.0%

6.1.2 Key Sources

The key source 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	all
4 B 1	Cattle	N_2O	all LA, TA 97, 98, 01-04
4 B 1	Cattle	CH_4	all LA, TA 97, 00-04
4 B 8	Swine	CH_4	all LA, TA 04
4 D 1	Direct Soil Emissions	N_2O	all LA, TA 97, 00-04
4 D 3	Indirect Emissions	N_2O	all

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

Table 141 presents uncertainties for emissions as well as for activity data and the EFs applied as estimated or as provided by the IPCC GPG (for the cases where default values were used for estimating emissions).

Compared to high uncertainties of emission factors, the uncertainty of the underlying statistical activity data is relatively low reducing the uncertainty of the calculated emissions.

Table 141: Uncertainties of Emissions and Emission Factors (Agriculture)

Categories		CH_4 Emissions	N_2O Emissions	EF CH_4	EF N_2O
4A1a, 4A1b	Cattle	+/- 8%[3]	--	+/- 20%[1]	--
4A3/ 4A4	Sheep, Goats	+/- 62%[3]	--	+/- 30%[2]	--
4A6	Horses	+/- 10%[3]	--	+/- 30%[2]	--
4A8	Swine	+/- 42%[3]	--	+/- 30%[2]	--
4A9	Poultry	--	--	--	--
4B1a	Dairy Cattle			+/- 65%[1]	- 50% to + 100%[2]
4B1b	Non-dairy Cattle			+/- 75%[1]	- 50% to + 100%[2]
4B8	Swine	+/- 90%[1]		+/- 70%[1]	- 50% to + 100%[2]
4B 3/ 4/ 6/ 9	Sheep, Goats, Horses, Poultry	+/- 90%[1]		+/- 20%[2]	- 50% to + 100%[2]
4D	Agricultural Soils	--	+/- 48%[3]	--	(see Table 183)
4F	Field Burning	--	--	--	--
Activity Data					
	animal population	+/- 10%[4]			
	agricultural used land	+/- 5%[4]			

(1) (AMON et al. 2002), University of Natural Resources and Applied Life Sciences, Vienna

(2) IPCC

(3) Monte Carlo Analysis (GEBETSROITHER et al. 2002)

(4) (WINIWARTER & RYPDAL 2001)

6.1.6 Recalculations

Update of activity data:

4 D 4 Other: Amounts of agriculturally applied sewage sludge of the years 2002 to 2004 have been updated with data from the National Austrian Waste Water Database operated by the Umweltbundesamt.

Improvements of methodologies and emission factors:

4 A, 4 B, 4 D Enteric Fermentation, Manure Management, Agricultural Soils:

As recommended in the Centralized Review 2004, Austrian N excretion values have been revised. N excretion rates of dairy and mother cows are higher now, which led to higher emissions of N_2O from source category 4 B 1. Higher amounts of animal waste resulted in higher emissions from source category 4 D 1, 4 D 2 and 4 D 3.

Within the revision of N excretion rates also the GE-intake and VS excretion data of dairy and mother cows have been recalculated. This resulted in higher CH_4 emissions from source category 4 A 1 and 4 B 1.

The improved methodology is based on the following literature: (GRUBER & POETSCH 2005), (PÖTSCH et al. 2005), (STEINWIDDER & GUGGENBERGER 2003), (UNTERARBEITSGRUPPE N-ADHOC 2004) and (ZAÖR 2004)

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
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	Laying hens, broilers,	✓	✓

IPCC Category		SNAP		CH_4	N_2O
		/08/09	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	Animal Production	1002	Cultures without fertilizers	NO	✓
4 D 3	Indirect Emissions	1001 / 1002	Cultures with and without fertilizers	NO	✓
4 D 4	Other (Sewage Sludge)	1001	Cultures with fertilizers	✓	✓
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 2004 78.6% 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 12.9% to 155.9 Gg in 2004. Almost all emissions (93.8% in 2004) are caused by cattle farming. The contribution of *Dairy Cattle* to total emissions from cattle decreased from 49.3% in 1990 to 39.7% in 2004.

Table 143: Greenhouse gas emissions from Enteric Fermentation by sub categories 1990-2004

Year	CH4 emissions [Gg] 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	162.84	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	155.55	62.90	82.84	2.60	0.27	1.57	4.87	0.17	0.33
2004	155.94	61.88	84.41	2.62	0.28	1.57	4.69	0.17	0.33
Share 2004	*100%*	*39.7%*	*54.1%*	*1.7%*	*0.2%*	*1.0%*	*3.0%*	*0.1%*	*0.2%*
Trend 1990-2004	-12.9%	-29.9%	3.9%	5.6%	48.7%	77.0%	-15.3%	-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 gross energy intake and milk yield of milk cattle 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 livestock* 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 2004) provides national data of annual livestock numbers on a very detailed level. These data are based on livestock counts held in December each year[31]. The inherent uncertainty is estimated to be about 5% (FREIBAUER & KALTSCHMITT 2001).

In Table 144 and Table 145 applied animal data are presented. Background information to the data is listed below:

From 1990 onwards: The strong 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. The increased financial support for *mother and suckling cows* results in a shift from dairy to mother cows (numbers of mother cows strongly increase).

1991: A minimum counting threshold for *poultry* was introduced. Farms with less than 11 poultry were not counted any more.

The marked 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 (EEA) and the EU guidelines for farm animal population categories. This is the reason why the 1993 data are not fully comparable with the previous data. For example, in 1993 part of the "*Young cattle < 1 yr*" category was included in the "*Young cattle 1-2 yr*". The same cause is the main reason of the shift from "Young swine < 50 kg" to "Fattening pigs > 50 kg" (before 1993 the limits were 6 months and not 50 kg which led to the shift). Following the recommendations of the Centralized Review 2003, to ensure consistency the age class split for *swine* categories of the years 1990-1992 was adjusted using the split from 1993.

31 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.

1996-1998: The increase of *dairy cattle* numbers is connected with a decrease of *mother cows* in this period: STATISTIK AUSTRIA derives the *mother cow* numbers from premium data. The total cow number (dairy + mother cows >2yr) is based on livestock counts held in December each year. Total cow number less a decreasing mother cow number from 1996 to 1998 resulted in an increasing dairy cattle number for this period. Reasons are multifarious: BSE epidemic in Europe, changing market prices, 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 1990-2004 (I)

Year	Population size [heads] *							
	Livestock Category							
	Dairy	Non Dairy	Mother Cows (suckling cows >2yr)	Young Cattle <1yr	Young Cattle 1-2yr	Cattle > 2yr	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
Trend	*-40.5%*	*-9.9%*	*456.2%*	*-30.1%*	*-21.3%*	*11.5%*	*5.6%*	*48.7%*

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. It was decided to use the STATISTIK AUSTRIA data, because they are the best available.

Table 145: Domestic livestock population and its trend 1990-2004 (II)

Year	Population size [heads] *								
	Livestock Category								
	Horses	Swine	Fattening Pig >50kg	Swine for breeding >50kg	Young Swine <50kg	Poultry	Chicken	Other Poultry	Other
1990	49 200	3 687 981	1 308 525	382 335	1 997 120	13 820 961	13 139 151	681 810	37 100
1991	57 803	3 637 980	1 290 785	377 152	1 970 044	14 397 143	13 478 820	918 323	37 100
1992	61 400	3 719 653	1 319 744	385 613	2 014 243	13 683 900	12 872 100	811 800	37 100
1993	64 924	3 819 798	1 355 295	396 001	2 068 502	14 508 473	13 588 850	919 623	37 100
1994	66 748	3 728 991	1 323 145	394 938	2 010 908	14 178 834	13 265 572	913 262	37 736
1995	72 491	3 706 185	1 312 334	401 490	1 992 361	13 959 316	13 157 078	802 238	40 323
1996	73 234	3 663 747	1 262 391	398 633	2 002 723	12 979 954	12 215 194	764 760	41 526
1997	74 170	3 679 876	1 268 856	397 742	2 013 278	14 760 355	13 949 648	810 707	56 244
1998	75 347	3 810 310	1 375 037	386 281	2 048 992	14 306 846	13 539 693	767 153	50 365
1999	81 566	3 433 029	1 250 775	343 812	1 838 442	14 498 170	13 797 829	700 341	39 086
2000	81 566	3 347 931	1 211 988	334 278	1 801 665	11 786 670	11 077 343	709 327	38 475
2001	81 566	3 440 405	1 264 253	350 197	1 825 955	12 571 528	11 905 111	666 417	38 475
2002	81 566	3 304 650	1 187 908	341 042	1 775 700	12 571 528	11 905 111	666 417	38 475
2003	87 072	3 244 866	1 243 807	334 329	1 666 730	13 027 145	12 354 358	672 787	41 190
2004	87 072	3 125 361	1 159 501	317 033	1 648 827	13 027 145	12 354 358	672 787	41 190
Trend	77.0%	-15.3%	-11.4%	-17.1%	-17.4%	-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[32] 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

32 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.

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, mother cows, calves etc.).

Table 146 shows the results of the shares of organic farming in the relevant livestock categories for 1997-2000.

Table 146: Share of animal population under organic farming systems (average 1997-2000, calculations by ARCS, based on INVEKOS data)

IPCC Category	% organic	IPCC Category	% organic
CATTLE	15%	SHEEPS	26%
MATURE DAIRY CATTLE		GOATS	29%
Dairy Cattle > 2 yr	15%	POULTRY	
MATURE NON DAIRY		Chicken	3%
CATTLE		Other Poultry	2%
Mother Cows > 2 yr	25%		
Cattle > 2 yr	20%	SOLIPEDS	
YOUNG CATTLE		Horses	Not estimated
Young Cattle < 1 yr	13%	Other Solipeds	Not estimated
Young Cattle 1-2 yr	12%	OTHER ANIMALS	Not estimated
SWINE	1%		
MATURE SWINE			
Fattening pig > 50 kg	1%		
Swine for breeding > 50 kg	1%		
YOUNG SWINE			
Young Swine < 50 kg	2%		

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 after 2000 the data for 2000 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 2004, emissions from *Enteric Fermentation - Cattle* contributed 3.6% 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).

$$EF = (GE * Y_m * 365\ days/yr) / 55.65\ \text{MJ/kg}$$

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). Within the revision of Austrian N excretion values energy intake data of dairy and mother cows were recalculated by (PÖTSCH 2005).

Table 147: 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 5 802 kg/cow (2004). The time series of average milk yields per dairy cow was taken from national statistics and are presented in Table 148. For dairy cattle there was a 15.5% increase of GE intake between 1990 and 2004 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 148: Annual milk yield, Gross Energy Intake and Emission Factors of Dairy Cattle 1990-2004

Year	Milk Yield [kg/cow*yr]	Gross Energy Intake [MJ/head*day]	Emission Factor [kg CH_4/head*yr]
1990	3 791	248	97.6
1991	3 862	249	97.9
1992	3 934	249	98.1
1993	4 005	250	98.3
1994	4 076	255	100.2
1995	4 619[1)]	259	102.0
1996	4 670	262	102.9
1997	4 787	264	103.9
1998	4 924	266	104.8

Year	Milk Yield [kg/cow*yr]	Gross Energy Intake [MJ/head*day]	Emission Factor [kg CH_4/head*yr]
1999	5 062	269	105.7
2000	5 210	273	107.3
2001	5 394	277	108.9
2002	5 487	281	110.5
2003	5 638	287	112.8
2004	5 802	292	115.0

[1)]From 1995 onwards premium data have been taken into account by STATISTIK AUSTRIA, which led to significant higher milk yield data of Austrian dairy cows.

GE Gross Energy Intake of Non-Dairy Cattle (1 A 1 b)

For mother cows an average milk yield of 3 000 kg was assumed. Following the calculations described above this results in a Gross Energy Intake of 235.3 MJ per head and day (see Table 147).

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 149.

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 149: Typical Austrian diets and gross energy intake of Non-Dairy Cattle, conventional and organic production system.

		cattle < 1 year	cattle 1-2 years	non dairy cattle > 2 years
CONVENTIONAL	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
		cattle < 1 year	cattle 1-2 years	n. dairy cattle > 2 yrs
ORGANIC	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 1990-2003, 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 150: Emission Factors and Gross Energy Intake of Non- Dairy Cattle 1990-2004

IPCC Category	Farming type	Gross Energy Intake [MJ/head*day]	Calculated Emission Factor [kg CH_4/head.yr]
Mother cows suckling > 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 4.9% to total emissions from this category in 2004. The most important sub source is *Swine*, with a contribution of 2.4%, followed by *Sheep* (1.3%), *Horses* (0.8%), *Other Livestock/ Deer* 0.2% and finally *Goats and Poultry* with each 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 151: 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 the study (MINONZIO 1998).

Activity data were obtained from national statistics and are presented in Table 144 and Table 145.

6.2.3 Uncertainties

Uncertainty of total CH_4 emissions from Enteric Fermentation: +/- 8%

Uncertainties of CH_4 emissions from *Enteric Fermentation* were estimated with a "Monte Carlo" simulation. Assuming a normal probability distribution, the calculated standard deviation is 4%. This indicates there is a 95% probability that CH_4 emissions are between +/- 2 standard deviations.

Uncertainties that were taken into account for calculations of the total uncertainty:

- Gross Energy Intake (GE): +/- 20% (estimated by expert judgement of Dr. Amon)
- Methane Conversion Factor (Y_m) cattle: +/- 8.3% (IPCC GUIDELINES 1997)
- Livestock: (STATISTIK AUSTRIA; sample survey –) statistical accuracy 95%
- Share of organic farming: +/- 10% (estimated by expert judgement of the ARC-Team)
- EF for Sheep, Swine, Horses, Goats (IPCC default values): +/- 30% (IPCC GUIDELINES 1997)
- The emission factors for the "Tier 2" method are determined by the uncertainty of the gross energy intake (GE) and the CH_4 conversion rates (Y_m). The uncertainty was estimated to be to be about +/- 20% (AMON et al. 2002).

Table 152 presents the standard deviations for CH_4 emissions from animal categories. The uncertainty is defined as +/- 2 σ.

Table 152: Uncertainties of emission estimates for Enteric Fermentation

IPCC Category	Farming Type	Standard deviation (σ) in%
CATTLE	Conventional	4
CATTLE	Organic	6
CATTLE	Total	4
MATURE DAIRY CATTLE		
Dairy Cattle > 2 yr	Conventional	8
Dairy Cattle > 2 yr	Organic	11

IPCC Category	Farming Type	Standard deviation (σ) in%
Dairy Cattle > 2 yr	Total	8
MATURE NON DAIRY CATTLE		
Mother Cows > 2 yr	Conventional	8
Mother Cows > 2 yr	Organic	11
Mother Cows > 2 yr	Total	8
Cattle > 2 yr	Conventional	8
Cattle > 2 yr	Organic	11
Cattle > 2 yr	Total	8
YOUNG CATTLE		
Young Cattle < 1 yr	Conventional	8
Young Cattle < 1 yr	Organic	11
Young Cattle < 1 yr	Total	8
Young Cattle 1-2 yr	Conventional	8
Young Cattle 1-2 yr	Organic	11
Young Cattle 1-2 yr	Total	8
SWINE	Conventional	21
SWINE	Organic	24
SWINE	Total	21
MATURE SWINE		
Fattening pig > 50 kg	Conventional	30
Fattening pig > 50 kg	Organic	32
Fattened pig > 50 kg	Total	30
Swine for breeding > 50 kg	Conventional	30
Swine for breeding > 50 kg	Organic	32
Swine for breeding > 50 kg	Total	30
YOUNG SWINE		
Young Swine < 50 kg	Conventional	31
Young Swine < 50 kg	Organic	32
Young Swine < 50 kg	Total	31
SHEEPS	Conventional	31
SHEEPS	Organic	32
SHEEPS	Total	31
GOATS	Conventional	31
GOATS	Organic	32
GOATS	Total	31
POULTRY	Total	Not estimated
SOLIPEDS	Total	5
Horses	Conventional	5
Other Solipeds	Conventional	Not estimated
OTHER ANIMAL	Conventional	Not estimated
Total		**4**

6.2.4 Recalculations

GE-intake data of *dairy* and *mother cows* have been recalculated (PÖTSCH 2005 following GRUBER & STEINWIDDER 1996), which resulted in higher CH_4 emissions from source category 4 A 1.

Table 153: Difference to last year's submission of CH_4 emissions from subcategories of Category 4 A

Year	CH_4 emissions [Gg]		
	4 A Total	4 A 1 a Dairy	4 A 1 b Non-Dairy
1990	8.97	8.16	0.81
1991	8.77	7.78	0.99
1992	8.40	7.36	1.04
1993	8.32	7.13	1.19
1994	7.05	5.50	1.55
1995	7.14	3.52	3.62
1996	7.15	3.48	3.66
1997	6.54	3.61	2.94
1998	6.32	3.66	2.66
1999	6.56	3.51	3.04
2000	7.72	3.36	4.35
2001	7.90	3.47	4.44
2002	7.86	3.64	4.22
2003	8.24	4.05	4.19

The increasing recalculation difference of *non-dairy cattle* 1990-2003 reflects the increasing number of *mother cows* in Austria.

6.2.5 Planned Improvements

A comprehensive investigation on Austria's agricultural practice currently is carried out by the Department of Sustainable Agricultural Systems - Division of Agricultural Engineering, University of Natural Resources and Applied Life Sciences, Vienna. New results are planned to implement in the Austrian Greenhouse Gas Emission Inventory.

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 2004 21% of the agricultural CH_4 emissions and 24% of the agricultural N_2O emissions were caused by this source category.

6.3.1 Source Category Description

From 1990 to 2004 CH_4 emissions from *Manure Management* decreased by 17.0% to 41.9 Gg. This is mainly due a decrease of the livestock categories cattle and swine.

Table 154: CH_4 Emissions from Manure Management 1990-2004

	CH_4 emissions from Manure Management [Gg]								
	Livestock Categories								
	4 B Total	4 B 1 a Dairy	4 B 1 b N. 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	43.18	11.29	11.13	0.06	0.01	0.12	19.54	1.02	0.01
2004	41.89	10.95	11.37	0.06	0.01	0.12	18.35	1.02	0.01
Share 2004	*100%*	26.1%	27.1%	0.1%	0.0%	0.3%	43.8%	2.4%	0.0%
Trend 1990-2004	-17.0%	-37.8%	9.8%	5.6%	48.7%	77.0%	-13.9%	-5.7%	11.0%

From 1990 to 2004 the N_2O emissions from *Manure Management* decreased by 11.8% to 2.9 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 1990-2004

	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
Share 2004	*100%*	40.0%	50.4%	0.2%	0.0%	0.0%	7.6%	1.8%	0.0%
Trend 1990-2004	-11.8%	-26.5%	4.7%	5.6%	48.7%	77.0%	-14.0%	-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 of Austria's manure management system distribution were taken from KONRAD (1995).

Activity data

(STATISTIK AUSTRIA 2003) 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):

$$EF_i = VS_i * 365 \text{ [days yr}^{-1}] * B_{0i} * 0.67 \text{ [kg m}^{-3}] * \Sigma_{jK} MCF_{jK} * MS\%_{ijK}$$

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

Due to the lack of sufficiently detailed information about manure systems in Austria, 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 used.

Manure Management Systems

In Austria national statistics on manure management systems are not available. Up to now, only one comprehensive survey has been carried out (KONRAD, 1995) (Table 156). This manure management system distribution was used for the whole period from 1990-2004.

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.

VS Values

Austrian specific values for dairy cows were calculated in dependency of annual milk yields and corresponding feed intake data (gross energy intake, feed digestibility, ash content, see Table 147 and Table 157). Within the revision of Austrian N excretion values (following a recommondation of the Centralized Review 2005) energy intake data and VS excretion data of *dairy* and *mother 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 was calculated by interpolation of these data (see Table 158). For the calculation of VS excretion of mother (suckling) cows an average milk yield of 3 000 kg was assumed (see Table 157).

Table 158: VS excretion of Austrian diary cows for the period 1990-2004

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Milk Yield [1] [kg/cow*yr]	3791	3862	3934	4005	4076	4619	4670	4787	4924	5062	5210	5394	5487	5638	5802
VS	4.04	4.05	4.05	4.06	4.07	4.09	4.10	4.11	4.11	4.12	4.14	4.16	4.18	4.21	4.23

1) From 1995 onwards premium data have been taken into account by STATISTIK AUSTRIA, which led to significant higher milk yield data of Austrian dairy cows.

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 149).

As no major changes in diets of *Non-Dairy Cattle* occurred in the period from 1990-2004, 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]..Estimation of Dipl.-Ing. Alfred Pöllinger (Federal Research Institute, Gumpenstein) following (KONRAD 1995)

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. A differentiation between organic and conventional management is not possible due to lack of data.

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

Livestock category	Emission Factor [kg CH_4 per head per yr]	Livestock category	Emission Factor [kg CH_4 per head per yr]
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 used to estimate N_2O emissions from *Manure Management* are the same as those that were used to estimate CH_4 emissions from *Manure Management* (see Table 156 and Table 160).

N excretion

As recommended in the Centralized Review 2004, Austrian N excretion values were reviewed and recalculated by (PÖTSCH 2005 following GRUBER & STEINWIDDER 1996). Especially N excretion rates of dairy and mother cows are higher now (see Table 163):

Table 163: Austria specific N excretion values of dairy cows for the period 1990-2004

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	1997	4 787	85.58
1990	3 791	76.62	1998	4 924	86.82
1991	3 862	77.26	1999	5 062	88.06
1992	3 934	77.90	2000	5 210	89.39
1993	4 005	78.54	2001	5 394	91.05
1994	4 076	79.18	2002	5 487	91.88
1995	4 619[1)]	84.07	2003	5 638	93.24
1996	4 670	84.53	2004	5 802	94.72

1) From 1995 onwards premium data have been taken into account by STATISTIK AUSTRIA, which led to significant higher milk yield data of Austrian dairy cows.

Austrian revised N excretion values for all other livestock categories are listed in Table 164

Table 164: Austria specific N excretion values of other livestock categories

Livestock category	*Nitrogen excretion* [kg per animal per 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

Austrian revised N excretion values as shown in Table 163 and Table 164 base on following literature: (GRUBER & POETSCH 2005), (PÖTSCH et al. 2005), (STEINWIDDER & GUGGENBERGER 2003), (UNTERARBEITSGRUPPE N-ADHOC 2004) and (ZAÖR 2004)

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 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	0.02
Pasture/Range/Paddock	0.02
Other Systems	0.005

6.3.3 Uncertainties

Uncertainties are presented in Table 141.

6.3.4 Recalculations

As recommended in the Centralized Review 2004, Austrian N excretion values have been revised. Especially N excretion rates of *dairy* and *mother cows* are higher now, which resulted in higher N_2O emissions from source category 4 B 1. The recalculation of VS excretion values of *dairy* and *mother cows* resulted in higher CH_4 emissions from these source categories. The improved methodology is based on the following literature: (GRUBER & POETSCH 2005), (PÖTSCH et al. 2005), (STEINWIDDER & GUGGENBERGER 2003), (UNTERARBEITSGRUPPE N-ADHOC 2004) and (ZAÖR 2004)

Table 167: Difference to last submission of CH_4 emissions from subcategories of Category 4 B

Year	CH_4 emissions [Gg]		
	4 B Total	4 B 1 a Dairy	4 B 1 b Non-Dairy
1990	1.90	1.80	0.09
1991	1.85	1.74	0.11
1992	1.78	1.66	0.12
1993	1.77	1.63	0.14
1994	1.44	1.26	0.18
1995	1.23	0.81	0.42
1996	1.21	0.78	0.43
1997	1.13	0.78	0.34
1998	1.08	0.77	0.31
1999	1.08	0.72	0.35
2000	1.17	0.66	0.51
2001	1.05	0.66	0.39
2002	1.04	0.67	0.37
2003	1.02	0.65	0.37

Table 168: Difference to last submission of N_2O emissions from subcategories of Category 4 B

Year	N_2O emissions [Gg]				
	4 B Total	4 B 1 a Dairy	4 B 1 b Non-Dairy	4 B 8 Swine	4 B 9 Poultry
1990	0.71	0.42	0.37	-0.05	-0.03
1991	0.70	0.42	0.37	-0.05	-0.03
1992	0.67	0.41	0.35	-0.05	-0.03
1993	0.66	0.41	0.33	-0.05	-0.03
1994	0.63	0.37	0.34	-0.05	-0.03
1995	0.66	0.37	0.38	-0.05	-0.03
1996	0.65	0.36	0.37	-0.05	-0.03
1997	0.63	0.38	0.35	-0.05	-0.03
1998	0.63	0.39	0.33	-0.05	-0.03
1999	0.64	0.38	0.34	-0.05	-0.03
2000	0.64	0.35	0.37	-0.05	-0.03

Year	N_2O emissions [Gg]				
	4 B Total	4 B 1 a Dairy	4 B 1 b Non-Dairy	4 B 8 Swine	4 B 9 Poultry
2001	0.63	0.34	0.37	-0.05	-0.03
2002	0.61	0.33	0.36	-0.05	-0.03
2003	0.60	0.32	0.36	-0.05	-0.03

6.3.5 Planned Improvements

A comprehensive investigation on Austria's agricultural practice currently is carried out by the Department of Sustainable Agricultural Systems - Division of Agricultural Engineering, University of Natural Resources and Applied Life Sciences, Vienna. New results are planned to implement in the Austrian Greenhouse Gas Emission Inventory.

6.4 Agricultural Soils (CRF Source Category 4 D)

6.4.1 Source Category Description

N_2O emissions from source category *4 D 1 Direct Soil Emissions* and source category *4 D 3 Indirect Soil Emissions* are a key source.

In 2004 76% of total N_2O emissions from *Agriculture* (53% 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 Waste*.

Emissions from this category contributed 3.1% (2 820.5 Gg CO_2 equivalents) to Austria's total greenhouse gas emissions in the year 2004. This is 35.9% of total GHG emissions of the sector *Agriculture*.

The trend of N_2O emissions from this category is decreasing: in 2004 emissions were 14.4% below 1990 levels.

Table 169 presents N_2O emissions of *Agricultural Soils* by sub-category as well as their trends and their share in total N_2O emissions.

Table 169: N_2O emissions from Category 4 D, 1990-2004

Year	**N_2O emissions [Gg]** IPCC Categories										
	4 D total	**4 D 1** Direct Soil Emissions	Synthetic Fertilisers	Organic Fertiliser	Crop Residue	N-fixing Crops	**4 D 2** Pasture	**4 D 3** Indir. Soil Emissions	Nitrogen Leaching	Athm. Deposition	**4 D 4** Sewage Sludge
1990	10.60	5.65	2.62	2.27	0.43	0.33	0.70	4.23	3.55	0.67	0.02
1991	11.42	6.18	3.07	2.27	0.48	0.36	0.72	4.50	3.83	0.66	0.02
1992	10.55	5.71	2.60	2.20	0.46	0.46	0.70	4.12	3.48	0.64	0.02
1993	9.77	5.19	2.05	2.22	0.47	0.45	0.74	3.81	3.19	0.62	0.03
1994	11.25	6.16	2.88	2.22	0.61	0.45	0.74	4.32	3.69	0.63	0.03
1995	11.39	6.19	2.92	2.26	0.69	0.32	0.77	4.40	3.76	0.64	0.03
1996	10.33	5.49	2.42	2.23	0.51	0.34	0.77	4.04	3.43	0.61	0.03
1997	10.47	5.62	2.45	2.23	0.53	0.40	0.77	4.05	3.45	0.60	0.03
1998	10.55	5.71	2.47	2.22	0.58	0.43	0.75	4.06	3.45	0.61	0.03
1999	10.27	5.54	2.35	2.18	0.61	0.39	0.75	3.94	3.35	0.59	0.03
2000	9.91	5.29	2.30	2.13	0.48	0.37	0.73	3.86	3.27	0.59	0.03
2001	9.87	5.30	2.28	2.12	0.54	0.36	0.72	3.83	3.24	0.59	0.03
2002	9.87	5.32	2.34	2.07	0.54	0.38	0.70	3.81	3.23	0.58	0.03
2003	9.46	5.04	2.11	2.08	0.46	0.39	0.71	3.68	3.11	0.57	0.03
2004	9.07	4.83	1.86	2.06	0.51	0.40	0.71	3.50	2.94	0.56	0.03
Share 2004	*100%*	*53.2%*	*20.5%*	*22.7%*	*5.6%*	*4.4%*	*5.9%*	*38.6%*	*32.4%*	*6.2%*	*0.3%*
Trend 90-04	*-14.5%*	*-14.5%*	*-29.2%*	*-9.1%*	*18.0%*	*22.1%*	*0.7%*	*-17.1%*	*-17.2%*	*-16.7%*	*28.3%*

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 0.42 Gg CH_4 2004). This is about 0.2% of total CH_4 from sector *Agriculture*.

Table 170: CH_4 emissions from Category 4 D, 1990-2004

	CH_4 emissions [Gg]	
	IPCC Category	
Year	4 D total	4 D 4 Other (sewage sludge application)
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
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	0.42	0.42
Share 2004	*100.0%*	*100.0%*
Trend 90-04	*28.3%*	*28.3%*

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 171: 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		
4 D 2 Pasture, Range and Paddock Manure		

Category	Emission Factor [t N_2O-N / t N]	Source
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)
4 D 4 Other		
Sewage Sludge Spreading	0.0125	IPCC GPG (Table 4.17)

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 172: Data sources for nitrogen input to Agricultural Soils

Category	Data Sources
4 D 1 Direct Soil Emissions	
Synthetic Fertilizers (mineral fert.)	fertilizer consumption: Grüner Bericht 2005 (BMLFUW 2005) (1) ; urea application in Austria: Sales data RWA, 2005 (2)
Animal Waste applied to soils	(BARBARA AMON 2002) following (GRUBER & STEINWIDDER 1996). Recalculations by (PÖTSCH 2005)
N- fixing Crops	Cropped area legume production: (BMLFUW 2005) (1)
Crop Residue	Harvested amount of agricultural crops: (BMLFUW 2005) (1)
4 D 2 Pasture, Range and Paddock Manure	
Grazing Animals	(BARBARA AMON 2002) following (GRUBER & STEINWIDDER 1996). Recalculations by (PÖTSCH 2005)
4 D 3 Indirect Soil Emissions	
Athmospheric Deposition	(BARBARA AMON 2002) following (GRUBER & STEINWIDDER 1996). Recalculations by (PÖTSCH 2005)
Nitrogen Leaching (and Run- off)	see above (synthetic fertilizers, animal waste, sewage sludge)
4 D 4 Other	
Sewage Sludge Spreading	Water Quality Report 2000 (PHILIPPITSCH et al. 2001), Report on sewage sludge (SCHARF et al. 1997), Gewässerschutzbericht 2002 (BMLFUW 2002), National Austrian Waste Water Database 2005

[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 synthetic 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 fertilizers ("mineral fertilizers").

The S&A report 2004 noticed high inter-annual variations in N_2O emissions of sector 4 D synthetic fertilizer use. These variations are caused by effects of storage as well as the difference between the calendar year and the agricultural economic year: the amounts of synthetic fertilizers over the years reflect the amounts sold in one calendar year. However, the economic year for the farmer does not correspond to the calendar year. Not the whole amount purchased is applied in the year of purchase.

Considering these effects, the arithmetic average of each two years is used as fertilizer application data. The time series for fertilizer consumption is presented in Table 173.

Table 173: Mineral fertiliser N consumption in Austria 1990-2004 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[4], RWA[2]	126 650	4 899
1997	131 800	6 440	GB[4], RWA[2]	128 550	5 520
1998	127 500	6 440	GB[4], RWA[2]	129 650	6 440
1999	119 500	6 808	GB[4], RWA[2]	123 500	6 624
2000	121 600	3 848	GB[4], RWA[2]	120 550	5 328
2001	117 100	3 329	GB[4], RWA[2]	119 350	3 589
2002	127 600	5 297	GB[4], RWA[2]	122 350	4 313
2003	94 400	8 608	GB[4], RWA[2]	111 000	6 952
2004	100 800	5 160	GB[4], RWA[2]	97 600	6 884

1 (BMLFUW 2000)

2 Raiffeisen Ware Austria, sales company

3 (BMLFUW 2003)

4 (BMLFUW, 2005)

Values of Table 173 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 2005).

Table 174: Cropped area legume production, 1990-2004

	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

Harvest Data

Harvest data were taken from (BMLFUW 2005) and the datapool of (BUNDESANSTALT FÜR AGRARWIRTSCHAFT 2005) and are presented in Table 175.

Table 175: Harvest Data I, 1990-2004

	Harvest [1000 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

Table 176: Harvest Data II, 1990-2004

Year	Harvest [1000 t] silo-green maize	clover-hey	rape	sunflow er	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

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 (BMLFUW 2002). For 2001 to 2004 data from the National Austrian Waste Water Database operated by the Umweltbundesamt was used (UMWELTBUNDESAMT 2005).

The federal provinces (Bundesländer) Salzburg, Steiermark and Wien didn't report data for 2004. Niederösterreich didn't report data for 2003 and 2004. Due the lack of data, for these Bundesländer the values of the last available year have been used.

Table 177: Amount of sewage sludge (dry matter) produced in Austria, 1990-2004

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	273 017	39 186	14.4
2004	145 118	40 510	27.9

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.* 53.2% (4.83 Gg in 2004) of N_2O emissions from *Agricultural Soils* arise from this sub-category (see Table 169).

Calculation of direct N_2O emissions from soils is based on the assumption that 1.25% of the nitrogen input to agricultural soils is emitted in the form of N_2O (expressed as N). In this method, the nitrogen input is corrected for gaseous losses through volatilization of NH_3 and NO_X.

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
- Crop residues remaining on the field after harvest

Nitrogen input from all sources were 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 was 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 mineral 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 173)

$Frac_{GASF}$ = 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 (EMEP/CORINAIR 1999) p.1010-15, 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.

Ammonia emissions from housig and storage were calculated following the CORINAIR EMEP - methodology (detailed methodology for cattle and swine). A detailed description of the method applied is given in the report "Austria's Informative Report 2004 – Submission under the UNECE Convention on Long-range Transboundary Air Pollution".

In Table 178 the nitrogen left for spreading for the years 1990-2004 per animal type is presented.

Table 178: Animal manure left for spreading on agricultural soils per livestock category 1990-2004

	Nitrogen left for spreading [Mg N per year]													
year	IPCC Livestock Categories													
	total	dairy cattle	suckling cows	cattle 1-2 a	cattle < 1 a	cattle > 2 a	sows	fattening pigs	chicken	other poultry	sheep	goats	horses / solipeds	oth. animals
1990	140962	55395	2 398	18215	19192	8 193	8 525	10334	8 100	1 057	5 909	712	2 225	708
1991	140726	54091	2 924	18041	18548	8 468	8 409	10194	8 309	1 424	6 217	781	2 614	708
1992	136231	52406	3 084	16925	17251	8 167	8 598	10423	7 935	1 259	5 948	752	2 776	708
1993	137856	51985	3 535	18609	14636	8 845	8 829	10704	8 377	1 426	6 365	902	2 935	708
1994	137515	51260	4 589	18617	14658	8 332	8 806	10450	8 178	1 416	6 523	949	3 018	720
1995	140164	47470	10733	18330	14344	8 570	8 952	10364	8 111	1 244	6 964	1 034	3 278	769
1996	137929	47123	10847	17454	13907	8 619	8 888	9 970	7 530	1 186	7 261	1 039	3 311	792
1997	138421	49274	8 697	16711	13087	9 054	8 868	10021	8 600	1 257	7 314	1 113	3 354	1 073
1998	137825	50562	7 867	16116	13175	8 815	8 613	10860	8 347	1 189	6 879	1 035	3 407	961
1999	135383	49117	9 010	15860	13081	8 924	7 666	9 878	8 506	1 086	6 716	1 106	3 688	746
2000	131866	44366	12891	15152	13595	8 949	7 453	9 572	6 829	1 100	6 468	1 070	3 688	734
2001	131251	43513	13143	14802	13669	8 293	7 808	9 985	7 339	1 033	6 110	1 134	3 688	734
2002	128329	43251	12491	14614	13278	8 009	7 604	9 382	7 339	1 033	5 803	1 103	3 688	734
2003	128822	41574	12397	14490	13310	9 144	7 454	9 823	7 616	1 043	6 206	1 042	3 937	786
2004	127859	40723	13337	14337	13420	9 137	7 069	9 157	7 616	1 043	6 237	1 059	3 937	786

Values of Table 178 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.

NH_3-N losses were calculated following the CORINAIR EMEP – methodology (detailed methodology for cattle and swine - see 'Austria's Informative Report 2004 – Submission under the UNECE Convention on Long-range Transboundary Air Pollution'). NO_x-N-losses from animal waste spreading were estimated using a conservative emission factor of 1% of manure nitrogen beeing emitted in the form of NO_x-N (FREIBAUER & KALTSCHMITT 2001).

This procedure enables the use of country specific data, which is more accurate than the use of the default value for $Frac_{gasm}$.

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:

$$F_{BN} = LCA * B_{Fix} / 1000$$

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 1990-2004 can be found in Table 174.

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 publication made by the Umweltbundesamt (GÖTZ 1998); these values are constant over the time series.

Nitrogen input from 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 and 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 175)
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 2005) and the datapool of (BUNDESANSTALT FÜR AGRARWIRTSCHAFT 2005) and are presented in Table 175. The other parameters used are presented in the following table:

Table 179: Input parameters used to estimate emissions from crop residues 2004

	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	0.005	0.0	0.0000
Sugarbeet	0.45	0.8	0.005	0.0	0.0000
Fodderbeet	0.20	3.0	0.005	1.0	0.0000
Maize (silo)	0.30	0.0	0.005	1.0	0.0000
Clover-hay	0.86	0.0	0.005	1.0	0.0000
Rape	0.86	21	0.005	0.0	0.0000
Sunflower	0.86	2.5	0.015	0.0	0.0000
Sojabean	0.40	15.0	0.015	0.0	0.0000
Fodderbean	0.40	1.5	0.015	0.0	0.0000
Peas	0.40	1.0	0.015	0.0	0.0000
Vegetables	0.20	0.8	0.005	0.0	0.0000
Oil pumpkin	0.80	72.0	0.015	0.0	0.0000

The Centralized Review 2005 noted that the value for $Frac_{NCRBF}$ ist the lowest of the reporting parties. In fact, there happened a transcription error in additional table 4.D. For the fraction of nitrogen in N-fixing crops ($Frac_{NCRBF}$) an average value of 0.015 and not 0.005 was used.

The fraction of nitrogen in non-N-fixing crops ($Frac_{NCRO}$) varies from 0.005 (cereals) to 0.015 (Oil pumpkins and sunflowers (see Table 179).

Values were taken from (GÖTZ 1998) and had been worked out by Austrian Experts (Ministery of Agriculture, Fachbeirat für Bodenschutz und Bodenfruchtbarkeit).

6.4.2.2 Pasture, Range and Paddock Manure (4 D 2)

Key Source: No

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 180

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 180: Nitrogen excreted during grazing (N_{exGRAZ}) 1990-2004

Year	N excretion grazing [kg/animal/yr]	Year	N excretion grazing [kg/animal/yr]
1990	22 422	1998	23 819
1991	22 881	1999	23 774
1992	22 177	2000	23 192
1993	23 428	2001	22 797
1994	23 700	2002	22 384
1995	24 570	2003	22 589
1996	24 381	2004	22 576
1997	24 359		

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 173)
$Frac_{GASF}$	=	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 (EMEP/CORINAIR 1999) p.1010-15, 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 181: N-losses and $Frac_{Gasm}$ 1990 to 2004

Year	total N-losses [t N/yr]	$Frac_{Gasm}$ (N_{losses}/Nex_{total})
1990	39 271	0.22
1991	38 107	0.22
1992	36 920	0.22
1993	36 459	0.21
1994	36 060	0.21
1995	36 581	0.21
1996	35 524	0.21
1997	34 523	0.20
1998	35 025	0.21
1999	34 015	0.20
2000	34 053	0.21
2001	34 144	0.21
2002	33 361	0.21
2003	32 935	0.21
2004	32 501	0.20

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 with the CORINAIR detailed methodology (EMEP/CORINAIR 1999), for the other categories the CORINAIR simple methodology was used.

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 178) 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 2004 – Submission under the UNECE Convention on Long-range Transboundary Air Pollution'.

N_2O emissions through nitrogen leaching losses

The method applied for calculation of the emissions 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 173)
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 178)
N_{exGRAZ}	=	Annual amount of animal manure nitrogen produced by grazing animals and directly dropped on agricultural soils during grazing [t N] (see Table 180)
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 (0.03 [t/t] following IPCC GUIDELINES 1997, WORKBOOK TABLE 4-19)
$EF\text{-}N_2O_{LL}$	=	Emission factor for N_2O from leaching, expressed as N_2O-N (0.025 [t/t] following IPCC GUIDELINES 1997, WORKBOOK TABLE 4-18)

6.4.2.4 Sewage Sludge Application (4 D 4)

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 2004 N_2O emissions from sewage sludge contributed only 0.34% of N_2O emissions from category 4 D Agricultural Soils.

A mean value of 3.9% N in dry matter based on a large set of measurements (SCHARF et al. 1997) was taken to calculate the nitrogen content. 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 177)

Annual nitrogen input from sewage sludge applied on agricultural soils is presented in Table 182.

Table 182: Annual nitrogen input from sewage sludge applied on agricultural soils (F_{SSlu}) 1990-2004

Year	N input sewage sludge [Mg/N/yr]	Year	N input sewage sludge [Mg/N/yr]
1990	1 232	1998	1 686
1991	1 232	1999	1 686
1992	1 170	2000	1 686
1993	1 755	2001	1 622
1994	1 502	2002	1 407
1995	1 654	2003	1 528
1996	1 675	2004	1 580
1997	1 675		

CH_4 emissions

According to the Institute for Applied Ecology and a study (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.

6.4.3 Uncertainties

The uncertainties for N_2O emissions are presented in Table 183 and were calculated by Monte Carlo analysis, using a model implemented with @risk software. The model uses a probability distribution as an input value instead of a single fixed value.

Table 183: Uncertainties of N_2O emissions from agricultural soils

Category	Uncertainty (standard deviation)*
4 D 1 Direct soil emissions	
Mineral fertilizer application	+/- 27%
Animal waste application	+/- 25%
Crop residues	+/- 25%
Biological N fixation	+/- 50%
4 D 2 Pasture, Range and Paddock Manure	
Grazing Animals	+/- 58%
4 D 3 Indirect emissions	
Leaching	+/- 25%
Atmospheric deposition	+/- 57%
4 D 4 Other	
Sewage sludge application	+/- 25%
Total	**+/- 24%**

*There is a 65% probability that the "real value" is within +/-1 standard deviation of the calculated value; and a 95% probability of that the "real value" is +/-2 standard deviation of the calculated value.

6.4.4 Recalculations

Revised N excretion data of Austrian livestock led to higher amounts of animal waste spread on agricultural soils and excreta deposited on pastures by grazing animals.

Table 184: Difference to submission 2004 of N_2O emissions from Category 4 D Agricultural Soils

Year	N_2O emissions [Gg]			
	4 D Total	4 D 1 Direct Soil Emissions	4 D 2 Pasture Manure	4 D 3 Indirect Emissions
1990	0.71	0.33	0.04	0.34
1991	0.69	0.33	0.03	0.33
1992	0.66	0.31	0.03	0.32

Year	N_2O emissions [Gg]			
	4 D Total	4 D 1 Direct Soil Emissions	4 D 2 Pasture Manure	4 D 3 Indirect Emissions
1993	0.64	0.30	0.03	0.30
1994	0.59	0.28	0.02	0.28
1995	0.63	0.30	0.02	0.31
1996	0.81	0.42	0.02	0.38
1997	0.60	0.30	0.01	0.29
1998	0.62	0.31	0.02	0.30
1999	0.92	0.49	0.02	0.42
2000	0.72	0.36	0.02	0.35
2001	0.43	0.18	0.02	0.23
2002	0.74	0.37	0.02	0.35
2003	0.90	0.48	0.01	0.40

6.4.5 Planned Improvements

A comprehensive investigation on Austria's agricultural practice currently is carried out by the Department of Sustainable Agricultural Systems - Division of Agricultural Engineering, University of Natural Resources and Applied Life Sciences, Vienna. New results are planned to implement in the Austrian Greenhouse Gas Emission Inventory.

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 2004 total emissions from this category amounted to 2.4 Gg CO_2 equivalent, this is a share of 0.03% in total GHG emissions from *Sector Agriculture*. CH_4 and N_2O emissions for the years from 1990 to 2004 are presented in Table 185.

Table 185: Greenhouse gas emissions from Category 4 F Field Burning of Agricultural Residues 1990-2004

	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
2001	0.07	0.001
2002	0.07	0.001
2003	0.06	0.001
2004	0.09	0.002
Trend 1990-2004	*36.5%*	*45.3%*
Share in Agriculture	*0.05%*	*0.01%*

6.5.2 Methodological Issues

6.5.2.1 Cereals/ Wheat (4 F 1 a)

Key Source: No

Following a recommendation of the Centralized Review 2003 the IPCC method with default emission factors was applied.

According to an expert judgement from Dr. Reindl from the *Presidential Conference of Austrian Agricultural Chambers*, about 3 400 ha of straw fields were burnt 2004 (this corresponds to about 0.4% of total area under cereals). For the years before an average value of 2 500 ha was indicated.

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). 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 186: Activity data for 4 F Field Burning of Agricultural Waste 1990–2003

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	51 214	3 841
2004	51 214	3 841

The emission factors (4 828 g CH_4 /t and 49.7 g N_2O/t 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 187: 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 Cropland	C Grassland	D Wetlands(2)	E Settlements(2)	F Other land (2)
1990	-11961	-12146	-513	450	18	90	140
1991	-17890	-18072	-518	451	18	90	140
1992	-12699	-12892	-507	451	18	90	140
1993	-16521	-16722	-443	421	17	81	125
1994	-15426	-15620	-450	421	17	81	125
1995	-14411	-14784	-270	419	17	81	125
1996	-9695	-10035	-248	390	15	72	111
1997	-18783	-19136	-235	390	15	72	111
1998	-16900	-17284	-203	389	15	72	111
1999	-21375	-21777	-185	389	15	72	111
2000	-16026	-16437	-176	389	15	72	111
2001	-18762	-19211	-179	430	15	72	111
2002	-15125	-15493	-188	359	15	72	111
2003	-16597	-17047	-127	379	15	72	111
2004	-16629	-17047	-120	340	15	72	111
Trend BY - 2004	39.0%	40.4%	-40.4%	-76.6%	-24.5%	-20.0%	-20.0%

(1) Other GHG are also considered, therefore the totals are different compared to the totals in the CRF tables.

(2) Only conversion from forest land is estimated

As can be seen from the table, 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 and category 5 B cropland 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 only 3-6% 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 17% of total GHG in Austria (without LUCF), compared to 15% in the base year. The removals increased by 39.0% from the base year to 2004, mainly due to an increase of the carbon stock in forest land.

Due to methodological changes the figures of previous NIRs and submissions are not comparable with the actual figures. However, the whole time series from 1990 up to 2004 has been recalculated with this submission.

7.1.2 Methodology

For the sub category *5 A Forest Land* an improved methodology has been applied which is not yet officially approved by the accreditation body – however, the approval is scheduled for early 2007.

The methodology for estimating emissions from this category is described in the sub chapters 7.2, 7.3 and 7.4. 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.

Table 188 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 188: 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	**3,894,000**	**3,960,000**	**66,000**
1. Forest Land remaining Forest Land			
productive forest	3,332,667	3,371,000	38,333
non-productive forest	546,743	577,618	30,875
2. Land converted to Forest Land	14,590	11,382	-3,208
2.1 Cropland converted to Forest Land	2,350	1,822	-528
2.2 Grassland converted to Forest Land	8,650	6,720	-1,930
2.3 Wetland converted to Forest Land	720	570	-150
2.4 Settlement converted to Forest Land	2,010	1,590	-420
2.5 Other Land converted to Forest Land	860	680	-180
5.B Cropland - total area	**1,507,533**	**1,460,067**	**-47,466**
1. Cropland remaining Cropland	1,474,796	1,422,183	-52,613
2. Land converted to Cropland	33,899	39,081	5,182
2.1Forest Land converted to Cropland	330	270	-60
2.2 Grassland Land converted to Cropland	33,569	38,811	5,242
5.C. Grassland - total area	**1,992,764**	**1,957,169**	**-35,595**
1. Grassland remaining Grassland	1,962,943	1,925,072	-37,871
2. Land converted to Grassland	29,821	32,097	2,276

Area in ha	1990	2001	Diff 1990-2001
2.1 Forest Land converted to Grassland	3,540	2,810	-730
2.2 Arable Land converted to Grassland	26,281	29,287	3,006
5 D Wetlands - total area	**4,775**	**11,796**	**7,022**
1. Wetlands remaining Wetlands	4,117	9,875	5,758
2. Land converted to Wetlands	658	1,921	1,263
2.1 Forest Land converted to Wetlands	200	160	-40
2.2 Arable Land converted to Wetlands	NO	NO	NO
2.3 Grassland converted to Wetlands	458	-	-458
2.4 Other Land converted to Wetlands	-	1,761	1,761
5 E Settlements - total area	**323,994**	**449,678**	**125,684**
1. Settlements Remaining Settlements	312,118	438,252	126,134
2. Land converted to Settlements	11,876	11,426	-450
2.1 Forest Land converted to Settlements	1,000	800	-200
2.2 Arable Land converted to Settlements	5,828	2,041	-3,787
2.3 Grassland converted to Settlements	5,048	-	-5,048
2.4 OTher Land converted to Settlements	-	8,585	8,585
5 F Other Land - total area	656,991	541,346	**-115,644**
Waterbodies	127,498	128,678	1,180
2.1 Forest Land converted to Other Land	1,600	1,270	-330
Total Area	8,380,056	8,380,056	-

7.1.3 Completeness

Table 189 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 189: IPCC categories according to the IPCC-Good Practice Guidance for Land-Use, Land-Use Change and Forestry.

IPCC categories[33]/ 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	✓	
	Coniferous	Net carbon stock change in dead organic matter	✓	

33 IPCC categories – applied according to the "Good Practice Guidance for LULUCF (2003)"

IPCC categories[33]/ Sub division for calculation	Description	Status for CO_2	Other GHG
Coniferous	Net carbon stock change in soils	✓	
Deciduous	Increase, decrease, net change of carbon stock	✓	
Deciduous	Net carbon stock change in dead organic matter	✓	
Deciduous	Net carbon stock change in soils	✓	
5.A.2	Land converted to forest land	✓	
5.A.2.1	Cropland converted to forest land	✓	
5.A.2.2	Grassland converted to forest land	✓	
5.A.2.3	Wetlands converted to forest land	✓	
5.A.2.4	Settlements converted to forest land	✓	
5.A.2.5	Other land converted to forest land	✓	
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	✓	
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	✓	
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[33]/ Sub division for calculation	Description	Status for CO_2	Other GHG
5 D 2 1	Forest land converted to wetlands	✓	
5 D 2 2	Cropland converted to wetlands	NO	
5 D 2 3	Grassland converted to wetlands	NE	
5 D 2 4	Settlements converted to wetlands	NO	
5 D 2 5	Other land converted to wetlands	NE	
5 E	Settlements		
5 E 2 1	Forest land converted to settlements	✓	
5 E 2 2	Cropland converted to settlements	NE	
5 E 2 3	Grassland converted to settlements	NE	
5 E 2 4	Wetlands converted to settlements	NO	
5 E 2 5	Other land converted to settlements	NE	
5 F	Other Land		
5 F 2 1	Forest land converted to other land	✓	
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 CaCO3: Total amount applied	CO_2 emissions due to liming of cropland and grassland	✓	
5(IV) 5 B Limestone CaCO3: 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)	✓ N20 ✓ CH4

(1) CO2 emissions caused by wildfires (CRF Table 5(V)) are included in the category 5.A.1. N2O and CH4 emissions from this category have been reported for the first time. 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 – 2004[34] range from 10,035 Gg CO_2 to 21,777 Gg CO_2 (mean: 16,247 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.

In this report CO_2 emissions/removals from forest soils and dead wood are reported for the first time. 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 0.58 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 12031 Gg CO_2 (from 5085 Gg CO_2 to 17755 Gg CO_2). Between 1990 and 2002 the net carbon sink of this category equals to about 19% 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. In comparison to the submission in 2005 new calculation methods as described in chapter 7.2.1 were used, so that the figures of previous reports are not comparable with the actual figures. The new estimates for the years 1990 to 2002 show higher results for the increase (on average +19%), the decrease (on average +4%) and the net change (on average +55%) of the Carbon stocks in living biomass of total forest land plus forest land converted to other uses, compared to the previous submission. The main reasons for these differences are the new use of actually derived country specific biomass functions for all tree species instead of the previously used biomass expansion factors (see chapter 7.2.1).

Details on the methodology, uncertainty assessment, quality assurance, quality control and verification are given in each sub chapter.

For the reported period 1990 to 2004 the total annual net CO_2 removals (biomass and soil) from land use changes to forest range from about 112 Gg CO_2 to 143 Gg CO_2. The total annual emissions (biomass and soil) from land use changes from forests vary between 445 Gg CO_2 and 559 Gg CO_2. These figures are in the order of approximately ± 1 to 3% of the annual net CO_2 removals under sector 5.

34 For the year 2003 the means for the last period (2000 to 2002) of the National Forest Inventory (NFI) have been reported

Table 190: CO_2 removals/emissions from IPCC Category 5 for Forest Land from 1990-2004

	GHG removals/emissions [Gg CO_2]										*Trend BY-2004*
	1990	1996	1997	1998	1999	2000	2001	2002	2003	2004	%
5	-11972	-9707	-18794	-16911	-21386	-16037	-18775	-15136	-16606	-16641	39.0
5.A	-12146	-10035	-19136	-17284	-21777	-16437	-19211	-15493	-17047	-17047	40.4
5.A.1	-12003	-9924	-19024	-17173	-21665	-16325	-19100	-15382	-16936	-16936	41.1
5.A.2	-143	-112	-112	-112	-112	-112	-112	-112	-112	-112	-21.8
5 Forestland Conv	559	445	445	445	445	445	445	445	445	445	-20.4
5A1_BiomassBurn_wild_CO_2	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
5A1_BiomassBurn_wild_CH4	0.012	0.002	0.001	0.006	0.000	0.003	0.001	0.012	0.004	0.004	NA
5A1_BiomassBurn_wild_N_2O	0.0002	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0002	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 new 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 AND 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 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 new 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 commercial forests had to be made and subtracted from the total net CO_2 figures. 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 – as in the previous Austrian estimates - to the year in the middle of an inventory period. This methodological change 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[35] 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 AND 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 191). 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 191: 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

35 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 biomassfunctions (BF,Table 192) 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 192: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 previous estimates:

Table 193: 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 reason 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 an increment that strongly depends on weather conditions, but also for harvest, when e.g. storm fellings are taken into account.

Dead wood

C-stock changes in dead wood are reported for the first time. The estimates only include 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 191 were used. These conversion factors do not include any estimates for roots and branches of these 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 0.59 Gg CO_2, which is a negligible part of the total C-balance of sector 5.

Soil

As given in the introduction, (WEISS et al. 2000) estimated the carbon-stock of the Austrian forest soils by using 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 litterfall 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 proposal 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 would 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. However, estimates of emissions from non-CO_2 gases from this category are reported for the first time. According to the IPCC (GPG 2003) a TIER 1 method following the equation 3.2.20 was applied.

$$Lfire\ (t\ GHG) = A*B*C*D*10^{-6}$$

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 AND 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 194). 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 194. A new uncertainty assessment is planned for the future.

This previous calculation of the uncertainty of the reported data for category 5 A 1 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[36]

• and the uncertainty of each conversion and expansion factor.

The estimates of the uncertainty include 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 194), 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 between 1961 and 1996.

Table 194: Relative uncertainties of the previous estimates (WEISS et al. 2000)

<table>
<tr><th></th><th colspan="5">Relative uncertainties [%]</th></tr>
<tr><th></th><th>Forest inventory</th><th>Uncertainty related to the calculation of annual data and to the necessary consistency of different statistics</th><th>Conversion factor
„m^3 o.b. → t dm“</th><th>Conversion factor
„t dm stemwood → t dm whole tree“</th><th>Conversion factor
„t dm → t C“</th></tr>
<tr><td>Increment</td><td>2.0</td><td>3.2</td><td rowspan="2">11.1</td><td rowspan="2">6.5</td><td rowspan="2">2.0</td></tr>
<tr><td>Harvest</td><td>3.5</td><td>12.2</td></tr>
</table>

7.2.1.3 Recalculations

For the total time series, starting from 1961, the C-stock changes in biomass were calculated by using a new methodology. The new methodology comprises a more accurate allocation of the measured annual means of the increment and harvest data of each NFI to the specific observation periods, the revision of conversion factors and the usage of new biomass functions for estimating the biomass in branches, needles and roots.

CO_2 emissions and removals from net carbon stock changes in dead organic matter have been estimated for the first time, as well as non CO_2 emissions (CH_4 and N_2O) from biomass burning due to wildfires.

36 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 195 and Table 196. 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 68000 ha (total forest area). The loss of forest area for the same period was calculated with about 32000 ha, leading to a net increase of the total forest area of about 36000 ha (19.000 ha for the productive forest) between these NFIs.

Table 195: 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 196: 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 [1000 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 195 and Table 196 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 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 land use decrease 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 197 the conversion factors for the total above ground biomass (with no further division into coniferous and deciduous) is shown.

Table 197: 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 same methodological approach as described in chapter 7.3.3.3. The input data for soil C stocks represent 0-50 cm soil depth (instead of 0-30 cm soil depth in chapter 7.3.3.3). The following soil C stocks have been used: forests 121 t C/ha (WEISS et al. 2001), cropland 60 t C/ha, vineyards 58 t C/ha, orchards/gardenland 78 t C/ha, intensive grassland 81 t C/ha, extensive grassland 119 t C/ha (GERZABEK et al. 2005). These values 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 (BORIS)). In addition, the following estimated soil C pools were used: surface waters and reed beds 0 t C/ha, bogs 150 t C/ha, industrial areas and dumpings 0 t C/ha, settlements and traffic areas 30 t C/ha (based on their distribution of sealed area/green area and soil C stocks for the green area), alpine shrublands 119 t C/ha, rocks and stone slopes 0 t C/ha, other land uses 30 t C/ha. The changes from these land uses to forests and vice versa were compiled according to the land use change categories in the reporting tables and the soil C stock changes were estimated on the basis of the measured land use change areas by the NFI.

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 few of the observed grid points of the NFI by chance describe a forest boundary, where land use changes can be detected. Therefore a high uncertainty on the results of the sub categories on land use changes from and to forests must be considered (expert judgement: between 50 and 100% deriving mainly from the area uncertainty).

7.2.2.3 Recalculations

With regard to the previous submission the average loss of stemwood o.b. on lost forest areas was recalculated according to the results of the new inventory period 2000/02. The recalculation led to an increase of loss of stemwood from 13.8 m^3/ha to 60 m^3/ha.

7.3 Cropland (5 B)

In this category emissions/removals from cropland management are considered.

1.45 Mio ha of Austria are arable land including annual and permanent crops (STATISTIK AUSTRIA 2005). The annual removals range between 120 Gg CO_2 equivalent and 517 Gg CO_2 equivalent. They are mainly caused by living biomass of perennial crops (orchards, vineyards..).

In the National Inventory Report of 2005 a first estimation of emissions from cropland remaining cropland, grassland remaining grassland and liming has been carried out for the year 1990. For these categories a recalculation was carried out which was based on land management factors of the GPG (IPCC 2003) and several activity data. The new estimations also consider the emissions/removals of land use changes from and to cropland and grassland. The calculations were made for the individual years from 1990 to 2004.

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 where thus estimated for the sub categories and related sources/sinks as shown in Table 198.

Table 198: 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 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 199: Activity data for cropland (1990-2004) in ha

	5.B Total Cropland	1 Cropland remaining Cropland	Perennial Cropland converted to Cropland	Cropland converted to perenial Cropland	2 Land converted to Cropland	2 1 Forest Land converted to Cropland	2 2 Grassland converted to Cropland	Grassland converted to perenial Cropland	2.3 Wetlands converted to Cropland	2.5 Other Land converted to Cropland	2.4 Settlements converted to Cropland
1990	1,507,533	1,473,634	487	676	33,899	330	33,467	102	NO	NO	NO
1991	1,526,723	1,492,577	490	681	34,146	330	33,712	103	NO	NO	NO
1992	1,518,074	1,484,040	489	678	34,034	330	33,602	103	NO	NO	NO
1993	1,500,454	1,466,740	485	673	33,714	300	33,312	102	NO	NO	NO
1994	1,501,408	1,467,681	485	673	33,727	300	33,325	102	NO	NO	NO
1995	1,492,280	1,458,900	480	666	33,380	300	32,979	101	NO	NO	NO

	5.B Total Cropland	1 Cropland remaining Cropland	Perennial Cropland converted to Cropland	Cropland converted to perenial Cropland	2 Land converted to Cropland	2 1 Forest Land converted to Cropland	2 2 Grassland converted to Cropland	Grassland converted to perenial Cropland	2.3 Wetlands converted to Cropland	2.5 Other Land converted to Cropland	2.4 Settlements converted to Cropland
1996	1,491,907	1,458,584	479	665	33,323	270	32,952	101	NO	NO	NO
1997	1,500,207	1,466,897	479	665	33,310	270	32,939	101	NO	NO	NO
1998	1,507,728	1,474,562	477	662	33,166	270	32,796	100	NO	NO	NO
1999	1,470,396	1,437,234	477	662	33,162	270	32,791	100	NO	NO	NO
2000	1,462,108	1,429,159	474	658	32,949	270	32,579	100	NO	NO	NO
2001	1,460,067	1,420,986	524	673	39,081	270	38,675	136	NO	NO	NO
2002	1,459,095	1,427,353	337	729	31,742	270	31,377	95	NO	NO	NO
2003	1,459,991	1,432,082	559	568	27,909	270	27,571	68	NO	NO	NO
2004	1,454,572	1,419,891	392	485	34,681	270	34,360	51	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 accoring to GPG (IPCC 2003). Emissions were estimated applying the IPCC Tier 1 methodology, except 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 484 Gg CO_2 and 82 Gg CO_2.

Table 200: Emissions from cropland management (1990-2004) in Gg CO_2

	5.B Total Cropland	1 Cropland remaining Cropland	Perennial Cropland converted to Cropland	Cropland converted to perennial Cropland	Liming (cropland and grassland)	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 equivalent)	2.3 Wetlands converted to Cropland	2.5 Other Land converted to Cropland	2.4 Settlements converted to Cropland
1990	-513.44	-484.74	104.17	6.32	90.30	-119.00	27.98	-158.91	0.60	11.33	NO	NO	NO
1991	-517.77	-488.74	104.93	6.36	91.06	-120.09	27.98	-160.08	0.60	11.41	NO	NO	NO
1992	-506.58	-477.70	104.59	6.34	90.72	-119.60	27.98	-159.55	0.60	11.37	NO	NO	NO
1993	-443.21	-413.04	103.68	6.29	90.69	-120.86	25.44	-158.18	0.60	11.27	NO	NO	NO
1994	-450.36	-420.17	103.72	6.29	90.73	-120.92	25.44	-158.24	0.60	11.28	NO	NO	NO
1995	-270.35	-242.92	102.65	6.23	91.97	-119.40	25.44	-156.60	0.60	11.16	NO	NO	NO

	5.B Total Cropland	1 Cropland remaining Cropland	Perennial Cropland converted to Cropland	Cropland converted to perennial Cropland	Liming (cropland and grassland)	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 equivalent)	2.3 Wetlands converted to Cropland	2.5 Other Land converted to Cropland	2.4 Settlements converted to Cropland
1996	-248.35	-218.48	102.57	6.22	91.95	-121.82	22.90	-156.47	0.60	11.15	NO	NO	NO
1997	-235.05	-205.37	102.52	6.22	92.08	-121.76	22.90	-156.40	0.60	11.15	NO	NO	NO
1998	-203.20	-173.71	102.08	6.19	91.64	-121.13	22.90	-155.73	0.60	11.10	NO	NO	NO
1999	-185.14	-155.66	102.06	6.19	91.63	-121.11	22.90	-155.70	0.60	11.10	NO	NO	NO
2000	-176.42	-146.60	101.40	6.15	90.35	-120.18	22.90	-154.70	0.60	11.03	NO	NO	NO
2001	-179.45	-122.67	112.06	6.30	90.27	-147.05	22.90	-183.64	0.60	13.10	NO	NO	NO
2002	-188.29	-163.64	72.16	6.82	90.23	-114.88	22.90	-148.99	0.60	10.62	NO	NO	NO
2003	-126.62	-118.79	119.65	5.31	90.27	-98.10	22.90	-130.92	0.60	9.33	NO	NO	NO
2004	-119.89	-82.11	83.84	4.54	90.27	-128.05	22.90	-163.16	0.60	11.61	NO	NO	NO

Methodological Issues

Activity data

The data on the areas were taken from STATISTIK AUSTRIA (1990-2005). 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 change between and within grassland and cropland a sample representing more than 4600 cadastral municipalities for the year 2001-2003 was taken to calculate the land use change. From these results the land use change of Austria was extrapolated (except for Alps and alpine meadows). From the land use change of these three years an average "land use factor" for cropland and grassland was calculated and applied for the years 1990-2004. 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 insufficient collected in IACS. Land use change from and to settlement and other land is not collected in 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.

For the perennial cultures – a steady state of biomass increase in the first 30 year 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. The observation period started in 1960. The data from 1960-1975 were taken from FAOSTAT (2005) and Statistic Austria (1976-1990).

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.

7.3.1.2 Changes of carbon stocks in biomass of perennial cropland converted to annual cropland

The average annual land use change from perennial cropland to annual cropland from 1990-2004 was 474 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 (IPCC 2003):

*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 annual crops carbon accumulation rate is 5 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 average annual land use change from annual cropland to perennial cropland from 1990-2004 was 654 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):

*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} = IPCC default value of carbon stock of annual crops before conversion is 5 t C $ha^{-1}yr^{-1}$ f

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 201: Weighted mean values of management factors

	F_{LU}	F_{MG}	F_I
factor	modified	modified	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 most soil inventories were carried out around that year. The carbon stock change of soil from 1990-2004 was 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:

$$SOC_{1990+20} = SOC_{1990} + (SOC_{1990} \times ((Flu \times Fmg \times Fi)_{2003} / (Flu \times Fmg \times Fi)_{1990} \times 100)$$

$$\Delta SOC_{20} = (SOC_{1990+20} - SOC_{1990}) / 20 = 0.07 t\ C\ ha^{-1}\ a^{-1}$$

Annual change in carbon stock of mineral soils in cropland remaining cropland = ΔSOC_{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})

ΔSOC_{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

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 Austrian value is between 48-67 t C ha^{-1} (0-30 cm), applying Austrian specific management factors the average carbon stock of soils of perennial cropland is 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*

ΔSOC_{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

Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of perennial cropland annual cropland, respectively.

Annual land use change in carbon stock of mineral soils in perennial cropland converted to cropland=

*Δ SOC * conversion area*

$\Delta SOC = (SOC_O - SOC_{O-T}) / 20 = 0.35$ 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-T}….. carbon stock change in Austrian cropland soils before conversion→ 50 t C ha^{-1}

Calculation steps see chapter 1.1.1.1

7.3.1.7 Liming

The application of lime to agricultural soil 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. Especially with respect to lime quality (dolomite, $CaCO_3$) information is incomplete. For the estimation of CO_2 emission from liming the calculation does not differentiate between cropland and grassland. 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 croplands and grasslands 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 for 2004 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 +/- 25%

→ perennial cropland to annual cropland +/- 61%

→ 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 202: 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 ranges 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. The annual area converted from Forest Land to Cropland ranges from 270 ha to 330 ha causing annual emission rates due to the loss of biomass and C changes in soil from 23 Gg CO_2 to 28 Gg CO_2.

7.3.3 Grassland converted to Cropland (5 B 2 2)

From 1990-2004 the average annually converted area was 33.096 ha.

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 see Table 199.

Emissions were estimated applying the IPCC Tier 1 methodology, except for soil carbon stocks, where a country specific methodology was used.

7.3.3.1 Changes of carbon stock in biomass of grassland converted to cropland

For the calculation of the annual change in carbon stocks in living biomass of grassland converted to cropland the following formula was applied – IPCC Tier 1 (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} = IPCC default value for carbon accumulation rate in annual crops is 5 t C $ha^{-1}yr^{-1}$

C_{after} = carbon stock immediately after conversion is 0

C_{before} = IPCC default value for carbon stock of grassland biomass before conversion is 1.6 * 0.5+(1.6 *0.5*2.8)

1.6 = t DM IPCC default value above ground living biomass for grassland

0.5 = t C/t TM default carbon content of biomass

2.8 = IPCC default root:shoot ratio for grassland

7.3.3.2 Changes of carbon stock in biomass of grassland converted to perennial cropland

The average annual land use change area from grassland to perennial cropland was 98 ha (1990-2004).

*Annual change in biomass =annual area of converted land * (* $L_{conversion} + \Delta C_{growth}$*)*

$L\ conversion = C_{after} - C_{before}$

For calculation the IPCC default 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} = IPCC default value for carbon stock of grassland biomass before conversion is 1.6 * 0.5+(1.6 *0.5*2.8) → description see chapter 7.3.3.1.

7.3.3.3 Changes of carbon stock in mineral soils of grassland converted to 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 soil organic carbon content the 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 cropland soils the following formula was applied – IPCC Tier 1 (Calculation steps see chapter 1.1.1.1).

$\Delta SOC = ((SOC_O - SOC_{O-T}) * 0.66) / 20 = - 0.665\ t\ C\ ha^{-1}\ a^{-1}$

annual change in carbon stock of mineral soils converted from grassland to cropland =

*Δ SOC * conversion area*

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 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}

0.66 = According to literature (TRUMBORE et al. 1996), (HARRISON et al. 1993A), (HARRISON et al. 1993B), (HARRISON et al. 1995), (HARRISON 1996) it is assumed that 2/3 of the difference of the carbon stock between cropland and grassland soils is reduced within the first 20 years whereas the turn-over of the rest needs many centuries.

7.3.3.4 Changes of carbon stock in mineral soils of grassland converted to perennial cropland

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 1.1.1.1).

$\Delta SOC = (SOC_O - SOC_{O-T}) / 20 = 0.65\ t\ C\ ha^{-1}\ a^{-1}$

annual change in carbon stock of mineral soils converted from grassland to perennial cropland =

*Δ SOC * conversion area*

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 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}

7.3.3.5 N2O 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 to perennial cropland respectively) was taken from Table 199. 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 (for most sources these default values were used), and on expert judgement and literature (GERZABEK et al. 2003) :

→cropland area: +/-10%

→converted area grassland to cropland: +/- 9%

→ 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 202.

The total uncertainty of this category estimated by expert judgement is +/- 40%.

7.4 Grassland (5 C)

In this category emissions/removals from grassland management (grassland remaining grassland and land converted to grassland) are considered. 1.84 Mio ha of Austria are grassland (STATISTIK AUSTRIA 2005). Total grassland includes one cut meadows, two and more cut meadows, cultivated pastures, litter meadows, rough pastures, alpine meadows and pastures and abandoned grassland.

The annual emissions range between 340 Gg CO_2 and 451 Gg CO_2.

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.

Table 203: 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 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 204: Activity data of grassland 1990-2004 in ha

	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	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	1,992,764	1,962,943	29,821	3,540	26,099	181	NO	NO	NO
1991	1,992,764	1,966,290	26,474	3,540	26,291	183	NO	NO	NO
1992	1,992,765	1,955,233	26,387	3,540	26,204	182	NO	NO	NO
1993	1,981,620	1,955,461	26,159	3,175	25,979	181	NO	NO	NO
1994	1,981,620	1,955,451	26,169	3,175	25,989	181	NO	NO	NO
1995	1,976,571	1,950,673	25,898	3,175	25,719	179	NO	NO	NO
1996	1,976,571	1,950,694	25,877	2,810	25,698	179	NO	NO	NO
1997	1,980,408	1,954,542	25,866	2,810	25,688	179	NO	NO	NO
1998	1,980,408	1,954,654	25,754	2,810	25,576	178	NO	NO	NO
1999	1,980,408	1,954,658	25,750	2,810	25,573	178	NO	NO	NO
2000	1,957,169	1,931,585	25,584	2,810	25,407	177	NO	NO	NO
2001	1,957,169	1,925,072	32,097	2,810	29,001	286	NO	NO	NO

	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	Perennial cropland converted to Grassland	2 3 Wetlands converted to Grassland	2 4 Settlements converted to Grassland	2 5 Other Land converted to Grassland
2002	1,957,169	1,931,464	25,705	2,810	22,803	92	NO	NO	NO
2003	1,957,169	1,929,878	27,291	2,810	24,329	152	NO	NO	NO
2004	1,848,102	1,828,168	19,934	2,810	17,021	103	NO	NO	NO

Table 205: Emissions from grassland management in gG CO_2

	5 C Total Grassland	1 Grassland remaining Grassland	2 Land converted to Grassland	21 Forest Land converted to Grassland	2.2 Cropland converted to Grassland	cropland converted to Grassland	2.3 Wetlands converted to Grassland	2.4 Settlements converted to Grassland	2.5 Other Land converted to Grassland
1990	449.87	5.29	444.57	274.76	122.97	39.46	NO	NO	NO
1991	450.96	5.19	445.77	274.76	123.87	39.75	NO	NO	NO
1992	451.06	5.83	445.23	274.76	123.47	39.62	NO	NO	NO
1993	420.55	5.82	414.73	246.43	122.40	39.28	NO	NO	NO
1994	420.61	5.82	414.79	246.43	122.45	39.29	NO	NO	NO
1995	419.21	6.09	413.12	246.43	121.18	38.89	NO	NO	NO
1996	389.99	6.09	383.90	218.10	121.08	38.85	NO	NO	NO
1997	389.70	5.87	383.83	218.10	121.03	38.84	NO	NO	NO
1998	389.00	5.86	383.14	218.10	120.51	38.67	NO	NO	NO
1999	388.98	5.86	383.11	218.10	120.49	38.66	NO	NO	NO
2000	389.28	7.20	382.08	218.10	119.71	38.41	NO	NO	NO
2001	430.34	7.57	422.77	218.10	136.64	62.16	NO	NO	NO
2002	358.59	7.20	351.39	218.10	107.44	19.99	NO	NO	NO
2003	378.84	7.29	371.55	218.10	114.63	32.96	NO	NO	NO
2004	339.63	13.17	326.46	218.10	80.20	22.30	NO	NO	NO

Methodological Issues

Activity data

The area of grassland remaining grassland represents the total grassland minus land converted to grassland. The areas were estimated from national statistics of land use (STATISTIK AUSTRIA 1990-2005). 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 of the survey before were taken.

Data for land use change were taken from IACS (description see chapter 7.3.1).

Emissions were estimated applying the IPCC Tier 1 methodology, except for soil carbon stocks, where a country specific methodology was used.

7.4.1 Grassland remaining grassland (5 C 1)

On average the area of grassland remaining grassland from 1990-2004 was 1.94 Mio. ha.

The annual emissions range between 5 Gg CO_2 and 13 Gg CO_2.

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 206: Weighted mean values of management factors for grassland

	F_{LU}	F_{MG}	F_I
factor	modified	modified	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} grassland soil represents the soil carbon stock of 1990. Most Austrian soil inventories were carried out around that year. The carbon stock change of soil from 1990-2004 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 = ΔSOC_{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 0. 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 of soil inventories of the Federal Provinces of Austrian 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 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 annual area converted from Forest Land to Grassland ranges from 2810 ha to 3540 ha between the year 1990 and 2004. 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 224 Gg CO_2 to 282 Gg CO_2.

7.4.3 Cropland converted to grassland (5 C 2)

7.4.3.1 Changes of carbon stock in biomass of cropland converted to grassland

On average the annual area of cropland converted to grassland from 1990-2004 was 25.158 ha.

For the calculation of the annual change in carbon stocks of living biomass land at cropland converted to grassland the following formula was applied – IPCC Tier 1 (equation 3.3.8) =

*Annual change in biomass =annual area of converted land ** $(L_{conversion} + \Delta C_{growth})$

$L_{conversion} = C_{after} - C_{before}$

C_{after} = carbon stock immediately after conversion is 0

ΔC_{growth} = IPCC default value for grassland 3.05 t C $ha^{-1} yr^{-1}$

C_{before} = IPCC default value of carbon stock of annual crops before conversion is 5 t C $ha^{-1} yr^{-1}$

7.4.3.2 Changes of carbon stock in biomass of perennial cropland converted to grassland

On average the annual area of perennial cropland converted to grassland from 1990-2004 was 174 ha.

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 $ha^{-1}yr^{-1}$

7.4.3.3 Changes of carbon stock in mineral soil of cropland converted to grassland

For calculation IPCC Tier 1 method with a four step approach was used. 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. It is assumed that 2/3 of the difference (=13.3 t C ha^{-1}) is built up during this time period.

Step 4: Multiply the annual carbon stock change by the conversion area.

Average annual carbon stock change $(t\ C\ ha^{-1}\ a^{-1}) = ((SOC_O - SOC_{O-T})*0.66)/20 = 0.665$

SOC_O…… carbon stock in Austrian grassland soils after conversion →70t C ha^{-1}

SOC_{O-T}….. carbon stock change in Austrian cropland soils before conversion→ 50 t C ha^{-1}

0.66 = According to literature (TRUMBORE et al. 1996), (HARRISON et al. 1993A), (HARRISON et al. 1993B), (HARRISON et al. 1995), (HARRISON 1996) it is assumed that 2/3 of the difference of the carbon stock between cropland and grassland soils is built up within the first 20 years whereas the rest needs many decades.

7.4.3.4 Changes of carbon stock in mineral soil of perennial cropland converted to grassland

Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of perennial cropland annual cropland respectively.

Equation and calculation steps see chapter 7.4.3.3.

$\Delta SOC = (SOC_O - SOC_{O-T}) / 20 = 0.65\ t\ C\ ha^{-1}\ a^{-1}$

annual change in carbon stock of mineral soils converted from grassland to perennial cropland =

ΔSOC * *conversion area*

SOC_O…… carbon stock in Austrian grassland soils after conversion →70t C ha^{-1}

SOC_{O-T}…… carbon stock in Austrian perennial cropland soils before conversion →57 t C ha^{-1}

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 (for most sources these default values were used), and on expert judgement and literature (GERZABEK et al. 2003):

→ grassland area→ +/-10%

→ converted area: annual cropland to grassland +/- 5%

→ perennial cropland to grassland +/- 33%

→ 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 207: 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%.

7.5 Categories 5 D, 5 E, 5 F

For the categories 5 D Wetland, 5 E settlement and 5 F Other land only Land use changes from forests were estimated so far. The methodology and activity data are described in chapter 7.2.2.

7.6 Planned improvements

It is planned to further reduce the number of NEs in sector 5. There is a steady re-evaluation and substitution of the used input parameters.

It is planned to update estimates on the uncertainty of sector 5A1.

8 WASTE (CRF SECTOR 6)

8.1 Sector Overview

This chapter includes information on and descriptions of 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 2004 amounted to 2 552.01 Gg CO_2 equivalent. These are about 2.8% of total greenhouse gas emissions in Austria in 2004 and 4.5% in the base year. In 2004, greenhouse gas emissions from the waste sector were 28.2% below the level of the base year. Figure 24 presents the trend of GHG emissions from IPCC sector 6 Waste for the time period 1990 to 2004.

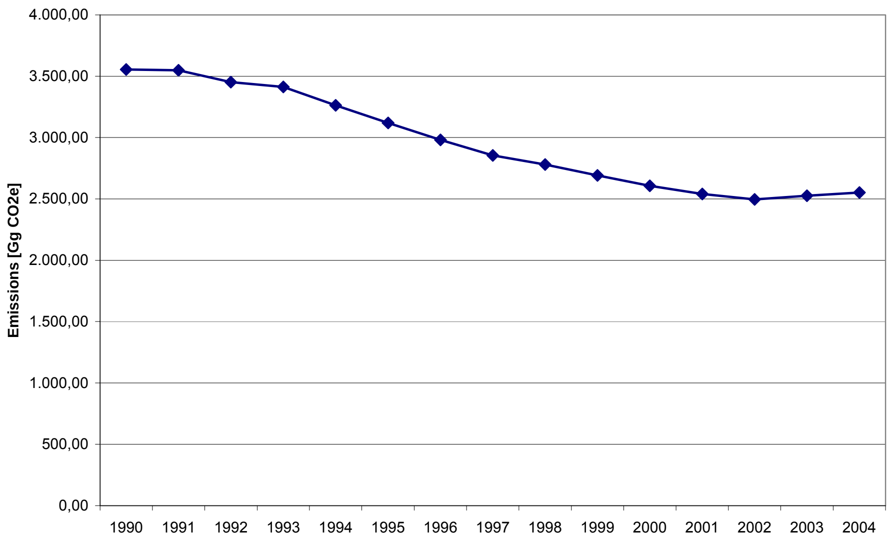

Figure 24: GHG emissions from IPPC Sector 6 Waste 1990-2004

Table 208 presents the emission trend by GHG. The major greenhouse gas emissions from this sector are CH_4 emissions, which represent 89.5% of all emissions from this sector in 2004 followed by N_2O (1.2%) and CO_2 (0.7%).

CH_4 emissions

CH_4 emissions originate from most subcategories within the sector but the largest source is *Solid Waste Disposal on Land*.

The increase of CH_4 emissions is a result of waste management policies; while the amount of land filled waste has decreased the implemented methane recovery systems have increased during the period. In the years 2003 and 2004 the amount of land filled waste increased again mainly due to clean up operations of old landfills.

N_2O emissions

N_2O emissions from the waste sector have remarkably increased over the considered period (see Table 208). In 2004, N_2O emissions from the Waste sector amounted to 255.33 Gg CO_2 equivalent. This was 521% above the level of the base year.

N_2O emissions mainly arise from the category Other Waste (Compost production) but also from *Wastewater Handling* (*Domestic and Commercial Wastewater* and *Industrial Wastewater*). *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 208). In 2004, 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 Incineration of Corpses*). 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 208: Emissions of greenhouse gases and their trend from 1990-2004 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	3 487.74	41.10	3 555.73
1991	23.40	3 481.35	42.74	3 547.49
1992	10.86	3 392.44	48.09	3 451.39
1993	10.60	3 347.00	55.65	3 413.25
1994	10.65	3 172.05	79.79	3 262.48
1995	10.97	3 002.04	106.47	3 119.48
1996	11.30	2 839.93	129.74	2 980.97
1997	11.62	2 702.52	140.00	2 854.14
1998	11.94	2 600.41	167.64	2 779.99
1999	12.26	2 491.20	187.85	2 691.31
2000	12.26	2 382.83	210.88	2 605.97
2001	12.26	2 282.37	246.14	2 540.77
2002	12.26	2 238.35	244.99	2 495.60
2003	12.26	2 260.06	253.20	2 525.53

	CO_2 [Gg CO_2 e]	CH_4 [Gg CO_2 e]	N_2O [Gg CO_2 e]	Total [Gg CO_2 e]
2004	12.26	2 284.42	255.33	2 552.01
Trend 1990-2004	-54.4%	-34.5%	+521.3%	-28.2%

Emission trends by sources

Table 209 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 2004, *Solid Waste Disposal on Land* contributed 86.9% to total greenhouse gas emissions of sector *Waste*.

Table 209: Total greenhouse gas emissions and trend from 1990–2004 by subcategories of Category 6 Waste

CO_2 equivalent [Gg]	6 A	6 B	6 C	6 D	Total
1990	3 374.97	118.89	27.09	34.78	3 555.73
1991	3 368.30	119.18	23.58	36.43	3 547.49
1992	3 279.95	117.14	10.91	43.39	3 451.39
1993	3 234.08	114.36	10.64	54.17	3 413.25
1994	3 059.35	128.07	10.69	64.37	3 262.48
1995	2 891.84	148.41	11.01	68.22	3 119.48
1996	2 735.74	162.51	11.33	71.38	2 980.97
1997	2 605.74	166.40	11.66	70.34	2 854.14
1998	2 509.95	185.28	11.98	72.78	2 779.99
1999	2 404.92	197.04	12.30	77.04	2 691.31
2000	2 302.16	214.63	12.30	76.87	2 605.97
2001	2 206.99	243.99	12.30	77.49	2 540.77
2002	2 167.91	237.42	12.30	77.96	2 495.60
2003	2 194.44	239.53	12.30	79.25	2 525.53
2004	2 218.79	241.66	12.30	79.25	2 552.01
Trend 1990 -2004	-34.3	+103.3	-54.6	+127.8	-28.2

8.1.2 Key Sources

Key source analysis is presented in Chapter 1.5. This chapter includes information about the key sources in the IPCC Sector *6 Waste*. Table 210 presents the source categories in the level of aggregation as used for the key source analysis.

The key sources of *IPCC Category 6* are *6 A Managed Waste disposal on Land* and *6 B Wastewater Handling*.

In the base year, 4.4% of total greenhouse gas emissions originate from the two key sources of the sector Waste, whereas Wastewater Handling has a share of less than 0.1%. In the year 2004 2.4% of total greenhouse gas emissions originate from the sector Waste - the share of Wastewater Handling is 0.04%.

Table 210: 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-LA04 TA97-TA04
6 B	Wastewater Handling	N_2O	TA98-TA04

LA00= Level Assessment 2000

TA00= Trend Assessment BY-2001

8.1.3 Methodology

For the sub category *6 A Solid Waste Disposal On Land* the methodology has been changed to the IPCC Tier 2 methodology following recommendations of the ERT. However, 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 will take place early 2007.

The methodology for the sub category *6 B Wastewater Handling* is not yet officially approved by the accreditation body – however, the approval is scheduled for early 2007.

Detailed information on the methodology can be found in the corresponding subchapters, where it was applied.

8.1.4 Uncertainty Assessment

In this submission uncertainty estimates based on expert judgement by Umweltbundesamt for sub-category Solid Waste Disposal on Land and Wastewater Handling is 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 220) and 6 B Wastewater Handling (see Table 224). For further information please refer to the respective subchapters.

8.1.6 Completeness

Table 211 gives an overview of the IPCCC 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 211: 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	NO	✓	
6 A 2 Unmanaged Waste Disposal	090402 Unmanaged Waste Disposal			
6 B WASTEWATER HANDLING				
6 B 1 Industrial Wastewater	091001 Wastewater treatment in industry		✓	✓
6 B 2 Domestic and Commercial Wastewater	091002 Wastewater treatment in residential/commercial sect.		✓	✓
6 C WASTE INCINERATION				
	090901 Incineration of corpses 090201 Incineration of municipal waste 090207 Incineration of hospital wastes 090208 Incineration of waste oil	✓ ✓ ✓ ✓	NO ✓ ✓ NA	NO ✓ ✓ ✓
6 D OTHER WASTE				
	091003 Sludge spreading 091005 Compost production	IE NO	IE ✓	IE ✓

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 2003 about 359 landfill sites received waste (see Table 212), 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 2002, landfill gas was recovered at 54 landfills.

Table 212: Number and type of landfill sites

landfills for	2002	2003
mass waste	61	62
residual waste	18	23
construction-waste	64	63
excavated-soil	108	211

From 1990 to 2001 the amount of deposited residual waste has decreased significantly but in the years 2002 and 2004 it has increased. This increase can be explained mainly by clean up operations: In these two years some old landfills were cleaned up and the resulting waste was land filled again.

As the amount of this waste is reported by the operators of landfills as residual waste and because there is no additional information available it is considered in the Austrian estimates as residual waste as well.

Table 213 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 - 2004.

Table 213: Activity data, greenhouse gas emissions and implied emission factors for "*Residual waste" and "Non Residual Waste" 1990–2004*

Year	Non Residual Waste [Mg/a]	Residual Waste [Mg/a]	Total Waste [Mg/a]	CH4 Emissions [Mg]	IEF CH4 [kg/Mg]
1990	664 536	1 995 747	2 660 283	160 712.7	60.4
1991	677 827	1 799 718	2 477 545	160 395.4	64.7
1992	691 383	1 614 157	2 305 541	156 188.3	67.7
1993	705 211	1 644 718	2 349 929	154 003.8	65.5

Year	Non Residual Waste [Mg/a]	Residual Waste [Mg/a]	Total Waste [Mg/a]	CH4 Emissions [Mg]	IEF CH4 [kg/Mg]
1994	719 315	1 142 067	1 861 382	145 683.6	78.3
1995	733 702	1 049 709	1 783 410	137 706.7	77.2
1996	748 376	1 124 169	1 872 545	130 273.2	69.6
1997	763 343	1 082 634	1 845 977	124 082.9	67.2
1998	778 610	1 081 114	1 859 724	119 521.6	64.3
1999	841 215	1 084 625	1 925 840	114 520.0	59.5
2000	843 779	1 052 061	1 895 840	109 626.9	57.8
2001	795 262	1 065 592	1 860 854	105 094.8	56.5
2002	812 081	1 374 543	2 186 624	103 234.0	47.2
2003	899 547	1 815 944	2 715 491	104 497.0	38.5
2004	899 547	1 815 944	2 715 491	105 656.7	38.9

8.2.1.2 Methodological Issues

IPCC Tier 2 method is applied.

In the framework of a national study (SCHACHERMAYER, 2005) the IPCC method was compared to the country specific method that was used until now. As a result the method was changed: For calculation of emissions of solid waste disposal on land IPCC Tier 2 method is applied.

Until now for calculation of emissions of solid waste disposal on land the directly deposited waste is separated into two categories: "residual waste" and "non residual waste". The emissions of residual waste were calculated according to TABASARAN and RETTENBERGER and for the calculation of the emissions of non residual waste the methodology of MARTICORENA was used. Both methodologies are described in (BAUMELER et al 1998).

Comparisons between the IPCC methodology and Austrian estimates showed that on the one hand the emissions calculated according to the Tabasaran & Rettenberger model are nearly identical to the emissions calculated according to the IPCC model (see Figure 25) but on the other hand the Marticorena model seems to overestimate the emissions (see Figure 25). Thus considering the larger methodological uncertainties - the Marticorena model was developed to calculate CH_4 emissions of one single landfill and not national totals - it was decided to change the methodology and use the IPCC Tier 2 model.

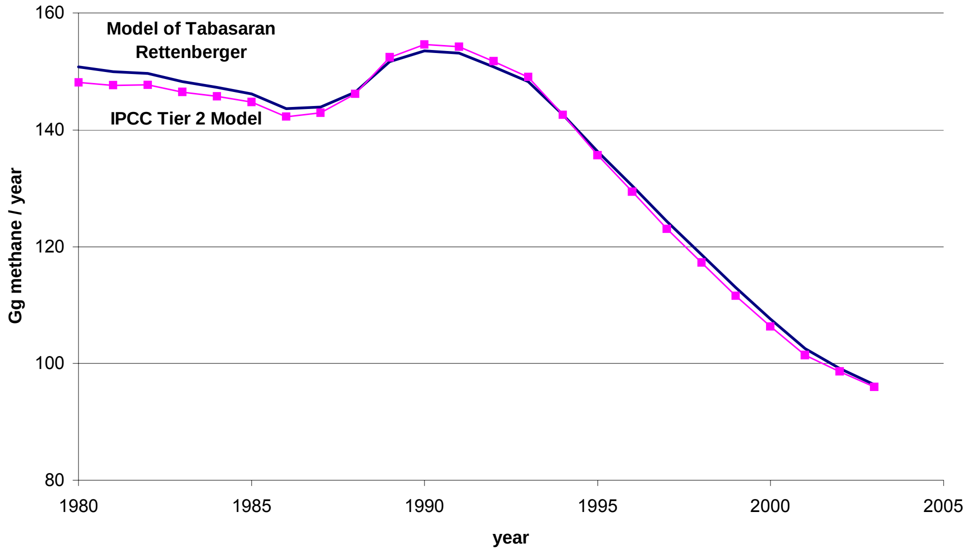

Figure 25: Residual waste: Comparison of produced Methane calculated according to Tabasaran Rettenberger and IPCC respectively

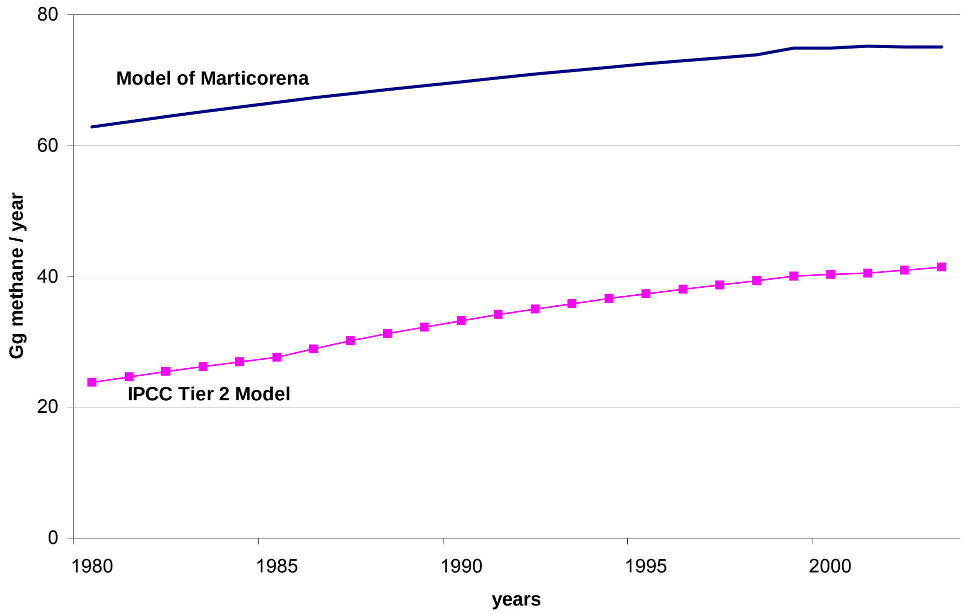

Figure 26: Non Residual waste: Comparison of produced Methane calculated according to Marticorena and IPCC respectively

Activity data - Residual waste

"Residual waste" corresponds to waste from households and similar establishments 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 household waste was deposited in 2004. The remaining part was recycled, incinerated or treated biologically. According to the recent federal waste management plans 2001 and 2005 recycling and treatment of waste from households and similar establishments followed the following routes in 1999 and 2004 respectively:

Table 214: recycling and treatment of waste from households and similar establishments

Treatment	1999	2004
mechanico-biological pre-treatment	6.3%	11.2%
thermal treatment (incineration)	14.7%	28.3%
treatment in plants for hazardous waste	0.8%	1.2%
recycling	34.3%	35.6%
recycling (biogenous waste)	15.4%	16.0%
direct deposition at landfills ("residual waste")	28.5%	7.7%

The quantities of "residual waste"

- from 1998 to 2004 were taken from the database for solid waste disposals "Deponiedatenbank" ("Austrian landfill database"). According to the Landfill Ordinance[37], 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 the database for solid waste disposals.
- from 1989 to 1997 were taken from the current "Bundesabfallwirtschaftsplan" (federal waste management plan) 1999 and 2001.
- from 1950 to 1988 were taken from a national study (HACKL & MAUSCHITZ 1999)

However in the federal waste management plan and the national study (HACKL & MAUSCHITZ 1999) the amount of waste from administrative facilities of industry is not considered, whereas it is reported by the operators of landfill sites and included in the "Deponiedatenbak". Thus to achieve a consistent time series the share of waste from administrative facilities of industry was estimated and the data from the federal waste management plan and the national study (HACKL & MAUSCHITZ 1999) adjusted. In fact it was assumed that the share of waste from administrative facilities of industry remained constant over the time series.

[37] Deponieverordnung, Federal Gazette BGBl. Nr 164/1996

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 2004 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 215 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, sludges, other waste, bio waste, textiles, construction waste and fats.

There are no data available for the years before1998. Thus extrapolation was done using the Austrian GDP (gross domestic product) as indicator.

Until now "non residual waste" was assumed to be constant for all inventory years. That's why the ERT recommended developing an extrapolation of the non-residual waste figures, taking into account population growth and changes in management practices such as incineration and recycling. But because non residual waste is mainly industrial waste an extrapolation using the GDP as indicator seemed to be more appropriate.

Table 215: 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 dagerous 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	sludges 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	wastes from solvent extraction	200108	biodegradable kitchen and canteen waste
30105	sawdust, shavings, cuttings, wood, particle board and veneer	200111	textiles
30304	de-inking sludges from paper recycling	200201	biodegradable wastes
30307	mechanically separated rejects from pulping of waste paper and cardboard	200302	waste from markets
30310	fibre rejects, fibre-, filler-, and coating sludges from mechanical separation	200307	bulky waste
40106	sludges, in particular from on-site effluent treatment containing chromium	190811 - 14	sludges 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 factors were used based. Otherwise, where no factors were available IPCC default values were used. Table 216 summarises the parameters used plus the corresponding references.

Table 216: Parameters for Calculating CH4 emissions of SWDS

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	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 217). IPCC default taking into account national waste expertises								

Parameters	residual waste	wood	paper	sludges	bulky waste and other waste	Bio-waste	textiles	Construct. waste	fats
DOC_F									
DOC	See Table 218	0.45	0.3	0.11	0.16	0.16	0.5	0.09	0.2
	(HACKL & MAUSCHITZ,1999) (ROLLAND & SCHEIBENGRAF, 2003)	(BAUMELER et al. 1998)							
Half life period	7	25	15	7	20	15	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	55								
	IPCC default including data for 3 to 5 half lives								
Fraction of CH4 in Landfill Gas	0.55								
	Mean value cited in the literature, also inside the recommended band width of the IPCC								
Methane Oxidation in the upper layer	10%								
	IPCC default								
Landfill gas recovery	See Figure 28								
	(ROLLAND & OLIVA 2004)								

Biodegradable organic carbon of residual waste

According to the study "Biologisch abbaubarer Kohlenstoff im Restmüll" (ROLLAND & SCHEIBENGRAF 2003) the content of biodegradable organic carbon of directly deposited residual waste decreased over the time series due to increasing separate collection of bio-waste in bio-waste containers and separate collection of paper. Figure 27 presents the trend of separate collection and organic share of residual waste over the time series. As can be seen the amount of bio-waste that is collected separately increased while the organic share of residual waste decreased. Table 217 presents the composition of residual waste for several years between 1990 and 1999. On the basis of this information a time series for DOC was estimated (see Table 218). For the years before 1990, quantities according to a national study (HACKL & MAUSCHITZ 1999) were used.

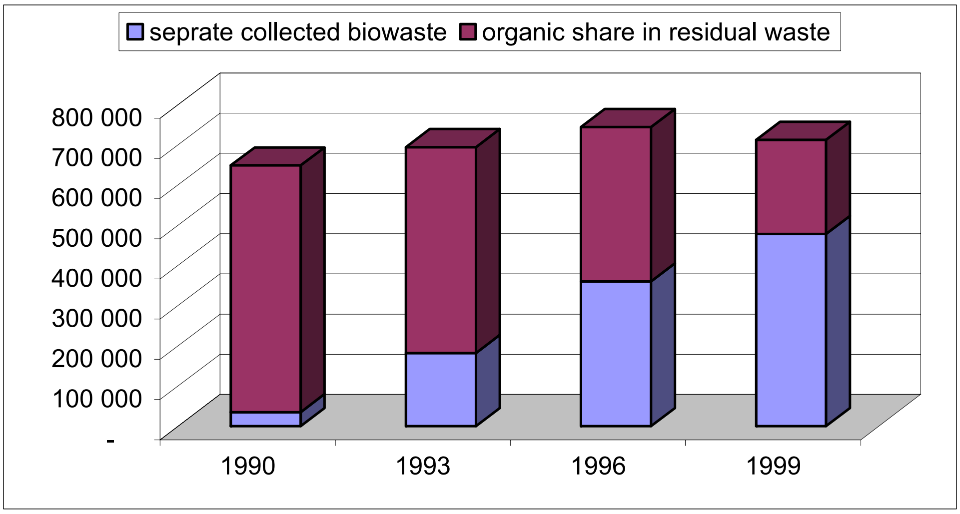

Figure 27: Separate collection of bio-waste and organic share of residual waste

Table 217: Composition of residual waste (ROLLAND & SCHEIBENGRAF 2003), (BUNDESABFALLWIRTSCHAFTSPLAN 2005)

Residual waste	1990 [% of moist mass]	1993 [% of moist mass]	1996 [% of moist mass]	1999 [% of moist mass]	2004 [% 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 218: Time series of bio-degradable organic carbon content of directly deposited residual waste 1950-1989: (HACKL & MAUSCHITZ 1999), 1990-2003: (ROLLAND & SCHEIBENGRAF 2003)

	bio-degradable organic carbon [g/kg Waste (moist mass)]
1950-1959	240
1960-1969	230
1970-1979	220
1980-1989	210
1990	200
1991	190
1992	180
1993	170
1994	160
1995	150
1996	140
1997	130
1998	130
1999	120
2000	120
2001	120
2002	120
2003	120

Landfill gas recovery

In 2004 the *Umweltbundesamt* made an investigation (ROLLAND & OLIVA 2004) and asked the operators of landfill sites to report their annual collected landfill gas. The results are presented in Figure 28: the amount of collected and burnt landfill gas increased constantly over the time period. 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 considers only the amount of collected landfill gas from 1990 to 2002, the data were extrapolated constantly for the years 2003 and 2004 as well.

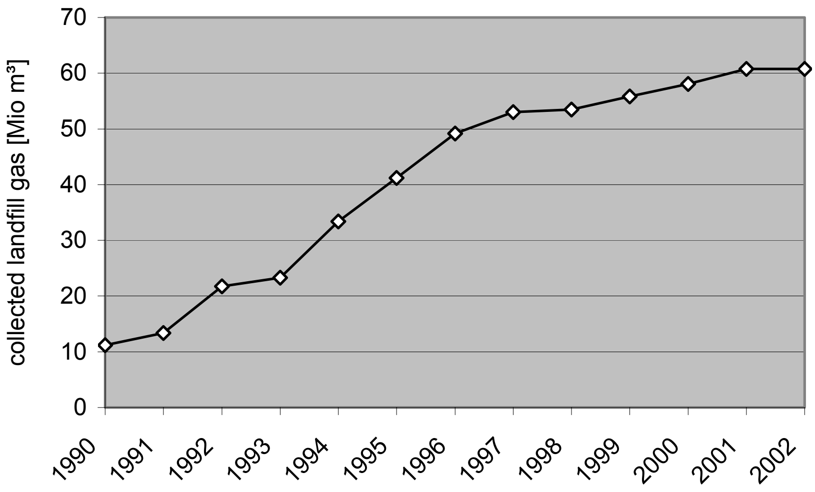

Figure 28: Amount of collected landfill gas 1990 to 2002 (ROLLAND & OLIVA 2004)

Uncertainty Assessment

According to (WINIWARTER & ORTHOFER 2000) the uncertainty for emission factors for *6 A Solid Waste Disposal* is 35% and 25% for activity data, respectively.

The study refers to data of submission 2000 but since then the method was improved continually:

- IPCC Tier 2 method is used
- activity data is now taken from the Austrian landfill database reported from landfill operators,
- data on the amount of annual collected landfill gas were collected and the DOC was updated according to a study of the *Umweltbundesamt*
- emission factors were determined taking into account IPCC default values and national experts on waste and landfills

That's why experts of the *Umweltbundesamt* assumed that the uncertainty is now lower: 12% for activity data and 25% for the emission factors, respectively (see Table 219).

Table 219: Uncertainty assessment for managed waste disposal on land

	WINNIWARTER, RYPDAL 2001	Expert judgement 2005 Submission 2005
Activity data:	25%	12%
Emission factors:	35%	25%

8.2.1.3 Recalculations

The following improvements have been made compared to last year's submission:

- The methodology was changed from country specific to IPCC Tier 2.

- The activity data of "residual waste" and "non residual waste" were updated. According to the Landfill Ordinance[37] the operators of landfill sites have to report their data annually. Due to reports after the due-date there are minor changes of the activity data in this submission compared to the previous submission.
- For those years where no data were available for non-residual wastes (before 1998), extrapolation taking into account the GDP was used as recommended by ERT instead of considering it as constant.
- Due to QA/QC activities it was identified that the amount of construction waste was counted twice. This was corrected in this submission.

Table 220: Recalculations with respect to previous submission from Category Managed Waste Disposal on Land 1990-2003

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
CH_4 [Gg Difference]	-36.6	-36.4	-36.3	-36.3	-36.7	-36.9	-37.0	-36.9	-36.6	-36.6	-35.9	-35.3	-34.0	-30.2

8.3 Wastewater Handling (CRF Source Category 6 B)

8.3.1 Source Category Description

Key Source: Yes

Emissions: CH_4, N_2O

In the year 2004, greenhouse gas emissions from Wastewater Handling contributed 0.2% to total greenhouse gas emissions in Austria.

The trend of greenhouse gas emissions during the period is increasing. From 1990 to 2004 greenhouse gas emissions increased by 103% due to increasing amounts of wastewater that is treated in treatment plants and increasing amount of denitrification. Table 221 presents CH_4 and N_2O emissions from category Wastewater Handling for the period from 1990 to 2004.

This source category is separated into the subcategories *6 B 1 Industrial Wastewater Handling* and *6 B 2 Urban Wastewater Handling*.

Table 221: Greenhouse gas emissions from Subcategories Industrial Wastewater Handling 6B1 and Urban Wastewater Handling 6B2 for the period 1990-2003

	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]	[CO_2 equivalent Gg]
1990	0.01	4.85	0.04	118.89
1991	0.01	4.84	0.04	119.18
1992	0.01	4.70	0.05	117.14
1993	0.01	4.56	0.05	114.36
1994	0.03	4.39	0.09	128.07
1995	0.04	4.21	0.15	148.41
1996	0.06	3.87	0.20	162.51
1997	0.07	3.53	0.23	166.40
1998	0.09	3.19	0.29	185.28
1999	0.10	2.93	0.34	197.04
2000	0.12	2.68	0.39	214.63
2001	0.14	2.42	0.48	243.99
2002	0.14	2.18	0.48	237.42
2003	0.15	1.93	0.49	239.53
2004	0.15	1.93	0.50	241.66
Trend 1990-2004	1 079%	-60.1%	1 079%	+103.3

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. As in there occur anaerobic processes methane emissions are produced.

CH4 emissions from cesspools and septic tanks are calculated pursuant to the IPCC method. Whereas 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)

Activity data

The amount of inhabitants not connected to sewage systems and wastewater treatment plants was taken from the recent Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHT 2002). Data for the years 1971, 1981, 1991, 1995 and 1998 were available. The missing data were interpolated.

For the years 1971 to 1998 statistical data were available for the categories "municipal wastewater treatment", "domestic sewage treatment plant", "septic tank" and "other treatment". But statistical investigations were changed and thus from 2001 to 2004 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 2004 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 CH4 emissions are 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 can not be estimated. But according to national experts the amount of CH4 emissions from industrial wastewater treatment and sewage sludge treatment is negligible because CH4 gas is usually used for energy recovery or is flared.

8.3.2.2 N_2O Emissions

N_2O emissions from Urban Wastewater Handling were calculated on the basis of the IPCC methodology. 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 is considered additionally. 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 this category 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][38]
$Frac_{NPR}$	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/ kg N]

It is assumed that industrial wastewater handling additionally contributes 30% of N_2O emissions from urban wastewater handling (ORTHOFER et al. 1995). As there are no better data available this percentage is still used for calculating the emissions. But as the ERT recommended for the next submission efforts will be made to survey the industrial wastewater amounts or to develop an apropiate extrapolation method.

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 222. Data were taken from the Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHTE 1993 – 2002); data in between were interpolated.

Table 222: Trend of amount of wastewater that is treated in sewage plants 1990 – 2004 and amount of nitrogen that is denitrificated

	Wastewater treatment [%]	Denitrification [%]
1990	59.0	0.10
1991	60.0 *)	0.10
1992	61.4	0.10
1993	62.7	0.10
1994	64.1	0.18
1995	73.5 *)	0.27
1996	74.2	0.35 *)
1997	75.0	0.40
1998	80.9 *)	0.46

[38] Daily protein intake per capita taken from FAO statistics: http://apps.fao.org/page/collections?subset=nutrition

	Wastewater treatment [%]	Denitrification [%]
1999	81.4	0.51 *)
2000	81.9	0.60
2001	86.0 *)	0.68 *)
2002	86.0	0.68
2003	88.9	0.68
2004	88.9	0.68

**) data were taken from Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHTE 1993 – 2002);*

The number of inhabitants was provided by STATISTIK AUSTRIA. The daily protein intake was updated according to FAO statistics. The data are presented in Table 223.

Table 223: Number of inhabitants and protein intake per capita 1990–2003

Year	Inhabitants	Protein intake [g/ day/ capita]
1990	7 678 000	102
1991	7 754 891	102
1992	7 840 709	103
1993	7 905 632	102
1994	7 936 118	104
1995	7 948 278	104
1996	7 959 016	106
1997	7 968 041	104
1998	7 976 789	109
1999	7 992 323	110
2000	8 011 566	110
2001	8 043 046	111
2002	8 083 797	110
2003	8 117 754	110
2004	8 174 733	110

8.3.3 Recalculation

The following improvements have been made compared to last year's submission:

– The methodology for calculating the CH4 emissions was changed from country specific to IPCC.

– There were no recalculations for N2O, besides extrapolating the amount of wastewater treated in the years 2003 and 2004.

Table 224 Recalculations with respect to previous submission from Category Wastewater Handling 1990-2003

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
CH_4 [Gg Difference]	-8.8	-8.9	-9.2	-9.5	-9.7	-9.9	-10.3	-10.6	-11.0	-11.3	-11.6	-11.9	-12.2	-12.5
N2O [Gg 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	0.2

8.4 Waste Incineration (CRF Source Category 6 C)

8.4.1 Source Category Description

Key source: No

In this category CO_2 emissions from incineration of corpses and waste oil are included as well as CO_2, CH_4 and N_2O 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 0.8% for the year 1990 and 0.5% for the year 2004.

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 225: 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
Trend 1990-2004	-54.4%	-90.1%	-74.4%	-54.6%

Completeness

Table 226 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 226: Overview of subcategories of Category 6 C Waste Incineration, transformation into SNAP Codes and status of estimation

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
6 C WASTE INCINERATION				
	090201 Incineration of domestic or municipal waste.	✓	✓	✓
	090207 Incineration of hospital waste	✓	✓	✓
	090208 Incineration of waste oil	✓	NA	✓

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 CO_2 and CH_4 are taken from (BMWA-EB 1990), (BMWA-EB 1996) and (UMWELTBUNDESAMT 2001). N_2O emission factors are taken from a national study (ORTHOFER et al. 1995).

For waste oil, the emission factors for heavy oil (CO_2: 80 [t/TJ]) were selected and a heating value of 40.3 GJ/Mg Waste Oil was used to convert the emission factors from [kg/TJ] to [kg/Mg].

For municipal solid waste and clinical waste the CO_2 emission factor was calculate by means of default assumptions from (IPCC-GPG 2000) as presented in Table 227.

Table 227: Emission factors and parameters of IPCC Category 6 C Waste Incineration.

Waste Type	Carbon content	Share in fossil carbon	Combustio n 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	-	-	-	3224.00	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. For the next submission it is planned to update activity data for clinical waste and waste oil incineration.

Table 228: 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	0	3 100	3 000
2000	0	3 100	3 000
2001	0	3 100	3 000
2002	0	3 100	3 000
2003	0	3 100	3 000
2004	0	3 100	3 000

Recalculations

For incineration of municipal solid waste without energy recovery the IPCC default CO_2 emission factor is now used, because the emission factor used in the previous submission was based on a non-verified expert guess. CO_2, CH_4 and N_2O emissions from incineration of clinical waste without energy recovery are additionally estimated by means of expert guess activity data and IPCC default emission factors.

CO_2 emissions from cremation are set to "NA" due to elimination of double counting with category 1 A 4 a Commercial/Institutional-Gaseous fuels.

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 compost production, which are presented in Table 229 for the period from 1990 to 2004.

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 229: Greenhouse gas emissions from Category Compost Production 1990-2004

	CH_4 emissions [Gg]	N_2O emissions [Gg]	Total [CO_2 equ. Gg]
1990	0.52	0.08	34.8
1991	0.54	0.08	36.4
1992	0.65	0.10	43.4
1993	0.82	0.12	54.2
1994	0.98	0.14	64.4
1995	1.04	0.15	68.2
1996	1.09	0.16	71.4
1997	1.08	0.15	70.3
1998	1.12	0.16	72.8
1999	1.18	0.17	77.0
2000	1.16	0.17	76.9
2001	1.17	0.17	77.5
2002	1.17	0.17	78.0
2003	1.19	0.18	79.3
2004	1.19	0.18	79.3
Trend 1990-2004	*130.2*	*126.8*	*127.8*

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 three fractions of composted waste:

- mechanical biological treated residual waste
- Bio-waste, loppings, home composting
- Sewage Sludge

Emissions were calculated by multiplying an emission factor by the quantity of waste.

Activity data

The activity data were taken from several national studies. For years where no data were available inter- or extrapolation was done.

Table 230: Activity data for IPCC Category 6 D Other Waste (Compost Production)

	total	bio-waste, loppings, home composting[(1)]		mechanical biological treated residual waste		sewage sludge	
	[Gg/a]	[Gg/a]	ref.	[Gg/a]	references	[Gg/a]	references
1990	765.0	413.2	(AMLINGER 2003)	345.0	(BAUMELER et al. 1998)	6.8	
1991	800.1	448.3		345.0		6.8	(BAWP 1995)
1992	947.5	591.3		345.0		11.1	
1993	1 176.7	816.2		345.0		15.5	
1994	1 393.3	1 028.5		345.0		19.8	
1995	1 470.8	1 151.6		295.0	(ANGERER 1997)	24.2	(SCHARF et al. 1998)
1996	1 537.5	1 233.5		280.0		24.0	
1997	1 513.0	1 244.1		245.0	(LAHL et al. 1998)	23.9	
1998	1 564.7	1 300.9		240.0	(LAHL et al. 2000)	23.8	(BAWP 2001)
1999	1 654.3	1 355.6	(AMLINGER et al 2004)	265.0	(GRECH & ROLLAND 2001)	33.6	
2000	1 647.2	1 338.8		265.0		43.0	
2001	1 657.0	1 338.8		265.0		53.3	(AMLINGER et al. 2004)
2002	1 667.0	1 348.8		265.0		53.3	
2003	1 696.8	1 348.8		294.8	(DOMENIG 2004)	53.3	
2004	1 696.8	1 348.8		294.8		53.3	

Emission factors

Due to different emission factors in different national references an average value was used for each of the three fractions of composted waste.

Table 231: 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)
sewage sludge	0.04	0.2	(AMLINGER et al. 2003)

8.5.1.2 Recalculations

No recalculations were done.

9 RECALCULATIONS AND IMPROVEMENTS

This chapter quantifies the changes in emissions for all six greenhouse gases compared to the previous submission – UNFCCC 2005 (in the format of the IPCC Summary Table 1A).

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, ...
- 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*.

Below an overview of recalculations made in response to the UNFCCC review process is given.

Table 232: Improvements made in response to the UNFCCC review process (centralized review 2005)

Energy
1 A 2 a Iron and Steel: Coke oven gas consumption (included in solid fuels) of integrated steel plants has been recalculated.
Cross-sectoral: Natural gas CO_2 emission factors have been changed from 55 t/TJ to 55.4 t/TJ for the whole period by means of calculations based on the chemical specification.
Cross-sectoral: Industrial waste CO_2 emission factors are now based on IPCC default values (104.17 kg/TJ) whereas in the previous submission the values were based on a country-specific expert judgement (10 to 50 kg/TJ).

1 B 1 a Coal Mining: Activity data for 2002 and 2003 have been updated

Industrial Processes

2 B 1 Ammonia: During QC checks it was found that CO_2 emissions as reported by the plant operator had not been determined in accordance with the IPCC guidelines. Consequently, CO_2 emissions have been recalculated from the natural gas input (from the national energy balance) with a standard emission factor, accounting additionally for carbon bound in the melamine production.

Agriculture

4 A, 4 B, 4 D Enteric Fermentation, Manure Management, Agricultural Soils:

As recommended in the Centralized Review 2004 Austrian N excretion values have been revised. Especially N excretion rates of dairy and mother cows are higher now, which has led to higher emissions of N_2O from source category 4 B and 4 D.

With the revision of N excretion rates, the GE intake and VS excretion data were also recalculated. This has led to higher CH_4 emissions from source categories 4 A and 4 B.

Waste

6 A 1 Managed waste disposal on land:

For those years where no data were available for non-residual wastes (before 1998) extrapolation according to the GDP was used as recommended by ERT, instead of assuming the amount of non-residual wastes to be constant.

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 2005).

Energy (IPCC Category 1)

Combustion Activities (1 A)

Update of activity data:

Cross-sectoral: Coke oven coke net calorific values have been revised from 1990 to 2003. Consumption of gasworks gas 1990 to 1995 is additionally considered in sub-categories *1 A 2 f* and *1 A 4*.

1 A 1 a Public Electricity and Heat Production: Natural gas consumption 1997 and biomass consumption 2003 increased due to changes of the national energy balance. Consumption of biomass and industrial waste decreased from 1992 to 2003 due to elimination of double counting.

1 A 1 b Petroleum Refining: Liquid fuels consumption 1990 to 1992 increased due to changes of the national energy balance. Liquid fuel consumption from 1999 to 2001 has been adapted to plant-specific data.

1 A 1 c Manufacture of Solid Fuels and Other Energy Industries: Transformation losses from gasworks are now considered in this category for 1990 to 1995. Natural gas consumption of *Other Energy Industries* 1991 to 1995 changed due to changes of the national energy balance.

1 A 2 a Iron and Steel: Coke oven gas consumption (included in solid fuels) of integrated steel plants has been recalculated.

Coke oven coke consumption for blast furnaces has been updated for 2003.

1 A 2 b,c,d,e: The minor changes of each sub-category are due to changes of the energy balance, mainly due to shifts between categories. Final consumption of gasworks gas 1990 to 1995 which is not considered in the energy balance reported to EUROSTAT/IEA is additionally considered in the specific subcategories as specified in the "Austrian energy balance".

1 A 2 f Manufacturing Industries and Construction-Other: Consumption of hard coal 1990 to 1993 has been moved from *1 A 4 Other Sectors* to "Non metallic Mineral Products Industry" according to cement industry emissions declarations.

1 A 3 b Transport – Road: Update of the statistical data for light and heavy duty vehicles (new splitting up by Statistik Austria) from 1990 – 2003.

1 A 3 e Pipeline compressors: Update of 2003 natural gas consumption according to the updated national energy balance.

1 A 4 Stationary: Natural gas consumption has been moved from or to other sub-categories of *1 A Fuel Consumption* according to the updated energy balance. Consumption of gas works gas has been additionally considered. Solid biomass consumption from 2000 to 2003 has been revised according to changes of the national energy balance.

<u>Improvements of methodologies and emission factors:</u>

Cross-sectoral: The natural gas CO_2 emission factor has been changed from 55 t/TJ to 55.4 t/TJ for the whole period by means of calculations based on the chemical specification. Industrial waste CO_2 emission factors are now based on IPCC default values (104.17 kg/TJ) whereas in the previous submission the values where based on country-specific expert guesses (10 to 50 kg/TJ).

1 A 2 f Manufacturing Industries and Construction-Other / Cement industries: CO_2 emissions from industrial waste have been recalculated for the whole time series. In the previous submission non-fossil CO_2 (1996 to 2003) and a share of emissions from coal (1990 to 1993) were reported as emissions from industrial waste.

1 A 3 a Civil Aviation: The splitting up of the energy data into national and international aviation of 2003 and 2004 has been updated according to the energy balance. (Statistik Austria)

1 A 4 Other Sectors: Consideration of "new" pellets, wood chips, fuelwood heating technologies from 2001 onwards. This results in lower CH_4 emissions from the combustion of biomass.

Fugitive Emissions (1 B)

<u>Update of activity data:</u>

1 B 1 a Coal Mining: Activity data for 2002 and 2003 have been updated (following recommendations from the ERT).

1 B 2 a Refining/Storage: Activity data have been updated for 2002 and 2003 according to data from the national energy balance.

1 B 2 b Natural gas transmission and storage: Activity data for Natural gas storage have been updated

Improvements of methodologies and emission factors:

1 B 2 b *Gas Distribution:* The method to calculate CH_4 emissions has been changed to the IPCC Tier 1 methodology. The relevant activity data are now the km of distribution mains. The EF is the mean IPCC default EF (0.615 Mg CH_4/km).

Industrial Processes (IPCC Category 2)

Addition of source categories:

2 A 3 Limestone and Dolomite Use: Limestone used for desulphurization has been added to the inventory.

2 F Consumption of Halocarbons and SF_6: HFC emissions from the sub-categories 4 Aerosols/Metered dose inhalers and 5 Solvents have been added to the inventory.

2 B 5 Other – Ethylene: CH_4 emissions from this source have been added to the inventory.

Update of activity data:

2 A 1 Cement Production: Activity and emission data for CO_2 emissions from *Cement Production* 2003 has been updated using data from a study based on plant-specific data.

2 A 2 Lime: Activity data for 2003 has been updated.

2 A 7a Bricks: Activity data for 2003 has been updated.

2 A 7b Magnesia Sinter: Activity data for the whole time series have been changed to Magnesia used for Magnesia sinter production using information from industry. CO_2 emissions have been updated for 2003.

2 B 4 Calcium Carbide: Activity data for 2003 have been updated.

2 C 2 Ferroalloys: Activity data for the years 1999-2003 have been updated.

Improvements of methodologies and emission factors:

2 A 3 Dolomite Use: During QC checks an error in the emission factor was found that was corrected. CO_2 emissions from dolomite use are now calculated with the IPCC default emission factor for the whole time series.

2 A 7a Bricks: Emissions 1998 to 2001 were updated with validated data. This lead to a recalculation of the whole time series, because emissions of the years before 1998 were calculated with the IEF for 1998; and the IEF from 2001 was used to calculate emissions after 2001.

2 B 1 Ammonia: During QC checks it was found that CO_2 emissions as reported by the plant operator were not determined in accordance with the IPCC guidelines. Consequently, CO_2 emissions have been recalculated from the natural gas input (from the national energy balance) with a standard emission factor. 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 plant melamine is produced, a product in which carbon can be assumed to be stored for a long time. Thus, account was taken of the carbon bound in the melamine production, and it was subtracted from the total CO_2 emissions.

2 C 1 Iron and Steel: Process-specific CO_2 emissions from pig iron production have been recalculated as the underlying activity data used for the calculation (non-energy use of coke) have been updated in the national energy balance.

2 F Consumption of Halocarbons and SF_6:

HFC emissions from the sub-category 2 Foam Blowing have been recalculated incorporating the results from a new study on HFC used in foam blowing. The following study was used: Obernosterer R., Smutny R., Jäger E., Merl A. (2004): HFKW Gase in Dämmschäumen des Bauwesens. Umweltbundesamt, Internal Report

HFC emissions from disposal have been estimated for the sub-category 1 Refrigeration and Air conditioning equipment.

Solvent and other Product Use (IPCC Category 3)

Improvements of methodologies and emission factors:

Indirect CO_2 emissions from solvent use have been updated for 2002 and 2003 by means of 2001 data and sector-specific technological and economic development; previously the 2001 estimate had been used for these years.

Agriculture (IPCC Category 4)

Update of activity data:

4 D 1, 4 D 2, 4 D 3 Agricultural Soils: Revised N excretion data of Austrian livestock has led to higher amounts of animal waste spread on agricultural soils.

4 D 4 Other: Amounts of agriculturally applied sewage sludge of 2002 to 2004 have been updated according to data from the National Austrian Waste Water Database.

Improvements of methodologies and emission factors:

4 A, 4 B, 4 D Enteric Fermentation, Manure Management, Agricultural Soils: As recommended in the Centralized Review 2004, Austrian N excretion values have been revised. Especially N excretion rates of dairy and mother cows are higher now, which has resulted in higher emissions of N_2O from source category 4 B and 4 D.

With the revision of N excretion rates, the GE intake and VS excretion data were also recalculated. This has resulted in higher CH_4 emissions from source categories 4 A and 4 B.

LULUCF (IPCC Category 5)

Addition of source or sink categories:

5 B 1, 5 C 1, 5 B 2 2, 5 C 2 2: CO_2 and emissions and removals from cropland and grassland management (categories *5 B 1* and *5 C 1*) including liming have been recalculated and estimations have been made for each year from 1990 onwards. Emissions from land use changes from cropland to grassland (5 B 2 2) and from grassland to cropland (5 C 2 2) have been added.

Improvements of methodologies and emission factors:

5A1: For the total time series, starting from 1961, the C-stock changes in biomass were calculated by using a new methodology. The new methodology comprises a more accurate allocation of the measured annual means of the increment and harvest data of each NFI to the specific observation periods, the revision of conversion factors and the usage of new biomass functions for estimating the biomass in branches, needles and roots.

CO_2 emissions and removals from net carbon stock changes in dead organic matter have been estimated for the first time, as well as non CO_2 emissions (CH_4 and N_2O) from biomass burning due to wildfires.

5A2: With regard to the previous submission the average loss of stemwood o.b. on lost forest areas was recalculated according to the results of the new inventory period 2000/02. The recalculation led to an increase of loss of stemwood from 13.8 m^3/ha to 60 m^3/ha.

Land use changes from and to cropland and grassland have been added to the inventory. The data are based on results of the IACS System (Integrated Administration and Controlling System). Emission factors have been calculated according to the Tier 1 Method (IPCC 2003) except for carbon stocks in soils of cropland and grassland. The estimation of carbon stocks in soils has been taken from national calculations (GERZABEK et al. 2003), (STREBL et al. 2003).

Waste (IPCC Category 6)

Update of activity data

6 A 1 Managed waste disposal on land: The activity data (1998 to 2004) have 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, there are minor changes of the activity data in this submission compared to the previous submission.

For those years where no data were available on non-residual wastes (before 1998) extrapolation according to the GDP was used as recommended by ERT, instead of assuming the amount of non-residual wastes to be constant.

Double Counting of the amount of construction waste has been corrected.

Improvements of methodology:

6 A 1 Managed Waste Disposal on Land: The IPCC Tier 2 Methodology is now used instead of a country-specific one.

6 B Waste Water Handling: For calculating CH_4 emissions, the IPCC Methodology is now used instead of a country-specific one.

6 C Waste Incineration: For incineration of municipal solid waste without energy recovery, the IPCC default CO_2 emission factor is now used because the emission factor used in the previous submission was based on a non-verified expert guess. CO_2, CH_4 and N_2O emissions from the incineration of clinical waste without energy recovery are additionally estimated by means of activity data based on expert guesses and IPCC default emission factors.

CO_2 emissions from cremation are now reported as "NA" due to elimination of double counting with category *1 A 4 a Commercial/Institutional*-G*aseous fuels.*

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 2003 which are submitted this year differ from data reported previously.

Other than in previous reports, 1990 has been chosen as the base year for all greenhouse gases.

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 233: Recalculation difference of Austria's greenhouse gas emissions compared to the previous submission

	1990 (Base year)	2003
	Recalculation Difference [%]	
TOTAL	+0.5%	+1.0%
CO_2	+1.1%	+1.8%
CH_4	-6.3%	-5.7%
N_2O	+9.3%	+9.0%
HFC, PFC, SF6	-10.9%	-22.1%

Emissions without LULUCF

The main reasons for the increase of reported CO_2 emissions are

- revised coke oven coke net calorific values (cross-sectoral),
- a revised natural gas CO_2 emission factor (cross-sectoral),
- a revised industrial waste CO_2 emission factor (cross-sectoral)
- and higher emissions from Industrial Processes mainly due to the improved methodology for 2 B 1 Ammonia Production.

The main reasons for the decrease of reported methane emissions are methodological changes in the sectors *6 A 1 Managed Waste Disposal on Land* and 6 B Waste Water Handling.

The main reason for the increase of reported N_2O emissions is the revision of the N excretion rates in the Agriculture sector that lead to higher emissions in 4 B Manure Management and 4 D Agricultural soils.

The main reason for the decrease of reported emissions of fluorinated compounds is the incorporation of a new study on HFC use and emissions in the sub-category 2 F 2 Foam Blowing.

Table 234 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 234: Recalculation Difference of National Total GHG Emissions

Year	National Total GHG emissions without LUCF		
	Submission 2005 [Gg CO_2e]	Submission 2006 [Gg CO_2e]	Recalculation Difference [%]
Base year*	78535.22	78959.40	0.5%
1990	78573.05	78959.40	0.5%
1991	82647.00	82997.57	0.4%
1992	76062.64	76300.77	0.3%
1993	76177.63	76270.69	0.1%
1994	77045.38	77113.09	0.1%
1995	80159.10	80234.57	0.1%
1996	83237.39	83567.37	0.4%
1997	83046.10	83146.28	0.1%
1998	82513.72	82605.15	0.1%
1999	80402.96	80800.09	0.5%
2000	81083.55	81278.83	0.2%
2001	84871.78	85145.37	0.3%
2002	86433.79	86858.79	0.5%
2003	91566.42	92526.59	1.0%

*Base year is 1990 for all gases in submission 2006; and in submission 2005: 1990 for CO_2, CH_4 and N_2O and 1995 for HFC, PFC and SF_6

9.3 Implications for Emission Trends

As can be seen in Table 234 and Figure 29, Austria's greenhouse gas emissions as reported in the UNFCCC submission 2006 are higher than the values reported last year due to recalculations: for the base year they are 0.5% higher and for the year 2003 1.0%. This results in a stronger increasing trend: last year the trend from the base year to 2003 was plus 16.6% whereas now it is plus 17.2% (for explanations please refer to Chapters 9.1 and 9.2).

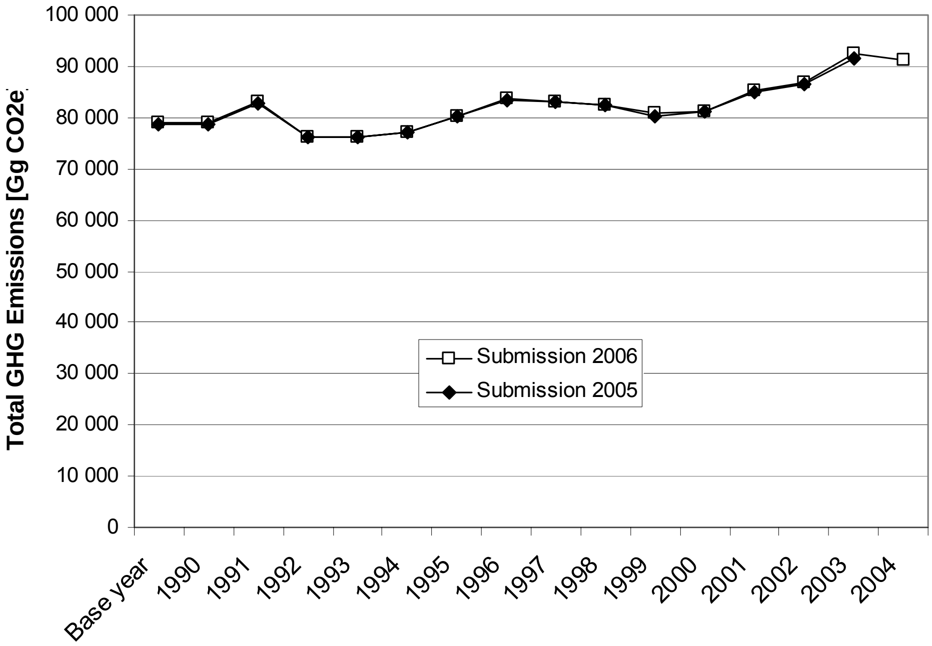

Figure 29: Emission estimate of the submission 2005 and recalculated values of the submission 2006

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, 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
LUCF	Land Use Change and Forestry – IPCC-CRF Category 5

LULUCF	Land Use, Land-Use Change and Forestry
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 000g	
1t	= 1 000kg	= 1Mg
1kt	= 1 000t	= 1Gg
1Mt	= 1 Mio t	= 1Tg

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 1: KEY SOURCE 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 2006.

Table A1.1 presents results from the Level Assessment of the key source analysis.

Table A1.2 presents results from the Trend Assessment of the key source analysis.

Table A1.3 presents emission sources in the level of aggregation as used for the key source analysis. Emissions from 1990 to 2004 for these sources are also included.

Table A1.4 summarizes the key sources identified including their ranking in the level and trend assessments.

Rank	IPCC Source Categories		GHG	Unit	BY (1990)	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	14.14%	14.14%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	10.02%	24.16%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 444.2	9.43%	33.59%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	7.91%	41.50%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	6.35%	47.85%
6	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	5.08%	52.94%
7	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	4.51%	57.45%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4.49%	61.94%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 375.0	4.27%	66.21%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 756.9	3.49%	69.70%
11	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	3.36%	73.06%
12	2 A 1	Cement Production	CO2	Gg	2 033.4	2.58%	75.64%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 960.2	2.48%	78.12%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 751.0	2.22%	80.34%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 314.8	1.67%	82.00%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.8	1.66%	83.66%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1.56%	85.22%
18	2C3	Aluminium production	PFCs	GgCO2e	1 050.2	1.33%	86.55%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 018.4	1.29%	87.84%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	1.16%	88.99%
21	4 B 1	Cattle	N2O	Gg CO2e	908.1	1.15%	90.14%
22	4 B 1	Cattle	CH4	Gg CO2e	587.1	0.74%	90.89%
23	2 B 1	Ammonia Production	CO2	Gg	517.4	0.66%	91.54%
24	2 A 7 b	Sinter Production	CO2	Gg	481.2	0.61%	92.15%
25	4 B 8	Swine	CH4	Gg CO2e	447.7	0.57%	92.72%
26	2 A 2	Lime Production	CO2	Gg	396.2	0.50%	93.22%
27	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	0.47%	93.70%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	314.7	0.40%	94.09%
29	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	0.36%	94.45%
30	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	0.35%	94.80%
31	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	0.32%	95.12%

Rank	IPCC Source Categories		GHG	Unit	1991	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 771.2	14.18%	14.18%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 678.7	10.46%	24.64%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 818.3	9.42%	34.06%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 817.0	8.21%	42.27%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 829.9	5.82%	48.09%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 760.0	5.74%	53.83%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 508.4	4.23%	58.05%
8	4 A 1	Cattle	CH4	Gg CO2e	3 503.5	4.22%	62.28%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 368.3	4.06%	66.33%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 145.0	3.79%	70.12%
11	1 A 4 solid	Other Sectors	CO2	Gg	2 934.3	3.54%	73.66%
12	2 A 1	Cement Production	CO2	Gg	2 005.0	2.42%	76.07%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 915.7	2.31%	78.38%
14	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 911.7	2.30%	80.69%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 498.0	1.80%	82.49%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 394.3	1.68%	84.17%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 178.2	1.42%	85.59%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 059.3	1.28%	86.87%
19	2C3	Aluminium production	PFCs	GgCO2e	1 050.2	1.27%	88.13%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	927.3	1.12%	89.25%
21	4 B 1	Cattle	N2O	Gg CO2e	896.1	1.08%	90.33%
22	4 B 1	Cattle	CH4	Gg CO2e	576.9	0.70%	91.02%
23	2 B 1	Ammonia Production	CO2	Gg	546.4	0.66%	91.68%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	468.0	0.56%	92.25%
25	4 B 8	Swine	CH4	Gg CO2e	441.7	0.53%	92.78%
26	2 A 7 b	Sinter Production	CO2	Gg	391.6	0.47%	93.25%
27	2 A 2	Lime Production	CO2	Gg	361.3	0.44%	93.68%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	341.7	0.41%	94.10%
29	1 B 2 b	Natural gas	CH4	Gg CO2e	288.1	0.35%	94.44%
30	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	277.2	0.33%	94.78%
31	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	272.4	0.33%	95.11%

Rank	IPCC Source Categories		GHG	Unit	1992	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 834.3	15.51%	15.51%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 297.1	10.87%	26.38%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 293.8	9.56%	35.94%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 156.9	6.76%	42.70%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 139.0	5.42%	48.13%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 009.5	5.25%	53.38%
7	4 A 1	Cattle	CH4	Gg CO2e	3 340.8	4.38%	57.76%
8	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 280.0	4.30%	62.06%
9	2 C 1	Iron and Steel Production	CO2	Gg	3 073.9	4.03%	66.09%
10	1 A 4 solid	Other Sectors	CO2	Gg	2 510.7	3.29%	69.38%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 414.2	3.16%	72.54%
12	2 A 1	Cement Production	CO2	Gg	2 105.0	2.76%	75.30%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 919.6	2.52%	77.82%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 771.5	2.32%	80.14%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 481.6	1.94%	82.08%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 276.6	1.67%	83.75%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 220.1	1.60%	85.35%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 070.6	1.40%	86.76%
19	4 B 1	Cattle	N2O	Gg CO2e	858.5	1.13%	87.88%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	837.5	1.10%	88.98%
21	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	571.0	0.75%	89.73%
22	2 B 1	Ammonia Production	CO2	Gg	553.5	0.73%	90.45%
23	4 B 1	Cattle	CH4	Gg CO2e	552.0	0.72%	91.18%
24	4 B 8	Swine	CH4	Gg CO2e	451.6	0.59%	91.77%
25	2C3	Aluminium production	PFCs	GgCO2e	417.6	0.55%	92.31%
26	2 A 2	Lime Production	CO2	Gg	355.1	0.47%	92.78%
27	2 A 7 b	Sinter Production	CO2	Gg	336.1	0.44%	93.22%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	316.4	0.41%	93.64%
29	1 B 2 b	Natural gas	CH4	Gg CO2e	307.1	0.40%	94.04%
30	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	293.4	0.38%	94.42%
31	2F6	Semiconductor Manufacture	FCs	GgCO2e	287.8	0.38%	94.80%
32	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	0.33%	95.13%

Rank	IPCC Source Categories		GHG	Unit	1993	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	12 339.5	16.18%	16.18%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 958.7	10.43%	26.61%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 201.1	9.44%	36.05%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 677.5	7.44%	43.50%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 318.5	5.66%	49.16%
6	4 A 1	Cattle	CH4	Gg CO2e	3 330.5	4.37%	53.53%
7	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 234.1	4.24%	57.77%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 144.7	4.12%	61.89%
9	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 088.9	4.05%	65.94%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 912.9	3.82%	69.76%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 188.3	2.87%	72.63%
12	1 A 4 solid	Other Sectors	CO2	Gg	2 080.0	2.73%	75.36%
13	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 052.0	2.69%	78.05%
14	2 A 1	Cement Production	CO2	Gg	2 031.9	2.66%	80.71%
15	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 610.2	2.11%	82.82%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 230.9	1.61%	84.44%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 180.0	1.55%	85.98%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 036.2	1.36%	87.34%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	878.7	1.15%	88.49%
20	4 B 1	Cattle	N2O	Gg CO2e	857.4	1.12%	89.62%
21	4 B 1	Cattle	CH4	Gg CO2e	546.3	0.72%	90.33%
22	2 B 1	Ammonia Production	CO2	Gg	539.6	0.71%	91.04%
23	4 B 8	Swine	CH4	Gg CO2e	463.7	0.61%	91.65%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	367.2	0.48%	92.13%
25	2 A 2	Lime Production	CO2	Gg	365.2	0.48%	92.61%
26	2F6	Semiconductor Manufacture	FCs	GgCO2e	360.4	0.47%	93.08%
27	1 B 2 b	Natural gas	CH4	Gg CO2e	326.7	0.43%	93.51%
28	2 A 7 b	Sinter Production	CO2	Gg	324.6	0.43%	93.94%
29	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	316.1	0.41%	94.35%
30	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	309.0	0.41%	94.76%
31	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	277.2	0.36%	95.12%

Rank	IPCC Source Categories		GHG	Unit	1994	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	12 961.8	16.81%	16.81%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 673.0	9.95%	26.76%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 586.9	8.54%	35.30%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 914.7	7.67%	42.97%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 237.0	5.49%	48.47%
6	2 C 1	Iron and Steel Production	CO2	Gg	3 411.1	4.42%	52.89%
7	4 A 1	Cattle	CH4	Gg CO2e	3 350.1	4.34%	57.23%
8	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 279.1	4.25%	61.49%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 059.4	3.97%	65.45%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 827.9	3.67%	69.12%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 328.3	3.02%	72.14%
12	2 A 1	Cement Production	CO2	Gg	2 102.3	2.73%	74.87%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 909.3	2.48%	77.34%
14	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 901.7	2.47%	79.81%
15	1 A 4 solid	Other Sectors	CO2	Gg	1 855.6	2.41%	82.21%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 339.4	1.74%	83.95%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 311.6	1.70%	85.65%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 063.4	1.38%	87.03%
19	4 B 1	Cattle	N2O	Gg CO2e	858.1	1.11%	88.14%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	825.2	1.07%	89.21%
21	4 B 1	Cattle	CH4	Gg CO2e	542.2	0.70%	89.92%
22	2 B 1	Ammonia Production	CO2	Gg	507.9	0.66%	90.58%
23	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	486.3	0.63%	91.21%
24	4 B 8	Swine	CH4	Gg CO2e	457.1	0.59%	91.80%
25	2F6	Semiconductor Manufacture	FCs	GgCO2e	430.9	0.56%	92.36%
26	2 A 2	Lime Production	CO2	Gg	390.5	0.51%	92.86%
27	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	372.8	0.48%	93.35%
28	1 B 2 b	Natural gas	CH4	Gg CO2e	342.7	0.44%	93.79%
29	2 A 7 b	Sinter Production	CO2	Gg	322.9	0.42%	94.21%
30	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	309.4	0.40%	94.61%
31	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	286.6	0.37%	94.98%
32	3	SOLVENT AND OTHER PRODUCT USE	N2O	Gg CO2e	232.5	0.30%	95.29%

Rank		IPCC Source Categories	GHG	Unit	1995	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 058.9	17.52%	17.52%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 411.3	9.24%	26.76%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 248.3	9.03%	35.79%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	6 553.4	8.17%	43.96%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 529.8	5.65%	49.61%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 457.8	5.56%	55.16%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 921.0	4.89%	60.05%
8	4 A 1	Cattle	CH4	Gg CO2e	3 372.6	4.20%	64.25%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 891.8	3.60%	67.86%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 628.6	3.28%	71.13%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 172.5	2.71%	73.84%
12	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 918.7	2.39%	76.23%
13	1 A 4 solid	Other Sectors	CO2	Gg	1 746.4	2.18%	78.41%
14	2 A 1	Cement Production	CO2	Gg	1 631.3	2.03%	80.44%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 556.3	1.94%	82.38%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 364.1	1.70%	84.08%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 219.9	1.52%	85.60%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 038.5	1.29%	86.90%
19	4 B 1	Cattle	N2O	Gg CO2e	879.2	1.10%	87.99%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	857.2	1.07%	89.06%
21	2 B 1	Ammonia Production	CO2	Gg	538.1	0.67%	89.73%
22	4 B 1	Cattle	CH4	Gg CO2e	532.8	0.66%	90.40%
23	2F6	Semiconductor Manufacture	FCs	GgCO2e	505.7	0.63%	91.03%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	500.0	0.62%	91.65%
25	4 B 8	Swine	CH4	Gg CO2e	458.5	0.57%	92.22%
26	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	443.1	0.55%	92.77%
27	2 A 7 b	Sinter Production	CO2	Gg	409.9	0.51%	93.28%
28	2 A 2	Lime Production	CO2	Gg	394.6	0.49%	93.78%
29	1 B 2 b	Natural gas	CH4	Gg CO2e	368.0	0.46%	94.23%
30	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	302.4	0.38%	94.61%
31	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	294.2	0.37%	94.98%
32	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	259.2	0.32%	95.30%

Rank		**IPCC Source Categories**	**GHG**	Unit	**1996**	**Level Assessment**	**Cumulative Total**
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 219.0	18.21%	18.21%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	8 688.1	10.40%	28.61%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 385.9	10.03%	38.64%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 855.7	8.20%	46.85%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 695.9	5.62%	52.47%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 400.0	5.27%	57.73%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 702.9	4.43%	62.16%
8	4 A 1	Cattle	CH4	Gg CO2e	3 320.4	3.97%	66.14%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 735.7	3.27%	69.41%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 444.2	2.92%	72.33%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 185.5	2.62%	74.95%
12	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 703.3	2.04%	76.99%
13	1 A 4 solid	Other Sectors	CO2	Gg	1 657.7	1.98%	78.97%
14	2 A 1	Cement Production	CO2	Gg	1 634.2	1.96%	80.93%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 550.0	1.85%	82.78%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 338.7	1.60%	84.38%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 252.2	1.50%	85.88%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 010.1	1.21%	87.09%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	874.2	1.05%	88.14%
20	4 B 1	Cattle	N2O	Gg CO2e	865.0	1.04%	89.17%
21	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	610.6	0.73%	89.90%
22	2 B 1	Ammonia Production	CO2	Gg	539.6	0.65%	90.55%
23	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	538.3	0.64%	91.19%
24	4 B 1	Cattle	CH4	Gg CO2e	525.7	0.63%	91.82%
25	4 B 8	Swine	CH4	Gg CO2e	447.6	0.54%	92.36%
26	2F6	Semiconductor Manufacture	FCs	GgCO2e	403.9	0.48%	92.84%
27	1 B 2 b	Natural gas	CH4	Gg CO2e	393.9	0.47%	93.31%
28	2 A 2	Lime Production	CO2	Gg	382.7	0.46%	93.77%
29	2 A 7 b	Sinter Production	CO2	Gg	355.4	0.43%	94.20%
30	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	337.5	0.40%	94.60%
31	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	324.4	0.39%	94.99%
32	1 A 4 other	Other Sectors	CO2	Gg	302.0	0.36%	95.35%

Rank		IPCC Source Categories	GHG	Unit	1997	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 678.9	17.65%	17.65%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	7 968.6	9.58%	27.24%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 245.7	8.71%	35.95%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 497.0	7.81%	43.77%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 018.7	6.04%	49.80%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 002.2	6.02%	55.82%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 099.9	4.93%	60.75%
8	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 394.5	4.08%	64.83%
9	4 A 1	Cattle	CH4	Gg CO2e	3 253.7	3.91%	68.75%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 605.7	3.13%	71.88%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 159.4	2.60%	74.48%
12	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 925.2	2.32%	76.79%
13	2 A 1	Cement Production	CO2	Gg	1 760.9	2.12%	78.91%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 743.1	2.10%	81.01%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 431.8	1.72%	82.73%
16	1 A 4 solid	Other Sectors	CO2	Gg	1 294.5	1.56%	84.29%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 256.6	1.51%	85.80%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 026.1	1.23%	87.03%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	862.6	1.04%	88.07%
20	4 B 1	Cattle	N2O	Gg CO2e	851.4	1.02%	89.09%
21	2F6	Semiconductor Manufacture	FCs	GgCO2e	593.8	0.71%	89.81%
22	2 B 1	Ammonia Production	CO2	Gg	533.1	0.64%	90.45%
23	4 B 1	Cattle	CH4	Gg CO2e	520.5	0.63%	91.07%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	506.9	0.61%	91.68%
25	4 B 8	Swine	CH4	Gg CO2e	448.3	0.54%	92.22%
26	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	418.3	0.50%	92.73%
27	2 A 2	Lime Production	CO2	Gg	412.5	0.50%	93.22%
28	1 B 2 b	Natural gas	CH4	Gg CO2e	410.3	0.49%	93.71%
29	2 A 7 b	Sinter Production	CO2	Gg	384.3	0.46%	94.18%
30	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	349.2	0.42%	94.60%
31	1 A 4 other	Other Sectors	CO2	Gg	270.7	0.33%	94.92%
32	2F8	Other Sources of SF6	SF6	GgCO2e	256.1	0.31%	95.23%

Rank	IPCC Source Categories		GHG	Unit	1998	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 994.8	18.15%	18.15%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 738.1	11.79%	29.94%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 267.3	8.80%	38.74%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 798.5	8.23%	46.97%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 484.9	5.43%	52.40%
6	2 C 1	Iron and Steel Production	CO2	Gg	3 900.4	4.72%	57.12%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 498.1	4.23%	61.35%
8	4 A 1	Cattle	CH4	Gg CO2e	3 226.7	3.91%	65.26%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 151.3	3.81%	69.08%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 510.0	3.04%	72.11%
11	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 211.2	2.68%	74.79%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 175.4	2.63%	77.42%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 769.1	2.14%	79.57%
14	2 A 1	Cement Production	CO2	Gg	1 598.7	1.94%	81.50%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 378.2	1.67%	83.17%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 259.6	1.52%	84.69%
17	1 A 4 solid	Other Sectors	CO2	Gg	1 127.3	1.36%	86.06%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 041.2	1.26%	87.32%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	896.7	1.09%	88.41%
20	4 B 1	Cattle	N2O	Gg CO2e	848.1	1.03%	89.43%
21	2 B 1	Ammonia Production	CO2	Gg	526.3	0.64%	90.07%
22	4 B 1	Cattle	CH4	Gg CO2e	517.0	0.63%	90.70%
23	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	492.3	0.60%	91.29%
24	2F6	Semiconductor Manufacture	FCs	GgCO2e	477.8	0.58%	91.87%
25	4 B 8	Swine	CH4	Gg CO2e	462.4	0.56%	92.43%
26	2 A 2	Lime Production	CO2	Gg	453.8	0.55%	92.98%
27	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	427.3	0.52%	93.50%
28	1 B 2 b	Natural gas	CH4	Gg CO2e	424.9	0.51%	94.01%
29	2 A 7 b	Sinter Production	CO2	Gg	345.4	0.42%	94.43%
30	2F8	Other Sources of SF6	SF6	GgCO2e	286.1	0.35%	94.77%
31	2 A 3	Limestone and Dolomite Use	CO2	Gg	264.1	0.32%	95.09%

Rank	**IPCC Source Categories**		**GHG**	Unit	**1999**	**Level Assessment**	**Cumulative Total**
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 147.1	18.75%	18.75%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 525.1	11.79%	30.53%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 146.9	8.85%	39.38%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 317.7	7.82%	47.20%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 342.2	5.37%	52.57%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 779.4	4.68%	57.25%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 759.3	4.65%	61.90%
8	4 A 1	Cattle	CH4	Gg CO2e	3 204.8	3.97%	65.87%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 478.9	3.07%	68.94%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 404.9	2.98%	71.91%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 059.5	2.55%	74.46%
12	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 998.7	2.47%	76.94%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 718.6	2.13%	79.06%
14	2 A 1	Cement Production	CO2	Gg	1 607.4	1.99%	81.05%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 401.4	1.73%	82.79%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 222.6	1.51%	84.30%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 047.9	1.30%	85.60%
18	1 A 4 solid	Other Sectors	CO2	Gg	1 041.9	1.29%	86.89%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	923.5	1.14%	88.03%
20	4 B 1	Cattle	N2O	Gg CO2e	843.6	1.04%	89.07%
21	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	605.2	0.75%	89.82%
22	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	539.3	0.67%	90.49%
23	2 B 1	Ammonia Production	CO2	Gg	531.2	0.66%	91.15%
24	4 B 1	Cattle	CH4	Gg CO2e	510.4	0.63%	91.78%
25	2F6	Semiconductor Manufacture	FCs	GgCO2e	453.9	0.56%	92.34%
26	2 A 2	Lime Production	CO2	Gg	453.1	0.56%	92.90%
27	1 B 2 b	Natural gas	CH4	Gg CO2e	451.7	0.56%	93.46%
28	4 B 8	Swine	CH4	Gg CO2e	416.6	0.52%	93.98%
29	2 A 7 b	Sinter Production	CO2	Gg	350.0	0.43%	94.41%
30	1 A 4 other	Other Sectors	CO2	Gg	264.0	0.33%	94.74%
31	2 A 3	Limestone and Dolomite Use	CO2	Gg	247.4	0.31%	95.04%

Rank	IPCC Source Categories		GHG	Unit	2000	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 565.8	17.92%	17.92%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	10 771.8	13.25%	31.17%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 617.7	8.14%	39.32%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 105.3	7.51%	46.83%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 004.2	6.16%	52.98%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 762.0	5.86%	58.84%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 201.8	5.17%	64.01%
8	4 A 1	Cattle	CH4	Gg CO2e	3 190.5	3.93%	67.94%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 302.2	2.83%	70.77%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 200.0	2.71%	73.48%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 994.2	2.45%	75.93%
12	2 A 1	Cement Production	CO2	Gg	1 711.6	2.11%	78.04%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 638.6	2.02%	80.05%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 315.6	1.62%	81.67%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 214.2	1.49%	83.16%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 195.9	1.47%	84.64%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 061.5	1.31%	85.94%
18	1 A 4 solid	Other Sectors	CO2	Gg	955.4	1.18%	87.12%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	951.6	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	592.8	0.73%	90.05%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	562.6	0.69%	90.74%
23	2 B 1	Ammonia Production	CO2	Gg	518.8	0.64%	91.38%
24	4 B 1	Cattle	CH4	Gg CO2e	501.3	0.62%	91.99%
25	2 A 2	Lime Production	CO2	Gg	497.5	0.61%	92.61%
26	1 B 2 b	Natural gas	CH4	Gg CO2e	469.7	0.58%	93.18%
27	2F6	Semiconductor Manufacture	FCs	GgCO2e	407.1	0.50%	93.69%
28	4 B 8	Swine	CH4	Gg CO2e	404.3	0.50%	94.18%
29	2 A 7 b	Sinter Production	CO2	Gg	339.2	0.42%	94.60%
30	2 A 3	Limestone and Dolomite Use	CO2	Gg	275.6	0.34%	94.94%
31	2F8	Other Sources of SF6	SF6	GgCO2e	265.2	0.33%	95.27%

Rank		**IPCC Source Categories**	**GHG**	Unit	**2001**	**Level Assessment**	**Cumulative Total**
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 482.8	18.18%	18.18%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	11 962.0	14.05%	32.23%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 489.2	8.80%	41.03%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 149.6	7.22%	48.25%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 956.6	7.00%	55.25%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 423.6	5.20%	60.44%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 159.4	4.89%	65.33%
8	4 A 1	Cattle	CH4	Gg CO2e	3 140.0	3.69%	69.02%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 209.9	2.60%	71.61%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 207.0	2.59%	74.20%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 014.5	2.37%	76.57%
12	2 A 1	Cement Production	CO2	Gg	1 719.9	2.02%	78.59%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 642.2	1.93%	80.52%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 383.9	1.63%	82.14%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 365.4	1.60%	83.75%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 186.8	1.39%	85.14%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 076.5	1.26%	86.40%
18	1 A 4 solid	Other Sectors	CO2	Gg	889.5	1.04%	87.45%
19	4 B 1	Cattle	N2O	Gg CO2e	824.5	0.97%	88.42%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	786.5	0.92%	89.34%
21	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	691.7	0.81%	90.15%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	515.0	0.60%	90.76%
23	2 A 2	Lime Production	CO2	Gg	506.6	0.60%	91.35%
24	4 B 1	Cattle	CH4	Gg CO2e	486.6	0.57%	91.92%
25	1 B 2 b	Natural gas	CH4	Gg CO2e	476.5	0.56%	92.48%
26	2 B 1	Ammonia Production	CO2	Gg	473.2	0.56%	93.04%
27	4 B 8	Swine	CH4	Gg CO2e	422.5	0.50%	93.54%
28	2F6	Semiconductor Manufacture	FCs	GgCO2e	416.9	0.49%	94.03%
29	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	336.8	0.40%	94.42%
30	2 A 7 b	Sinter Production	CO2	Gg	334.0	0.39%	94.81%
31	2 A 3	Limestone and Dolomite Use	CO2	Gg	271.1	0.32%	95.13%

Rank	IPCC Source Categories		GHG	Unit	2002	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 451.4	17.79%	17.79%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	13 526.0	15.57%	33.36%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 272.1	8.37%	41.73%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 621.5	7.62%	49.36%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 510.1	6.34%	55.70%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 144.1	5.92%	61.62%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 606.8	5.30%	66.93%
8	4 A 1	Cattle	CH4	Gg CO2e	3 086.5	3.55%	70.48%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 167.9	2.50%	72.98%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 145.7	2.47%	75.45%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 851.8	2.13%	77.58%
12	2 A 1	Cement Production	CO2	Gg	1 735.7	2.00%	79.58%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 649.8	1.90%	81.48%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 422.2	1.64%	83.11%
15	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 181.8	1.36%	84.47%
16	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 081.8	1.25%	85.72%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	843.7	0.97%	86.69%
18	4 B 1	Cattle	N2O	Gg CO2e	809.0	0.93%	87.62%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	807.2	0.93%	88.55%
20	2 F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	778.6	0.90%	89.45%
21	1 A 4 solid	Other Sectors	CO2	Gg	743.4	0.86%	90.30%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	643.3	0.74%	91.04%
23	2 A 2	Lime Production	CO2	Gg	546.6	0.63%	91.67%
24	1 B 2 b	Natural gas	CH4	Gg CO2e	496.6	0.57%	92.25%
25	2 B 1	Ammonia Production	CO2	Gg	487.0	0.56%	92.81%
26	4 B 1	Cattle	CH4	Gg CO2e	476.4	0.55%	93.36%
27	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	432.3	0.50%	93.85%
28	2 F 6	Semiconductor Manufacture	FCs	GgCO2e	425.8	0.49%	94.34%
29	4 B 8	Swine	CH4	Gg CO2e	403.3	0.46%	94.81%
30	2 A 7 b	Sinter Production	CO2	Gg	373.5	0.43%	95.24%

Rank	IPCC Source Categories		GHG	Unit	2003	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	16 689.3	18.04%	18.04%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 112.2	16.33%	34.37%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 159.3	8.82%	43.19%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 915.0	7.47%	50.66%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 772.0	7.32%	57.98%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 969.3	5.37%	63.35%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 523.1	4.89%	68.24%
8	4 A 1	Cattle	CH4	Gg CO2e	3 060.6	3.31%	71.55%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 194.4	2.37%	73.92%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 051.0	2.22%	76.14%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 894.9	2.05%	78.18%
12	2 A 1	Cement Production	CO2	Gg	1 754.5	1.90%	80.08%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 562.7	1.69%	81.77%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 416.6	1.53%	83.30%
15	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 141.6	1.23%	84.53%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 117.5	1.21%	85.74%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 086.9	1.17%	86.92%
18	2 B 2	Nitric Acid Production	N2O	Gg CO2e	883.4	0.95%	87.87%
19	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	861.4	0.93%	88.80%
20	4 B 1	Cattle	N2O	Gg CO2e	799.8	0.86%	89.67%
21	1 A 4 solid	Other Sectors	CO2	Gg	793.3	0.86%	90.52%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	681.0	0.74%	91.26%
23	2 A 2	Lime Production	CO2	Gg	574.6	0.62%	91.88%
24	2 B 1	Ammonia Production	CO2	Gg	527.1	0.57%	92.45%
25	1 B 2 b	Natural gas	CH4	Gg CO2e	515.3	0.56%	93.01%
26	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	488.6	0.53%	93.54%
27	2F6	Semiconductor Manufacture	FCs	GgCO2e	483.0	0.52%	94.06%
28	4 B 1	Cattle	CH4	Gg CO2e	470.9	0.51%	94.57%
29	4 B 8	Swine	CH4	Gg CO2e	410.3	0.44%	95.01%

Rank		**IPCC Source Categories**	**GHG**	Unit	**2004**	**Level Assessment**	**Cumulative Total**
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	16 962.0	18.57%	18.57%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 805.8	17.31%	35.88%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 097.5	7.77%	43.65%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 676.4	7.31%	50.96%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 586.8	7.21%	58.17%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 992.1	5.47%	63.64%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 414.8	4.83%	68.47%
8	4 A 1	Cattle	CH4	Gg CO2e	3 072.1	3.36%	71.83%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 218.8	2.43%	74.26%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 164.6	2.37%	76.63%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 847.9	2.02%	78.66%
12	2 A 1	Cement Production	CO2	Gg	1 754.5	1.92%	80.58%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 496.4	1.64%	82.22%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 460.8	1.60%	83.82%
15	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 144.4	1.25%	85.07%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 085.6	1.19%	86.26%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 061.0	1.16%	87.42%
18	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	900.5	0.99%	88.40%
19	4 B 1	Cattle	N2O	Gg CO2e	800.7	0.88%	89.28%
20	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	760.6	0.83%	90.11%
21	1 A 4 solid	Other Sectors	CO2	Gg	618.4	0.68%	90.79%
22	2 A 2	Lime Production	CO2	Gg	599.5	0.66%	91.45%
23	1 B 2 b	Natural gas	CH4	Gg CO2e	539.1	0.59%	92.04%
24	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	537.1	0.59%	92.63%
25	2F6	Semiconductor Manufacture	FCs	GgCO2e	497.3	0.54%	93.17%
26	4 B 1	Cattle	CH4	Gg CO2e	468.8	0.51%	93.68%
27	2 B 1	Ammonia Production	CO2	Gg	468.5	0.51%	94.20%
28	4 B 8	Swine	CH4	Gg CO2e	385.3	0.42%	94.62%
29	2 A 7 b	Sinter Production	CO2	Gg	328.5	0.36%	94.98%
30	2 A 3	Limestone and Dolomite Use	CO2	Gg	297.5	0.33%	95.30%

Rank		IPCC Source Categories	GHG	Unit	BY	1997	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	7 968.6	9.59%	0.043	19.88%	19.88%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	14 678.9	17.66%	0.033	15.50%	35.37%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 497.0	7.82%	0.021	9.74%	45.11%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	5 002.2	6.02%	0.018	8.37%	53.48%
5	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	1 294.5	1.56%	0.017	7.97%	61.45%
6	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 375.0	2 605.7	3.13%	0.011	5.04%	66.48%
7	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 925.2	2.32%	0.007	3.35%	69.83%
8	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 444.2	7 245.7	8.72%	0.007	3.15%	72.98%
9	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 253.7	3.91%	0.006	2.63%	75.62%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 756.9	3 394.5	4.08%	0.006	2.61%	78.23%
11	2F6	Semiconductor Manufacture	FCs	GgCO2e	133.1	593.8	0.71%	0.005	2.41%	80.64%
12	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	418.3	0.50%	0.005	2.10%	82.74%
13	2 A 1	Cement Production	CO2	Gg	2 033.4	1 760.9	2.12%	0.004	2.02%	84.76%
14	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4 099.9	4.93%	0.004	1.94%	86.71%
15	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	5 018.7	6.04%	0.003	1.39%	88.10%
16	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	410.3	0.49%	0.001	0.65%	88.75%
17	2F8	Other Sources of SF6	SF6	GgCO2e	126.6	256.1	0.31%	0.001	0.65%	89.40%
18	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.8	1 256.6	1.51%	0.001	0.65%	90.05%
19	2 A 7 b	Sinter Production	CO2	Gg	481.2	384.3	0.46%	0.001	0.65%	90.70%
20	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	239.3	0.29%	0.001	0.61%	91.31%
21	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	506.9	0.61%	0.001	0.60%	91.91%
22	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	190.1	0.23%	0.001	0.57%	92.48%
23	4 B 1	Cattle	N2O	Gg CO2e	908.1	851.4	1.02%	0.001	0.56%	93.04%
24	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 751.0	1 743.1	2.10%	0.001	0.53%	93.57%
25	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	862.6	1.04%	0.001	0.52%	94.09%
26	4 B 1	Cattle	CH4	Gg CO2e	587.1	520.5	0.63%	0.001	0.52%	94.61%
27	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 960.2	2 159.4	2.60%	0.001	0.51%	95.12%

Rank	IPCC Source Categories		GHG	Unit	BY	1998	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
7	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	2 211.2	2.68%	0.011	4.05%	4.05%
22	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	233.8	0.28%	0.001	0.48%	4.54%
3	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	3 498.1	4.24%	0.035	13.30%	17.84%
19	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 960.2	2 175.4	2.63%	0.001	0.55%	18.38%
8	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	4 484.9	5.43%	0.009	3.33%	21.72%
14	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 756.9	3 151.3	3.82%	0.003	1.17%	22.89%
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	9 738.1	11.79%	0.064	24.26%	47.15%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 798.5	8.23%	0.017	6.47%	53.62%
4	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	1 127.3	1.36%	0.019	7.22%	60.84%
10	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 444.2	7 267.3	8.80%	0.006	2.28%	63.12%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	14 994.8	18.16%	0.038	14.50%	77.62%
18	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	424.9	0.51%	0.002	0.61%	78.23%
9	2 A 1	Cement Production	CO2	Gg	2 033.4	1 598.7	1.94%	0.006	2.31%	80.54%
16	2 A 7 b	Sinter Production	CO2	Gg	481.2	345.4	0.42%	0.002	0.69%	81.24%
15	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	3 900.4	4.72%	0.002	0.84%	82.07%
24	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	164.2	0.20%	0.001	0.44%	82.51%
12	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	492.3	0.60%	0.005	2.06%	84.57%
13	2F6	Semiconductor Manufacture	FCs	GgCO2e	133.1	477.8	0.58%	0.004	1.48%	86.06%
17	2F8	Other Sources of SF6	SF6	GgCO2e	126.6	286.1	0.35%	0.002	0.67%	86.73%
20	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	172.2	0.21%	0.001	0.54%	87.27%
11	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 226.7	3.91%	0.006	2.18%	89.45%
23	4 B 1	Cattle	N2O	Gg CO2e	908.1	848.1	1.03%	0.001	0.45%	89.90%
21	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.8	1 259.6	1.53%	0.001	0.48%	90.39%
6	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 375.0	2 510.0	3.04%	0.012	4.47%	94.86%
25	6 B	WASTEWATER HANDLING	N2O	Gg CO2e	17.0	118.4	0.14%	0.001	0.44%	95.30%

Rank		**IPCC Source Categories**	**GHG**	Unit	**BY**	**1999**	**Level Assessment**	**Trend Assessment**	**Contribution to Trend**	**Cumulative Total**
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	9 525.1	11.79%	0.066	23.57%	23.57%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	15 147.1	18.75%	0.045	16.17%	39.74%
3	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	3 779.4	4.68%	0.032	11.37%	51.11%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 317.7	7.82%	0.022	7.73%	58.84%
5	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	1 041.9	1.29%	0.020	7.28%	66.12%
6	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 375.0	2 404.9	2.98%	0.013	4.56%	70.69%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	4 342.2	5.38%	0.010	3.43%	74.12%
8	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 998.7	2.47%	0.009	3.22%	77.34%
9	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	539.3	0.67%	0.006	2.25%	79.60%
10	2 A 1	Cement Production	CO2	Gg	2 033.4	1 607.4	1.99%	0.006	2.06%	81.66%
11	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 444.2	7 146.9	8.85%	0.006	2.05%	83.70%
12	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 204.8	3.97%	0.005	1.91%	85.61%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 756.9	2 478.9	3.07%	0.004	1.49%	87.10%
14	2F6	Semiconductor Manufacture	FCs	GgCO2e	133.1	453.9	0.56%	0.004	1.38%	88.48%
15	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	22.2	0.03%	0.003	1.03%	89.52%
16	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	605.2	0.75%	0.003	0.96%	90.48%
17	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	451.7	0.56%	0.002	0.75%	91.23%
18	2 A 7 b	Sinter Production	CO2	Gg	481.2	350.0	0.43%	0.002	0.62%	91.85%
19	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	3 759.3	4.65%	0.002	0.57%	92.42%
20	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	158.4	0.20%	0.002	0.57%	92.99%
21	6 B	WASTEWATER HANDLING	N2O	Gg CO2e	17.0	135.5	0.17%	0.001	0.51%	93.50%
22	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.8	1 222.6	1.51%	0.001	0.51%	94.02%
23	2F8	Other Sources of SF6	SF6	GgCO2e	126.6	246.4	0.30%	0.001	0.51%	94.52%
24	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	236.0	0.29%	0.001	0.50%	95.02%

Rank	IPCC Source Categories		GHG	Unit	BY	2000	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	10 771.8	13.26%	0.079	28.40%	28.40%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	14 565.8	17.92%	0.037	13.12%	41.52%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 105.3	7.51%	0.024	8.72%	50.23%
4	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	955.4	1.18%	0.021	7.60%	57.83%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	5 004.2	6.16%	0.017	6.10%	63.93%
6	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 375.0	2 302.2	2.83%	0.014	5.01%	68.94%
7	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 444.2	6 617.7	8.14%	0.012	4.47%	73.41%
8	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 756.9	2 200.0	2.71%	0.008	2.73%	76.14%
9	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	592.8	0.73%	0.007	2.44%	78.58%
10	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4 201.8	5.17%	0.007	2.36%	80.94%
11	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 190.5	3.93%	0.006	2.03%	82.97%
12	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	4 762.0	5.86%	0.005	1.71%	84.68%
13	2 A 1	Cement Production	CO2	Gg	2 033.4	1 711.6	2.11%	0.005	1.63%	86.31%
14	2F6	Semiconductor Manufacture	FCs	GgCO2e	133.1	407.1	0.50%	0.003	1.15%	87.47%
15	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	7.6	0.01%	0.003	1.08%	88.55%
16	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	469.7	0.58%	0.002	0.81%	89.36%
17	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	562.6	0.69%	0.002	0.76%	90.12%
18	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 751.0	1 638.6	2.02%	0.002	0.70%	90.82%
19	2 A 7 b	Sinter Production	CO2	Gg	481.2	339.2	0.42%	0.002	0.67%	91.48%
20	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.8	1 195.9	1.47%	0.002	0.65%	92.13%
21	6 B	WASTEWATER HANDLING	N2O	Gg CO2e	17.0	158.4	0.19%	0.002	0.60%	92.74%
22	2F8	Other Sources of SF6	SF6	GgCO2e	126.6	265.2	0.33%	0.002	0.58%	93.31%
23	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	234.9	0.29%	0.001	0.48%	93.80%
24	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	181.0	0.22%	0.001	0.47%	94.27%
25	4 B 1	Cattle	CH4	Gg CO2e	587.1	501.3	0.62%	0.001	0.44%	94.71%
26	1 A 4 other	Other Sectors	CO2	Gg	239.1	144.6	0.18%	0.001	0.43%	95.14%

Rank	IPCC Source Categories		GHG	Unit	BY	2001	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	11 962.0	14.05%	0.083	28.95%	28.95%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	15 482.8	18.19%	0.037	13.04%	41.99%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 149.6	7.22%	0.026	9.03%	51.02%
4	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	889.5	1.04%	0.021	7.48%	58.50%
5	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 375.0	2 207.0	2.59%	0.016	5.43%	63.93%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	4 423.6	5.20%	0.011	3.73%	67.66%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	5 956.6	7.00%	0.008	2.96%	70.61%
8	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 756.9	2 209.9	2.60%	0.008	2.89%	73.51%
9	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 140.0	3.69%	0.008	2.65%	76.16%
10	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	691.7	0.81%	0.007	2.54%	78.70%
11	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 444.2	7 489.2	8.80%	0.006	2.04%	80.74%
12	2 A 1	Cement Production	CO2	Gg	2 033.4	1 719.9	2.02%	0.005	1.79%	82.53%
13	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4 159.4	4.89%	0.004	1.27%	83.81%
14	2F6	Semiconductor Manufacture	FCs	GgCO2e	133.1	416.9	0.49%	0.003	1.04%	84.84%
15	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	7.6	0.01%	0.003	1.01%	85.85%
16	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 751.0	1 642.2	1.93%	0.003	0.93%	86.78%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.8	1 186.8	1.39%	0.002	0.86%	87.64%
18	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	336.8	0.40%	0.002	0.79%	88.43%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	786.5	0.92%	0.002	0.75%	89.18%
20	1 A 4 other	Other Sectors	CO2	Gg	239.1	65.6	0.08%	0.002	0.73%	89.91%
21	1 A 3 a jet kerosene	Civil Aviation	CO2	Gg	24.2	213.3	0.25%	0.002	0.71%	90.62%
22	2 A 7 b	Sinter Production	CO2	Gg	481.2	334.0	0.39%	0.002	0.70%	91.32%
23	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	476.5	0.56%	0.002	0.69%	92.01%
24	6 B	WASTEWATER HANDLING	N2O	Gg CO2e	17.0	193.1	0.23%	0.002	0.66%	92.67%
25	4 B 1	Cattle	N2O	Gg CO2e	908.1	824.5	0.97%	0.002	0.59%	93.26%
26	4 B 1	Cattle	CH4	Gg CO2e	587.1	486.6	0.57%	0.002	0.56%	93.81%
27	2F8	Other Sources of SF6	SF6	GgCO2e	126.6	268.3	0.32%	0.001	0.50%	94.31%
28	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	193.6	0.23%	0.001	0.42%	94.74%
29	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	515.0	0.60%	0.001	0.42%	95.16%

Rank		IPCC Source Categories	GHG	Unit	BY	2002	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	13 526.0	15.58%	0.095	30.73%	30.73%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	15 451.4	17.79%	0.033	10.68%	41.41%
3	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	743.4	0.86%	0.023	7.34%	48.75%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 621.5	7.62%	0.022	7.02%	55.77%
5	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 375.0	2 167.9	2.50%	0.016	5.21%	60.98%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	5 510.1	6.34%	0.014	4.59%	65.57%
7	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 756.9	1 851.8	2.13%	0.012	3.98%	69.55%
8	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 444.2	7 272.1	8.37%	0.010	3.09%	72.65%
9	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 086.5	3.55%	0.009	2.80%	75.45%
10	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	778.6	0.90%	0.008	2.55%	78.00%
11	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4 606.8	5.30%	0.007	2.38%	80.38%
12	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	843.7	0.97%	0.005	1.71%	82.09%
13	2 A 1	Cement Production	CO2	Gg	2 033.4	1 735.7	2.00%	0.005	1.69%	83.78%
14	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	5 144.1	5.92%	0.004	1.26%	85.04%
15	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	432.3	0.50%	0.003	1.02%	86.06%
16	2F6	Semiconductor Manufacture	FCs	GgCO2e	133.1	425.8	0.49%	0.003	0.94%	87.00%
17	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 751.0	1 649.8	1.90%	0.003	0.93%	87.93%
18	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	7.6	0.01%	0.003	0.91%	88.85%
19	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.8	1 181.8	1.36%	0.003	0.87%	89.72%
20	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	643.3	0.74%	0.002	0.78%	90.50%
21	1 A 4 other	Other Sectors	CO2	Gg	239.1	64.3	0.07%	0.002	0.67%	91.17%
22	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	496.6	0.57%	0.002	0.66%	91.83%
23	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	807.2	0.93%	0.002	0.66%	92.49%
24	4 B 1	Cattle	N2O	Gg CO2e	908.1	809.0	0.93%	0.002	0.64%	93.14%
25	6 B	WASTEWATER HANDLING	N2O	Gg CO2e	17.0	191.6	0.22%	0.002	0.58%	93.72%
26	4 B 1	Cattle	CH4	Gg CO2e	587.1	476.4	0.55%	0.002	0.57%	94.29%
27	2 A 7 b	Sinter Production	CO2	Gg	481.2	373.5	0.43%	0.002	0.53%	94.82%
28	2F8	Other Sources of SF6	SF6	GgCO2e	126.6	268.0	0.31%	0.001	0.43%	95.25%

Rank	IPCC Source Categories		GHG	Unit	BY	2003	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	15 112.2	16.34%	0.096	31.87%	31.87%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	16 689.3	18.04%	0.033	11.03%	42.90%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 772.0	7.32%	0.023	7.65%	50.55%
4	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	793.3	0.86%	0.021	7.09%	57.64%
5	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 375.0	2 194.4	2.37%	0.016	5.39%	63.03%
6	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 756.9	1 894.9	2.05%	0.012	4.09%	67.12%
7	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 060.6	3.31%	0.010	3.41%	70.52%
8	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	4 969.3	5.37%	0.008	2.78%	73.30%
9	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	861.4	0.93%	0.008	2.56%	75.86%
10	2 A 1	Cement Production	CO2	Gg	2 033.4	1 754.5	1.90%	0.006	1.92%	77.79%
11	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 444.2	8 159.3	8.82%	0.005	1.73%	79.51%
12	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 751.0	1 562.7	1.69%	0.005	1.50%	81.01%
13	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	6 915.0	7.47%	0.004	1.24%	82.25%
14	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.8	1 141.6	1.23%	0.004	1.20%	83.46%
15	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4 523.1	4.89%	0.003	1.13%	84.58%
16	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	488.6	0.53%	0.003	1.07%	85.66%
17	2F6	Semiconductor Manufacture	FCs	GgCO2e	133.1	483.0	0.52%	0.003	1.00%	86.66%
18	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 117.5	1.21%	0.003	0.99%	87.64%
19	4 B 1	Cattle	N2O	Gg CO2e	908.1	799.8	0.86%	0.002	0.81%	88.45%
20	2 A 7 b	Sinter Production	CO2	Gg	481.2	311.5	0.34%	0.002	0.77%	89.23%
21	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 960.2	2 051.0	2.22%	0.002	0.75%	89.98%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	681.0	0.74%	0.002	0.74%	90.72%
23	4 B 1	Cattle	CH4	Gg CO2e	587.1	470.9	0.51%	0.002	0.66%	91.39%
24	1 A 4 other	Other Sectors	CO2	Gg	239.1	67.6	0.07%	0.002	0.65%	92.04%
25	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	515.3	0.56%	0.002	0.60%	92.64%
26	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	883.4	0.95%	0.002	0.57%	93.20%
27	6 B	WASTEWATER HANDLING	N2O	Gg CO2e	17.0	198.9	0.22%	0.002	0.55%	93.75%
28	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	191.1	0.21%	0.001	0.43%	94.18%
29	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	314.7	235.8	0.25%	0.001	0.41%	94.59%
30	1 A 3 a jet kerosene	Civil Aviation	CO2	Gg	24.2	154.1	0.17%	0.001	0.39%	94.97%
31	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 314.8	1 416.6	1.53%	0.001	0.38%	95.35%

Rank	IPCC Source Categories		GHG	Unit	BY	2004	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	15 805.8	17.31%	0.106	31.46%	31.46%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	16 962.0	18.58%	0.038	11.40%	42.86%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 586.8	7.21%	0.024	7.22%	50.08%
4	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	618.4	0.68%	0.023	6.91%	56.99%
5	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 375.0	2 218.8	2.43%	0.016	4.75%	61.73%
6	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 444.2	7 097.5	7.77%	0.014	4.26%	65.99%
7	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 756.9	1 847.9	2.02%	0.013	3.78%	69.77%
8	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 072.1	3.36%	0.010	2.95%	72.72%
9	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	900.5	0.99%	0.008	2.47%	75.19%
10	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	4 992.1	5.47%	0.008	2.27%	77.46%
11	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	280.9	0.31%	0.007	2.18%	79.64%
12	2 A 1	Cement Production	CO2	Gg	2 033.4	1 754.5	1.92%	0.006	1.68%	81.33%
13	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	6 676.4	7.31%	0.005	1.54%	82.87%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 751.0	1 496.4	1.64%	0.005	1.49%	84.36%
15	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.8	1 085.6	1.19%	0.004	1.21%	85.57%
16	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	537.1	0.59%	0.004	1.13%	86.70%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 061.0	1.16%	0.003	1.01%	87.71%
18	2F6	Semiconductor Manufacture	FCs	GgCO2e	133.1	497.3	0.54%	0.003	0.97%	88.68%
19	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	760.6	0.83%	0.003	0.92%	89.60%
20	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4 414.8	4.84%	0.003	0.89%	90.49%
21	4 B 1	Cattle	N2O	Gg CO2e	908.1	800.7	0.88%	0.002	0.70%	91.19%
22	2 A 7 b	Sinter Production	CO2	Gg	481.2	328.5	0.36%	0.002	0.64%	91.84%
23	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	539.1	0.59%	0.002	0.63%	92.47%
24	4 B 1	Cattle	CH4	Gg CO2e	587.1	468.8	0.51%	0.002	0.59%	93.06%
25	6 B	WASTEWATER HANDLING	N2O	Gg CO2e	17.0	201.0	0.22%	0.002	0.51%	93.57%
26	1 A 3 a jet kerosene	Civil Aviation	CO2	Gg	24.2	184.6	0.20%	0.001	0.44%	94.01%
27	2 A 2	Lime Production	CO2	Gg	396.2	599.5	0.66%	0.001	0.40%	94.41%
28	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	189.8	0.21%	0.001	0.39%	94.79%
29	4 B 8	Swine	CH4	Gg CO2e	447.7	385.3	0.42%	0.001	0.37%	95.17%

IPCC 96	Bezeichnung	Gas	Unit	BY (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1 A 1 a liquid	Public Electricity and Heat Production	CH4	Gg CC	0.3	0.4	0.4	0.6	0.5	0.4	0.5	0.5	0.6	0.5	0.3	0.3	0.2	0.2	0.2
1 A 1 a solid	Public Electricity and Heat Production	CH4	Gg CC	1.5	1.7	0.9	0.7	0.6	0.5	0.4	0.4	0.1	0.1	0.2	0.3	0.2	0.2	0.2
1 A 1 a gaseou	Public Electricity and Heat Production	CH4	Gg CC	0.5	0.5	0.5	0.6	0.6	0.7	1.1	1.2	1.2	1.0	1.0	0.8	1.2	1.8	1.8
1 A 1 a biomas	Public Electricity and Heat Production	CH4	Gg CC	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	1.0	1.2
1 A 1 a other	Public Electricity and Heat Production	CH4	Gg CC	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	2.3
1 A 1 c liquid	Manufacture of Solid fuels and Other Energy	CH4	Gg CC	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO	NO	0.0	NO
1 A 1 c gaseou	Manufacture of Solid fuels and Other Energy	CH4	Gg CC	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1 A 2 mobile-lic	Manufacturing Industries and Construction	CH4	Gg CC	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 A 2 stat-liquic	Manufacturing Industries and Construction	CH4	Gg CC	0.9	1.1	0.8	0.9	0.9	0.8	0.7	0.9	0.8	0.6	0.6	0.5	0.4	0.4	0.4
1 A 2 solid	Manufacturing Industries and Construction	CH4	Gg CC	1.6	1.7	1.7	1.6	1.4	1.4	1.5	1.7	1.7	1.5	1.7	1.6	1.6	1.5	1.3
1 A 2 gaseous	Manufacturing Industries and Construction	CH4	Gg CC	2.2	2.2	2.3	2.2	2.8	2.9	3.0	3.1	3.0	2.8	3.1	3.0	3.1	3.1	3.4
1 A 2 biomass	Manufacturing Industries and Construction	CH4	Gg CC	1.2	1.2	1.2	1.3	1.4	1.4	1.4	1.5	1.3	1.8	1.5	1.6	1.6	1.9	1.7
1 A 2 other	Manufacturing Industries and Construction	CH4	Gg CC	1.1	1.3	1.6	1.2	1.3	1.4	1.6	1.4	1.5	1.7	1.7	1.8	2.1	2.3	2.4
1 A 3 a jet kerc	Civil Aviation	CH4	Gg CC	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.2	0.3
1 A 3 b gasolin	Road Transportation	CH4	Gg CC	58.1	57.1	51.6	47.1	42.7	38.5	34.2	30.8	29.0	25.9	23.3	21.3	20.1	18.6	16.8
1 A 3 b diesel c	Road Transportation	CH4	Gg CC	2.5	2.7	2.6	2.7	2.6	2.7	3.3	2.7	3.0	2.7	2.8	2.9	3.0	3.2	3.2
1 A 3 c liquid	Railways	CH4	Gg CC	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 CC	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 CC	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 CC	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 CC	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3
1 A 4 mobile-di	Other Sectors	CH4	Gg CC	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 A 4 mobile-ga	Other Sectors	CH4	Gg CC	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
1 A 4 mobile-lic	Other Sectors	CH4	Gg CC	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
1 A 4 stat-liquic	Other Sectors	CH4	Gg CC	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.7	0.7	0.8	0.7
1 A 4 solid	Other Sectors	CH4	Gg CC	61.8	66.7	54.9	49.1	44.8	43.4	42.3	27.6	24.0	22.2	20.4	19.0	15.9	16.9	13.2
1 A 4 gaseous	Other Sectors	CH4	Gg CC	4.0	4.1	3.5	3.0	1.9	1.2	1.2	1.2	1.2	1.5	1.3	1.6	1.3	1.4	1.4
1 A 4 biomass	Other Sectors	CH4	Gg CC	314.7	341.7	316.4	316.1	286.6	302.4	324.4	248.8	242.4	245.7	229.0	248.9	223.3	235.8	239.8
1 A 4 other	Other Sectors	CH4	Gg CC	0.6	0.5	0.5	0.3	0.4	0.4	0.7	0.7	0.4	0.6	0.3	0.2	0.2	0.2	0.4
1 A 5 liquid	Other	CH4	Gg CC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1
1 B 1 a	Coal Mining	CH4	Gg CC	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
1 B 2 a	Oil	CH4	Gg CC	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
1 B 2 b	Natural gas	CH4	Gg CC	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
2 B	CHEMICAL INDUSTRY	CH4	Gg CC	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
2 C	METAL PRODUCTION	CH4	Gg CC	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
4 A 1	Cattle	CH4	Gg CC	3 560.9	3 503.5	3 340.8	3 330.5	3 350.1	3 372.6	3 320.4	3 253.7	3 226.7	3 204.8	3 190.5	3 140.0	3 086.5	3 060.6	3 072.1
4 A 3	Sheep	CH4	Gg CC	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
4 A 4	Goats	CH4	Gg CC	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
4 A 6	Horses	CH4	Gg CC	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
4 A 8	Swine	CH4	Gg CC	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
4 A 9	Poultry	CH4	Gg CC	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
4 A-10	Other	CH4	Gg CC	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
4 B 1	Cattle	CH4	Gg CC	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	470.9	468.8
4 B 3	Sheep	CH4	Gg CC	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
4 B 4	Goats	CH4	Gg CC	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 CC	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
4 B 8	Swine	CH4	Gg CC	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
4 B 9	Poultry	CH4	Gg CC	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
4 B-10	Other	CH4	Gg CC	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
4 D	AGRICULTURAL SOILS	CH4	Gg CC	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	8.8
4 F	FIELD BURNING OF AGRICULTURAL RES	CH4	Gg CC	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
6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	3 375.0	3 368.3	3 280.0	3 234.1	3 059.4	2 891.8	2 735.7	2 605.7	2 510.0	2 404.9	2 302.2	2 207.0	2 167.9	2 194.4	2 218.8
6 B	WASTEWATER HANDLING	CH4	Gg CC	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	40.6
6 C	WASTE INCINERATION	CH4	Gg CC	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

IPCC 96	Bezeichnung	Gas	Unit	BY (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
6 D	OTHER WASTE	CH4	Gg CC	10.9	11.4	13.7	17.2	20.6	21.9	23.0	22.7	23.5	24.7	24.5	24.5	24.6	25.0	25.0
1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 498.0	1 481.6	2 052.0	1 901.7	1 556.3	1 550.0	1 925.2	2 211.2	1 998.7	1 214.2	1 365.4	843.7	1 117.5	1 061.0
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	3 498.1	3 779.4	5 004.2	5 956.6	5 510.1	6 915.0	6 676.4
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	236.0	234.9	336.8	432.3	488.6	537.1
1 A 1 b liquid	Petroleum refining	CO2	Gg	1 960.2	1 911.7	1 919.6	2 188.3	2 328.3	2 172.5	2 185.5	2 159.4	2 175.4	2 059.5	1 994.2	2 014.5	2 145.7	2 051.0	2 164.6
1 A 1 c liquid	Manufacture of Solid fuels and Other Energy	CO2	Gg	3.9	2.6	0.0	0.1	0.1	0.0	NO	NO	NO	NO	NO	NO	NO	6.4	NO
1 A 2 stat-liquic	Manufacturing Industries and Construction	CO2	Gg	2 756.9	3 145.0	2 414.2	2 912.9	2 827.9	2 628.6	2 444.2	3 394.5	3 151.3	2 478.9	2 200.0	2 209.9	1 851.8	1 894.9	1 847.9
1 A 2 mobile-lic	Manufacturing Industries and Construction	CO2	Gg	1 018.4	1 059.3	1 070.6	1 036.2	1 063.4	1 038.5	1 010.1	1 026.1	1 041.2	1 047.9	1 061.5	1 076.5	1 081.8	1 086.9	1 144.4
1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.6	4 760.0	4 139.0	4 318.5	4 237.0	4 457.8	4 400.0	5 018.7	4 484.9	4 342.2	4 762.0	4 423.6	5 144.1	4 969.3	4 992.1
1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	468.0	571.0	367.2	486.3	500.0	538.3	506.9	427.3	605.2	562.6	515.0	643.3	681.0	760.6
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
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	213.3	68.8	154.1	184.6
1 A 3 b gasolin	Road Transportation	CO2	Gg	7 911.2	8 678.7	8 297.1	7 958.7	7 673.0	7 411.3	6 855.7	6 497.0	6 798.5	6 317.7	6 105.3	6 149.6	6 621.5	6 772.0	6 586.8
1 A 3 b diesel (	Road Transportation	CO2	Gg	4 012.9	4 829.9	5 156.9	5 677.5	5 914.7	6 553.4	8 688.1	7 968.6	9 738.1	9 525.1	10 771.8	11 962.0	13 526.0	15 112.2	15 805.8
1 A 3 c liquid	Railways	CO2	Gg	161.1	168.6	167.7	164.2	165.9	153.8	138.0	141.8	140.3	174.5	174.6	174.2	172.1	176.1	168.0
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
1 A 3 d gas/die	Navigation	CO2	Gg	42.9	38.1	37.1	37.4	46.4	44.7	44.8	52.7	53.3	53.9	54.6	63.7	70.7	75.4	77.7
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
1 A 4 mobile-lic	Other Sectors	CO2	Gg	142.1	142.6	144.0	144.8	143.8	144.6	143.6	142.5	141.6	140.8	140.6	140.5	140.6	140.3	140.2
1 A 4 mobile-di	Other Sectors	CO2	Gg	1 314.8	1 178.2	1 220.1	1 230.9	1 311.6	1 219.9	1 338.7	1 431.8	1 378.2	1 401.4	1 315.6	1 383.9	1 422.2	1 416.6	1 460.8
1 A 4 mobile-ga	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
1 A 4 stat-liquic	Other Sectors	CO2	Gg	7 444.2	7 818.3	7 293.8	7 201.1	6 586.9	7 248.3	8 385.9	7 245.7	7 267.3	7 146.9	6 617.7	7 489.2	7 272.1	8 159.3	7 097.5
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	1 041.9	955.4	889.5	743.4	793.3	618.4
1 A 4 other	Other Sectors	CO2	Gg	239.1	195.3	215.1	123.7	146.9	147.8	302.0	270.7	157.3	264.0	144.6	65.6	64.3	67.6	148.7
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	122.9	41.0	89.3	106.6
1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	11 771.2	11 834.3	12 339.5	12 961.8	14 058.9	15 219.0	14 678.9	14 994.8	15 147.1	14 565.8	15 482.8	15 451.4	16 689.3	16 962.0
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
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
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	1 754.5
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	574.6	599.5
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
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
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
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
2 B 1	Ammonia Production	CO2	Gg	517.4	546.4	553.5	539.6	507.9	538.1	539.6	533.1	526.3	531.2	518.8	473.2	487.0	527.1	468.5
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
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
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
2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	3 508.4	3 073.9	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	4 414.8
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	16.7
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
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	193.6	192.3	191.1	189.8
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
1 A 1 a liquid	Public Electricity and Heat Production	N2O	Gg CC	6.7	7.8	7.0	9.9	9.5	7.5	7.7	10.0	11.5	10.8	6.0	6.5	4.2	5.9	5.8
1 A 1 a solid	Public Electricity and Heat Production	N2O	Gg CC	23.0	27.3	17.4	15.0	14.9	19.6	15.4	14.2	14.9	16.5	22.1	24.3	22.9	27.3	27.8
1 A 1 a gaseou	Public Electricity and Heat Production	N2O	Gg CC	10.2	10.0	9.2	9.2	10.6	11.2	12.0	8.6	11.2	10.8	9.2	10.2	10.3	11.4	10.3
1 A 1 a biomas	Public Electricity and Heat Production	N2O	Gg CC	2.0	3.2	3.7	3.7	4.0	4.8	6.9	6.9	7.9	7.9	10.4	14.1	16.4	20.3	22.7
1 A 1 a other	Public Electricity and Heat Production	N2O	Gg CC	1.0	1.3	1.5	1.6	1.7	1.7	2.1	2.1	2.1	2.0	2.0	2.5	2.9	3.4	3.9
1 A 1 b liquid	Petroleum refining	N2O	Gg CC	2.6	2.6	2.5	3.3	3.6	3.4	3.1	3.1	3.1	3.0	3.2	2.9	3.3	3.4	3.4
1 A 1 b gaseou	Petroleum refining	N2O	Gg CC	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.2
1 A 1 c liquid	Manufacture of Solid fuels and Other Energy	N2O	Gg CC	0.0	0.0	0.0	0.0	0.0	0.0	NO	NO	NO	NO	NO	NO	NO	0.0	NO
1 A 1 c gaseou	Manufacture of Solid fuels and Other Energy	N2O	Gg CC	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1 A 2 mobile-lic	Manufacturing Industries and Construction	N2O	Gg CC	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
1 A 2 stat-liquic	Manufacturing Industries and Construction	N2O	Gg CC	9.5	11.0	8.3	9.8	9.9	9.1	8.3	11.2	10.5	8.6	7.8	7.9	6.1	6.1	5.6

IPCC 96	Bezeichnung	Gas	Unit	BY (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1 A 2 solid	Manufacturing Industries and Construction	N2O	Gg CO	17.2	17.3	15.5	15.1	14.9	16.5	16.2	18.4	18.9	17.9	20.1	18.6	20.8	20.4	20.4
1 A 2 gaseous	Manufacturing Industries and Construction	N2O	Gg CO	2.4	2.4	2.5	2.4	3.0	3.1	3.3	3.4	3.3	3.1	3.3	3.3	3.4	3.3	3.7
1 A 2 biomass	Manufacturing Industries and Construction	N2O	Gg CO	20.5	21.0	21.6	24.9	25.3	24.6	23.3	27.9	20.9	33.1	25.9	28.8	29.8	37.2	29.8
1 A 2 other	Manufacturing Industries and Construction	N2O	Gg CO	1.9	2.3	2.8	2.1	2.3	2.4	2.8	2.4	2.6	3.0	3.0	3.1	3.6	4.0	4.1
1 A 3 a jet kero	Civil Aviation	N2O	Gg CO	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.9	0.9	1.0	2.6	0.9	2.0	2.4
1 A 3 b gasolin	Road Transportation	N2O	Gg CO	219.4	272.4	293.4	309.0	309.4	294.2	264.4	242.3	247.9	216.6	200.1	192.0	196.5	187.7	167.4
1 A 3 b diesel (	Road Transportation	N2O	Gg CO	33.3	39.0	40.8	44.0	45.4	49.2	62.2	58.3	70.0	69.3	77.3	84.4	94.6	104.1	108.5
1 A 3 c liquid	Railways	N2O	Gg CO	6.6	6.9	6.7	6.5	6.4	5.9	5.2	5.2	5.1	6.2	6.1	6.0	5.8	5.8	5.9
1 A 3 c solid	Railways	N2O	Gg CO	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
1 A 3 d gas/die	Navigation	N2O	Gg CO	3.8	3.4	3.2	3.2	3.9	3.7	3.7	4.3	4.2	4.2	4.2	4.8	5.3	5.5	5.6
1 A 3 d gasolin	Navigation	N2O	Gg CO	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 CO	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3
1 A 4 mobile-di	Other Sectors	N2O	Gg CO	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
1 A 4 mobile-ga	Other Sectors	N2O	Gg CO	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-liq	Other Sectors	N2O	Gg CO	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
1 A 4 stat-liquic	Other Sectors	N2O	Gg CO	26.1	28.6	26.8	27.4	25.4	27.7	31.8	28.7	28.8	27.7	25.5	28.8	28.1	31.5	27.4
1 A 4 solid	Other Sectors	N2O	Gg CO	20.6	22.8	19.6	16.1	14.3	13.4	12.7	10.0	8.6	8.1	7.3	6.8	5.7	6.0	4.7
1 A 4 gaseous	Other Sectors	N2O	Gg CO	14.3	17.7	19.5	22.2	19.5	23.1	22.9	21.7	22.7	26.9	23.1	29.0	24.6	25.9	26.1
1 A 4 biomass	Other Sectors	N2O	Gg CO	85.4	94.2	88.5	90.0	82.8	89.1	96.8	90.9	88.4	89.5	83.6	93.0	85.4	91.9	96.1
1 A 4 other	Other Sectors	N2O	Gg CO	1.0	0.8	0.9	0.5	0.6	0.6	1.3	1.1	0.7	1.1	0.6	0.3	0.3	0.3	0.6
1 A 5 liquid	Other	N2O	Gg CO	0.9	0.9	0.9	1.0	1.0	0.8	1.0	0.9	1.0	0.9	1.1	2.4	1.0	2.1	2.3
2 B 2	Nitric Acid Production	N2O	Gg CO	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
3	SOLVENT AND OTHER PRODUCT USE	N2O	Gg CO	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5
4 B 1	Cattle	N2O	Gg CO	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
4 B 3	Sheep	N2O	Gg CO	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
4 B 4	Goats	N2O	Gg CO	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
4 B 6	Horses	N2O	Gg CO	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
4 B 8	Swine	N2O	Gg CO	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
4 B 9	Poultry	N2O	Gg CO	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
4 B-10	Other	N2O	Gg CO	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
4 D 1	Direct Soil Emissions	N2O	Gg CO	1 751.0	1 915.7	1 771.5	1 610.2	1 909.3	1 918.7	1 703.3	1 743.1	1 769.1	1 718.6	1 638.6	1 642.2	1 649.8	1 562.7	1 496.4
4 D 2	Animal Production	N2O	Gg CO	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
4 D 3	Indirect Emissions	N2O	Gg CO	1 309.8	1 394.3	1 276.6	1 180.0	1 339.4	1 364.1	1 252.2	1 256.6	1 259.6	1 222.6	1 195.9	1 186.8	1 181.8	1 141.6	1 085.6
4 D 4	Other	N2O	Gg CO	7.5	7.5	7.1	10.7	9.1	10.1	10.2	10.2	10.3	10.3	10.3	9.9	8.6	9.3	9.6
4 F	FIELD BURNING OF AGRICULTURAL RES	N2O	Gg CO	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
6 B	WASTEWATER HANDLING	N2O	Gg CO	17.0	17.6	18.3	18.7	35.9	60.1	81.3	92.3	118.4	135.5	158.4	193.1	191.6	198.9	201.0
6 C	WASTE INCINERATION	N2O	Gg CO	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
6 D	OTHER WASTE	N2O	Gg CO	23.9	25.0	29.7	37.0	43.8	46.3	48.4	47.6	49.2	52.3	52.4	53.0	53.3	54.3	54.3
2C3	Aluminium production	PFCs	GgCO	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
2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	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
2F7	Electrical Equipment	SF6	GgCO	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
2F6	Semiconductor Manufacture	FCs	GgCO	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	497.3
2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	21.1	42.1	44.6	151.9	200.0	259.2	337.5	418.3	492.3	539.3	592.8	691.7	778.6	861.4	900.5
2F8	Other Sources of SF6	SF6	GgCO	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
	TOTAL		**GgCO**	**78 959.4**	**82 997.6**	**76 300.8**	**76 270.7**	**77 113.1**	**80 234.6**	**83 567.4**	**83 146.3**	**82 605.1**	**80 800.1**	**81 278.8**	**85 145.4**	**86 858.8**	**92 526.6**	**91 332.6**

IPCC Category	Description	Gas	LA90	LA91	LA92	LA93	LA94	LA95	LA96	LA97	LA98	LA99	LA00	LA01	LA02	LA03	**LA04**	TA97	TA98	TA99	TA00	TA01	TA02	TA03	**TA04**
1 A gaseous	Fuel Combustion (stationary)	CO2	***1***	1	1	1	1	1	1	1	1	1	1	1	1	1	**1**	2	2	2	2	2	2	2	**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**	1	1	1	1	1	1	1	**1**
1 A 4 stat-liquid	Other Sectors	CO2	***3***	3	3	3	3	3	3	3	3	3	3	3	3	3	**3**	8	10	11	7	11	8	11	**6**
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**	4	3	3	5	7	6	13	**13**
1 A 3 b gasoline	Road Transportation	CO2	***2***	2	2	2	2	2	4	4	4	4	4	4	4	5	**5**	3	5	4	3	3	4	3	**3**
1 A 2 solid	Manufacturing Industries and Construc	CO2	***5***	6	5	5	5	6	6	5	5	5	6	6	6	6	**6**	15	8	7	12	6	14	8	**10**
2 C 1	Iron and Steel Production	CO2	***8***	7	9	8	6	7	7	7	6	7	7	7	7	7	**7**	14	15	19	10	13	11	15	**20**
4 A 1	Cattle	CH4	***7***	8	7	6	7	8	8	9	8	8	8	8	8	8	**8**	9	11	12	11	9	9	7	**8**
6 A	SOLID WASTE DISPOSAL ON LAND	CH4	***9***	9	8	7	9	9	9	10	10	10	9	10	9	9	**9**	6	6	6	6	5	5	5	**5**
1 A 1 b liquid	Petroleum refining	CO2	***13***	14	13	11	11	11	11	11	12	11	11	11	10	10	**10**	27	19					21	
1 A 2 stat-liquid	Manufacturing Industries and Construc	CO2	***10***	10	11	10	10	10	10	8	9	9	10	9	11	11	**11**	10	14	13	8	8	7	6	**7**
2 A 1	Cement Production	CO2	***12***	12	12	14	12	14	14	13	14	14	12	12	12	12	**12**	13	9	10	13	12	13	10	**12**
4 D 1	Direct Soil Emissions	N2O	***14***	13	14	15	13	12	12	14	13	13	13	13	13	13	**13**	24			18	16	17	12	**14**
1 A 4 mobile-die	Other Sectors	CO2	***15***	17	17	16	17	17	16	15	15	15	14	14	14	14	**14**							31	
1 A 2 mobile-liqu	Manufacturing Industries and Construc	CO2	***19***	18	18	18	18	18	18	18	18	17	17	17	16	17	**15**								
4 D 3	Indirect Emissions	N2O	***16***	16	16	17	16	16	17	17	16	16	16	16	15	15	**16**	18	21	22	20	17	19	14	**15**
1 A 1 a liquid	Public Electricity and Heat Production	CO2	***17***	15	15	13	14	15	15	12	11	12	15	15	17	16	**17**	7	7	8			12	18	**17**
2 F1/2/3/4/5	ODS Substitutes	HFCs						32	30	26	23	22	21	21	20	19	**18**	12	12	9	9	10	10	9	**9**
4 B 1	Cattle	N2O	***21***	21	19	20	19	19	20	20	20	20	20	19	18	20	**19**	23	23			25	24	19	**21**
1 A 2 other	Manufacturing Industries and Construc	CO2	***27***	24	21	24	23	24	22	24	27	21	22	22	22	22	**20**	21		16	17	29	20	22	**19**
1 A 4 solid	Other Sectors	CO2	***11***	11	10	12	15	13	13	16	17	18	18	18	21	21	**21**	5	4	5	4	4	3	4	**4**
2 A 2	Lime Production	CO2	***26***	27	26	25	26	28	28	27	26	26	25	23	23	23	**22**								**27**
1 B 2 b	Natural gas	CH4	***30***	29	29	27	28	29	27	28	28	27	26	25	24	25	**23**	16	18	17	16	23	22	25	**23**
1 A 1 a other	Public Electricity and Heat Production	CO2												29	27	26	**24**	20	22	24	23	18	15	16	**16**
2 F 6	Semiconductor Manufacture	FCs			31	26	25	23	26	21	24	25	27	28	28	27	**25**	11	13	14	14	14	16	17	**18**
4 B 1	Cattle	CH4	***22***	22	22	21	21	22	24	23	22	24	24	24	26	28	**26**	26			25	26	26	23	**24**
2 B 1	Ammonia Production	CO2	***23***	23	23	22	22	21	23	22	21	23	23	26	25	24	**27**								
4 B 8	Swine	CH4	***25***	25	24	23	24	25	25	25	25	28	28	27	29	29	**28**								**29**
2 A 7 b	Sinter Production	CO2	***24***	26	27	28	29	27	29	29	29	29	29	30	30		**29**	19	16	18	19	22	27	20	**22**
2 A 3	Limestone and Dolomite Use	CO2									31	31	30	31			**30**								
2 B 2	Nitric Acid Production	N2O	***20***	20	20	19	20	20	19	19	19	19	19	20	19	18		25				19	23	26	**11**
1 A 4 biomass	Other Sectors	CH4	***28***	28	28	29	31	30	31															29	
6 B	WASTEWATER HANDLING	N2O																	25	21	21	24	25	27	**25**
3	SOLVENT AND OTHER PRODUCT U	CO2	***29***				32											22	20	20	24	28		28	**28**
1 A 3 a jet kerose	Civil Aviation	CO2																				21		30	**26**
1 A 3 b gasoline	Road Transportation	N2O		31	30	30	30	31																	
1 A 4 other	Other Sectors	CO2							32	31		30									26	20	21	24	
2 F 8	Other Sources of SF6	SF6								32	30		31					17	17	23	22	27	28		
2 C 3	Aluminium production	PFCs	***18***	19	25																				
2 C 4	SF6 Used in Al and Mg Foundries	SF6	***31***	30	32	31	27	26	21	30									24	15	15	15	18		
	LA00= Level Assessment 2000																								
	TA00= Trend Assessment BY-2000																								

Table A1.4: Ranking of Key Sources

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	8 611
1993	8 310	0.15	0.13	8 353
1994	8 600	0.14	0.13	8 643
1995	9 716	0.14	0.14	9 764
1996	10 897	0.17	0.14	10 944
1997	10 957	0.18	0.13	11 003
1998	10 016	0.18	0.15	10 068
1999	9 874	0.16	0.15	9 925
2000	9 858	0.16	0.16	9 911
2001	11 050	0.17	0.19	11 111
2002	10 714	0.19	0.18	10 774
2003	13 422	0.25	0.22	13 495
2004	12 799	0.27	0.23	12 875
Trend 1990-2004	17.6%	81.6%	64.0%	17.8%

As can be seen from Table 2 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 4% in 2004.

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%

	Liquid	Solid	Gaseous	Other
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	20%	38%	39%	2%
2000	12%	51%	35%	2%
2001	12%	54%	31%	3%
2002	8%	51%	37%	4%
2003	8%	52%	37%	4%
2004	8%	52%	35%	4%

1 A 1 b Petroleum Refining

The following table shows 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	2 467	0.009	2 469
1991	2 499	0.010	2 502
1992	2 455	0.009	2 458
1993	2 736	0.012	2 739
1994	2 712	0.012	2 716
1995	2 594	0.012	2 598
1996	2 650	0.011	2 653
1997	2 643	0.011	2 647
1998	2 636	0.011	2 640
1999	2 466	0.010	2 469
2000	2 346	0.011	2 350
2001	2 423	0.010	2 427
2002	2 554	0.011	2 558
2003	2 554	0.011	2 558
2004	2 530	0.012	2 533
Trend 1990-2004	2.6%	28.2%	2.6%

Table 4 presents the share of CO_2 emissions on the different fuel types.

Table 4: Share of fuel types on total CO_2 emissions from Category 1 A 1 b.

	Liquid	Gaseous
1990	79%	21%
1991	76%	24%
1992	78%	22%
1993	80%	20%
1994	86%	14%
1995	84%	16%
1996	82%	18%
1997	82%	18%
1998	83%	17%
1999	84%	16%
2000	85%	15%
2001	83%	17%
2002	84%	16%
2003	84%	16%
2004	81%	19%

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

The following table shows 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	308	0.008	0.0006	309
1991	312	0.008	0.0006	312
1992	293	0.008	0.0005	293
1993	310	0.008	0.0006	311
1994	303	0.008	0.0005	303
1995	331	0.009	0.0006	331
1996	192	0.005	0.0003	193
1997	236	0.006	0.0004	236
1998	202	0.005	0.0004	203
1999	139	0.004	0.0003	140
2000	198	0.005	0.0004	198
2001	187	0.005	0.0003	187
2002	173	0.005	0.0003	173
2003	214	0.006	0.0005	214
2004	164	0.004	0.0003	165
Trend 1990-2004	-46.7%	-46.1%	-51.4%	-46.7%

Table 6 shows that almost all emissions of category *1 A 1 c* originated from natural gas combustion.

Table 6: Share of fuel types on total CO_2 emissions from Category 1 A 1 c.

	Liquid	Gaseous
1990	1%	99%
1991	1%	99%
1992	0%	100%
1993	0%	100%
1994	0%	100%
1995	0%	100%
1996	0%	100%
1997	0%	100%
1998	0%	100%
1999	0%	100%
2000	0%	100%
2001	0%	100%
2002	0%	100%
2003	3%	97%
2004	0%	100%

1 A 2 a Iron and Steel

The following table shows 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	4 938	0.025	0.0454	4 952
1991	4 610	0.023	0.0443	4 624
1992	3 929	0.020	0.0379	3 941
1993	4 187	0.022	0.0383	4 199
1994	4 438	0.026	0.0415	4 452
1995	4 770	0.026	0.0470	4 785
1996	4 663	0.030	0.0435	4 678
1997	5 291	0.035	0.0486	5 306
1998	4 926	0.033	0.0525	4 943
1999	4 854	0.030	0.0512	4 870
2000	5 313	0.038	0.0589	5 332
2001	5 168	0.035	0.0569	5 186
2002	5 498	0.037	0.0583	5 517
2003	5 512	0.037	0.0596	5 531
2004	5 858	0.037	0.0631	5 878
Trend 1990-2004	18.6%	48.5%	39.1%	18.7%

As can be seen from Table 8, CO_2 emissions from category *1 A 2 a* mainly arise from solid fossil fuels.

Table 8: Share of fuel types in total CO_2 emissions from Category 1 A 2 a.

	Liquid	Solid	Gaseous
1990	9.0%	77.9%	13.2%
1991	9.6%	75.8%	14.6%
1992	11.0%	72.7%	16.3%
1993	10.9%	74.5%	14.6%
1994	10.9%	73.9%	15.3%
1995	11.6%	72.5%	15.9%
1996	9.9%	70.1%	20.0%
1997	9.9%	69.7%	20.5%
1998	13.6%	64.8%	21.6%
1999	13.6%	65.7%	20.7%
2000	15.5%	66.1%	18.3%
2001	17.0%	64.4%	18.6%
2002	12.0%	69.5%	18.5%
2003	10.1%	71.4%	18.5%
2004	11.7%	69.3%	19.0%

1 A 2 b Non-Ferrous Metals

The following table shows 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	131	0.003	0.0009	131
1991	118	0.003	0.0008	118
1992	126	0.003	0.0007	126
1993	157	0.004	0.0008	158
1994	263	0.007	0.0011	263
1995	169	0.004	0.0008	169
1996	176	0.004	0.0009	176
1997	226	0.004	0.0012	226
1998	211	0.004	0.0011	211
1999	226	0.005	0.0015	226
2000	199	0.005	0.0011	199
2001	203	0.005	0.0010	204
2002	212	0.005	0.0011	213
2003	220	0.005	0.0010	220
2004	239	0.006	0.0010	239

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
Trend 1990-2004	82.4%	91.2%	14.5%	82.3%

As can be seen from Table 10 the main share in CO_2 emissions arise from combustion of natural gas and residual fuel oil.

Table 10: Share of fuel types in total CO_2 emissions from Category 1 A 2 b

	Liquid	Solid	Gaseous
1990	26%	17%	57%
1991	28%	15%	57%
1992	24%	6%	70%
1993	20%	12%	67%
1994	16%	6%	79%
1995	24%	6%	71%
1996	27%	9%	64%
1997	33%	9%	58%
1998	32%	8%	61%
1999	37%	10%	53%
2000	27%	9%	64%
2001	25%	5%	70%
2002	23%	8%	69%
2003	19%	7%	74%
2004	14%	9%	77%

1 A 2 c Chemicals

The following table shows 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	955	0.053	0.018	962
1991	960	0.057	0.019	967
1992	1 076	0.068	0.022	1 084
1993	1 085	0.055	0.016	1 091
1994	1 031	0.053	0.014	1 037
1995	1 066	0.056	0.014	1 071
1996	1 113	0.060	0.019	1 120
1997	1 205	0.059	0.020	1 212
1998	1 130	0.053	0.017	1 137
1999	1 538	0.081	0.023	1 547
2000	1 416	0.068	0.016	1 422
2001	1 381	0.058	0.014	1 387

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
2002	1 426	0.072	0.018	1 433
2003	1 409	0.069	0.017	1 415
2004	1 595	0.084	0.022	1 604
Trend 1990-2004	67.0%	60.3%	0.209	66.8%

As can be seen in Table 12, natural gas is still the main source of CO_2 emissions from category *1 A 2 c*. CO_2 emissions from solid fossil fuel combustion increased whereas liquid fossil fuel got less important.

Table 12: Share of fuel types in total CO_2 emissions from Category 1 A 2 c

	Liquid	Solid	Gaseous	Other
1990	8%	12%	56%	25%
1991	8%	15%	49%	28%
1992	5%	18%	47%	30%
1993	7%	18%	56%	19%
1994	9%	15%	54%	22%
1995	8%	14%	54%	24%
1996	8%	17%	52%	23%
1997	12%	21%	50%	17%
1998	11%	22%	51%	16%
1999	6%	20%	53%	21%
2000	4%	18%	61%	17%
2001	5%	18%	66%	11%
2002	4%	18%	59%	19%
2003	5%	18%	58%	19%
2004	2%	16%	59%	22%

1 A 2 d Pulp, Paper and Print

The following table shows 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	2 237	0.123	0.059	2 258
1991	2 588	0.133	0.065	2 611
1992	2 199	0.126	0.062	2 221
1993	2 037	0.127	0.076	2 063
1994	2 559	0.143	0.080	2 587
1995	2 291	0.138	0.079	2 319
1996	2 232	0.131	0.065	2 255

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1997	2 858	0.150	0.081	2 886
1998	2 675	0.140	0.067	2 699
1999	2 024	0.124	0.065	2 047
2000	2 182	0.126	0.056	2 202
2001	2 022	0.117	0.052	2 041
2002	1 935	0.121	0.062	1 957
2003	1 800	0.127	0.083	1 828
2004	1 844	0.129	0.078	1 871
Trend 1990-2004	-17.6%	5.0%	0.317	-17.1%

As can be seen in Table 14, 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.

Table 14: Share of fuel types in total CO_2 emissions from Category 1 A 2 d.

	Liquid	Solid	Gaseous
1990	37%	18%	43%
1991	42%	20%	36%
1992	29%	20%	47%
1993	33%	21%	44%
1994	25%	14%	59%
1995	22%	17%	59%
1996	17%	16%	63%
1997	19%	15%	65%
1998	18%	16%	65%
1999	12%	17%	70%
2000	8%	19%	72%
2001	9%	18%	72%
2002	8%	21%	70%
2003	10%	20%	69%
2004	8%	20%	71%

1 A 2 e Food Processing, Beverages and Tobacco

The following table shows 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	851	0.018	0.005	852
1991	913	0.020	0.006	915

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1992	835	0.018	0.005	837
1993	872	0.016	0.005	874
1994	903	0.019	0.005	905
1995	940	0.020	0.005	942
1996	881	0.019	0.004	882
1997	1 060	0.021	0.004	1 062
1998	965	0.020	0.004	966
1999	974	0.025	0.010	978
2000	1 151	0.028	0.005	1 153
2001	1 069	0.026	0.005	1 071
2002	1 249	0.032	0.005	1 251
2003	1 109	0.027	0.005	1 111
2004	1 179	0.030	0.005	1 181
Trend 1990-2004	38.6%	65.6%	-0.5%	38.6%

As can be seen in Table 16, natural gas combustion 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.

Table 16: Share of fuel types in total CO_2 emissions from Category 1 A 2 e.

	Liquid	Solid	Gaseous
1990	38%	2%	60%
1991	41%	2%	57%
1992	39%	1%	60%
1993	43%	2%	55%
1994	38%	2%	60%
1995	35%	1%	64%
1996	28%	1%	71%
1997	31%	1%	67%
1998	28%	1%	71%
1999	25%	1%	74%
2000	17%	4%	79%
2001	20%	2%	78%
2002	14%	3%	83%
2003	17%	3%	80%
2004	11%	4%	86%

1 A 2 f Manufacturing Industries and Construction – Other

The following table shows 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	4 341	0.186	0.392	4 466
1991	4 533	0.200	0.408	4 664
1992	4 419	0.206	0.409	4 550
1993	4 620	0.200	0.399	4 748
1994	4 768	0.203	0.419	4 902
1995	4 910	0.208	0.407	5 041
1996	5 144	0.218	0.408	5 275
1997	5 364	0.218	0.430	5 502
1998	5 041	0.217	0.433	5 180
1999	4 359	0.199	0.431	4 497
2000	4 265	0.209	0.418	4 399
2001	4 246	0.225	0.425	4 383
2002	4 430	0.216	0.407	4 561
2003	4 510	0.224	0.376	4 631
2004	4 613	0.202	0.324	4 717
Trend 1990-2004	6.3%	8.6%	-17.3%	5.6%

As can be seen from Table 18, 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.

Table 18: Share of fuel types in total CO_2 emissions from Category 1 A 2 f.

	Liquid	Solid	Gaseous	Other
1990	48%	14%	36%	2%
1991	48%	12%	36%	3%
1992	45%	14%	37%	4%
1993	51%	12%	35%	2%
1994	48%	9%	39%	4%
1995	44%	9%	43%	4%
1996	43%	11%	42%	4%
1997	52%	11%	31%	5%
1998	51%	11%	33%	5%
1999	51%	11%	33%	6%
2000	46%	12%	35%	7%
2001	45%	11%	37%	8%
2002	41%	14%	37%	8%
2003	43%	8%	40%	9%
2004	43%	5%	44%	8%

1 A 2 f Manufacturing Industries and Construction - Other - stationary sources

The following table shows 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	3 323	0.11	0.04	3 337
1991	3 474	0.12	0.04	3 489
1992	3 348	0.13	0.04	3 362
1993	3 584	0.12	0.04	3 599
1994	3 705	0.13	0.04	3 719
1995	3 871	0.13	0.03	3 885
1996	4 133	0.15	0.04	4 150
1997	4 338	0.15	0.05	4 356
1998	4 000	0.15	0.04	4 015
1999	3 311	0.14	0.06	3 332
2000	3 204	0.15	0.06	3 225
2001	3 170	0.17	0.07	3 195
2002	3 348	0.16	0.06	3 370
2003	3 423	0.17	0.06	3 446
2004	3 468	0.15	0.04	3 483
Trend 1990-2004	4.4%	36.5%	-3.7%	4.4%

As can be seen in Table 20, natural gas and liquid fossil fuel combustion is the main stationary source of CO_2 emissions from category *1 A 2 f*. Solid fuels got less important but CO_2 emissions from combustion of industrial waste are increasing.

Table 20: Share of fuel types on total CO_2 emissions from Category 1 A 2 f stationary sources.

	Liquid	Solid	Gaseous	Other
1990	32%	19%	47%	2%
1991	33%	16%	47%	4%
1992	28%	19%	48%	5%
1993	37%	15%	45%	3%
1994	33%	11%	50%	6%
1995	29%	12%	55%	5%
1996	29%	13%	53%	5%
1997	41%	14%	39%	7%
1998	39%	14%	41%	6%
1999	35%	14%	43%	8%
2000	28%	16%	47%	9%
2001	26%	14%	49%	11%

	Liquid	Solid	Gaseous	Other
2002	23%	18%	49%	11%
2003	25%	11%	52%	12%
2004	24%	7%	58%	11%

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

The following table 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	0.05	0.01	1 060
1991	1 038	0.06	0.01	1 043
1992	1 107	0.06	0.02	1 113
1993	1 038	0.06	0.01	1 044
1994	1 089	0.06	0.01	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	0.06	0.01	858
1999	826	0.06	0.01	831
2000	866	0.07	0.01	872
2001	807	0.08	0.01	812
2002	830	0.07	0.01	835
2003	821	0.08	0.01	826
2004	804	0.06	0.01	808
Trend 1990-2004	-23.8%	20.5%	-36.2%	-23.8%

<u>1 A 2 f Manufacturing Industries and Construction - Other - mobile sources</u>

The following table present greenhouse gas emissions mobile machinery of industry.

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	1 038	0.07	0.37	1 156

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO2-equ [Gg]
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
Trend 1990 - 2004	12.4%	-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	225
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	433	0.012	0.0008	433
2000	535	0.014	0.0010	535
2001	457	0.012	0.0008	458
2002	508	0.014	0.0009	509
2003	541	0.015	0.0010	541
2004	613	0.017	0.0011	614
Trend 1990-2004	173.3%	173.3%	173.3%	173.3%

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	14 391	18.48	0.94	15 072
1991	15 481	19.98	0.95	16 196
1992	14 915	18.19	0.94	15 588
1993	14 781	17.87	0.95	15 450
1994	13 575	16.21	0.93	14 204
1995	14 672	16.86	0.94	15 318
1996	15 969	17.88	1.03	16 663
1997	14 308	13.57	1.02	14 911
1998	14 179	13.08	1.00	14 762
1999	14 849	13.16	1.01	15 437
2000	13 354	12.23	0.92	13 897
2001	15 186	13.11	0.99	15 769
2002	14 092	11.72	0.95	14 632
2003	15 259	12.35	0.97	15 817
2004	14 181	12.37	0.96	14 738
Trend 1990-2004	-1.5%	-33.1%	1.5%	-2.2%

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 CO_2 emissions from natural gas combustion increased.

Table 25: Share of fuel types on total CO_2 emissions from Category 1 A 4.

	Liquid	Solid	Gaseous
1990	62%	18%	18%
1991	59%	19%	20%
1992	58%	17%	23%
1993	58%	14%	27%
1994	60%	14%	26%
1995	59%	12%	28%
1996	62%	10%	26%
1997	62%	9%	27%
1998	62%	8%	29%
1999	59%	7%	32%
2000	61%	7%	31%
2001	60%	6%	34%
2002	63%	5%	31%
2003	64%	5%	30%
2004	62%	4%	33%

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]	Change on Heating degree days compared to previous year
1990	12 889	18.19	0.48	13 418	2.0%
1991	14 119	19.70	0.53	14 697	11.6%
1992	13 509	17.91	0.50	14 040	-7.1%
1993	13 363	17.59	0.50	13 889	1.8%
1994	12 075	15.92	0.46	12 552	-8.1%
1995	13 263	16.58	0.50	13 765	8.8%
1996	14 441	17.59	0.53	14 976	11.8%
1997	12 689	13.28	0.49	13 121	-8.8%
1998	12 615	12.80	0.48	13 033	-5.0%
1999	13 262	12.89	0.49	13 686	-2.0%
2000	11 855	11.98	0.45	12 246	-9.1%
2001	13 618	12.87	0.51	14 046	13.5%
2002	13 618	12.87	0.51	14 046	-3.1%
2003	13 655	12.14	0.50	14 066	8.6%
2004	12 534	12.17	0.50	12 945	-3.1%
Trend 1990-2004	-2.7%	-33.1%	5.2%	-3.5%	5.4%

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 quite constant share over the total time series. Since 1990 solid fossil fuels became less important whereas CO_2 emissions from natural gas combustion increased.

Table 27: Share of fuel types in total CO_2 emissions from Category 1 A 4 stationary sources.

	Liquid	Solid	Gaseous	Other
1990	58%	21%	20%	1.9%
1991	55%	21%	22%	1.4%
1992	54%	19%	26%	1.6%
1993	54%	16%	30%	0.9%
1994	55%	15%	29%	1.2%
1995	55%	13%	31%	1.1%
1996	58%	11%	28%	2.1%
1997	57%	10%	31%	2.1%
1998	58%	9%	32%	1.2%
1999	54%	8%	36%	2.0%

	Liquid	Solid	Gaseous	Other
2000	56%	8%	35%	1.2%
2001	55%	7%	38%	0.5%
2002	54%	5%	32%	0.5%
2003	60%	6%	34%	0.5%
2004	57%	5%	37%	1.2%

Recalculations

In 2005 STATISTIK AUSTRIA revised the energy balance and the following improvements have been made.

Implications on activity data by fuels

102A Hard Coal, 105A Lignite, 107A Coke Oven Coke

Revision of hard coal (+31 kt) and coke oven coke (+184 kt) gross inland deliveries 2003 due to better information from industry that has become available.

Hard coal, lignite and coke oven coke final consumption is shifted from *Other Sectors* to *Industry* according to consumption data reported by cement, chemical and pulp/paper industry.

NCVs of coke oven coke has been revised from 1990 to 1992 (+1.1%) and 1999 (+0.8%) to 2003 (+1.8%).

203X Residual Fuel Oil

Gross inland deliveries of residuel fuel oil has been revised for 2001 (+40 kt) and 2002 (101 kt). For 1999 to 2003 shifts between final energy consumption of *Industry* and *Other Sectors.*

224A Other Oil Products

Slight shift for 1990 to 1991 (2 kt) of G*ross Inland Deliveries* to *Refinery Fuels.*

301A Natural Gas

For 2003 gross inland deliveries have been revised following new statistical data that has become available. For 1990-1996 and 1998 shifts (up to 1.9 PJ) between *Industry* and small *Other Sectors* final energy consumption. For 1997 shifts (9.2 PJ) from final energy consumption of *Industry* and *Other Sectors* to *Public Electricity*.

111 A Fuel Wood

Revision of gross inland deliveries from 2000 (-1.6 PJ) to 2003 (7.9 PJ) which leads to a lower final energy consumption of *Other Sectors*.

116A Other Biomass, Pellets, Wood Chips

Revision of gross inland deliveries from 2000 (+0.8 PJ) to 2003 (+5.4 PJ) which leads to a higher final consumption of *Other Sectors* and *Public Heat Plants*.

115A Industrial waste, 215A Black Liquor

For 2002 and 2003 revision of Industrial Waste (up to +0.9PJ) and Black Liquor (up to -0.6 PJ). This mainly affects final energy consumption of *Chemical Industry* and *Pulp/Paper Industry*.

Table 28 presents the recalculation difference of fuel consumption for the base year 1990 and the years 2002 and 2003.

Table 28: Recalculation difference of fuel consumption [PJ] with respect to previous submission.

	Fuel Consumption [PJ]								
	1990			2002			2003		
IPCC Category / Fuel Group	Subm. 2005	Subm. 2006	Difference	Subm. 2005	Subm. 2006	Difference	Subm. 2005	Subm. 2006	Difference
1 A FUEL COMBUSTION ACTIVITIES	822.61	822.48	-0.12	1 017.88	1 008.89	-8.99	1 107.07	1 101.33	-5.74
1 A liquid	376.78	377.83	1.05	474.08	478.06	3.97	516.00	517.98	1.98
1 A solid	140.86	139.68	-1.17	119.65	114.70	-4.95	131.13	128.14	-3.00
1 A gaseous	201.60	201.60	-	278.91	278.91	0.00	301.26	301.25	-0.01
1 A biomass	94.38	94.38	0.00	126.86	121.49	-5.38	139.82	136.33	-3.49
1 A other	8.99	8.99	0.00	18.38	15.74	-2.64	18.85	17.64	-1.22
1 A 1 Energy Industries	186.25	186.40	0.15	203.23	200.77	-2.46	242.57	241.49	-1.08
1 A 1 liquid	46.29	46.45	0.15	42.74	42.66	-0.08	44.72	44.72	0.00
1 A 1 solid	61.40	61.40	0.00	56.13	56.13	0.00	70.89	70.89	0.00
1 A 1 gaseous	74.10	74.10	0.00	81.39	81.39	0.00	100.84	100.84	0.00
1 A 1 biomass	2.04	2.04	0.00	14.07	13.83	-0.24	16.36	17.28	0.92
1 A 1 other	2.41	2.41	0.00	8.90	6.76	-2.15	9.77	7.76	-2.00
1 A 1 a Public Electricity and Heat Production	140.95	140.95	0.00	160.72	158.26	-2.46	199.47	198.39	-1.08
1 A 1 a liquid	15.63	15.63	0.00	10.72	10.65	-0.07	14.01	14.01	0.00
1 A 1 a solid	61.40	61.40	0.00	56.13	56.13	0.00	70.89	70.89	0.00
1 A 1 a gaseous	59.46	59.46	0.00	70.90	70.90	0.00	88.45	88.46	0.00
1 A 1 a biomass	2.04	2.04	0.00	14.07	13.83	-0.24	16.36	17.28	0.92
1 A 1 a other	2.41	2.41	0.00	8.90	6.76	-2.15	9.77	7.76	-2.00
1 A 1 b Petroleum refining	39.80	39.89	0.09	39.39	39.39	0.00	39.28	39.28	0.00
1 A 1 b liquid	30.66	30.75	0.09	32.02	32.01	0.00	30.64	30.64	0.00
1 A 1 b solid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 1 b gaseous	9.14	9.14	0.00	7.37	7.37	0.00	8.64	8.64	0.00
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	5.49	5.56	0.06	3.12	3.12	0.00	3.83	3.83	0.00

	Fuel Consumption [PJ]								
	1990			2002			2003		
IPCC Category / Fuel Group	Subm. 2005	Subm. 2006	Differen ce	Subm. 2005	Subm. 2006	Differen ce	Subm. 2005	Subm. 2006	Differen ce
Industries									
1 A 1 c liquid	NO	0.06	0.06	NO	NO	-	0.08	0.08	0.00
1 A 1 c solid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 1 c gaseous	5.49	5.49	0.00	3.12	3.12	0.00	3.74	3.74	0.00
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	207.17	209.20	2.02	252.12	245.13	-6.99	255.76	248.99	-6.77
1 A 2 liquid	49.30	49.33	0.02	38.53	38.27	-0.26	45.03	38.79	-6.24
1 A 2 solid	48.10	50.08	1.98	55.19	50.61	-4.58	53.08	48.75	-4.33
1 A 2 gaseous	77.38	77.40	0.02	109.77	108.83	-0.94	105.84	106.98	1.15
1 A 2 biomass	28.11	28.11	0.00	39.77	39.05	-0.72	43.77	45.24	1.47
1 A 2 other	4.28	4.28	0.00	8.86	8.37	-0.49	8.05	9.23	1.18
1 A 2 a Iron and Steel	56.65	55.36	-1.29	69.52	63.81	-5.71	67.57	63.54	-4.02
1 A 2 a liquid	5.72	5.72	0.00	6.80	8.45	1.65	7.20	7.14	-0.06
1 A 2 a solid	39.20	37.91	-1.29	44.33	36.98	-7.35	43.95	38.03	-5.92
1 A 2 a gaseous	11.73	11.73	0.00	18.38	18.38	0.00	16.42	18.38	1.96
1 A 2 a biomass	NO	NO	-	0.00	0.00	0.00	0.00	0.00	0.00
1 A 2 a other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 b Non-ferrous Metals	1.89	2.07	0.17	3.49	3.49	0.00	3.49	3.65	0.16
1 A 2 b liquid	0.50	0.50	0.00	0.68	0.68	0.00	0.90	0.58	-0.32
1 A 2 b solid	0.04	0.21	0.17	0.16	0.16	0.00	0.05	0.16	0.11
1 A 2 b gaseous	1.35	1.35	0.00	2.65	2.65	0.00	2.54	2.92	0.38
1 A 2 b biomass	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 b other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 c Chemicals	16.60	16.87	0.27	24.46	23.46	-1.00	31.75	22.91	-8.84
1 A 2 c liquid	0.99	0.99	0.00	0.84	0.83	0.00	1.46	0.92	-0.54
1 A 2 c solid	0.78	1.14	0.37	2.64	2.64	0.01	2.69	2.63	-0.07
1 A 2 c gaseous	9.67	9.57	-0.10	16.06	15.11	-0.94	15.58	14.82	-0.76
1 A 2 c biomass	2.90	2.90	0.00	2.31	2.25	-0.06	9.23	2.00	-7.24
1 A 2 c other	2.27	2.27	0.00	2.62	2.62	0.00	2.78	2.55	-0.23
1 A 2 d Pulp, Paper and Print	53.87	54.37	0.50	58.95	58.68	-0.28	55.34	62.02	6.68
1 A 2 d liquid	10.54	10.54	0.00	1.99	1.97	-0.01	2.42	2.23	-0.19
1 A 2 d solid	3.68	4.08	0.40	4.36	4.36	0.00	3.30	3.87	0.58
1 A 2 d gaseous	17.11	17.22	0.10	24.53	24.53	0.00	24.64	22.46	-2.19
1 A 2 d biomass	21.88	21.88	0.00	27.97	27.71	-0.27	24.82	33.31	8.49
1 A 2 d other	0.66	0.65	0.00	0.10	0.10	0.00	0.16	0.15	-0.01

	Fuel Consumption [PJ]								
	1990			2002			2003		
IPCC Category / Fuel Group	Subm. 2005	Subm. 2006	Differen ce	Subm. 2005	Subm. 2006	Differen ce	Subm. 2005	Subm. 2006	Differen ce
1 A 2 e Food Processing, Beverages and Tobacco	13.54	13.66	0.12	21.60	21.59	-0.01	21.74	19.03	-2.72
1 A 2 e liquid	4.21	4.21	0.00	2.31	2.30	-0.01	3.39	2.44	-0.95
1 A 2 e solid	0.06	0.18	0.12	0.30	0.31	0.01	0.10	0.31	0.21
1 A 2 e gaseous	9.14	9.15	0.00	18.81	18.81	0.00	18.07	16.08	-1.99
1 A 2 e biomass	0.13	0.13	0.00	0.18	0.17	-0.01	0.18	0.20	0.02
1 A 2 e other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 f Other	64.63	66.87	2.24	74.10	74.10	0.00	75.87	77.84	1.97
1 A 2 f liquid	27.34	27.36	0.02	25.91	24.04	-1.87	29.67	25.49	-4.18
1 A 2 f solid	4.35	6.56	2.21	3.40	6.15	2.76	2.99	3.75	0.76
1 A 2 f gaseous	28.38	28.39	0.01	29.35	29.35	0.00	28.57	32.33	3.76
1 A 2 f biomass	3.21	3.21	0.00	9.31	8.92	-0.39	9.54	9.73	0.20
1 A 2 f other	1.36	1.36	0.00	6.13	5.64	-0.49	5.10	6.53	1.43
1 A 3 Transport	166.91	166.91	0.00	286.58	286.73	0.15	309.77	312.14	2.37
1 A 3 liquid	105.29	162.79	57.50	89.56	277.53	187.97	91.70	302.36	210.66
1 A 3 solid	0.07	0.07	-	0.02	0.02	0.00	0.02	0.02	0.00
1 A 3 gaseous	4.05	4.05	0.00	9.17	9.17	0.00	8.81	9.76	0.95
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	-	1.03	1.05	0.02	0.92	2.23	1.31
1 A 3 a aviation gasoline	0.11	0.11	-	0.09	0.10	0.02	0.09	0.11	0.02
1 A 3 a jet kerosene	0.33	0.33	-	0.95	0.95	0.00	0.83	2.12	1.29
1 A 3 b Road Transportation	159.39	159.39	0.00	272.90	273.03	0.14	296.54	296.56	0.02
1 A 3 b gasoline	105.17	105.17	0.00	89.44	89.43	-0.01	91.58	91.42	-0.15
1 A 3 b diesel oil	54.22	54.22	0.00	183.46	183.61	0.15	204.97	205.14	0.17
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	-	2.36	2.44	0.09	2.36	2.44	0.09
1 A 3 c solid	2.26	2.26	-	2.33	2.42	0.09	2.33	2.42	0.09
1 A 3 c liquid	0.07	0.07	-	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	-

IPCC Category / Fuel Group	Fuel Consumption [PJ] 1990 Subm. 2005	1990 Subm. 2006	1990 Difference	2002 Subm. 2005	2002 Subm. 2006	2002 Difference	2003 Subm. 2005	2003 Subm. 2006	2003 Difference
1 A 3 d Navigation	0.70	0.70	-	1.14	1.14	0.00	1.14	1.14	0.00
1 A 3 d residual oil	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 d gas/diesel oil	0.58	0.58	-	1.02	1.02	0.00	1.02	1.02	0.00
1 A 3 d gasoline	0.12	0.12	-	0.12	0.12	0.00	0.12	0.12	0.00
1 A 3 d other liquid	NO	NO	-	NO	NO	-	NO	NO	-
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	8.81	9.76	0.95	8.81	9.76	0.95
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	8.81	9.76	0.95	8.81	9.76	0.95
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	261.79	259.49	-2.30	298.47	297.48	-0.99	298.47	297.48	-0.99
1 A 4 liquid	117.91	118.79	0.87	124.81	130.88	6.07	124.81	130.88	6.07
1 A 4 solid	31.29	28.14	-3.15	7.15	8.48	1.33	7.15	8.48	1.33
1 A 4 gaseous	46.07	46.05	-0.02	85.77	83.67	-2.11	85.77	83.67	-2.11
1 A 4 biomass	64.22	64.22	0.00	79.70	73.81	-5.89	79.70	73.81	-5.89
1 A 4 other	2.29	2.29	0.00	1.04	0.65	-0.40	1.04	0.65	-0.40
1 A 4 a Commecial/Institutional	36.77	36.90	0.13	34.13	51.80	17.67	34.13	51.80	17.67
1 A 4 a liquid	17.91	18.12	0.20	11.04	28.00	16.96	11.04	28.00	16.96
1 A 4 a solid	1.03	0.95	-0.08	0.26	1.23	0.98	0.26	1.23	0.98
1 A 4 a gaseous	13.36	13.36	0.00	17.89	17.91	0.02	17.89	17.91	0.02
1 A 4 a biomass	2.17	2.18	0.00	3.90	4.01	0.11	3.90	4.01	0.11
1 A 4 a other	2.29	2.29	0.00	1.04	0.65	-0.40	1.04	0.65	-0.40
1 A 4 b Residential	193.75	191.41	-2.34	234.04	216.50	-17.54	234.04	216.50	-17.54
1 A 4 b liquid	73.73	74.40	0.67	90.33	80.55	-9.79	90.33	80.55	-9.79
1 A 4 b solid	29.63	26.64	-2.99	6.75	7.10	0.35	6.75	7.10	0.35
1 A 4 b gaseous	32.35	32.33	-0.02	67.12	65.02	-2.10	67.12	65.02	-2.10
1 A 4 b biomass	58.05	58.05	0.00	69.83	63.83	-6.00	69.83	63.83	-6.00
1 A 4 b other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 4 c Agriculture/Forestry/Fisheries	31.27	31.19	-0.09	30.31	29.19	-1.12	30.31	29.19	-1.12

	Fuel Consumption [PJ]								
	1990			2002			2003		
IPCC Category / Fuel Group	Subm. 2005	Subm. 2006	Differen ce	Subm. 2005	Subm. 2006	Differen ce	Subm. 2005	Subm. 2006	Differen ce
1 A 4 c liquid	26.28	26.28	0.00	23.44	22.33	-1.10	23.44	22.33	-1.10
1 A 4 c solid	0.63	0.55	-0.08	0.14	0.14	0.00	0.14	0.14	0.00
1 A 4 c gaseous	0.37	0.37	0.00	0.76	0.73	-0.03	0.76	0.73	-0.03
1 A 4 c biomass	4.00	4.00	0.00	5.96	5.98	0.01	5.96	5.98	0.01
1 A 4 c other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 5 Other	0.48	0.48	-	0.50	1.23	0.73	0.50	1.23	0.73
1 A 5 liquid	0.48	0.48	-	0.50	1.23	0.73	0.50	1.23	0.73
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	-	19.96	17.94	-2.02	19.96	17.94	-2.02

A "-" indicates that no recalculations were carried out.

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 2006.

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. The revised year 2003 and the new energy balance for 2004 has been submitted to IEA and EUROSTAT in December 2005.

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, 2005] and their correspondence to IPCC categories.

IEA-Category and ISIC Codes*	Comments	SNAP	IPCC-Category
Production			Reference Approach: Production
Imports			Reference Approach: Import

IEA-Category and ISIC Codes*	Comments	SNAP	IPCC-Category
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 Rail Inland Waterways	Division to SNAP categories is performed by means of studies.	07 08 0201	1 A 2 f Manuf. Ind. and Constr. - Other 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	0201	1 A 4 a Commercial/ Institutional

IEA-Category and ISIC Codes*	Comments	SNAP	IPCC-Category
	Lubricants.		
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)		

*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.

(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.

Table 30: Categories of the national energy balance [IEA-JQ, 2005] 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)		
Agriculture	No consumption (1)		
Non Specified	No consumption (1)		

**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.*

(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		IPCC Fuel Category [(3)]
Code [(1)]	Category	Category	Average Net Calorific Value[(2)]	
102 A	Hard Coal	Bituminous Coal and Anthracite	28.44	Solid (coal)
104 A	Hard Coal Briquettes	Patent Fuel	31.00	Solid (coal)
105 A	Brown Coal	Lignite/Brown Coal	9.80	Solid (coal)
106 A	Brown Coal Briquettes	BKB/PB	19.30	Solid (coal)
107 A	Coke	Coke Oven Coke	28.71	Solid (coal)
113 A	Peat	Peat	8.80	Solid
304 A	Coke Oven Gas	Coke Oven Gas	-	Solid
305 A	Blast Furnace Gas	Blast Furnace Gas	-	Solid
110 A	Petrol Coke	Petrol Coke	33.93	Liquid
203 B	Light Fuel Oil Sulphur Content < 0,2 %	Residual Fuel Oil	41.42	Liquid (residual oil)
203 C	Medium Fuel Oil Sulphur Content < 0,4%	Residual Fuel Oil	41.42	Liquid (residual oil)
203 D	Heavy Fuel Oil Sulphur Content >= 1%	Residual Fuel Oil	41.42	Liquid (residual oil)
204 A	Gasoil	Heating and other Gasoil	42.82	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	42.50	Liquid (aviation gasoline)
208 0	Motor Gasoline	Motor Gasoline	42.50	Liquid (gasoline)
224 A	Other Petroleum Products	Other Products	43.91	Liquid
303 A	Liquified Petroleum Gas (LPG)	LPG	46.00	Liquid
308 A	Refinery Gas	Refinery Gas	45.93	Liquid
301 A	Natural Gas	Natural Gas	35.85	Gaseous (natural gas)

Inventory Fuel Category Code [(1)]	Inventory Fuel Category Category	IEA Fuel Category Category	Average Net Calorific Value[(2)]	IPCC Fuel Category [(3)]
114 B	Municipal Waste	Municipal Solid Waste Renewable	8.93	Other Fuels
		Municipal Solid Waste Non Renewable	9.14	Other Fuels
114 C	Hazardous Waste	Industrial Wastes	15.76	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)	11.36	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	7.92	Biomass
309 A	Biogas	Biogas	22.06	Biomass
309 B	Sewage Sludge Gas	Sewage Sludge Gas	22.06	Biomass
310 A	Landfill Gas	Landfill Gas	17.00	Biomass

(1) First three digits are based on CORINAIR / NAPFUE 94–Code

(2) Units: [MJ / kg] or [MJ / m^3 Gas] respectively, for the Year 2004 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 (0.1%) between the national and IEA reference approach.

Energy Consumption and CO_2 Emissions by Sectors and Fuel Types

In Table 32 to Table 46 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 2004 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: 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**	**48.82**	**0.02**	**6.61**	**124.52**	**6.68**	**4.99**	**0.00**	**0.62**	**12.29**
102A	Hard Coal	59.70	5.44	0.02	1.54	66.70	5.65	0.51	0.00	0.14	6.30
104A	Hard Coal Briquettes				0.04	0.04				0.00	0.00
105A	Brown Coal	9.37	1.93		0.21	11.51	1.03	0.19		0.02	1.24
106A	Brown Coal Briquettes		0.00		1.13	1.13		0.00		0.11	0.11
107A	Coke		39.63		3.68	43.32		4.12		0.34	4.46
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		1.81			1.81		0.17			0.17
	Total Liquid	**46.01**	**38.77**	**313.65**	**117.62**	**516.06**	**3.23**	**2.99**	**22.84**	**8.74**	**37.91**
110A	Petrol Coke	2.00	3.36			5.37	0.20	0.34			0.54
203B	Light Fuel Oil	0.62	3.84		16.15	20.61	0.05	0.30		1.24	1.59
203C	Medium Fuel Oil				1.58	1.58				0.12	0.12
203D	Heavy Fuel Oil	12.80	12.77			25.57	1.02	1.00			2.02
204A	Gasoil	0.17	1.36		70.87	72.40	0.01	0.10		5.32	5.43
2050	Diesel	0.02	15.61	220.51	20.90	257.05	0.00	1.14	16.05	1.52	18.72
206A	Other Kerosene		0.01		0.16	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	89.06	1.67	90.82		0.01	6.60	0.12	6.73
224A	Other Petroleum Products	15.08				15.08	1.18				1.18
303A	Liquified Petroleum Gas (LPG)	0.14	1.72		6.30	8.15	0.01	0.11		0.40	0.52
308A	Refinery Gas	15.18				15.18	0.75				0.75
301A	**Total Gaseous** (Natural Gas)	**91.99**	**118.83**	**11.07**	**84.29**	**306.17**	**5.10**	**6.58**	**0.61**	**4.67**	**16.96**
	Total Other Fuel	**9.07**	**9.55**		**1.43**	**20.05**	**0.54**	**0.76**		**0.15**	**1.45**
114B	Municipal Waste	7.38				7.38	0.36				0.36
115A	Industrial Waste	1.69	9.55		1.43	12.67	0.18	0.76		0.15	1.09
	Total Biomass[(1)]	**19.41**	**40.12**		**77.38**	**136.91**	**(2.13)**	**(4.4)**		**(7.92)**	**(14.46)**
111A	Fuel Wood	0.35	1.20		59.18	60.73	0.04	0.12		5.92	6.07
116A	Wood Wastes	17.57	14.20		17.06	48.83	1.93	1.56		1.88	5.37

	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
118A Sewage Sludge	1.22				1.22	0.13				0.13
215A Black Liquor		24.24			24.24		2.67			2.67
309A Biogas	0.16	0.45			0.61	0.02	0.05			0.07
309B Sewage Sludge Gas	0.06			0.73	0.79	0.01			0.08	0.09
310A Landfill Gas	0.05	0.03		0.41	0.49	0.01	0.00		0.05	0.06
Total(1)	**235.55**	**256.09**	**324.74**	**287.32**	**1 103.70**	**15.54**	**15.33**	**23.45**	**14.18**	**68.61**

(1) CO_2 emissions of Biomass are not included in Total.

Table 33: 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**	**48.75**	**0.02**	**8.48**	**128.14**	**6.92**	**4.97**	**0.00**	**0.79**	**12.68**
102A Hard Coal	57.19	7.13	0.02	2.20	66.54	5.41	0.67	0.00	0.20	6.29
104A Hard Coal Briquettes				0.06	0.06				0.01	0.01
105A Brown Coal	13.70	1.70		0.27	15.67	1.51	0.17		0.03	1.70
106A Brown Coal Briquettes		0.00		1.38	1.38		0.00		0.13	0.13
107A Coke		38.06		4.56	42.62		3.96		0.42	4.38
113A Peat				0.00	0.00				0.00	0.00
304A Coke Oven Gas		1.85			1.85		0.18			0.18
Total Liquid	**44.72**	**38.79**	**303.58**	**130.88**	**517.98**	**3.17**	**2.98**	**22.31**	**9.76**	**38.32**
110A Petrol Coke	2.00	2.31			4.31	0.20	0.23			0.43
203B Light Fuel Oil	0.67	5.46		18.54	24.67	0.05	0.43		1.43	1.91
203C Medium Fuel Oil				1.61	1.61				0.13	0.13
203D Heavy Fuel Oil	14.30	11.57			25.87	1.14	0.90			2.05
204A Gasoil	0.15	2.90		82.51	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	15.36	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

		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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
207A	Aviation Gasoline			0.11		0.11			0.01		0.01
2080	Motor Gasoline		0.09	91.54	1.68	93.31		0.01	6.78	0.12	6.91
224A	Other Petroleum Products	14.83				14.83	1.16				1.16
303A	Liquified Petroleum Gas (LPG)	0.06	1.80		6.30	8.15	0.00	0.12		0.40	0.52
308A	Refinery Gas	12.53				12.53	0.59				0.59
301A	**Total Gaseous** (Natural Gas)	**100.84**	**106.98**	**9.76**	**83.67**	**301.25**	**5.59**	**5.93**	**0.54**	**4.64**	**16.69**
	Total Other Fuel	**7.76**	**9.23**		**0.65**	**17.64**	**0.49**	**0.68**		**0.07**	**1.24**
114B	Municipal Waste	5.78				5.78	0.28				0.28
115A	Industrial Waste	1.98	9.23		0.65	11.85	0.21	0.68		0.07	0.95
	Total Biomass(1)	**17.28**	**45.24**		**73.81**	**136.33**	**(1.9)**	**(4.97)**		**(7.5)**	**(14.36)**
111A	Fuel Wood	0.34	1.08		62.45	63.87	0.03	0.11		6.25	6.39
116A	Wood Wastes	15.77	20.83		10.39	46.99	1.73	2.29		1.14	5.17
118A	Sewage Sludge	0.89				0.89	0.10				0.10
215A	Black Liquor		22.97			22.97		2.53			2.53
309A	Biogas		0.32			0.32		0.04			0.04
309B	Sewage Sludge Gas	0.05			0.70	0.75	0.01			0.08	0.08
310A	Landfill Gas	0.23	0.04		0.27	0.53	0.03	0.00		0.03	0.06
	Total(1)	**241.49**	**248.99**	**313.36**	**297.48**	**1 101.33**	**16.17**	**14.56**	**22.85**	**15.26**	**68.92**

(1) CO_2 emissions of Biomass are not included in Total.

Table 34: 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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
	Total Solid	**56.13**	**50.61**	**0.02**	**7.93**	**114.70**	**5.51**	**5.14**	**0.00**	**0.74**	**11.40**
102A	Hard Coal	42.89	8.36	0.02	1.67	52.95	4.05	0.79	0.00	0.16	5.00
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

		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
107A	Coke		38.00		4.64	42.64		3.95		0.43	4.38
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		2.65			2.65		0.25			0.25
	Total Liquid	**42.66**	**38.27**	**278.09**	**119.03**	**478.06**	**2.99**	**2.93**	**20.48**	**8.88**	**35.32**
110A	Petrol Coke	2.75	2.22			4.97	0.28	0.22			0.50
203B	Light Fuel Oil	1.07	3.84		16.22	21.12	0.08	0.30		1.25	1.63
203C	Medium Fuel Oil				1.90	1.90				0.15	0.15
203D	Heavy Fuel Oil	9.70	12.49			22.20	0.77	0.97			1.75
204A	Gasoil	0.13	2.79		73.49	76.40	0.01	0.21		5.51	5.73
2050	Diesel	0.03	14.58	186.96	20.14	221.71	0.00	1.08	13.77	1.48	16.33
206A	Other Kerosene		0.01		0.18	0.19		0.00		0.01	0.02
206B	Jet Kerosene			1.48		1.48			0.07		0.11
207A	Aviation Gasoline			0.10		0.10			0.01		0.01
2080	Motor Gasoline		0.09	89.55	1.65	91.29		0.01	6.63	0.12	6.76
224A	Other Petroleum Products	14.78				14.78	1.15				1.15
303A	Liquified Petroleum Gas (LPG)	0.13	2.25		5.46	7.84	0.01	0.14		0.35	0.50
308A	Refinery Gas	14.07				14.07	0.68				0.68
301A	**Total Gaseous** (Natural Gas)	**81.39**	**108.83**	**9.17**	**79.51**	**278.91**	**4.51**	**6.03**	**0.51**	**4.40**	**15.45**
	Total Other Fuel	**6.76**	**8.37**		**0.62**	**15.74**	**0.43**	**0.64**		**0.06**	**1.14**
114B	Municipal Waste	4.91				4.91	0.24				0.24
115A	Industrial Waste	1.84	8.37		0.62	10.83	0.19	0.64		0.06	0.90
	Total Biomass(1)	**13.83**	**39.05**		**68.61**	**121.49**	**(1.52)**	**(4.28)**		**(6.95)**	**(12.76)**
111A	Fuel Wood	0.05	1.35		59.38	60.78	0.00	0.14		5.94	6.08
116A	Wood Wastes	12.88	14.61		8.27	35.76	1.42	1.61		0.91	3.93
118A	Sewage Sludge	0.79				0.79	0.09				0.09
215A	Black Liquor		22.78			22.78		2.51			2.51
309A	Biogas		0.28			0.28		0.03			0.03
309B	Sewage Sludge Gas	0.06			0.66	0.72	0.01			0.07	0.08
310A	Landfill Gas	0.06	0.03		0.30	0.38	0.01	0.00		0.03	0.04
	Total(1)	**200.77**	**245.13**	**287.29**	**275.70**	**1 008.89**	**13.44**	**14.75**	**20.99**	**14.09**	**63.31**

(1) CO_2 emissions of Biomass are not included in Total.

Table 35: 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	**60.73**	**43.60**	**0.03**	**9.49**	**113.86**	**5.96**	**4.42**	**0.00**	**0.89**	**11.27**
102A	Hard Coal	46.12	9.43	0.03	2.10	57.68	4.36	0.89	0.00	0.20	5.45
104A	Hard Coal Briquettes				0.02	0.02				0.00	0.00
105A	Brown Coal	14.05	1.43		0.40	15.87	1.54	0.14		0.04	1.72
106A	Brown Coal Briquettes	0.56	0.00		1.52	2.09	0.05	0.00		0.15	0.20
107A	Coke		32.01		5.44	37.45		3.33		0.50	3.83
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		0.74			0.74		0.07			0.07
	Total Liquid	**47.64**	**43.25**	**253.61**	**121.22**	**465.73**	**3.38**	**3.29**	**18.58**	**9.06**	**34.42**
110A	Petrol Coke	2.27	0.67			2.94	0.23	0.07			0.30
203B	Light Fuel Oil	2.57	6.56		17.44	26.57	0.20	0.51		1.34	2.05
203C	Medium Fuel Oil				1.40	1.40				0.11	0.11
203D	Heavy Fuel Oil	14.20	16.11		0.03	30.34	1.13	1.26		0.00	2.39
204A	Gasoil	0.79	3.12		76.69	80.60	0.06	0.23		5.75	6.05
2050	Diesel	0.01	14.51	165.66	19.62	199.81	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			4.59		4.59			0.21		0.33
207A	Aviation Gasoline			0.08		0.08			0.01		0.01
2080	Motor Gasoline		0.09	83.27	1.63	84.99		0.01	6.16	0.12	6.29
224A	Other Petroleum Products	12.82				12.82	1.00				1.00
303A	Liquified Petroleum Gas (LPG)		2.19		4.38	6.58		0.14		0.28	0.42
308A	Refinery Gas	14.96				14.96	0.76				0.76
301A	**Total Gaseous** (Natural Gas)	**71.96**	**105.86**	**8.25**	**93.39**	**279.47**	**3.99**	**5.86**	**0.46**	**5.17**	**15.48**
	Total Other Fuel	**5.68**	**7.21**		**0.63**	**13.52**	**0.34**	**0.51**		**0.07**	**0.92**
114B	Municipal Waste	4.61				4.61	0.23				0.23
115A	Industrial Waste	1.07	7.21		0.63	8.91	0.11	0.51		0.07	0.69
	Total Biomass(1)	**12.10**	**38.66**		**75.06**	**125.82**	**(1.33)**	**(4.24)**		**(7.63)**	**(13.2)**
111A	Fuel Wood	0.07	1.05		63.36	64.48	0.01	0.11		6.34	6.45
116A	Wood Wastes	10.99	14.00		10.31	35.30	1.21	1.54		1.13	3.88

	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
118A Sewage Sludge	0.90				0.90	0.10				0.10
215A Black Liquor		23.30			23.30		2.56			2.56
309A Biogas	0.02	0.21		0.02	0.25	0.00	0.02		0.00	0.03
309B Sewage Sludge Gas	0.05			0.67	0.72	0.01			0.08	0.08
310A Landfill Gas	0.07	0.10		0.69	0.86	0.01	0.01		0.08	0.10
Total(1)	**198.12**	**238.59**	**261.89**	**299.79**	**998.39**	**13.66**	**14.09**	**19.04**	**15.19**	**62.10**

(1) CO_2 emissions of Biomass are not included in Total.

Table 36: 2000 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	**51.07**	**46.94**	**0.03**	**10.20**	**108.23**	**5.00**	**4.76**	**0.00**	**0.96**	**10.72**
102A Hard Coal	39.11	10.46	0.03	2.10	51.70	3.70	0.98	0.00	0.20	4.88
104A Hard Coal Briquettes				0.11	0.11				0.01	0.01
105A Brown Coal	11.60	1.40		0.40	13.39	1.28	0.14		0.04	1.45
106A Brown Coal Briquettes	0.35	0.00		1.71	2.06	0.03	0.00		0.17	0.20
107A Coke		34.53		5.88	40.41		3.59		0.54	4.13
113A Peat				0.00	0.00				0.00	0.00
304A Coke Oven Gas		0.56			0.56		0.05			0.05
Total Liquid	**45.46**	**42.94**	**233.79**	**108.72**	**430.91**	**3.21**	**3.26**	**17.20**	**8.12**	**31.83**
110A Petrol Coke	1.61	0.81			2.43	0.16	0.08			0.24
203B Light Fuel Oil	1.98	5.98		15.18	23.14	0.15	0.47		1.17	1.79
203C Medium Fuel Oil				1.48	1.48				0.12	0.12
203D Heavy Fuel Oil	14.84	16.03		0.15	31.03	1.18	1.25		0.01	2.45
204A Gasoil	0.01	3.11		66.97	70.09	0.00	0.23		5.02	5.26
2050 Diesel	0.01	14.36	149.39	18.69	182.45	0.00	1.06	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

		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
207A	Aviation Gasoline			0.09		0.09			0.01		0.01
2080	Motor Gasoline		0.09	82.68	1.63	84.40		0.01	6.11	0.12	6.24
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	0.73				0.73
301A	**Total Gaseous** (Natural Gas)	**71.38**	**107.22**	**9.65**	**74.68**	**262.92**	**3.95**	**5.94**	**0.53**	**4.14**	**14.57**
	Total Other Fuel	**4.65**	**6.93**		**1.39**	**12.97**	**0.23**	**0.56**		**0.14**	**0.94**
114B	Municipal Waste	4.52				4.52	0.22				0.22
115A	Industrial Waste	0.13	6.93		1.39	8.45	0.01	0.56		0.14	0.72
	Total Biomass(1)	**9.16**	**36.84**		**67.58**	**113.59**	**(1.01)**	**(4.04)**		**(6.86)**	**(11.91)**
111A	Fuel Wood	0.04	0.89		57.70	58.62	0.00	0.09		5.77	5.86
116A	Wood Wastes	8.03	11.54		8.73	28.29	0.88	1.27		0.96	3.11
118A	Sewage Sludge	0.96				0.96	0.11				0.11
215A	Black Liquor		24.12			24.12		2.65			2.65
309A	Biogas	0.02	0.30		0.02	0.34	0.00	0.03		0.00	0.04
309B	Sewage Sludge Gas	0.05			0.74	0.79	0.01			0.08	0.09
310A	Landfill Gas	0.06			0.40	0.46	0.01			0.04	0.05
	Total(1)	**181.72**	**240.87**	**243.47**	**262.56**	**928.62**	**12.40**	**14.53**	**17.73**	**13.35**	**58.06**

(1) CO_2 emissions of Biomass are not included in Total.

Table 37: 1999 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	**37.79**	**42.84**	**0.03**	**11.09**	**91.76**	**3.78**	**4.34**	**0.00**	**1.04**	**9.17**
102A	Hard Coal	24.14	9.03	0.03	2.46	35.66	2.28	0.85	0.00	0.23	3.36
104A	Hard Coal Briquettes				0.12	0.12				0.01	0.01
105A	Brown Coal	13.65	1.16		0.52	15.33	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		31.04		5.93	36.97		3.23		0.55	3.77

		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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		1.61			1.61		0.15			0.15
	Total Liquid	**55.09**	**46.31**	**219.73**	**116.91**	**438.03**	**4.06**	**3.53**	**16.16**	**8.73**	**32.52**
110A	Petrol Coke	2.14	1.19			3.32	0.22	0.12			0.34
203B	Light Fuel Oil	1.35	7.59		14.53	23.47	0.11	0.59		1.12	1.82
203C	Medium Fuel Oil	0.09	0.00		2.13	2.22	0.01	0.00		0.17	0.17
203D	Heavy Fuel Oil	24.47	15.08		0.17	39.72	1.95	1.18		0.01	3.14
204A	Gasoil	0.29	5.58		73.75	79.62	0.02	0.42		5.53	5.97
2050	Diesel	0.10	14.17	132.46	19.85	166.59	0.01	1.05	9.75	1.46	12.27
206A	Other Kerosene		0.12		0.58	0.70		0.01		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	85.61	1.64	87.34		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	2.49		4.25	6.94	0.01	0.16		0.27	0.44
308A	Refinery Gas	14.29				14.29	0.79				0.79
301A	**Total Gaseous** (Natural Gas)	**79.53**	**99.26**	**7.81**	**86.82**	**273.41**	**4.41**	**5.50**	**0.43**	**4.81**	**15.15**
	Total Other Fuel	**4.66**	**6.92**		**2.53**	**14.12**	**0.24**	**0.61**		**0.26**	**1.11**
114B	Municipal Waste	4.52				4.52	0.22				0.22
115A	Industrial Waste	0.15	6.92		2.53	9.60	0.02	0.61		0.26	0.88
	Total Biomass(1)	**7.08**	**42.29**		**72.30**	**121.67**	**(0.78)**	**(4.63)**		**(7.31)**	**(12.73)**
111A	Fuel Wood	0.02	1.81		64.11	65.94	0.00	0.18		6.41	6.59
116A	Wood Wastes	6.02	16.51		7.00	29.53	0.66	1.82		0.77	3.25
118A	Sewage Sludge	0.96				0.96	0.11				0.11
215A	Black Liquor		23.65			23.65		2.60			2.60
309A	Biogas	0.01	0.31		0.02	0.35	0.00	0.04		0.00	0.04
309B	Sewage Sludge Gas	0.02			0.70	0.71	0.00			0.08	0.08
310A	Landfill Gas	0.04			0.48	0.52	0.00			0.05	0.06
	Total(1)	**184.15**	**237.62**	**227.56**	**289.66**	**938.99**	**12.48**	**13.97**	**16.60**	**14.85**	**57.94**

(1) CO_2 emissions of Biomass are not included in Total.

Table 38: 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**	**44.39**	**0.03**	**12.01**	**92.25**	**3.50**	**4.48**	**0.00**	**1.13**	**9.11**
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	7.34	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		30.95		6.26	37.21		3.22		0.58	3.79
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		0.84			0.84		0.08			0.08
	Total Liquid	**60.94**	**54.86**	**228.32**	**118.18**	**462.31**	**4.39**	**4.19**	**16.82**	**8.83**	**34.27**
110A	Petrol Coke	2.20	0.67			2.87	0.22	0.07			0.29
203B	Light Fuel Oil	2.11	15.31		9.86	27.29	0.16	1.19		0.76	2.12
203C	Medium Fuel Oil	0.14	0.00		2.13	2.28	0.01	0.00		0.17	0.18
203D	Heavy Fuel Oil	27.98	21.21		0.26	49.45	2.22	1.65		0.02	3.90
204A	Gasoil	0.20	0.53		80.48	81.21	0.02	0.04		6.04	6.09
2050	Diesel	0.08	14.00	134.57	19.51	168.16	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	92.14	1.64	93.87		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	3.05		3.57	6.74	0.01	0.19		0.23	0.43
308A	Refinery Gas	17.04				17.04	0.87				0.87
301A	**Total Gaseous** (Natural Gas)	**85.50**	**105.48**	**6.34**	**73.34**	**270.66**	**4.74**	**5.84**	**0.35**	**4.06**	**14.99**
	Total Other Fuel	**4.78**	**5.99**		**1.51**	**12.28**	**0.23**	**0.43**		**0.16**	**0.82**
114B	Municipal Waste	4.78				4.78	0.23				0.23
115A	Industrial Waste		5.99		1.51	7.50		0.43		0.16	0.58
	Total Biomass(1)	**7.02**	**32.13**		**70.45**	**109.59**	**(0.77)**	**(3.53)**		**(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	5.91	8.54		5.26	19.71	0.65	0.94		0.58	2.17
118A	Sewage Sludge	0.82				0.82	0.09				0.09

		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
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)	**194.06**	**242.85**	**234.70**	**275.50**	**947.10**	**12.86**	**14.95**	**17.17**	**14.18**	**59.20**

(1) CO_2 emissions of Biomass are not included in Total.

Table 39: 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	0.68		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		29.64		7.01	36.65		3.08		0.64	3.73
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		7.66			7.66		0.72			0.72
	Total Liquid	**57.29**	**57.77**	**200.21**	**118.61**	**433.89**	**4.08**	**4.42**	**14.74**	**8.86**	**32.15**
110A	Petrol Coke	2.15	0.49			2.64	0.22	0.05			0.27
203B	Light Fuel Oil	2.54	18.55		9.80	30.90	0.20	1.45		0.75	2.40
203C	Medium Fuel Oil	0.09	0.01		2.06	2.16	0.01	0.00		0.16	0.17
203D	Heavy Fuel Oil	23.22	21.57		0.17	44.95	1.84	1.68		0.01	3.54
204A	Gasoil	0.11	0.48		81.01	81.60	0.01	0.04		6.08	6.12
2050	Diesel	0.31	13.80	110.62	20.24	144.97	0.02	1.02	8.16	1.50	10.71
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	88.13	1.66	89.88		0.01	6.51	0.12	6.64

		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
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	0.88				0.88
301A	**Total Gaseous** (Natural Gas)	**81.41**	**109.34**	**4.20**	**70.01**	**264.96**	**4.51**	**6.06**	**0.23**	**3.88**	**14.68**
	Total Other Fuel	**4.89**	**5.63**		**2.60**	**13.12**	**0.24**	**0.51**		**0.27**	**1.02**
114B	Municipal Waste	4.89				4.89	0.24				0.24
115A	Industrial Waste		5.63		2.60	8.23		0.51		0.27	0.78
	Total Biomass(1)	**6.16**	**37.03**		**71.96**	**115.15**	**(0.68)**	**(4.07)**		**(7.25)**	**(12)**
111A	Fuel Wood	0.07	0.20		66.93	67.21	0.01	0.02		6.69	6.72
116A	Wood Wastes	5.23	14.61		4.39	24.22	0.58	1.61		0.48	2.66
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)	**200.72**	**259.94**	**204.44**	**276.96**	**942.06**	**13.84**	**16.00**	**14.98**	**14.31**	**59.16**

(1) CO_2 emissions of Biomass are not included in Total.

Table 40: 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	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	**47.52**	**43.93**	**0.06**	**17.65**	**109.16**	**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		26.29		9.46	35.75		2.73		0.87	3.60
113A	Peat				0.00	0.00				0.00	0.00

		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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
304A	Coke Oven Gas		6.53			6.53		0.62			0.62
	Total Liquid	**52.92**	**45.47**	**214.65**	**132.32**	**445.36**	**3.74**	**3.45**	**15.80**	**9.91**	**32.94**
110A	Petrol Coke	2.13	0.32			2.44	0.21	0.03			0.25
203B	Light Fuel Oil	1.88	11.84		22.22	35.93	0.15	0.92		1.71	2.78
203C	Medium Fuel Oil	0.34	0.00		1.66	2.00	0.03	0.00		0.13	0.16
203D	Heavy Fuel Oil	19.40	16.03		0.25	35.69	1.54	1.25		0.02	2.81
204A	Gasoil	0.06	0.49		83.18	83.74	0.00	0.04		6.24	6.28
2050	Diesel	0.14	13.59	120.24	19.00	152.97	0.01	1.01	8.87	1.41	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	93.03	1.66	94.78		0.01	6.86	0.12	7.00
224A	Other Petroleum Products	11.02				11.02	0.86				0.86
303A	Liquified Petroleum Gas (LPG)	0.38	3.10		3.83	7.32	0.02	0.20		0.25	0.47
308A	Refinery Gas	17.57				17.57	0.91				0.91
301A	**Total Gaseous** (Natural Gas)	**91.60**	**104.96**	**4.22**	**73.93**	**274.71**	**5.07**	**5.81**	**0.23**	**4.10**	**15.22**
	Total Other Fuel	**4.77**	**6.35**		**2.90**	**14.01**	**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)	**6.14**	**32.78**		**76.05**	**114.97**	**(0.68)**	**(3.6)**		**(7.64)**	**(11.92)**
111A	Fuel Wood	0.04	0.74		72.50	73.29	0.00	0.07		7.25	7.33
116A	Wood Wastes	5.30	10.59		2.87	18.76	0.58	1.16		0.32	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)	**202.95**	**233.49**	**218.92**	**302.85**	**958.21**	**13.74**	**14.21**	**16.04**	**15.97**	**59.99**

(1) CO_2 emissions of Biomass are not included in Total.

Table 41: 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**	**44.32**	**0.06**	**18.57**	**108.45**	**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		28.01		10.30	38.31		2.91		0.95	3.86
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		6.31			6.31		0.60			0.60
	Total Liquid	**51.92**	**48.15**	**193.32**	**115.74**	**409.14**	**3.73**	**3.67**	**14.23**	**8.66**	**30.32**
110A	Petrol Coke	1.87	0.36			2.23	0.19	0.04			0.22
203B	Light Fuel Oil	1.39	10.98		18.51	30.87	0.11	0.86		1.43	2.39
203C	Medium Fuel Oil	0.11	0.00		2.31	2.43	0.01	0.00		0.18	0.19
203D	Heavy Fuel Oil	23.30	19.63		0.46	43.38	1.85	1.53		0.04	3.42
204A	Gasoil	0.09	0.20		70.50	70.80	0.01	0.02		5.29	5.31
2050	Diesel	0.28	14.02	91.54	17.38	123.22	0.02	1.04	6.75	1.29	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	100.57	1.65	102.32		0.01	7.42	0.12	7.55
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
301A	**Total Gaseous** (Natural Gas)	**75.64**	**99.66**	**4.09**	**74.38**	**253.77**	**4.19**	**5.52**	**0.23**	**4.12**	**14.06**
	Total Other Fuel	**3.91**	**5.59**		**1.42**	**10.92**	**0.19**	**0.50**		**0.15**	**0.84**
114B	Municipal Waste	3.91				3.91	0.19				0.19
115A	Industrial Waste		5.59		1.42	7.00		0.50		0.15	0.65
	Total Biomass[(1)]	**4.37**	**33.86**		**69.63**	**107.86**	**(0.48)**	**(3.71)**		**(7)**	**(11.19)**
111A	Fuel Wood		1.07		66.28	67.35		0.11		6.63	6.74
116A	Wood Wastes	3.60	11.24		2.69	17.54	0.40	1.24		0.30	1.93
118A	Sewage Sludge	0.73				0.73	0.08				0.08

	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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
215A Black Liquor		21.39			21.39		2.35			2.35
309A Biogas		0.04			0.04		0.00			0.00
309B Sewage Sludge Gas	0.01			0.61	0.62	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)	**181.33**	**231.58**	**197.48**	**279.75**	**890.13**	**12.64**	**14.15**	**14.46**	**14.67**	**55.95**

(1) CO_2 emissions of Biomass are not included in Total.

Table 42: 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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
Total Solid	**32.97**	**42.25**	**0.06**	**19.73**	**95.01**	**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		25.29		11.20	36.48		2.63		1.03	3.66
113A Peat				0.00	0.00				0.00	0.00
304A Coke Oven Gas		7.91			7.91		0.75			0.75
Total Liquid	**59.12**	**51.03**	**188.33**	**108.24**	**406.72**	**4.23**	**3.89**	**13.86**	**8.09**	**30.11**
110A Petrol Coke	1.79	0.36			2.16	0.18	0.04			0.22
203B Light Fuel Oil	1.88	10.77		14.98	27.64	0.15	0.84		1.15	2.14
203C Medium Fuel Oil	0.09	0.00		2.86	2.95	0.01	0.00		0.22	0.23
203D Heavy Fuel Oil	27.62	22.35		0.37	50.34	2.20	1.74		0.03	3.97
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	1.38	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	104.16	1.66	105.92		0.01	7.68	0.12	7.81

		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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
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
301A	**Total Gaseous** (Natural Gas)	**70.73**	**96.54**	**3.78**	**62.92**	**233.97**	**3.92**	**5.35**	**0.21**	**3.49**	**12.96**
	Total Other Fuel	**3.82**	**5.29**		**1.41**	**10.53**	**0.19**	**0.49**		**0.15**	**0.82**
114B	Municipal Waste	3.82				3.82	0.19				0.19
115A	Industrial Waste		5.29		1.41	6.70		0.49		0.15	0.63
	Total Biomass(1)	**3.71**	**33.13**		**64.53**	**101.37**	**(0.41)**	**(3.64)**		**(6.48)**	**(10.53)**
111A	Fuel Wood		0.90		61.49	62.39		0.09		6.15	6.24
116A	Wood Wastes	2.97	12.62		2.32	17.91	0.33	1.39		0.25	1.97
118A	Sewage Sludge	0.74				0.74	0.08				0.08
215A	Black Liquor		19.61			19.61		2.16			2.16
309A	Biogas										
309B	Sewage Sludge Gas				0.64	0.64				0.07	0.07
310A	Landfill Gas				0.09	0.09				0.01	0.01
	Total(1)	**170.36**	**228.25**	**192.17**	**256.82**	**847.60**	**11.61**	**13.96**	**14.08**	**13.57**	**53.27**

(1) CO_2 emissions of Biomass are not included in Total.

Table 43: 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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
	Total Solid	**30.81**	**43.28**	**0.06**	**22.10**	**96.24**	**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		23.69		12.71	36.40		2.46		1.17	3.63
113A	Peat				0.00	0.00				0.00	0.00

		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
304A	Coke Oven Gas		8.41			8.41		0.80			0.80
	Total Liquid	**59.10**	**51.55**	**188.78**	**115.20**	**414.64**	**4.24**	**3.95**	**13.90**	**8.62**	**30.74**
110A	Petrol Coke	2.22	0.78			3.01	0.22	0.08			0.30
203B	Light Fuel Oil	2.22	12.55		18.48	33.25	0.17	0.98		1.42	2.57
203C	Medium Fuel Oil	0.39	0.04		3.50	3.92	0.03	0.00		0.27	0.31
203D	Heavy Fuel Oil	28.19	21.36		0.42	49.97	2.23	1.67		0.03	3.93
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	1.30	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	108.06	1.63	109.79		0.01	7.97	0.12	8.10
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
301A	**Total Gaseous** (Natural Gas)	**69.37**	**78.04**	**3.87**	**71.45**	**222.73**	**3.84**	**4.32**	**0.21**	**3.96**	**12.34**
	Total Other Fuel	**3.76**	**4.83**		**1.19**	**9.77**	**0.18**	**0.37**		**0.12**	**0.67**
114B	Municipal Waste	3.76				3.76	0.18				0.18
115A	Industrial Waste		4.83		1.19	6.02		0.37		0.12	0.49
	Total Biomass(1)	**3.52**	**32.12**		**69.53**	**105.16**	**(0.39)**	**(3.52)**		**(6.99)**	**(10.9)**
111A	Fuel Wood		0.80		66.37	67.18		0.08		6.64	6.72
116A	Wood Wastes	2.74	12.77		2.45	17.96	0.30	1.40		0.27	1.98
118A	Sewage Sludge	0.77				0.77	0.09				0.09
215A	Black Liquor		18.54			18.54		2.04			2.04
309A	Biogas										
309B	Sewage Sludge Gas				0.63	0.63				0.07	0.07
310A	Landfill Gas				0.08	0.08				0.01	0.01
	Total(1)	**166.56**	**209.82**	**192.71**	**279.47**	**848.56**	**11.36**	**12.96**	**14.12**	**14.78**	**53.25**

(1) CO_2 emissions of Biomass are not included in Total.

Table 44: 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**	**41.47**	**0.07**	**26.69**	**108.20**	**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		22.92		17.22	40.14		2.38		1.58	3.97
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		5.71			5.71		0.54			0.54
	Total Liquid	**48.41**	**45.52**	**183.87**	**115.99**	**393.79**	**3.40**	**3.48**	**13.71**	**8.70**	**29.33**
110A	Petrol Coke	2.30	0.93			3.23	0.23	0.09			0.33
203B	Light Fuel Oil	1.88	8.12		25.53	35.53	0.15	0.63		1.97	2.75
203C	Medium Fuel Oil	0.12	0.07		3.68	3.87	0.01	0.01		0.29	0.30
203D	Heavy Fuel Oil	19.86	19.51		1.13	40.50	1.57	1.52		0.09	3.18
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	5.36	1.29	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	110.29	1.60	111.98		0.01	8.31	0.12	8.43
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	0.85				0.85
301A	**Total Gaseous** (Natural Gas)	**67.46**	**79.21**	**3.97**	**62.98**	**213.62**	**3.74**	**4.39**	**0.22**	**3.49**	**11.83**
	Total Other Fuel	**3.48**	**6.46**		**2.06**	**12.01**	**0.17**	**0.57**		**0.22**	**0.96**
114B	Municipal Waste	3.48				3.48	0.17				0.17
115A	Industrial Waste		6.46		2.06	8.53		0.57		0.22	0.79
	Total Biomass[(1)]	**3.40**	**29.18**		**67.47**	**100.05**	**(0.37)**	**(3.2)**		**(6.77)**	**(10.35)**
111A	Fuel Wood		0.71		65.28	65.98		0.07		6.53	6.60
116A	Wood Wastes	2.74	10.40		2.19	15.34	0.30	1.14		0.24	1.69
118A	Sewage Sludge	0.66				0.66	0.07				0.07

	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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
215A Black Liquor		18.07			18.07		1.99			1.99
309A Biogas										
309B Sewage Sludge Gas										
310A Landfill Gas										
Total(1)	**162.72**	**201.84**	**187.91**	**275.20**	**827.66**	**11.32**	**12.58**	**13.94**	**14.91**	**52.79**

(1) CO_2 emissions of Biomass are not included in Total.

Table 45: 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	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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
Total Solid	**67.34**	**47.48**	**0.06**	**31.15**	**146.04**	**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		28.15		18.36	46.51		2.93		1.69	4.62
113A Peat				0.00	0.00				0.00	0.00
304A Coke Oven Gas		7.59			7.59		0.72			0.72
Total Liquid	**48.53**	**54.94**	**184.53**	**122.15**	**410.15**	**3.41**	**4.20**	**13.76**	**9.18**	**30.60**
110A Petrol Coke	2.20	1.02			3.22	0.22	0.10			0.32
203B Light Fuel Oil	2.08	10.60		27.90	40.58	0.16	0.83		2.15	3.14
203C Medium Fuel Oil	0.06	0.02		4.81	4.88	0.00	0.00		0.37	0.38
203D Heavy Fuel Oil	19.88	25.31		0.79	45.98	1.57	1.97		0.06	3.60
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	99.08	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

		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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
2080	Motor Gasoline		0.09	115.37	1.58	117.04		0.01	8.69	0.12	8.81
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
301A	**Total Gaseous** (Natural Gas)	**73.75**	**77.42**	**4.07**	**57.24**	**212.48**	**4.09**	**4.29**	**0.23**	**3.17**	**11.77**
	Total Other Fuel	**2.90**	**5.30**		**1.87**	**10.08**	**0.14**	**0.47**		**0.20**	**0.81**
114B	Municipal Waste	2.90				2.90	0.14				0.14
115A	Industrial Waste		5.30		1.87	7.18		0.47		0.20	0.66
	Total Biomass(1)	**3.02**	**28.46**		**71.36**	**102.84**	**(0.33)**	**(3.12)**		**(7.16)**	**(10.61)**
111A	Fuel Wood		0.73		69.23	69.96		0.07		6.92	7.00
116A	Wood Wastes	2.36	9.98		2.14	14.48	0.26	1.10		0.23	1.59
118A	Sewage Sludge	0.66				0.66	0.07				0.07
215A	Black Liquor		17.74			17.74		1.95			1.95
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**195.54**	**213.61**	**188.66**	**283.78**	**881.58**	**14.46**	**13.72**	**13.99**	**15.48**	**57.69**

(1) CO_2 emissions of Biomass are not included in Total.

Table 46: 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	Transpo rt	Other Sectors	Total	Energy Ind.	Industry	Transpo rt	Other Sectors	Total
	Total Solid	**61.40**	**50.08**	**0.07**	**28.14**	**139.68**	**6.25**	**5.01**	**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		29.07		16.04	45.11		3.02		1.48	4.50

		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
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		10.42			10.42		0.99			0.99
	Total Liquid	**46.45**	**49.33**	**163.28**	**118.79**	**377.83**	**3.19**	**3.78**	**12.17**	**8.95**	**28.12**
110A	Petrol Coke	1.95	0.98			2.92	0.20	0.10			0.29
203B	Light Fuel Oil	1.61	9.83		35.16	46.60	0.13	0.77		2.71	3.60
203C	Medium Fuel Oil	0.29	0.01		4.47	4.77	0.02	0.00		0.35	0.37
203D	Heavy Fuel Oil	16.97	21.71		1.63	40.32	1.34	1.69		0.13	3.16
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	105.29	1.63	107.01		0.01	7.92	0.12	8.05
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	0.95				0.95
301A	**Total Gaseous** (Natural Gas)	**74.10**	**77.40**	**4.05**	**46.05**	**201.60**	**4.10**	**4.29**	**0.22**	**2.55**	**11.17**
	Total Other Fuel	**2.41**	**4.28**		**2.29**	**8.99**	**0.12**	**0.37**		**0.24**	**0.73**
114B	Municipal Waste	2.41				2.41	0.12				0.12
115A	Industrial Waste		4.28		2.29	6.58		0.37		0.24	0.61
	Total Biomass(1)	**2.04**	**28.11**		**64.22**	**94.38**	**(0.22)**	**(3.09)**		**(6.44)**	**(9.75)**
111A	Fuel Wood		0.66		62.46	63.12		0.07		6.25	6.31
116A	Wood Wastes	1.38	9.65		1.77	12.80	0.15	1.06		0.19	1.41
118A	Sewage Sludge	0.66				0.66	0.07				0.07
215A	Black Liquor		17.80			17.80		1.96			1.96
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**186.40**	**209.20**	**167.40**	**259.49**	**822.48**	**13.66**	**13.45**	**12.40**	**14.39**	**53.94**

(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 2005] (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. For the following fuel types the energy statistics does not give detailed data:

- Ethane and Naphta is included in Refinery Feedstocks.
- Anthracite is included in Other Bituminous Coal.
- 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 2005]. 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 presents the calculation results for each fuel type of the Reference Approach.

Table 1: Actual CO_2 emissions (Gg CO_2)

Fuel Type	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Crude Oil	24 681	27 102	26 450	27 615	26 751	27 168	29 094	28 522	26 802	25 573	27 308	27 771	27 371	26 201
Orimulsion	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Liquids	116	113	113	133	121	150	122	637	199	302	154	149	261	249
Gasoline	-240	664	709	-184	386	-235	-933	-90	-278	514	225	672	1 217	1 294
Jet Kerosene	-843	-1 081	-1 087	-1 076	-1 206	-1 379	-1 464	-1 536	-1 445	-1 550	-1 245	-1 374	-1 126	-1 101
Other Kerosene	-44	-62	45	-33	-7	21	31	47	48	16	-1	10	11	9
Shale Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas / Diesel Oil	1 815	1 983	1 936	1 903	3 719	6 143	4 404	6 165	6 599	6 916	8 237	9 471	12 198	13 018
Residuel Fuel Oil	995	378	1 328	1 502	1 212	1 183	1 222	1 893	922	1 097	1 079	242	865	375
LPG	252	331	218	407	373	409	259	341	389	405	422	434	373	349
Ethane	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naphtha	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bitumen	-863	-1 220	-912	-998	-815	-838	-960	-950	-1 046	-1 100	-1 291	-1 336	-1 276	-1 391
Lubricants	148	96	61	54	-85	-165	-172	-158	-156	-166	-183	-165	-226	-204
Petroleum Coke	88	84	71	37	39	30	46	61	108	74	61	203	210	307
Refinery Feedstocks	3 031	2 843	3 262	2 418	1 643	2 366	2 589	1 719	2 592	1 600	1 870	1 513	620	1 171
OtherOil	-566	-1 165	-1 090	-1 427	-1 216	-1 468	-1 376	-1 534	-1 574	-1 384	-1 710	-1 753	-1 727	-1 841
Liquid Fossil Totals	**28 569**	**30 068**	**31 105**	**30 350**	**30 915**	**33 385**	**32 862**	**35 117**	**33 160**	**32 295**	**34 927**	**35 837**	**38 770**	**38 436**
Anthracite	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fuel Type	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Coking Coal	5 926	5 037	4 731	4 839	4 766	5 301	5 313	5 500	5 560	4 658	4 720	4 681	4 692	4 726
Other Bit. Coal	4 727	3 857	3 022	3 081	3 849	4 414	5 084	4 035	3 385	4 795	5 336	5 020	6 298	6 093
Sub- Bit. Coal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lignite	2 705	1 577	1 454	1 342	1 885	1 752	1 423	936	1 696	1 471	1 767	1 683	1 780	1 328
Oil Shale	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peat	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB & Patent Fuel	548	452	388	358	308	299	250	192	197	197	195	118	132	107
Coke Oven / Gas Coke	2 008	2 029	2 054	2 188	2 687	1 898	2 376	1 970	1 839	3 118	2 746	3 546	3 374	3 154
Solid Fuel Totals	**15 914**	**12 953**	**11 649**	**11 808**	**13 496**	**13 665**	**14 446**	**12 634**	**12 678**	**14 240**	**14 763**	**15 048**	**16 277**	**15 408**
Gaseous Fossil	12 238	12 705	13 399	13 782	15 048	16 017	15 437	15 848	16 125	15 388	16 309	16 494	17 833	17 988
TOTAL	**56 722**	**55 725**	**56 154**	**55 941**	**59 459**	**63 067**	**62 745**	**63 599**	**61 963**	**61 924**	**65 999**	**67 379**	**72 881**	**71 832**
Biomass Total	**9 105**	**9 653**	**10 155**	**9 789**	**10 416**	**11 104**	**11 124**	**10 589**	**11 757**	**10 977**	**12 161**	**11 737**	**13 172**	**13 231**
Solid Biomass	9 105	9 653	10 078	9 710	10 324	10 994	10 987	10 451	11 585	10 805	11 962	11 587	12 999	13 026
Liquid Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Biomass	0	0	77	79	92	110	137	138	172	172	199	150	173	205

Table 2 presents the apparent fuel consumption for each fuel type of the Reference Approach.

Table 2: Apparent Consumption (TJ)

Fuel Type	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Crude Oil	339 954	373 311	364 329	380 375	368 466	374 218	400 742	392 864	369 171	352 242	376 144	382 524	377 005	360 896
Orimulsion	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Liquids	1 854	1 809	1 809	2 125	1 944	2 400	1 961	10 206	3 194	4 842	2 473	2 394	4 182	3 987
Gasoline	-3 341	9 679	10 332	-2 684	5 621	-3 419	-13 593	-1 311	-4 059	7 489	3 275	9 798	17 738	18 863
Jet Kerosene	-11 906	-15 270	-15 351	-15 207	-17 043	-19 483	-20 686	-21 705	-20 411	-21 904	-17 584	-19 415	-15 913	-15 553
Other Kerosene	-623	-870	633	-461	-105	290	440	666	674	218	-14	137	154	133
Shale Oil	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas / Diesel Oil	24 755	27 038	26 399	25 959	50 721	83 770	60 058	84 070	90 000	94 318	112 339	129 157	166 359	177 541
Residuel Fuel Oil	12 990	4 941	17 342	19 611	15 825	15 450	15 949	24 720	12 033	14 316	14 090	3 158	11 291	4 892
LPG	4 029	5 306	3 486	6 517	5 974	6 545	4 147	5 464	6 224	6 486	6 763	6 956	6 025	5 682
Ethane	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Naphtha	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bitumen	10 811	2 452	5 064	5 426	7 475	9 324	9 766	11 092	9 407	9 798	8 685	7 412	8 668	8 554

Fuel Type	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Lubricants	5 313	3 738	2 693	2 532	563	-161	-201	-40	-82	-111	-355	-538	-1 270	-1 308
Petroleum Coke	883	837	709	366	393	304	462	607	1 083	743	609	2 031	2 108	3 074
Refinery Feedstocks	41 754	39 162	44 933	33 308	22 633	32 591	35 661	23 678	35 705	22 032	25 762	20 836	8 536	16 132
OtherOil	6 406	5 142	3 190	-733	-299	-774	5 581	-665	-706	374	-2 363	-3 000	-2 397	-2 806
Liquid Fossil Totals	**432 880**	**457 275**	**465 569**	**457 132**	**462 169**	**501 056**	**500 287**	**529 646**	**502 234**	**490 844**	**529 825**	**541 449**	**582 487**	**580 087**
Anthracite	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coking Coal	65 423	55 855	52 568	53 834	53 427	58 604	59 096	60 811	61 358	52 579	52 969	53 149	53 140	53 337
Other Bit. Coal	51 016	41 633	32 626	33 254	41 541	47 629	54 857	43 542	36 531	51 740	57 575	54 165	67 951	65 741
Sub- Bit. Coal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lignite	27 278	15 906	14 663	13 532	19 004	17 671	14 347	9 441	17 101	14 834	17 816	16 968	17 952	13 387
Oil Shale	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peat	4	4	4	4	4	4	4	4	4	4	4	4	4	4
BKB & Patent Fuel	5 912	4 872	4 185	3 858	3 323	3 221	2 694	2 066	2 126	2 127	2 099	1 277	1 422	1 153
Coke Oven / Gas Coke	19 100	19 290	19 534	20 818	25 549	18 090	22 623	18 769	17 540	29 618	26 103	33 668	32 043	29 942
Solid Fuel Totals	**168 733**	**137 560**	**123 581**	**125 301**	**142 849**	**145 218**	**153 621**	**134 632**	**134 660**	**150 904**	**156 567**	**159 232**	**172 512**	**163 565**
Gaseous Fossil	219 239	227 610	240 044	246 908	269 583	286 941	276 551	283 920	288 876	275 681	292 169	295 485	319 481	322 260
TOTAL	**820 853**	**822 445**	**829 194**	**829 341**	**874 601**	**933 215**	**930 460**	**948 198**	**925 769**	**917 429**	**978 560**	**996 166**	**1 074 480**	**1 065 912**
Biomass Total	**94 376**	**100 050**	**105 164**	**101 375**	**107 860**	**114 968**	**115 145**	**109 595**	**121 667**	**113 585**	**125 823**	**121 487**	**136 328**	**136 906**
Solid Biomass	94 376	100 050	104 456	100 649	107 011	113 954	113 882	108 326	120 079	112 000	123 987	120 103	134 733	135 018
Liquid Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Biomass	0	0	708	726	849	1 014	1 263	1 269	1 588	1 585	1 836	1 384	1 595	1 887

Table 3 presents the carbon stored for each fuel type of the Reference Approach.

Table 3: Carbon Stored (Gg C)

Fuel Type	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Crude Oil	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
Orimulsion	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
Natural Gas 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
Gasoline	2.9	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
Jet Kerosene	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
Other Kerosene	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

Fuel Type	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Shale Oil	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 / Diesel Oil	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
Residuel Fuel Oil	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
LPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.6
Ethane	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
Naphtha	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
Bitumen	475.7	389.9	362.5	394.3	389.0	435.9	479.2	505.8	495.1	518.7	546.7	531.0	542.3	571.4
Lubricants	65.6	48.2	37.0	35.8	34.6	42.2	43.4	42.6	41.4	43.4	43.3	34.7	36.9	30.2
Petroleum Coke	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
Refinery Feedstocks	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
OtherOil	283.9	423.7	364.0	378.5	329.0	389.0	490.8	409.3	419.5	388.7	423.9	422.9	427.9	451.1
Liquid Fossil Totals	**828.2**	**861.8**	**763.5**	**808.6**	**752.6**	**867.1**	**1 013.4**	**957.7**	**956.0**	**950.8**	**1 013.9**	**988.6**	**1 007.9**	**1 054.3**
Anthracite	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
Coking Coal	38.8	39.2	39.7	42.3	52.0	36.8	46.0	38.2	35.7	60.2	53.1	68.5	65.2	60.9
Other Bit. Coal	0.6	0.7	0.6	0.4	0.5	0.4	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.5
Sub- Bit. Coal	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
Lignite	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 Shale	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
Peat	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
BKB & Patent Fuel	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 Oven / Gas Coke	4.8	4.4	4.8	5.2	5.9	5.4	6.2	5.5	5.5	6.0	6.0	6.5	6.2	5.6
Solid Fuel Totals	**44.2**	**44.4**	**45.1**	**47.9**	**58.4**	**42.6**	**52.7**	**44.1**	**41.6**	**66.7**	**59.5**	**75.5**	**71.9**	**67.0**
Gaseous Fossil	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	**872.4**	**906.2**	**808.6**	**856.5**	**811.0**	**909.7**	**1 066.1**	**1 001.7**	**997.6**	**1 017.5**	**1 073.4**	**1 064.2**	**1 079.8**	**1 121.3**
Biomass Total	**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**
Solid Biomass	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
Liquid Biomass	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 Biomass	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

Table 4 presents international bunker fuels for the relevant fuel types of the Reference Approach.

Table 4: International Bunkers [Gg fuel]

Fuel Type	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Jet Kerosene	275	334	354	368	409	453	471	488	475	516	434	470	402	472

Table 5 presents 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/t] [TJ/1000 m3]	Carbon emission factor [t C/TJ]	Fraction ob 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	-	-	-
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	-	-	-
Coking Coal	28.00	25.80	0.98
Other Bit. Coal	28.00	25.80	0.98
Sub- Bit. Coal	-	-	-
Lignite	10.90	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	1.00	15.30	1.00
Solid Biomass	1.00	29.90	0.88
Liquid Biomass	-	-	-
Gas Biomass	1.00	29.90	0.99

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 2005.

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 1990-2004. Coking Coal [1000 tons].

101A Coking Coal	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	2 376	2 120	1 766	1 919	1 778	2 013	2 167	2 089	2 146	1 738	1 861	1 864	1 858	1 789
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	-125	111	4	130	80	-57	83	45	139	30	34	40	115
Gross Inland Deliveries (Obs.)	2 337	1 995	1 877	1 923	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898	1 898	1 905
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 337	1 995	1 877	1 923	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898	1 898	1 905
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	1 995	1 877	1 923	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898	1 898	1 905
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

101A Coking Coal	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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 1990-2004. Bituminous Coal & Anthracite [1000 tons].

102A Bitominous Coal & Anthracite	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	0	1	1	1	1	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	1 233	1 692	1 422	1 096	1 216	1 724	1 616	1 653	1 211	1 672	1 862	2 167	2 101	2 589
Total Exports (Balance)	0	9	0	0	1	2	4	0	0	0	0	0	0	21
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	589	-197	-257	91	268	-21	348	-97	94	176	194	-233	326	-220
Gross Inland Deliveries (Obs.)	1 822	1 487	1 165	1 188	1 484	1 701	1 959	1 555	1 305	1 848	2 056	1 934	2 427	2 348
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1 421	1 075	746	822	1 082	1 238	1 437	1 061	915	1 422	1 684	1 618	2 136	2 147
Public Electricity	964	647	394	485	550	1 069	1 275	890	740	1 203	1 390	1 373	1 908	1 908
Public Combined Heat and Power	409	352	318	327	518	128	127	127	140	161	244	194	177	193

102A Bitominous Coal & Anthracite	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	6	0	0	0
Auto Producers of Electricity	0	0	0	0	0	19	5	4	4	10	13	11	13	4
Auto Producers for CHP	48	76	34	10	14	22	31	40	32	48	31	39	38	42
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	7	33	2	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	7	33	2	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	410	417	365	400	462	521	493	381	392	369	315	289	200
Total Transport	3	1	0	0	0	1	1	1	1	1	1	1	1	0
Rail	3	1	0	0	0	1	1	1	1	1	1	1	1	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	288	264	218	251	306	400	383	291	316	293	254	208	145
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	7	36	45	42	45	50	73	70	88	57	70	71	68	62
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	199	223	181	142	164	196	208	199	131	172	152	98	74	11
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

102A Bitominous Coal & Anthracite	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	29	38	35	43	59	118	113	72	87	70	85	66	72
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	122	153	146	148	155	120	109	89	75	75	61	80	55
Commerce - Public Services	11	11	13	10	10	12	10	11	9	6	5	3	19	3
Residential	177	110	139	135	137	142	108	98	80	68	70	58	61	52
Agriculture	1	1	1	1	1	1	1	1	1	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	2	1	1	1	1	1	1	1	1	2	2	1

Table 3: National Energy Balance 1990-2004. Patent Fuel [1000 tons].

104A Patent Fuel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	0	0	0	0	0	0	7	4	4	4	1	1	2	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	0	0	7	4	4	4	1	1	2	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

104A Patent Fuel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	7	4	4	4	1	1	2	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	0	0	7	4	4	4	1	1	2	1

104A Patent Fuel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Commerce - Public Services	0	0	0	0	0	0	1	1	1	1	0	0	0	0
Residential	0	0	0	0	0	0	6	3	3	3	0	1	2	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 1990-2004. Lignite and Brown Coal [1000 tons].

105A Lignite and brown coal	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	2 448	1 771	1 691	1 369	1 297	1 108	1 130	1 140	1 137	1 249	1 206	1 412	1 152	235
Total Imports (Balance)	36	22	1	19	29	43	23	13	13	34	6	5	5	23
Total Exports (Balance)	3	3	1	0	0	0	0	0	1	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	-330	-347	-146	417	470	163	-287	419	78	423	140	490	970
Gross Inland Deliveries (Obs.)	2 503	1 459	1 345	1 241	1 743	1 621	1 316	866	1 569	1 361	1 635	1 557	1 647	1 228
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 133	1 167	1 068	984	1 524	1 495	1 205	763	1 417	1 212	1 481	1 390	1 477	1 039
Public Electricity	1 182	583	301	405	1 081	1 358	1 164	738	1 372	1 168	1 418	1 316	1 393	967
Public Combined Heat and Power	881	484	668	509	339	48	13	3	9	8	30	43	52	41
Public Heat Plants	16	9	7	7	9	9	4	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	4	0	0	0	0	0	0	0	0
Auto Producers for CHP	54	91	92	63	95	76	23	22	35	35	33	31	32	31
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	1	0	1	0	0	1	0	15	2	0	1	0	0
Coal Mines	3	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

105A Lignite and brown coal	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	1	0	1	0	0	1	0	15	2	0	1	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	291	277	257	219	126	111	103	137	147	153	166	170	189
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	118	136	139	115	33	46	45	83	107	113	133	142	167
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	4	0	1	4	6	3	3	15	40	45	59	72	100
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	1	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	132	112	133	139	111	27	43	42	69	67	68	74	70	67
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	2	1	1	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	173	141	117	104	93	65	58	54	40	41	34	28	22
Commerce - Public Services	9	6	9	10	5	3	3	3	4	4	5	5	3	4
Residential	208	168	132	108	99	90	62	55	50	37	36	29	24	17
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 5: National Energy Balance 1990-2004. Brown Coal Briquettes [1000 tons].

106A BKB-PB	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	295	239	237	181	173	167	133	103	106	95	108	65	72	59
Total Exports (Balance)	0	0	0	0	1	1	0	0	0	0	0	0	0	1
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	12	13	-20	19	1	0	0	0	0	11	0	0	0	0
Gross Inland Deliveries (Obs.)	306	252	217	200	172	167	133	103	106	107	108	65	72	58
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	12	13	12	10	0	0	0	0	0	18	29	0	0	0
Public Electricity	7	6	5	5	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	18	29	0	0	0
Public Heat Plants	5	8	7	5	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	239	205	190	172	167	133	103	106	88	79	65	72	58
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0

106A BKB-PB	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	20	18	24	14	13	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	1	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	63	19	18	24	14	13	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	219	187	166	158	154	132	103	106	88	79	65	72	58
Commerce - Public Services	8	9	8	11	6	6	20	11	11	13	5	4	6	1
Residential	214	202	172	149	146	142	108	88	91	72	71	59	63	55
Agriculture	8	8	7	6	6	6	5	4	4	3	3	3	3	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 1990-2004. Coke Oven Coke [1000 tons].

107A Coke Oven Coke	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	1 725	1 487	1 402	1 432	1 448	1 559	1 566	1 598	1 608	1 385	1 394	1 395	1 395	1 400
Total Imports (Balance)	815	685	580	607	718	652	764	642	654	981	1 091	1 073	1 173	1 130
Total Exports (Balance)	1	2	0	0	1	0	0	0	2	1	1	2	3	42
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-137	1	113	132	189	-10	39	24	-30	71	-164	124	-34	-27
Gross Inland Deliveries (Obs.)	2 402	2 171	2 094	2 171	2 354	2 200	2 369	2 264	2 230	2 435	2 320	2 589	2 531	2 462
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0

107A Coke Oven Coke	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total Transformation Sector	623	562	559	652	711	652	758	830	783	909	899	1 049	1 019	1 059
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	562	559	652	711	652	758	830	783	909	899	1 049	1 019	1 059
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	84	71	43	77	88	73	68	48	53	52	58	55	50
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	84	71	43	77	88	73	68	48	53	52	58	55	50
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	763	647	585	557	528	469	422	453	436	344	366	400	389
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	159	201	192	196	192	220	200	244	231	154	205	241	261
Iron and Steel	235	137	154	159	178	164	179	164	175	185	129	173	206	216
Chemical (incl.Petro-Chemical)	14	5	12	11	6	11	13	11	17	15	12	11	14	18
Non ferrous Metals	7	3	7	5	3	5	7	6	8	6	3	6	5	7
Non metallic Mineral Products	23	9	16	6	4	5	15	13	38	10	2	5	4	5

107A Coke Oven Coke	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	5	2	5	4	2	3	3	2	3	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	3	7	6	2	4	5	4	3	15	8	11	11	14
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	1	1	1	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	604	446	393	361	335	248	222	209	205	190	161	159	128
Commerce - Public Services	13	14	11	9	9	8	6	5	7	7	10	11	20	18
Residential	537	576	426	375	345	320	237	212	198	193	176	148	136	108
Agriculture	12	13	10	9	8	7	5	5	5	4	4	3	3	2
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	819	763	817	891	1 010	932	1 069	944	946	1 037	1 025	1 115	1 058	964

Table 7: National Energy Balance 1990-2004. Peat [1000 tons].

113A Peat	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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

113A Peat	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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

113A Peat	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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 1990-2004. Coke Oven Gas [TJ].

304A Coke Oven Gas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	13 117	11 164	10 636	10 790	10 906	11 419	11 605	12 166	12 220	10 466	9 776	9 579	10 931	10 971
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	11 164	10 636	10 790	10 906	11 419	11 605	12 166	12 220	10 466	9 776	9 579	10 931	10 971
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	3 385	2 885	2 960	3 490	6 228	3 545	3 270	3 087	4 005	3 794	3 984	3 092	1 871	2 499
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	2 183	2 002	2 033	2 649	3 256	3 449	2 639	1 255	2 193
Auto Producers for CHP	3 385	2 885	2 960	3 490	6 228	1 362	1 268	1 054	1 357	489	535	453	526	243
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	50	0	0	91	63
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	3 520	3 354	3 402	3 439	3 600	3 659	3 836	3 853	3 300	3 083	3 020	4 187	4 326
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0

304A Coke Oven Gas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	1 072	913	870	882	892	934	949	995	999	856	799	783	708	595
Blast Furnaces (Energy)	3 064	2 607	2 484	2 520	2 547	2 667	2 710	2 842	2 854	2 444	2 283	2 237	3 479	3 730
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	1 023	1 171	1 204
Final Consumption	5 596	4 759	4 322	3 898	1 239	4 273	4 675	5 243	4 361	3 372	2 710	2 444	3 703	2 942
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	4 759	4 322	3 898	1 239	4 273	4 675	5 243	4 361	3 372	2 710	2 444	3 703	2 942
Iron and Steel	5 596	4 759	4 322	3 898	1 239	4 273	4 675	5 243	4 361	3 372	2 710	2 444	3 703	2 942
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 1990-2004. Blast Furnace Gas [TJ].

305A Blast Furnace Gas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	4 822	4 405	5 223	5 876	6 213	6 259	7 906	7 625	6 703	6 260	6 273	8 027	7 958	9 571
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	4 493	5 447	5 320	4 530	5 257	5 404	7 240	6 784	8 881
Gross Inland Deliveries (Obs.)	4 822	4 405	5 223	5 876	6 213	1 766	2 459	2 305	2 173	1 003	869	786	1 174	690
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	9 682	8 732	9 190	10 717	11 685	10 613	12 332	13 536	13 156	15 254	15 077	17 613	17 325	16 475
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)	2 391	2 160	2 216	2 330	2 642	2 508	2 787	3 256	3 231	3 675	3 609	4 251	4 161	4 282
Patent Fuel Plants	7 291	6 572	6 973	8 387	9 044	8 105	9 545	10 280	9 924	11 579	11 468	13 363	13 164	12 194
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	1 111	653	967
Blast Furnaces (Energy)	2 590	2 274	932	1 290	1 605	846	344	1 367	2 014	3 871	3 749	2 558	2 527	2 563
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)	2 590	2 274	932	1 290	1 605	846	344	1 367	2 014	3 871	3 749	2 558	2 527	2 563

305A Blast Furnace Gas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Distribution Losses	2 590	2 274	932	1 290	1 605	846	344	1 367	2 014	3 871	3 749	2 558	2 527	2 563
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)	4 822	4 405	5 223	5 876	6 213	6 259	7 906	7 625	6 703	6 260	6 273	8 027	7 958	9 571
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	4 493	5 447	5 320	4 530	5 257	5 404	7 240	6 784	8 881
Non Specified (Others)	4 822	4 405	5 223	5 876	6 213	1 766	2 459	2 305	2 173	1 003	869	786	1 174	690
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Oil

Table 10: National Energy Balance 1990-2004. Crude Oil [1000 tons].

Crude Oil	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	1 149	1 180	1 154	1 099	1 035	992	972	959	1 003	971	957	957	1 113	971
Refinery Losses	120	179	124	60	153	75	82	156	226	122	210	121	115	170
Refinery Intake (Calculated)	7 952	8 732	8 522	8 898	8 619	8 754	9 374	9 190	8 636	8 240	8 799	8 947	8 819	8 442
Refinery Intake (Observed)	7 952	8 732	8 522	8 898	8 619	8 754	9 374	9 190	8 636	8 240	8 799	8 947	8 819	8 442
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Total Imports (Balance)	6 797	7 550	7 453	7 790	7 590	7 737	8 450	8 269	7 698	7 315	7 940	8 118	7 819	7 562
Total Exports (Balance)	0	0	0	0	0	51	25	44	51	61	63	0	0	0
Stock Change (National Territory)	6	3	-84	9	-6	75	-23	6	-14	16	-36	-128	-114	-91
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11: National Energy Balance 1990-2004. Natural Gas Liquids [1000 tons].

Natural Gas Liquids	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	41	40	40	47	43	53	55	88	60	101	55	53	92	88
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	41	40	40	47	43	53	43	226	71	107	55	53	92	88
Refinery Intake (Observed)	41	40	40	47	43	53	43	226	71	107	55	53	92	88
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	0	0	0	0	0	0	0	135	0	6	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	0	0	-12	2	10	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 1990-2004. Refinery Feedstocks [1000 tons].

Refinery Feedstocks	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	1 069	1 001	1 124	861	582	858	853	564	873	540	616	492	203	393
Refinery Intake (Observed)	1 069	1 001	1 124	861	582	858	853	564	873	540	616	492	203	393
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	1 009	902	708	915	600	916	761	746	740	627	534	593	374	222
Total Exports (Balance)	0	0	0	77	39	62	14	7	15	76	42	6	25	5

Stock Change (National Territory)	-26	19	349	-54	-28	-88	92	-182	115	-32	115	-96	-148	162

Table 13: National Energy Balance 1990-2004. Residual Fuel Oil [1000 tons].

203X; Residual Fuel Oil	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	1 913	1 821	1 678	1 472	1 502	1 441	1 540	1 347	1 308	979	1 047	1 012	978	1 031
Refinery Fuel	81	80	126	143	139	56	49	63	22	37	7	7	25	7
Total Imports (Balance)	602	376	541	456	532	386	449	671	468	262	317	241	328	306
Total Exports (Balance)	185	65	110	77	38	121	53	18	37	152	228	146	55	55
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-93	-188	1	109	-100	119	1	-38	-131	246	262	-17	8	-129
Gross Inland Deliveries (Obs.)	2 156	1 865	1 984	1 816	1 757	1 770	1 888	1 899	1 586	1 298	1 391	1 083	1 234	1 146
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	608	610	708	651	573	537	636	732	642	389	416	269	355	328
Public Electricity	28	10	102	95	88	194	313	348	271	110	79	34	104	94
Public Combined Heat and Power	253	338	408	398	316	178	151	234	281	161	191	168	203	197
Public Heat Plants	99	104	110	80	70	109	129	106	63	95	125	51	28	25
Auto Producers of Electricity	0	0	0	0	0	22	11	10	5	6	4	2	10	1
Auto Producers for CHP	227	156	87	77	97	33	31	33	20	15	16	13	8	10
Auto Producer Heat Plants	1	2	1	1	1	1	1	1	2	1	1	1	3	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	118	120	127	150	110	143	191	191	231	256	154	159	203
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	118	120	127	150	110	143	191	191	231	256	154	159	203
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

203X; Residual Fuel Oil	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Final Consumption	1 432	1 136	1 157	1 038	1 035	1 123	1 109	976	752	678	719	661	719	614
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	478	435	635	615	531	538	819	685	347	282	268	224	233	186
Iron and Steel	18	13	18	19	22	25	12	10	11	22	14	8	6	5
Chemical (incl.Petro-Chemical)	21	16	21	27	26	27	44	37	23	14	17	13	10	8
Non ferrous Metals	3	4	5	6	7	10	20	16	9	9	8	7	7	6
Non metallic Mineral Products	107	101	174	147	130	122	213	179	82	51	40	35	38	31
Transportation Equipment	12	12	17	19	17	5	6	5	5	5	6	3	4	3
Machinery	26	25	35	36	31	41	72	60	32	31	31	26	29	23
Mining and Quarrying	6	5	7	7	7	9	12	10	12	11	12	10	11	9
Food, Beverages and Tobacco	72	73	98	91	86	65	93	77	39	38	40	32	35	28
Pulp, Paper and Printing	116	108	155	153	105	91	152	128	57	40	37	30	41	33
Wood and Wood Products	14	12	16	17	20	26	45	38	19	9	4	12	13	11
Construction	30	20	26	27	21	34	48	40	17	16	12	10	12	9
Textiles and Leather	25	22	30	31	24	34	52	44	20	15	21	17	14	11
Non Specified (Industry)	28	24	32	36	35	47	48	40	23	23	27	21	13	10
Total Other Sectors	953	702	522	423	503	586	290	291	405	396	451	437	486	428
Commerce - Public Services	292	186	178	178	231	278	78	65	76	81	104	113	231	185
Residential	471	367	244	174	194	219	151	161	259	250	275	257	202	193
Agriculture	191	149	99	71	79	89	61	65	70	65	72	67	53	50
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	116	118	120	127	150	110	143	191	191	231	256	154	159	203

Table 14: National Energy Balance 1990-2004. Heating and Oher Gas Oil [1000 tons].

204A Heating and Other Gas Oil	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	1 239	1 412	1 639	1 614	1 454	1 598	1 604	1 280	1 245	1 062	1 301	1 062	1 103	928

204A Heating and Other Gas Oil	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Fuel	0	1	0	0	0	0	1	2	6	0	0	0	0	0
Total Imports (Balance)	0	0	88	18	165	376	355	577	615	533	626	734	860	805
Total Exports (Balance)	0	0	59	48	0	0	0	0	0	1	3	0	0	17
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	5	11	-65	-58	39	-17	-53	41	1	44	-41	-11	37	-25
Gross Inland Deliveries (Obs.)	1 244	1 422	1 604	1 526	1 658	1 956	1 906	1 895	1 854	1 638	1 883	1 785	1 999	1 691
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	2	2	2	1	2	3	1	0	19	3	4	4
Public Electricity	0	0	0	0	0	0	0	0	0	0	15	1	0	0
Public Combined Heat and Power	0	0	2	2	2	0	0	0	0	0	4	2	1	0
Public Heat Plants	0	0	0	0	0	1	2	2	0	0	0	0	3	4
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	1 244	1 422	1 601	1 524	1 656	1 955	1 904	1 893	1 853	1 637	1 864	1 782	1 996	1 687
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

204A Heating and Other Gas Oil	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	4	6	5	5	11	11	12	130	73	73	65	68	32
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	7	4	5	5	5	2
Non ferrous Metals	0	0	0	0	0	0	0	0	13	4	3	3	1	1
Non metallic Mineral Products	0	1	1	1	1	2	2	2	9	4	3	2	3	1
Transportation Equipment	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Machinery	0	1	2	1	1	3	3	3	22	11	11	10	11	5
Mining and Quarrying	0	0	0	0	0	1	1	1	3	2	2	2	2	1
Food, Beverages and Tobacco	0	0	1	0	1	1	1	1	30	19	20	18	21	10
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	2	1	1	1	1	1
Wood and Wood Products	0	0	0	0	0	0	0	0	5	2	2	2	1	0
Construction	0	1	1	1	1	3	3	3	25	18	17	16	16	8
Textiles and Leather	0	0	0	0	0	0	0	0	6	3	3	3	3	1
Non Specified (Industry)	0	0	0	0	0	1	1	1	8	3	3	3	3	2
Total Other Sectors	1 243	1 417	1 595	1 519	1 651	1 944	1 893	1 880	1 723	1 565	1 792	1 717	1 928	1 655
Commerce - Public Services	26	84	119	89	92	222	219	237	245	162	279	283	358	168
Residential	1 216	1 333	1 475	1 429	1 558	1 720	1 673	1 643	1 477	1 402	1 511	1 433	1 568	1 486
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 1990-2004. Diesel [1000 tons].

2050 Diesel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	1 531	1 833	1 965	2 034	1 920	2 008	2 311	2 615	2 430	2 662	2 658	2 922	2 746	2 601
Refinery Fuel	0	0	2	2	1	1	1	1	0	0	0	0	4	0
Total Imports (Balance)	576	589	609	800	937	1 777	1 159	1 898	1 877	2 075	2 433	2 728	3 491	4 078
Total Exports (Balance)	3	73	104	88	83	97	271	467	459	415	415	520	539	563
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-7	97	140	-24	112	-106	195	-108	44	-59	-8	49	-9	-179
Gross Inland Deliveries (Obs.)	2 097	2 446	2 608	2 720	2 885	3 581	3 394	3 937	3 892	4 263	4 668	5 180	5 685	5 936
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2050 Diesel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total Transformation Sector	0	0	5	5	8	4	7	1	3	1	0	0	0	0
Public Electricity	0	0	4	3	6	2	6	1	2	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	1	0	0	1	1	0	0	0	0
Auto Producers for CHP	0	0	1	1	2	1	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	2 446	2 603	2 715	2 877	3 578	3 388	3 936	3 889	4 261	4 668	5 179	5 685	5 935
Total Transport	1 533	1 804	1 927	2 016	2 140	2 692	2 542	2 977	2 879	3 238	3 560	3 970	4 373	4 573
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	1 748	1 872	1 961	2 088	2 645	2 495	2 931	2 831	3 190	3 513	3 919	4 321	4 520
Rail	54	49	48	49	45	41	41	41	42	42	41	44	44	44
Inland Waterways	7	7	7	6	6	6	6	6	6	6	7	8	8	9
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	357	387	407	440	574	539	640	686	700	776	867	960	1 006
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	3	4	4	5	5	7	6	7	8	8	9	10	11	12
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	4	5	6	6	7	9	8	10	10	10	12	13	14	15
Transportation Equipment	20	25	27	28	30	40	37	44	47	48	54	60	66	69
Machinery	1	1	1	1	1	2	2	2	2	2	2	3	3	3
Mining and Quarrying	20	25	27	29	31	41	38	45	49	50	55	61	68	71
Food, Beverages and Tobacco	1	1	2	2	2	2	2	3	3	3	3	3	4	4
Pulp, Paper and Printing	1	1	1	1	1	1	1	1	1	2	2	2	2	2
Wood and Wood Products	4	5	5	5	6	8	7	9	9	9	10	12	13	14
Construction	230	285	309	325	351	458	430	511	548	558	619	692	766	802

2050 Diesel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Textiles and Leather	3	4	4	4	5	6	6	7	7	8	8	9	10	11
Non Specified (Industry)	0	1	1	1	1	1	1	1	1	1	1	1	2	2
Total Other Sectors	275	285	289	292	297	312	307	318	323	324	332	342	352	357
Commerce - Public Services	34	42	46	48	52	68	64	76	81	83	92	103	114	119
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	241	242	243	244	245	244	243	242	242	241	240	240	239	238
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 16: National Energy Balance 1990-2004. Other Kerosene [1000 tons].

206A Other Kerosene	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	31	49	0	13	8	5	0	2	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	18	0	0	4	10	10	16	15	5	0	3	4	3
Total Exports (Balance)	21	31	9	13	6	5	2	2	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	-6	23	2	0	1	2	1	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	18	30	14	2	6	12	10	17	16	6	1	4	5	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

206A Other Kerosene	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	30	14	2	6	12	10	17	16	6	1	4	5	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	1	0	0	0	0	0	0	3	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	1	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	2	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	1	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	29	14	2	6	12	10	17	13	6	1	4	4	4
Commerce - Public Services	18	29	14	2	6	12	10	17	13	6	1	4	4	4
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

206A Other Kerosene	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 17: National Energy Balance 1990-2004. Kerosene Type Jet Fuel [1000 tons].

206B Kerosene Type Jet Fuel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	291	371	377	376	420	479	508	540	508	544	513	484	446	455
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	13	9	10	27	23	24	12	9	21	35	37	38	47	132
Total Exports (Balance)	5	10	1	0	0	0	0	6	5	5	1	1	5	4
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	-7	1	0	4	-8	-4	-2	2	-4	4	-3	4	-4
Gross Inland Deliveries (Obs.)	299	363	386	403	447	495	515	541	525	569	553	519	491	578
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

206B Kerosene Type Jet Fuel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	299	363	386	403	447	495	515	541	525	569	553	519	491	578
Total Transport	299	363	386	403	447	495	515	541	525	569	553	519	491	578
International Civil Aviation	269	335	363	378	425	466	493	511	489	537	447	484	414	486
Domestic Air Transport	30	28	24	25	22	29	22	30	36	32	106	34	77	92
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	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004

207A Gasoline Type Jet Fuel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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)	2	3	3	3	4	2	3	3	3	3	4	4	5	7
Total Exports (Balance)	0	0	0	0	0	1	1	0	1	1	1	2	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	0	0	-2	1	0	0	0	0	-1	0	1	-1
Gross Inland Deliveries (Obs.)	3	3	3	3	2	2	2	3	3	2	2	2	3	2
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	3	3	2	2	2	3	3	2	2	2	3	2
Total Transport	3	3	3	3	2	2	2	3	3	2	2	2	3	2
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	3	3	3	3	2	2	2	3	3	2	2	2	3	2

207A Gasoline Type Jet Fuel	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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 1990-2004. Motor Gasoline [1000 tons].

2080 Motor Gasoline	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	2 631	2 462	2 340	2 541	2 271	2 297	2 410	2 232	2 141	1 815	1 922	1 927	1 799	1 715
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	257	506	541	583	698	612	547	759	762	670	603	706	879	1 043
Total Exports (Balance)	281	214	311	640	596	700	831	824	824	472	582	496	474	614
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2080 Motor Gasoline	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Stock Change (National Territory)	-54	-79	-2	-6	20	10	-23	33	-31	-33	50	7	-12	-11
Gross Inland Deliveries (Obs.)	2 553	2 675	2 568	2 478	2 395	2 219	2 104	2 200	2 047	1 980	1 994	2 144	2 192	2 133
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	2 675	2 568	2 478	2 395	2 219	2 104	2 200	2 047	1 980	1 994	2 144	2 192	2 133
Total Transport	2 457	2 585	2 482	2 395	2 312	2 144	2 033	2 128	1 976	1 911	1 925	2 067	2 115	2 080
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	2 585	2 482	2 395	2 312	2 144	2 033	2 128	1 976	1 911	1 925	2 067	2 115	2 080
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

2080 Motor Gasoline	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total Industry	93	86	83	80	79	72	68	68	68	66	66	73	73	51
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	7	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	70	70	67	64	64	58	55	55	55	54	54	59	59	40
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	12	12	11	11	10	10	10	10	9	10	10	11	8
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	4	4	3	3	3	3	3	3	3	3	3	2
Commerce - Public Services	4	4	4	4	3	3	3	3	3	3	3	3	3	2
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	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 20: National Energy Balance 1990-2004. Lubricants [1000 tons].

219A Lubricants	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	31	27	25	26	73	109	113	107	105	111	117	100	123	108
Refinery Fuel	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	177	115	98	105	51	50	51	53	52	57	51	47	44	43
Total Exports (Balance)	32	48	35	34	41	49	57	53	51	58	65	62	80	70
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-13	26	4	-8	4	-5	1	-1	-3	-1	5	2	4	-6
Gross Inland Deliveries (Obs.)	163	120	92	89	86	105	108	106	103	108	108	86	92	75
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

219A Lubricants	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	18	13	10	10	9	11	12	12	11	12	12	9	10	8
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	1	1	1	0	0	1	1	1	1	1	1	0	1	0
Coke Ovens (Energy)	5	4	3	3	3	3	4	3	3	4	4	3	3	2
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)	10	7	6	5	5	6	7	6	6	6	6	5	6	4
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	145	107	82	79	77	94	96	94	92	96	96	77	82	67
Total Transport	67	49	38	36	35	43	44	43	42	44	44	36	38	31
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	66	48	37	35	34	42	43	42	41	43	43	35	37	30
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	1	1	1	1	1	1	1	0
Total Industry	75	55	42	41	40	48	50	49	48	50	50	40	42	35
Iron and Steel	14	10	8	8	7	9	9	9	9	9	9	7	7	7
Chemical (incl.Petro-Chemical)	6	5	4	3	3	4	4	4	4	4	4	3	4	3
Non ferrous Metals	2	2	1	1	1	1	2	1	1	2	2	1	1	1
Non metallic Mineral Products	10	7	6	5	5	6	7	6	6	7	7	5	6	5

219A Lubricants	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Transportation Equipment	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Machinery	3	2	2	2	2	2	2	2	2	2	4	3	3	3
Mining and Quarrying	3	2	2	2	2	2	2	2	2	2	2	2	2	1
Food, Beverages and Tobacco	10	8	6	6	5	7	7	7	7	7	7	5	6	5
Pulp, Paper and Printing	8	6	5	4	4	5	5	5	5	5	5	4	5	4
Wood and Wood Products	3	2	1	1	1	2	2	2	2	2	2	1	1	1
Construction	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Textiles and Leather	4	3	2	2	2	3	3	3	3	3	3	2	2	2
Non Specified (Industry)	8	6	5	5	4	5	6	5	5	6	4	3	3	2
Total Other Sectors	3	2	2	2	2	2	2	2	2	2	2	2	2	1
Commerce - Public Services	3	2	2	2	2	2	2	2	2	2	2	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	163	120	92	89	86	105	108	106	103	108	108	86	92	75

Table 21: National Energy Balance 1990-2004. White Spirit [1000 tons].

220A White Spirit	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	0	8	7	7	5	5	0	0	0	0	0	0	0	18
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	11	8	8	6	8	8	11	12	12	7	6	9	11	10
Total Exports (Balance)	0	3	1	0	0	1	1	1	0	0	0	1	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	1	0	1	-1	0	1	0	1	1	0	0	0	-18
Gross Inland Deliveries (Obs.)	11	14	14	14	12	12	11	11	13	7	6	8	10	10
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

220A White Spirit	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	14	14	12	12	11	11	13	7	6	8	10	10
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	14	14	12	12	11	11	13	7	6	8	10	10
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	11	10	10	10	10	9	8	5	4	3	3	5	4	4
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	4	4	4	2	3	3	6	8	3	4	4	6	6
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

220A White Spirit	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	1	1	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	14	14	12	12	11	11	13	7	6	8	10	10

Table 22: National Energy Balance 1990-2004. Bitumen [1000 tons].

222A Bitumen	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	269	380	284	311	254	263	299	300	326	343	402	416	398	433
Refinery Fuel	0	0	0	0	0	2	0	4	0	0	0	0	0	0
Total Imports (Balance)	292	70	154	154	187	250	242	279	231	292	296	248	296	295
Total Exports (Balance)	1	15	22	25	5	11	6	1	1	45	78	62	82	81
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-22	6	-6	7	4	-7	7	-2	4	-3	-1	-1	1	-2
Gross Inland Deliveries (Obs.)	538	441	410	446	440	493	542	572	560	587	618	601	613	646
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

222A Bitumen	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	441	410	446	440	493	542	572	560	587	618	601	613	646
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	441	410	446	440	493	542	572	560	587	618	601	613	646
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	441	410	446	440	493	542	572	560	587	618	601	613	646
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	441	410	446	440	493	542	572	560	587	618	601	613	646

Table 23: National Energy Balance 1990-2004. Other Oil Products [1000 tons].

224A Other Oil Products	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	499	743	754	893	761	923	953	960	927	859	988	1 030	1 048	1 084
Refinery Fuel	164	176	236	254	212	264	277	264	213	223	226	254	278	284
Total Imports (Balance)	182	66	188	0	29	14	143	102	101	149	85	87	91	63
Total Exports (Balance)	3	3	96	1	39	54	6	137	131	139	162	169	149	163

224A Other Oil Products	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-30	59	-19	-25	-4	14	-9	8	0	-7	11	-1	-13	39
Gross Inland Deliveries (Obs.)	483	689	591	614	534	633	803	668	683	638	697	693	699	738
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	23	0	1	1	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	0	1	1	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	460	689	590	614	534	633	803	668	683	638	697	693	699	738
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

224A Other Oil Products	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	460	689	590	614	534	633	803	668	683	638	697	693	699	738
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	460	689	590	614	534	633	803	668	683	638	697	693	699	738
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	460	689	590	614	534	633	803	668	683	638	697	693	699	738

Table 24: National Energy Balance 1990-2004. LPG [1000 tons].

303A LPG	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	47	51	96	37	60	20	45	30	19	34	0	23	50	57
Refinery Fuel	8	1	2	0	19	6	0	1	4	20	0	2	1	3
Total Imports (Balance)	97	151	114	210	149	184	148	132	152	159	140	155	137	132
Total Exports (Balance)	14	40	34	58	42	42	55	19	20	17	4	7	9	17
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	2	1	-6	-15	20	-3	-5	3	0	-5	6	-2	-1	5
Gross Inland Deliveries (Obs.)	125	162	168	174	166	152	132	144	147	150	143	168	176	174
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1	4	3	3	3	3	2	1	1	0	0	1	0	0
Public Electricity	0	0	0	0	0	0	1	0	0	0	0	0	0	0

303A LPG	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Public Heat Plants	1	4	3	3	3	3	1	1	1	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	158	165	172	163	150	130	143	147	150	143	168	176	174
Total Transport	9	10	10	10	11	15	11	13	14	14	14	14	14	15
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	10	10	10	11	15	11	13	14	14	14	14	14	15
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	48	55	65	62	67	60	66	54	55	48	49	39	37
Iron and Steel	4	4	4	4	3	12	12	13	6	1	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Non ferrous Metals	8	6	5	7	6	6	4	5	4	4	4	6	5	4
Non metallic Mineral Products	12	12	15	21	23	21	13	14	15	15	14	10	11	10

303A LPG	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Transportation Equipment	1	1	1	1	3	2	10	11	0	1	1	1	1	1
Machinery	11	11	12	14	13	12	10	11	11	14	13	14	11	10
Mining and Quarrying	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Food, Beverages and Tobacco	3	4	4	3	3	2	2	2	5	4	5	4	3	2
Pulp, Paper and Printing	1	1	2	1	1	2	1	1	1	2	1	2	1	1
Wood and Wood Products	0	0	1	0	0	0	0	0	1	1	1	1	1	1
Construction	23	9	10	11	9	8	7	7	9	13	6	6	5	4
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	1	1	1	1	1	0	1	1	0	1	1	0	0
Total Other Sectors	50	101	100	97	90	68	59	64	79	81	81	105	123	122
Commerce - Public Services	32	80	76	73	61	34	19	21	31	29	19	40	49	47
Residential	16	19	22	22	26	31	36	39	43	48	57	59	68	70
Agriculture	2	2	2	2	3	3	4	4	4	5	5	5	6	6
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	1	2

Table 25: National Energy Balance 1990-2004. Refinery Gas [1000 tons].

308A Refinery Gas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Refinery Gross Output	373	339	319	341	305	359	351	348	341	312	328	306	273	293
Refinery Fuel	373	339	319	341	305	359	351	348	338	310	326	306	273	331
Total Imports (Balance)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Exports (Balance)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	38
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	0	0	2	2	2	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	0	0	2	2	2	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	1	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	1	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

308A Refinery Gas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	0	0	2	2	1	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	0	0	2	2	1	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	2	2	1	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

308A Refinery Gas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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 1990-2004. Natural Gas [TJ NCV].

	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	46 376	47 729	51 722	53 559	48 776	53 336	53 701	51 404	56 440	62 524	64 826	62 194	67 541	75 094
Total Imports (Balance)	187 917	184 138	183 846	193 697	179 430	229 114	236 579	216 911	224 009	219 484	222 784	225 593	234 797	288 439
Total Exports (Balance)	0	0	12	0	189	576	0	0	698	0	633	14 713	19 139	36 879
Stock Change (National Territory)	-15 054	-73	-7 946	-7 212	18 891	-12 290	-3 340	8 236	4 168	6 867	-11 295	19 095	12 287	-7 172
Gross Inland Deliveries (Obs.)	219 239	231 794	227 610	240 044	246 908	269 583	286 941	276 551	283 920	288 876	275 681	292 169	295 485	319 481
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	74 710	76 968	74 215	80 159	94 010	95 817	108 680	96 912	100 569	99 236	83 076	82 051	88 953	107 087
Public Electricity	28 100	25 602	20 818	20 129	23 477	21 731	36 919	28 715	35 366	30 144	23 854	24 379	24 784	35 673
Public Combined Heat and Power	23 810	24 752	24 529	25 628	27 342	30 757	33 803	31 061	29 381	32 247	28 673	31 456	38 694	46 208
Public Heat Plants	7 552	7 200	7 148	8 135	7 517	9 579	9 022	8 641	8 780	7 282	8 926	5 375	7 417	6 575
Auto Producers of Electricity	9 596	12 218	13 670	16 532	22 453	21 241	18 211	20 694	19 173	18 436	12 715	14 655	6 814	5 330
Auto Producers for CHP	5 651	7 195	8 050	9 735	13 222	12 509	10 725	7 801	7 870	10 457	8 454	6 014	11 237	12 033
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	669	454	172	6	1 269
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
Conversion to Liquids	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	13 411	13 437	12 495	13 238	12 156	13 351	10 257	11 608	10 294	8 951	9 384	10 135	9 339	10 396
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	5 339	5 396	5 027	5 255	5 228	5 746	3 022	3 709	2 989	1 612	3 028	2 915	2 810	3 129
Inputs to Oil Refineries	8 045	8 041	7 469	7 983	6 928	7 606	7 236	7 898	7 305	7 339	6 356	7 220	6 528	7 267
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	28	1	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	2 726	3 352	3 259	2 303	2 904	5 293	1 449	920	2 702	4 818	2 256	2 751	6 244	6 951
Final Consumption	113 479	122 072	126 906	129 338	127 802	144 603	155 775	156 443	159 801	165 227	170 461	187 288	180 614	183 768
Total Transport	4 050	4 065	3 968	3 865	3 780	4 092	4 216	4 199	6 344	7 808	9 650	8 255	9 175	9 757
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	4 050	4 065	3 968	3 865	3 780	4 092	4 216	4 199	6 344	7 808	9 650	8 255	9 175	9 757
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	69 024	66 717	66 178	64 940	67 689	73 484	77 788	82 591	80 259	72 340	86 569	90 376	91 963	90 343
Iron and Steel	10 524	9 571	9 549	9 516	10 582	11 243	12 115	14 576	14 165	13 604	13 482	13 672	12 433	13 891
Chemical (incl.Petro-Chemical)	7 710	7 125	7 408	7 564	7 676	8 250	8 330	10 116	9 830	14 103	15 055	14 938	13 568	13 171
Non ferrous Metals	1 352	1 205	1 580	1 917	2 045	2 154	2 015	2 366	2 299	2 149	2 296	2 584	2 650	2 922
Non metallic Mineral Products	10 085	10 280	9 374	9 725	10 223	11 097	11 927	13 248	12 874	9 139	9 560	9 585	11 175	11 488
Transportation Equipment	1 535	1 772	1 931	2 091	2 403	2 555	2 408	1 162	1 130	752	938	1 480	1 182	1 682
Machinery	4 348	4 396	4 775	5 054	5 596	6 133	6 283	5 521	5 365	4 581	5 109	5 552	5 053	5 377
Mining and Quarrying	2 631	2 481	1 826	1 847	2 009	2 519	2 639	2 524	2 453	1 677	2 282	2 527	2 624	2 687
Food, Beverages and Tobacco	8 879	8 862	8 250	7 808	8 788	9 418	9 182	9 634	9 362	8 996	14 388	14 197	17 508	14 815
Pulp, Paper and Printing	12 862	12 230	12 288	10 074	8 896	9 783	10 920	16 855	16 379	10 219	15 965	17 404	16 828	13 966
Wood and Wood Products	1 717	1 702	1 790	1 673	1 937	2 044	2 250	1 657	1 610	1 770	1 671	1 898	1 659	2 110
Construction	731	709	878	1 220	1 399	1 533	1 475	550	534	1 640	1 420	1 790	3 105	1 772
Textiles and Leather	3 508	3 261	3 511	3 311	3 013	3 395	3 699	2 404	2 336	2 621	3 164	3 400	2 743	2 812
Non Specified (Industry)	3 142	3 120	3 019	3 137	3 121	3 358	4 545	1 977	1 921	1 089	1 239	1 350	1 435	3 649
Total Other Sectors	40 405	51 290	56 759	60 532	56 333	67 027	73 770	69 654	73 198	85 079	74 243	88 657	79 476	83 669
Commerce - Public Services	7 713	12 074	18 190	18 105	15 913	23 359	24 605	19 177	18 636	27 102	14 823	26 511	17 925	17 909
Residential	32 327	38 779	38 138	41 953	39 968	43 180	48 616	49 912	53 952	57 329	58 755	61 452	60 864	65 024
Agriculture	365	438	431	474	452	488	549	564	610	648	664	694	688	735
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	14 913	15 965	10 735	15 006	10 036	10 518	10 781	10 669	10 554	10 644	10 504	9 945	10 336	11 278

Renewable Fuels

Table 27: National Energy Balance 1990-2004. Fuel Wood [TJ].

111A Fuel Wood	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	61 401	63 235	64 028	60 260	65 763	70 726	65 357	63 416	64 483	57 001	62 859	59 057	62 273	58 454
Total Imports (Balance)	2 288	2 421	3 064	2 382	1 623	2 423	2 017	1 604	1 486	1 803	1 803	2 104	2 530	3 211
Total Exports (Balance)	28	57	29	73	222	107	114	140	34	180	180	379	931	931
Stock Change (National Territory)	-545	382	113	-179	189	243	-54	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	63 116	65 982	67 176	62 390	67 354	73 285	67 206	64 881	65 936	58 624	64 482	60 782	63 872	60 734
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	210	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	210	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
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	63 116	65 982	67 176	62 390	67 354	73 285	67 206	64 672	65 936	58 624	64 482	60 782	63 872	60 734
Total Transport	2	1	1	1	1	1	0	0	0	0	0	0	0	0
Rail	2	1	1	1	1	1	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	661	706	802	904	1 074	783	272	151	1 830	927	1 123	1 402	1 418	1 553
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	10	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	47	43	41	42	62	7	1	1	0	0	0	0	3	3
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	47	60	51	52	62	12	17	9	37	40	42	40	41	45
Mining and Quarrying	0	0	0	0	0	2	0	0	1	1	1	1	1	1
Food, Beverages and Tobacco	121	77	144	94	93	23	15	8	17	16	20	19	20	22
Pulp, Paper and Printing	9	0	0	0	0	54	1	1	0	0	0	0	0	0
Wood and Wood Products	233	221	226	291	300	319	76	42	1 576	678	831	1 117	1 108	1 216
Construction	0	102	113	156	289	142	79	44	105	101	116	122	126	137
Textiles and Leather	19	17	21	21	21	5	0	0	2	2	3	2	3	3
Non Specified (Industry)	186	187	195	249	248	219	83	46	93	88	111	101	116	126
Total Other Sectors	62 454	65 275	66 374	61 485	66 278	72 501	66 934	64 520	64 105	57 697	63 358	59 379	62 454	59 181
Commerce - Public Services	1 330	1 177	1 145	1 091	1 167	1 063	873	486	479	438	499	486	486	538
Residential	57 500	60 298	61 361	56 812	61 250	67 202	62 144	60 237	59 853	53 864	59 132	55 401	58 294	55 165
Agriculture	3 625	3 801	3 868	3 581	3 861	4 236	3 917	3 797	3 773	3 395	3 727	3 492	3 675	3 477
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 28: National Energy Balance 1990-2004. Wood Waste [TJ].

116A Wood waste; Other	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Indigenous Production	13 668	15 705	18 136	18 456	18 739	20 571	27 344	23 219	33 992	32 944	40 089	38 928	50 270	52 428
Total Imports (Balance)	1 864	2 536	2 116	2 418	2 144	1 744	2 838	2 344	2 641	2 819	4 095	4 472	4 472	4 472
Total Exports (Balance)	2 072	2 240	1 517	2 221	2 617	2 819	5 181	5 034	6 137	6 509	7 978	6 855	6 855	6 855
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	13 461	16 001	18 736	18 653	18 265	19 496	25 001	20 529	30 496	29 254	36 206	36 545	47 887	50 046
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 452	4 348	7 460	9 204	8 874	10 038	13 040	9 179	12 168	13 964	14 398	17 851	20 578	22 913
Public Electricity	0	0	0	0	0	0	0	13	17	9	517	1 377	1 155	2 366
Public Combined Heat and Power	0	0	0	0	0	47	101	98	81	130	624	736	1 013	3 179

Public Heat Plants	2 045	3 404	3 515	3 714	4 332	5 988	5 904	6 616	6 886	8 854	10 751	11 555	14 497	13 239
Auto Producers of Electricity	0	0	0	0	189	2 493	3 041	272	2 713	1 872	824	2 502	2 371	1 749
Auto Producers for CHP	407	944	3 945	5 490	4 353	1 509	3 921	2 102	2 379	3 016	1 522	1 554	1 403	2 224
Auto Producer Heat Plants	0	0	0	0	0	0	72	79	92	83	159	125	139	155
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	11 009	11 653	11 275	9 449	9 391	9 458	11 962	11 350	18 328	15 290	21 808	18 694	27 310	27 133
Total Transport	79	113	165	171	233	250	272	291	340	367	404	422	436	454
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)	79	113	165	171	233	250	272	291	340	367	404	422	436	454
Total Industry	9 243	9 460	8 826	7 133	6 699	6 584	7 577	6 459	11 753	7 577	11 590	10 437	16 916	10 141
Iron and Steel	0	0	0	0	0	20	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	2 898	3 258	2 173	1 808	1 722	2 062	2 413	1 575	1 884	722	1 396	1 143	1 546	2 337
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	2	0	0	0	0	0	7	47	74
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	22	18	17	42	41	123	103	161	254
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	10	10	9	9	9	6	1	1	156	147	186	127	153	244
Pulp, Paper and Printing	3 660	3 920	4 527	3 582	3 901	2 502	2 761	3 746	3 552	635	1 205	2 461	7 141	5 999
Wood and Wood Products	2 569	2 185	2 035	1 652	968	1 810	2 076	910	5 335	5 323	7 716	5 748	7 159	751
Construction	39	29	28	28	27	47	71	55	279	289	352	252	287	455
Textiles and Leather	0	0	0	0	0	0	0	0	4	4	5	3	4	7

Non Specified (Industry)	68	58	55	55	72	114	236	154	500	416	607	592	417	19
Total Other Sectors	1 687	2 080	2 284	2 144	2 459	2 624	4 114	4 600	6 235	7 346	9 814	7 835	9 958	16 538
Commerce - Public Services	765	793	731	736	698	581	1 425	1 351	1 656	1 597	2 022	1 637	2 123	3 135
Residential	551	804	1 009	996	1 137	1 330	1 795	2 198	3 182	4 026	5 525	4 322	5 534	9 675
Agriculture	371	483	545	412	624	713	894	1 051	1 397	1 723	2 268	1 876	2 302	3 728
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 29: National Energy Balance 1990-2004. Black Liquor [TJ].

215A Black Liquor	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	17 799	18 067	18 544	19 606	21 392	21 174	21 675	22 916	23 647	24 121	23 299	22 776	22 973	24 239
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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	17 799	18 067	18 544	19 606	21 392	21 174	21 675	22 916	23 647	24 121	23 299	22 776	22 973	24 239
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	5 260	6 076	7 091	8 897	9 267	9 505	8 580	11 354	10 234	7 635	7 612	9 961	11 036	10 718
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	2 618	3 024	4 033	5 060	5 271	5 406	5 140	8 867	6 156	2 001	3 116	2 782	6 647	6 193
Auto Producers for CHP	2 642	3 052	3 058	3 837	3 997	4 099	3 440	2 487	4 079	5 635	4 496	7 179	4 390	4 525
Auto Producer Heat Plants	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	12 540	11 991	11 453	10 709	12 125	11 669	13 094	11 562	13 413	16 486	15 687	12 815	11 937	13 521
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	12 540	11 991	11 453	10 709	12 125	11 669	13 094	11 562	13 413	16 486	15 687	12 815	11 937	13 521
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	12 540	11 991	11 453	10 709	12 125	11 669	13 094	11 562	13 367	16 425	15 626	12 757	11 880	13 521
Wood and Wood Products	0	0	0	0	0	0	0	0	46	61	61	56	57	0
Construction	0	0	0	0	0	0	0	0	0	0	0	1	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

Table 30: National Energy Balance 1990-2004. Biogas [TJ].

309A Biogas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	0	0	0	0	35	39	48	27	350	337	253	281	322	607
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
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	35	39	48	27	350	337	253	281	322	607

Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	35	39	48	27	130	184	149	204	199	285
Public Electricity	0	0	0	0	0	0	0	0	13	20	20	0	0	77
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	85
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	29	69	64	106	106	38
Auto Producers for CHP	0	0	0	0	35	39	48	27	88	95	64	98	93	85
Auto Producer Heat Plants	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	220	152	104	77	124	322
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	220	152	104	77	124	322
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	206	130	85	29	18	153
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	14	0	7	21	26	56
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	22	12	27	80	112
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

Table 31: National Energy Balance 1990-2004. Sewage Sludge Gas [TJ].

309B Sewage sludge gas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	0	0	631	638	619	668	691	715	714	791	725	721	745	789
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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	631	638	619	668	691	715	714	791	725	721	745	789
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	631	638	619	668	691	715	714	791	725	721	745	789
Public Electricity	0	0	0	0	10	31	52	50	17	49	52	57	49	61
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	4	2	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	39	40	0	0	0
Auto Producers for CHP	0	0	631	638	609	637	635	663	696	703	632	664	696	727
Auto Producer Heat Plants	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

Table 32: National Energy Balance 1990-2004. Landfill Gas [TJ].

310A Landfill Gas	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	0	0	77	88	195	307	524	527	524	457	859	381	527	492
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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	77	88	195	307	524	527	524	457	859	381	527	492
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	146	271	519	520	524	457	859	381	527	492
Public Electricity	0	0	0	0	0	0	0	0	43	58	63	58	207	47
Public Combined Heat and Power	0	0	0	0	29	31	27	30	0	0	4	0	18	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	117	240	492	490	481	399	752	298	266	398
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	39	26	0	13
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	37	34
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	77	88	49	36	5	7	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	77	88	49	36	5	7	0	0	0	0	0	0
Commerce - Public Services	0	0	77	88	49	36	5	7	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

Table 33: National Energy Balance 1990-2004. Municipal Solid Waste [TJ].

114B Municipal Solid Waste	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indigenous Production	2 414	3 485	3 759	3 823	3 911	4 769	4 895	4 782	4 519	4 520	4 609	4 915	5 785	7 581
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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	2 414	3 485	3 759	3 823	3 911	4 769	4 895	4 782	4 519	4 520	4 609	4 915	5 785	7 581
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 414	3 485	3 759	3 823	3 911	4 769	4 895	4 782	4 519	4 520	4 609	4 915	5 785	7 581
Public Electricity	0	0	0	0	0	0	0	0	513	595	595	667	1 551	2 888
Public Combined Heat and Power	1 724	2 314	2 157	2 243	2 318	2 499	2 594	2 579	2 340	2 233	2 235	2 283	2 426	2 598
Public Heat Plants	690	1 170	1 603	1 580	1 593	2 269	2 301	2 203	1 666	1 692	1 779	1 965	1 807	1 890
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	67
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	138
Auto Producer Heat Plants	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

Table 34: National Energy Balance 1990-2004. Industrial Waste [TJ].

115A Industrial Waste	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Indigenous Production	6 576	8 525	6 015	6 704	7 005	9 246	8 227	7 502	9 598	8 454	8 908	10 826	11 853	12 469
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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	6 576	8 525	6 015	6 704	7 005	9 246	8 227	7 502	9 598	8 454	8 908	10 826	11 853	12 469
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 542	2 945	1 841	1 927	1 929	4 735	3 614	2 152	3 614	1 966	1 905	2 902	2 922	3 092
Public Electricity	0	0	0	0	0	0	0	0	133	134	134	796	1 164	993
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	937	1 047	812	702
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	1 613	1 274	543	1 152	814	193	466	294	181
Auto Producers for CHP	2 542	2 945	1 841	1 927	1 929	3 122	2 340	1 609	2 329	1 018	591	593	605	1 181
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	50	0	46	34
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	4 034	5 580	4 174	4 777	5 076	4 511	4 614	5 351	5 984	6 488	7 002	7 924	8 931	9 377
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	2 924	4 888	3 845	4 266	4 556	3 958	4 031	4 738	5 379	5 933	6 372	7 306	8 282	8 155
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	1 567	2 303	1 502	1 648	1 908	989	1 168	1 102	1 627	1 387	965	1 629	1 711	2 154
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	1 311	1 876	1 819	1 935	1 976	2 165	2 101	2 664	2 877	3 557	4 545	4 471	5 305	4 437
Transportation Equipment	0	9	0	9	10	6	7	7	1	1	0	0	0	0
Machinery	0	0	0	0	0	1	1	2	0	0	0	1	1	8
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	5	6	6	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	60	66	70	136	131	113	94	98	158
Wood and Wood Products	37	580	441	573	553	645	587	787	692	813	688	1 048	1 100	1 309
Construction	0	18	9	9	10	8	9	10	16	16	22	23	24	31
Textiles and Leather	0	0	0	9	10	5	6	6	5	5	9	7	7	10
Non Specified (Industry)	9	101	74	83	90	73	81	85	24	24	30	34	36	48
Total Other Sectors	1 110	692	329	512	520	553	582	613	605	555	630	618	648	1 223
Commerce - Public Services	1 110	692	329	512	520	553	582	613	605	555	630	618	648	1 223
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

Net Calorific Values

At the following the selected net calorific values of each fuel are presented.

Table 35 presents the net calorific values from [IEA JQ 2005] which are used for unit conversion.

Table 35: Net calorific values for 1990-2004 in [MJ/kg], [MJ/m³] taken from [IEA JQ 2005].

Fuel Code	Fuel Name		1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	28.00	28.00	27.66	27.99	27.99	27.50	27.50	28.44
		T	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	27.23	28.00	28.09	27.37	27.43	28.42
104A	Hard Coal Briquettes	A	0.00	0.00	0.00	0.00	0.00	0.00	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	10.90	10.90	9.90	9.90	9.90	9.77	9.82	9.82	9.82	9.82	9.80
		T	10.90	10.90	10.90	10.90	10.90	9.90	9.90	9.90	9.77	9.84	9.70	9.74	9.48	9.29
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	28.50	28.50	28.20	28.20	28.20	28.42	28.67	28.70	28.75	28.72	28.71
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	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52
305A	Blast Furnace Gas	P	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
110A	Petrol Coke	A	34.30	34.30	34.30	30.55	28.35	32.15	32.80	33.99	33.92	33.93	33.93	33.93	33.93	33.93
201A	Crude Oil	A	42.50	42.50	42.50	42.50	42.50	42.50	42.51	42.50	42.52	42.52	42.50	42.50	42.52	42.52
203X	Residual Fuel Oil	A	41.00	41.10	41.30	41.30	40.46	40.33	40.28	40.27	40.69	41.67	41.71	41.48	41.42	41.42
204A	Gasoil	A	42.60	42.60	42.60	42.60	42.70	42.80	42.80	42.80	42.80	42.80	42.80	42.80	42.80	42.82
2050	Diesel	A	42.60	42.60	42.60	42.60	42.70	42.70	42.70	42.70	42.80	42.80	42.80	42.80	42.80	42.80
206A	Petroleum	A	43.60	43.60	43.60	43.60	43.30	43.38	43.41	43.41	43.31	43.30	43.30	43.30	43.30	43.30
206B	Kerosene	A	43.60	43.60	43.60	43.60	43.30	43.38	43.41	43.41	43.31	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	42.50	42.50	42.52	42.49	42.49	42.50
2080	Motor Gasoline	A	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.52	42.49	42.49	42.50
217A	Refinery Feedstock s	A	41.87	42.30	42.03	42.44	42.56	42.63	42.68	42.25	42.27	42.56	42.65	42.77	41.95	42.41

219A	Lubricants	A	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	44.04	43.62	43.84	44.15	43.95	43.95
220A	White Spirit	A	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	44.10	44.10	44.10	44.10	44.10	44.10
222A	Bitumen	A	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	44.04	43.62	43.84	44.15	43.95	43.91
224A	Other Petroleum Products	FC	34.30	34.30	34.30	30.55	28.35	32.15	32.80	33.99	33.92	33.93	33.93	33.93	33.93	33.93
		NEU	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	44.04	43.62	43.84	44.15	43.95	43.91
302A	Natural Gas Liquids (NGL)	A	42.50	42.50	42.50	42.50	42.50	42.50	42.51	42.50	42.52	42.52	42.50	42.50	42.52	42.52
303A	Liquified Petroleum Gas (LPG)	A	46.30	46.20	46.20	46.20	46.30	46.32	46.31	46.32	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	49.00	49.00	42.23	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	36.00	36.00	35.85	35.85	35.85	35.85	35.85	35.85

Legend: A:….Average; T. ...Transformation; FC. ... Final Consumption; P……Production; NEU….non-energy use;

Table 36 presents the net calorific values from STATISTIK AUSTRIA, which are used for unit conversion.

Table 36: 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 presents IPCC default values of net calorific values of gaseous biofuels which are used for unit conversion.

Table 37: 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 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.

Table 1: IPCC codes and names of categories

Total	National Total without LULUCF		
1	ENERGY	3	SOLVENT AND OTHER PRODUCT USE
1 A	FUEL COMBUSTION ACTIVITIES	4	AGRICULTURE
1 A 1	Energy Industries	4 A	ENTERIC FERMENTATION
1 A 2	Manufacturing Industries and Construction	4 A 1	Cattle
1 A 3	Transport	4 B	MANURE MANAGEMENT
1 A 4	Other Sectors	4 B 1	Cattle
1 A 5	Other	4 B 8	Swine
1 B	FUGITIVE EMISSIONS FROM FUELS	4 B 9	Poultry
1 B 1	Solid fuels	4 D	AGRICULTURAL SOILS
1 B 2	Oil and natural gas	4 D 1	Direct Soil Emissions
2	INDUSTRIAL PROCESSES	4 D 2	Animal Production
2 A 1	Cement Production	4 D 3	Indirect Emissions
2 A 2	Lime Production	4 D 4	Other
2 A 3	Limestone and Dolomite Use	5	LAND USE, LAND USE CHANGE AND FORESTRY
2 A 7	Other	6	WASTE
2 B 1	Ammonia Production	6 A 1	Managed Waste disposal
2 B 2	Nitric Acid Production	6 B 1	Industrial Wastewater
2 C 1	Iron and Steel Production	6 B 2	Domestic and Commercial Wastewater
2 C 2	Ferroalloys Production	6 C	WASTE INCINERATION
		I B	International Bunkers

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.

IPCC Cat.	CO_2 [Gg]; Differences with respect to Submission 2005													
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total	670.77	733.74	695.77	515.67	563.11	548.90	768.20	628.09	619.47	829.98	731.84	899.38	948.75	1 348.57
1	516.89	563.74	481.36	325.45	371.90	413.03	634.00	483.98	529.88	710.38	609.18	803.54	890.10	1 297.32
1 A	516.89	563.74	481.36	325.45	371.90	413.03	634.00	483.98	529.88	710.38	609.18	803.54	890.10	1 297.32
1 A 1	40.37	39.64	-28.18	-28.26	-30.03	-37.40	-23.12	465.03	-42.76	220.87	126.07	237.14	93.11	134.83
1 A 2	481.84	342.46	309.00	145.50	145.26	241.32	429.88	-117.98	358.49	416.41	227.21	25.71	355.41	395.46
1 A 3	-4.54	-3.86	-4.18	-3.64	-3.60	-3.71	-3.66	-1.33	-11.95	0.50	-0.75	151.40	12.65	157.33
1 A 4	-0.79	185.50	204.72	211.85	260.28	212.81	230.89	138.26	226.09	72.60	256.65	302.65	428.91	556.58
1 A 5	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.65	0.01	53.12
2	147.69	165.05	211.09	188.13	190.31	134.98	133.31	143.19	88.65	118.65	121.68	94.82	58.91	52.76
2 A 1														18.82
2 A 2														28.04
2 A 3	22.13	22.23	24.16	24.16	24.57	25.76	25.76	25.71	25.71	25.78	25.66	25.77	25.68	25.89
2 A 7	4.19	4.38	4.53	4.87	5.03	5.35	5.35	4.93	4.80	4.80	4.19	4.46	4.34	-62.18
2 B 1	121.38	138.41	182.44	136.75	126.46	69.78	74.26	76.03	25.05	59.08	55.78	31.24	41.92	33.54
2 B 4														0.83
2 C 1	-0.01	0.03	-0.04	22.34	34.24	34.09	27.93	36.52	33.08	29.00	36.05	34.16	-11.24	10.00
2 C 2												-0.82	-1.80	-2.18
3													-1.25	-2.50
4														
5	-2 959.02	-6 128.34	-4 275.38	-7 771.88	-7 797.78	-7 376.21	-4 515.05	-7 103.98	-4 204.37	-8 748.43	-2 390.81	-5 430.58	-3 824.76	-3 833.83
6	6.18	4.94	3.31	2.09	0.90	0.89	0.90	0.92	0.95	0.95	0.98	1.02	0.99	0.99
6 C	6.18	4.94	3.31	2.09	0.90	0.89	0.90	0.92	0.95	0.95	0.98	1.02	0.99	0.99
I B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-238.39	-0.02	-146.89

Blank fields indicate that no recalculation of emissions has been carried out.

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 3: Recalculation Difference of CH_4 Emissions.

IPCC Cat	CH4 [Gg]; Differences with respect to Submission 2005													
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total	-29.47	-29.02	-28.73	-28.37	-29.57	-29.65	-29.80	-29.72	-29.55	-28.86	-26.07	-25.85	-24.77	-21.06
1	4.72	5.36	6.27	6.93	7.96	8.47	8.72	9.73	10.29	11.04	12.17	12.00	12.26	12.06
1 A	-0.38	-0.23	-0.26	-0.14	-0.01	-0.05	-0.10	-0.07	-0.07	-0.13	-0.17	-0.58	-1.28	-1.63
1 A 1	0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	0.00	-0.01	-0.02	-0.01	-0.06
1 A 2	0.01	0.01	0.01	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.02
1 A 3	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	0.01	0.00	0.01
1 A 4	-0.40	-0.23	-0.25	-0.13	0.00	-0.04	-0.08	-0.06	-0.05	-0.13	-0.16	-0.57	-1.26	-1.61
1 B	5.10	5.59	6.52	7.06	7.97	8.52	8.82	9.81	10.36	11.17	12.35	12.58	13.54	13.69
1 B 1													-0.09	-0.14
1 B 2	5.10	5.59	6.52	7.06	7.97	8.52	8.82	9.81	10.36	11.17	12.35	12.58	13.62	13.83
2	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
3														
4	10.87	10.62	10.19	10.09	8.49	8.37	8.35	7.67	7.40	7.63	8.89	8.95	8.84	9.23
4 A 1	8.97	8.77	8.40	8.32	7.05	7.14	7.15	6.54	6.32	6.56	7.72	7.90	7.86	8.24
4 B 1	1.90	1.85	1.78	1.77	1.44	1.23	1.21	1.13	1.08	1.08	1.17	1.05	1.04	1.02
4 D 4													-0.06	-0.03
5	NA->0.01	NA->0	NA->0.01	NA->0.01	NA->0	NA->0	NA->0	NA->0	NA->0.01	NA->0	NA->0	NA->0	NA->0.01	NA->0
6	-45.41	-45.36	-45.54	-45.74	-46.37	-46.85	-47.22	-47.48	-47.59	-47.88	-47.48	-47.15	-46.21	-42.69
6 A 1	-36.62	-36.43	-36.32	-36.26	-36.67	-36.94	-36.95	-36.85	-36.61	-36.62	-35.92	-35.29	-34.04	-30.21
6 B 1	4,64->NA	4,68->NA	4,74->NA	4,78->NA	4,79->NA	4,8->NA	4,81->NA	4,81->NA	4,82->NA	4,83->NA	4,84->NA	4,86->NA	4,88->NA	4,9->NA
6 B 2	-4.15	-4.25	-4.48	-4.71	-4.91	-5.11	-5.46	-5.81	-6.16	-6.44	-6.71	-7.00	-7.29	-7.58
I B														

Blank fields indicate that no recalculation of emissions has been carried out.

Recalculation of N_2O Emissions by Categories

Explanations are provided in Chapter 9 Recalculations and in the sector specific chapters of this report.

Table 4: Recalculation Difference of N_2O Emissions.

IPCC Cat	N_2O [Gg]; Differences with respect to Submission 2005													
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total	1.71	1.66	1.56	1.48	1.37	1.41	1.54	1.29	1.32	1.61	1.40	1.11	1.40	1.60
1	0.30	0.28	0.23	0.19	0.15	0.12	0.08	0.05	0.07	0.04	0.03	0.05	0.05	0.09
1 A	0.30	0.28	0.23	0.19	0.15	0.12	0.08	0.05	0.07	0.04	0.03	0.05	0.05	0.09
1 A 1	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
1 A 2	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
1 A 3	0.30	0.28	0.23	0.19	0.15	0.12	0.08	0.06	0.07	0.05	0.04	0.06	0.07	0.08
1 A 4	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.02
2														
3														
4	1.41	1.39	1.33	1.29	1.22	1.29	1.46	1.23	1.26	1.56	1.36	1.06	1.35	1.50
4 B 1	0.79	0.78	0.76	0.75	0.71	0.75	0.73	0.72	0.73	0.73	0.72	0.71	0.69	0.68
4 B 8	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.06	-0.05	-0.05	-0.05	-0.05	-0.05
4 B 9	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
4 D 1	0.33	0.33	0.31	0.30	0.28	0.30	0.42	0.30	0.31	0.49	0.36	0.18	0.37	0.48
4 D 2	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.01
4 D 3	0.34	0.33	0.32	0.30	0.28	0.31	0.38	0.29	0.30	0.42	0.35	0.23	0.35	0.40
5	NA->0,04	NA->0,04	NA->0,04	NA->0,04	NA->0,04	NA->0,04	NA->0,04	NA->0,04	NA->0,04	NA->0,04	NA->0,04	NA->0,04	NA->0,03	NA->0,03
6														0.02
6 B 2														0.02
I B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01

Blank fields indicate that no recalculation of emissions has been carried out.

Recalculation of National Total GHG Emissions

Table 5 compares national total GHG emissions of UNFCCC submission 2006 with UNFCCC submission 2005. Explanations are provided in Chapter 9 Recalculations and in the sector specific chapters of this report. Other than in previous reports, 1990 has been chosen as the base year for all greenhouse gases.

Table 5: Recalculation Difference of National Total GHG Emissions

Year	National Total GHG emissions without LUCF		
	Submission 2005 [Gg CO_2e]	Submission 2006 [Gg CO_2e]	Recalculation Difference [%]
Base year*	78 535.22	78 959.40	0.5%
1990	78 573.05	78 959.40	0.5%
1991	82 647.00	82 997.57	0.4%
1992	76 062.64	76 300.77	0.3%
1993	76 177.63	76 270.69	0.1%
1994	77 045.38	77 113.09	0.1%
1995	80 159.10	80 234.57	0.1%
1996	83 237.39	83 567.37	0.4%
1997	83 046.10	83 146.28	0.1%
1998	82 513.72	82 605.15	0.1%
1999	80 402.96	80 800.09	0.5%
2000	81 083.55	81 278.83	0.2%
2001	84 871.78	85 145.37	0.3%
2002	86 433.79	86 858.79	0.5%
2003	91 566.42	92 526.59	1.0%

*Base year is 1990 for all gases in submission 2006; and in submission 2005: 1990 for CO_2, CH_4 and N_2O and 1995 for HFC, PFC and SF_6

Table 6 and Table 7 present recalculation differences per gas.

Table 6: Recalculation Difference of National CO_2 and CH_4 Emissions.

Year	CO_2 [Gg CO_2e]			CH_4 [Gg CO_2e]		
	Submission 2005	Submission 2006	Recalculation Difference [%]	Submission 2005	Submission 2006	Recalculation Difference [%]
Base Year*	61 262.62	61 933.39	1.1%	9 797.69	9 178.82	-6.3%
1990	61 262.62	61 933.39	1.1%	9 797.69	9 178.82	-6.3%
1991	64 752.08	65 485.82	1.1%	9 759.88	9 150.38	-6.2%

Year	CO_2 [Gg CO_2e] Submission 2005	Submission 2006	Recalculation Difference [%]	CH_4 [Gg CO_2e] Submission 2005	Submission 2006	Recalculation Difference [%]
1992	59 348.14	60 043.91	1.2%	9 460.60	8 857.19	-6.4%
1993	59 899.64	60 415.32	0.9%	9 425.66	8 829.83	-6.3%
1994	60 203.24	60 766.35	0.9%	9 257.72	8 636.77	-6.7%
1995	63 115.45	63 664.36	0.9%	9 142.84	8 520.12	-6.8%
1996	66 562.46	67 330.66	1.2%	8 958.72	8 333.02	-7.0%
1997	66 527.30	67 155.39	0.9%	8 681.40	8 057.19	-7.2%
1998	66 217.81	66 837.28	0.9%	8 557.07	7 936.47	-7.3%
1999	64 614.14	65 444.12	1.3%	8 365.73	7 759.62	-7.2%
2000	65 454.12	66 185.96	1.1%	8 146.25	7 598.87	-6.7%
2001	69 279.64	70 179.02	1.3%	8 020.50	7 477.62	-6.8%
2002	70 994.47	71 943.21	1.3%	7 856.28	7 336.10	-6.6%
2003	76 213.26	77 561.83	1.8%	7 806.62	7 364.43	-5.7%

*Base year is 1990 for all gases in submission 2006; and in submission 2005: 1990 for CO_2, CH_4 and N_2O and 1995 for HFC, PFC and SF_6

Table 7: Recalculation Difference of National N_2O and HFC, PFC, SF_6 Emissions

Year	N_2O [Gg] Submission 2005	Submission 2006	Recalculation Difference [%]	HFC, PFC, SF_6 [Gg CO_2-equivalent] Submission 2005	Submission 2006	Recalculation Difference [%]
Base Year	5 711.76	6 242.34	9.3%	1 763.16	1 604.85	-9.0%
1990	5 711.76	6 242.34	9.3%	1 800.99	1 604.85	-10.9%
1991	6 060.03	6 575.71	8.5%	2 075.01	1 785.65	-13.9%
1992	5 706.80	6 190.48	8.5%	1 547.10	1 209.20	-21.8%
1993	5 561.46	6 021.58	8.3%	1 290.86	1 003.97	-22.2%
1994	6 034.88	6 458.80	7.0%	1 549.54	1 251.18	-19.3%
1995	6 137.65	6 574.85	7.1%	1 763.16	1 475.24	-16.3%
1996	5 794.74	6 272.52	8.2%	1 921.47	1 631.16	-15.1%
1997	5 890.80	6 289.29	6.8%	1 946.60	1 644.40	-15.5%
1998	5 973.57	6 383.76	6.9%	1 765.27	1 447.63	-18.0%
1999	5 807.59	6 305.65	8.6%	1 615.50	1 290.70	-20.1%

Year	N_2O [Gg]			HFC, PFC, SF_6 [Gg CO_2-equivalent]		
	Submission 2005	Submission 2006	Recalculation Difference [%]	Submission 2005	Submission 2006	Recalculation Difference [%]
2000	5 758.53	6 192.10	7.5%	1 724.65	1 301.90	-24.5%
2001	5 730.53	6 074.87	6.0%	1 841.11	1 413.87	-23.2%
2002	5 636.41	6 069.33	7.7%	1 946.63	1 510.14	-22.4%
2003	5 542.26	6 039.35	9.0%	2 004.28	1 560.98	-22.1%

*Base year is 1990 for all gases in submission 2006; and in submission 2005: 1990 for CO_2, CH_4 and N_2O and 1995 for HFC, PFC and SF_6

ANNEX 6: TIER 1 UNCERTAINTY ASSESSMENT

This Annex includes the Tier 1 Uncertainty assessment that coincides with Table 6.1 of the IPCC GPG.

	A	B	C	D
	IPCC Source category	Gas	Base year emissions 1990	Year 2004 emissions
			Input data	Input data
			Gg CO2 equivalent	Gg CO2 equivalent
1 A gaseous	Fuel Combustion (stationary)	CO2	11 168.6	16 962.0
1 A 1 a liquid	Public Electricity and Heat Production	CO2	1 228.7	1 061.0
1 A 1 a other	Public Electricity and Heat Production	CO2	118.0	537.1
1 A 1 a solid	Public Electricity and Heat Production	CO2	6 247.0	6 676.4
1 A 1 b liquid	Petroleum refining	CO2	1 960.2	2 164.6
1 A 2 mob-liqu	Manufacturing Industries and Constr.	CO2	1 018.4	1 144.4
1 A 2 other	Manufacturing Industries and Constr.	CO2	374.7	760.6
1 A 2 solid	Manufacturing Industries and Constr.	CO2	5 014.6	4 992.1
1 A 2 stat-liqu	Manufacturing Industries and Constr.	CO2	2 756.9	1 847.9
1 A 3 a jet ker	Civil Aviation	CO2	24.2	184.6
1 A 3 b diesel	Road Transportation	CO2	4 012.9	15 805.8
1 A 3 b gasoli	Road Transportation	CO2	7 911.2	6 586.8
1 A 3 b gasoli	Road Transportation	N2O	219.4	167.4
1 A 4 biomass	Other Sectors	CH4	314.7	239.8
1 A 4 mob-die	Other Sectors	CO2	1 314.8	1 460.8
1 A 4 other	Other Sectors	CO2	239.1	148.7
1 A 4 solid	Other Sectors	CO2	2 654.1	618.4
1 A 4 stat-liqu	Other Sectors	CO2	7 444.2	7 097.5
1 B 2 b	Natural gas	CH4	272.7	539.1
2 A 1	Cement Production	CO2	2 033.4	1 754.5
2 A 2	Lime Production	CO2	396.2	599.5
2 A 3	Limestone and Dolomite Use	CO2	222.4	297.5
2 A 7 b	Magnesia Sinter Production	CO2	481.2	328.5
2 B 1	Ammonia Production	CO2	517.4	468.5
2 B 2	Nitric Acid Production	N2O	912.0	280.9
2 C 1	Iron and Steel Production	CO2	3 545.7	4 414.8
2 C 3	Aluminium production	PFCs	1 050.2	
2 C 4	SF6 used in Al and Mg Foundries	SF6	253.3	
2 F 1/2/3/4/5	ODS Substitutes	HFCs	21.1	900.5
2 F 6	Semiconductor Manufacture	FCs	133.1	497.3
2 F 8	Other Sources of SF6	SF6	126.6	100.1
3	Solvent and Other Product Use	CO2	282.7	189.8
4 A 1	Cattle	CH4	3 560.9	3 072.1
4 B 1	Cattle	N2O	908.1	800.7
4 B 1	Cattle	CH4	587.1	468.8
4 B 8	Swine	CH4	447.7	385.3
4 D 1	Direct Soil Emissions	N2O	1 751.0	1 496.4
4 D 3	Indirect Emissions	N2O	1 309.8	1 085.6
6 A	Solid Waste disposal on land	CH4	3 375.0	2 218.8
6 B	Wastewater handling	N2O	17.0	201.0
Total			76 226.2	88 555.7
	% of national total		96.5%	97.0%
	National Total without LULUCF		**78 959.4**	**91 332.6**

	E	F	G	H	I	J
	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity
	Input data	Input data			Note B	
	%	%	%	%	%	%
1 A gaseous	3	0.5	3.0	0.58	0.05	0.22
1 A 1 a liquid	2	0.5	2.1	0.02	- 0.00	0.01
1 A 1 a other	15	20	25.0	0.15	0.01	0.01
1 A 1 a solid	2	0.5	2.1	0.16	- 0.01	0.09
1 A 1 b liquid	3	0.5	3.0	0.07	- 0.00	0.03
1 A 2 mob-liqu	1	0.5	1.1	0.01	- 0.00	0.02
1 A 2 other	20	20	28.3	0.24	0.00	0.01
1 A 2 solid	3	0.5	3.0	0.17	- 0.01	0.07
1 A 2 stat-liqu	3	0.5	3.0	0.06	- 0.02	0.02
1 A 3 a jet ker	5	5	7.1	0.01	0.00	0.00
1 A 3 b diesel	0.5	0.5	0.7	0.13	0.15	0.21
1 A 3 b gasoli	0.5	0.5	0.7	0.05	- 0.03	0.09
1 A 3 b gasoli	10	40	41.2	0.08	- 0.00	0.00
1 A 4 biomass	10	50	51.0	0.14	- 0.00	0.00
1 A 4 mob-die	1	0.5	1.1	0.02	- 0.00	0.02
1 A 4 other	30	30	42.4	0.07	- 0.00	0.00
1 A 4 solid	3	0.5	3.0	0.02	- 0.03	0.01
1 A 4 stat-liqu	2	0.5	2.1	0.17	- 0.02	0.09
1 B 2 b	4.2	14.1	14.7	0.09	0.00	0.01
2 A 1	5	2	5.4	0.11	- 0.01	0.02
2 A 2	20	5	20.6	0.14	0.00	0.01
2 A 3	19.6	2	19.7	0.07	0.00	0.00
2 A 7 b	2	5	5.4	0.02	- 0.00	0.00
2 B 1	2	4.6	5.0	0.03	- 0.00	0.01
2 B 2	3	0	3.0	0.01	- 0.01	0.00
2 C 1	2	5	5.4	0.27	0.00	0.06
2 C 3	2	50	50.0	0.00	- 0.02	0.00
2 C 4	5	0	5.0	0.00	- 0.00	0.00
2 F 1/2/3/4/5	20	50	53.9	0.55	0.01	0.01
2 F 6	5	10	11.2	0.06	0.00	0.01
2 F 8	25	50	55.9	0.06	- 0.00	0.00
3	15	10	18.0	0.04	- 0.00	0.00
4 A 1	0	8	8.0	0.28	- 0.01	0.04
4 B 1	10	75	75.7	0.68	- 0.00	0.01
4 B 1	10	69	69.7	0.37	- 0.00	0.01
4 B 8	10	70	70.7	0.31	- 0.00	0.01
4 D 1	0	48	48.0	0.81	- 0.01	0.02
4 D 3	0	48	48.0	0.59	- 0.01	0.01
6 A	12	25	27.7	0.69	- 0.02	0.03
6 B	20	50	53.9	0.12	0.00	0.00
Total				**1.81**		

	K	L	M
	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions
	Note C	Note D	
	%	%	%
1 A gaseous	0.15735	0.94408	0.96
1 A 1 a liquid	0.00984	0.03937	0.04
1 A 1 a other	0.19929	0.14947	0.25
1 A 1 a solid	0.06193	0.24773	0.26
1 A 1 b liquid	0.02008	0.12048	0.12
1 A 2 mob-liqu	0.01062	0.02123	0.02
1 A 2 other	0.28222	0.28222	0.40
1 A 2 solid	0.04631	0.27785	0.28
1 A 2 stat-liqu	0.01714	0.10285	0.10
1 A 3 a jet ker	0.01713	0.01713	0.02
1 A 3 b diesel	0.14662	0.14662	0.21
1 A 3 b gasoli	0.06110	0.06110	0.09
1 A 3 b gasoli	0.12422	0.03105	0.13
1 A 4 biomass	0.22249	0.04450	0.23
1 A 4 mob-die	0.01355	0.02710	0.03
1 A 4 other	0.08279	0.08279	0.12
1 A 4 solid	0.00574	0.03442	0.03
1 A 4 stat-liqu	0.06584	0.26336	0.27
1 B 2 b	0.04099	0.04169	0.06
2 A 1	0.06510	0.16275	0.18
2 A 2	0.05561	0.22243	0.23
2 A 3	0.00103	0.10817	0.11
2 A 7 b	0.03048	0.01219	0.03
2 B 1	0.03998	0.01738	0.04
2 B 2	-	0.01563	0.02
2 C 1	0.40953	0.16381	0.44
2 C 3	-	-	0.00
2 C 4	-	-	0.00
2 F 1/2/3/4/5	0.83532	0.33413	0.90
2 F 6	0.09227	0.04614	0.10
2 F 8	0.09290	0.04645	0.10
3	0.03522	0.05283	0.06
4 A 1	0.45596	-	0.46
4 B 1	1.11411	0.14855	1.12
4 B 1	0.60017	0.08698	0.61
4 B 8	0.50044	0.07149	0.51
4 D 1	1.33264	-	1.33
4 D 3	0.96677	-	0.97
6 A	1.02912	0.49398	1.14
6 B	0.18650	0.07460	0.20
Total			**2.97**

ANNEX 7: CRF FOR 2004

This Annex includes the CRF-Tables for the year 2004 as included in Austria's data submission 2006 to the UNFCCC.

TABLE 1 SECTORAL REPORT FOR ENERGY
(Sheet 1 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_X	CO	NMVOC	SO_2
	(Gg)						
Total Energy	68 815.52	45.23	2.63	220.37	709.16	73.32	27.62
A. Fuel Combustion Activities (Sectoral Approach)	68 605.49	14.13	2.63	220.37	709.16	70.05	27.47
1. Energy Industries	15 535.20	0.28	0.24	15.25	4.17	0.88	7.69
a. Public Electricity and Heat Production	12 798.94	0.27	0.23	11.37	3.27	0.87	3.85
b. Petroleum Refining	2 571.84	IE,NO	0.01	3.44	0.87	IE	3.84
c. Manufacture of Solid Fuels and Other Energy Industries	164.43	0.00	0.00	0.45	0.03	0.00	NA
2. Manufacturing Industries and Construction	15 327.95	0.49	0.49	34.01	173.40	2.85	9.47
a. Iron and Steel	5 857.95	0.04	0.06	4.42	153.18	0.10	4.63
b. Non-Ferrous Metals	238.84	0.01	0.00	0.23	0.05	0.00	0.15
c. Chemicals	1 595.35	0.08	0.02	1.52	1.38	0.19	0.78
d. Pulp, Paper and Print	1 844.08	0.13	0.08	4.81	1.88	0.24	1.17
e. Food Processing, Beverages and Tobacco	1 179.10	0.03	0.00	1.09	0.20	0.02	0.44
f. Other *(as specified in table 1.A(a) sheet 2)*	4 612.65	0.20	0.32	21.94	16.72	2.30	2.30
Other non-specified	4 612.65	0.20	0.32	21.94	16.72	2.30	2.30
3. Transport	23 454.78	1.00	0.94	134.35	174.72	21.82	0.96
a. Civil Aviation	192.21	0.01	0.01	0.64	2.36	0.23	0.06
b. Road Transportation	22 392.53	0.95	0.89	129.56	168.89	20.70	0.78
c. Railways	170.18	0.01	0.02	1.72	0.47	0.23	0.10
d. Navigation	86.55	0.01	0.02	0.76	2.88	0.66	0.02
e. Other Transportation *(as specified in table 1.A(a) sheet 3)*	613.31	0.02	0.00	1.66	0.11	0.01	NA
Pipeline transport	613.31	0.02	0.00	1.66	0.11	0.01	NA

TABLE 1 SECTORAL REPORT FOR ENERGY
(Sheet 2 of 2)

Inventory 2004
Submission 2006 v1.3
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_X	CO	NMVOC	SO_2
	(Gg)						
4. Other Sectors	14 180.97	12.37	0.96	36.57	356.24	44.47	9.32
a. Commercial/Institutional	2 659.83	0.59	0.05	2.87	13.36	1.53	1.80
b. Residential	9 783.74	10.71	0.43	14.17	298.46	33.94	7.14
c. Agriculture/Forestry/Fisheries	1 737.40	1.07	0.48	19.54	44.41	9.00	0.38
5. Other *(as specified in table 1.A(a) sheet 4)*	106.59	0.00	0.01	0.18	0.64	0.04	0.03
a. Stationary	NA	NA	NA	NA	NA	NA	NA
b. Mobile	106.59	0.00	0.01	0.18	0.64	0.04	0.03
Military use	106.59	0.00	0.01	0.18	0.64	0.04	0.03
B. Fugitive Emissions from Fuels	210.04	31.10	IE,NA	IE,NA	IE,NA	3.27	0.14
1. Solid Fuels	IE,NA,NO	0.05	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
a. Coal Mining and Handling	IE,NA,NO	0.05	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	210.04	31.05	IE,NA	IE,NA	IE,NA	3.27	0.14
a. Oil	122.00	5.38	IE,NA	NA	NA	3.02	NA
b. Natural Gas	88.04	25.67				0.25	0.14
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	1 531.80	0.03	0.05	4.90	1.51	0.64	0.49
Aviation	1 531.80	0.03	0.05	4.90	1.51	0.64	0.49
Marine	NA,NO	NA,NO	NA,NO	NO	NO	NO	NO
Multilateral Operations	IE	IE	IE	IE	IE	IE	IE
CO_2 Emissions from Biomass	14 456.04						

[(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/2004: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.AA.1.B Petroleum Refining/2004:1 A 1 c Petroleum Refining: CH4 and NMVOC emissions are included in "1 B 2 fugitive emissions from fuels".

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 1 of 4)

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	1 103 703.35	NCV				68 605.49	14.13	2.63
Liquid Fuels	516 056.90	NCV	73.46	2.51	3.54	37 907.89	1.30	1.82
Solid Fuels	124 517.09	NCV	98.69	5.64	1.37	12 289.15	0.70	0.17
Gaseous Fuels	306 173.81	NCV	55.40	1.09	0.43	16 962.03	0.34	0.13
Biomass	136 905.53	NCV	105.59	84.43	3.50 [3]		11.56	0.48
Other Fuels	20 050.02	NCV	72.14	12.00	1.40	1 446.43	0.24	0.03
1.A.1. Energy Industries	235 550.56	NCV				15 535.20	0.28	0.24
Liquid Fuels	46 014.55	NCV	70.10	0.22	0.64	3 225.66	0.01	0.03
Solid Fuels	69 070.05	NCV	96.66	0.15	1.30	6 676.42	0.01	0.09
Gaseous Fuels	91 985.87	NCV	55.40	0.96	0.37	5 096.02	0.09	0.03
Biomass	19 409.51	NCV	109.85	2.97	3.78 [3]	2 132.04	0.06	0.07
Other Fuels	9 070.57	NCV	59.21	12.00	1.40	537.09	0.11	0.01
a. Public Electricity and Heat Production	192 508.72	NCV				12 798.94	0.27	0.23
Liquid Fuels	13 290.87	NCV	79.83	0.77	1.40	1 061.03	0.01	0.02
Solid Fuels	69 070.05	NCV	96.66	0.15	1.30	6 676.42	0.01	0.09
Gaseous Fuels	81 667.71	NCV	55.40	1.03	0.41	4 524.39	0.08	0.03
Biomass	19 409.51	NCV	109.85	2.97	3.78 [3]	2 132.04	0.06	0.07
Other Fuels	9 070.57	NCV	59.21	12.00	1.40	537.09	0.11	0.01
b. Petroleum Refining	40 073.87	NCV				2 571.84	IE,NO	0.01
Liquid Fuels	32 723.69	NCV	66.15	IE	0.33	2 164.64	IE	0.01
Solid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Gaseous Fuels	7 350.18	NCV	55.40	IE	0.10	407.20	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	2 967.97	NCV				164.43	0.00	0.00
Liquid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Solid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Gaseous Fuels	2 967.97	NCV	55.40	1.50	0.10	164.43	0.00	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)

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	256 085.03	NCV					15 327.95	0.49	0.49
Liquid Fuels	38 768.61	NCV	77.18	1.74	7.90		2 992.27	0.07	0.31
Solid Fuels	48 817.69	NCV	102.26	1.30	1.35		4 992.08	0.06	0.07
Gaseous Fuels	118 827.03	NCV	55.40	1.37	0.10		6 583.02	0.16	0.01
Biomass	40 120.19	NCV	109.73	1.99	2.39	(3)	4 402.19	0.08	0.10
Other Fuels	9 551.51	NCV	79.63	12.00	1.40		760.58	0.11	0.01
a. Iron and Steel	68 083.11	NCV					5 857.95	0.04	0.06
Liquid Fuels	8 818.98	NCV	77.98	0.52	1.00		687.66	0.00	0.01
Solid Fuels	39 179.07	NCV	103.56	0.46	1.34		4 057.58	0.02	0.05
Gaseous Fuels	20 084.89	NCV	55.40	0.72	0.10		1 112.70	0.01	0.00
Biomass	0.17	NCV	110.00	2.00	4.00	(3)	0.02	0.00	0.00
Other Fuels	NO	NCV	NO	NO	NO		NO	NO	NO
b. Non-Ferrous Metals	3 993.12	NCV					238.84	0.01	0.00
Liquid Fuels	476.55	NCV	71.87	1.08	0.85		34.25	0.00	0.00
Solid Fuels	201.09	NCV	104.00	2.00	1.40		20.91	0.00	0.00
Gaseous Fuels	3 315.48	NCV	55.40	1.50	0.10		183.68	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	26 576.37	NCV					1 595.35	0.08	0.02
Liquid Fuels	510.81	NCV	76.85	0.90	0.79		39.26	0.00	0.00
Solid Fuels	2 737.05	NCV	95.93	4.42	1.40		262.56	0.01	0.00
Gaseous Fuels	16 992.22	NCV	55.40	1.50	0.10		941.37	0.03	0.00
Biomass	2 955.65	NCV	110.16	1.96	3.77	(3)	325.58	0.01	0.01
Other Fuels	3 380.64	NCV	104.17	12.00	1.40		352.16	0.04	0.00
d. Pulp, Paper and Print	62 612.94	NCV					1 844.08	0.13	0.08
Liquid Fuels	1 808.22	NCV	77.62	1.74	0.95		140.36	0.00	0.00
Solid Fuels	3 874.81	NCV	94.73	5.49	1.40		367.07	0.02	0.01
Gaseous Fuels	23 690.94	NCV	55.40	1.50	0.10		1 312.48	0.04	0.00
Biomass	33 006.97	NCV	110.01	2.00	2.08	(3)	3 631.08	0.07	0.07
Other Fuels	231.99	NCV	104.17	12.00	1.40		24.17	0.00	0.00
e. Food Processing, Beverages and Tobacco	20 623.86	NCV					1 179.10	0.03	0.00
Liquid Fuels	1 673.09	NCV	76.33	0.90	0.81		127.70	0.00	0.00
Solid Fuels	398.66	NCV	104.00	2.00	1.40		41.46	0.00	0.00
Gaseous Fuels	18 229.88	NCV	55.40	1.50	0.10		1 009.94	0.03	0.00
Biomass	322.23	NCV	109.66	1.91	3.48	(3)	35.34	0.00	0.00
Other Fuels	NO	NCV	NO	NO	NO		NO	NO	NO
f. Other *(please specify)* [4]	74 195.62	NCV					4 612.65	0.20	0.32
Other non-specified									
Liquid Fuels	25 480.95	NCV	77.04	2.25	11.52		1 963.04	0.06	0.29
Solid Fuels	2 427.01	NCV	99.91	4.40	1.40		242.49	0.01	0.00
Gaseous Fuels	36 513.61	NCV	55.40	1.50	0.10		2 022.85	0.05	0.00
Biomass	3 835.18	NCV	106.95	2.00	3.97	(3)	410.17	0.01	0.02
Other Fuels	5 938.87	NCV	64.70	12.00	1.40		384.26	0.07	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)

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	323 279.00	NCV					23 454.78	1.00	0.94
Liquid Fuels	312 185.05	NCV	73.16	3.15	2.99		22 839.25	0.98	0.93
Solid Fuels	23.35	NCV	95.00	6.83	6.83		2.22	0.00	0.00
Gaseous Fuels	11 070.60	NCV	55.40	1.50	0.10		613.31	0.02	0.00
Biomass	NO	NCV	NO	NO	NO		NO	NO	NO
Other Fuels	NA,NO	NCV	NO	NO	NO	[3]	NA,NO	NA,NO	NA,NO
a. Civil Aviation	2 642.05	NCV					192.21	0.01	0.01
Aviation Gasoline	104.15	NCV	72.75	NO	NO		7.58	NO	NO
Jet Kerosene	2 537.90	NCV	72.75	5.19	3.02		184.64	0.01	0.01
b. Road Transportation	306 021.91	NCV					22 392.53	0.95	0.89
Gasoline	88 938.47	NCV	74.06	8.98	6.07		6 586.78	0.80	0.54
Diesel Oil	217 083.44	NCV	72.81	0.71	1.61		15 805.75	0.15	0.35
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	2 358.88	NCV					170.18	0.01	0.02
Liquid Fuels	2 335.52	NCV	71.91	2.29	8.11		167.96	0.01	0.02
Solid Fuels	23.35	NCV	95.00	6.83	6.83		2.22	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	1 185.57	NCV					86.55	0.01	0.02
Residual Oil (Residual Fuel Oil)	NO	NCV	NO	NO	NO		NO	NO	NO
Gas/Diesel Oil	1 066.13	NCV	72.87	1.50	16.91		77.69	0.00	0.02
Gasoline	119.44	NCV	74.19	88.83	1.93		8.86	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]	11 070.60	NCV					613.31	0.02	0.00
Pipeline transport	11 070.60	NCV					613.31	0.02	0.00
Liquid Fuels	NO	NCV	NO	NO	NO		NO	NO	NO
Solid Fuels	NO	NCV	NO	NO	NO		NO	NO	NO
Gaseous Fuels	11 070.60	NCV	55.40	1.50	0.10		613.31	0.02	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)

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	287 323.65	NCV				14 180.97	12.37	0.96
Liquid Fuels	117 623.58	NCV	74.34	1.96	4.65	8 744.11	0.23	0.55
Solid Fuels	6 605.99	NCV	93.62	95.23	2.31	618.43	0.63	0.02
Gaseous Fuels	84 290.32	NCV	55.40	0.80	1.00	4 669.68	0.07	0.08
Biomass	77 375.82	NCV	102.38	147.61	4.01 [(3)]	7 921.81	11.42	0.31
Other Fuels	1 427.94	NCV	104.17	12.00	1.40	148.75	0.02	0.00
a. Commercial/Institutional	45 577.42	NCV				2 659.83	0.59	0.05
Liquid Fuels	17 824.33	NCV	74.23	0.58	0.86	1 323.12	0.01	0.02
Solid Fuels	653.34	NCV	93.40	90.00	2.22	61.02	0.06	0.00
Gaseous Fuels	20 341.91	NCV	55.40	0.80	1.00	1 126.94	0.02	0.02
Biomass	5 329.90	NCV	109.42	90.61	2.57 [(3)]	583.18	0.48	0.01
Other Fuels	1 427.94	NCV	104.17	12.00	1.40	148.75	0.02	0.00
b. Residential	210 657.32	NCV				9 783.74	10.71	0.43
Liquid Fuels	76 745.58	NCV	74.71	0.97	1.17	5 733.99	0.07	0.09
Solid Fuels	5 837.80	NCV	93.63	95.92	2.31	546.60	0.56	0.01
Gaseous Fuels	63 233.86	NCV	55.40	0.80	1.00	3 503.16	0.05	0.06
Biomass	64 840.08	NCV	101.49	154.60	4.01 [(3)]	6 580.76	10.02	0.26
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
c. Agriculture/Forestry/Fisheries	31 088.91	NCV				1 737.40	1.07	0.48
Liquid Fuels	23 053.67	NCV	73.18	6.32	19.16	1 687.01	0.15	0.44
Solid Fuels	114.85	NCV	94.10	90.00	2.81	10.81	0.01	0.00
Gaseous Fuels	714.55	NCV	55.40	0.80	1.00	39.59	0.00	0.00
Biomass	7 205.85	NCV	105.17	126.84	5.07 [(3)]	757.87	0.91	0.04
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
1.A.5 Other *(Not specified elsewhere)* [(6)]	1 465.10	NCV				106.59	0.00	0.01
a. Stationary *(please specify)* [(7)]	NA	NCV				NA	NA	NA
b. Mobile *(please specify)* [(8)]	1 465.10	NCV				106.59	0.00	0.01
Military use								
Liquid Fuels	1 465.10	NCV	72.75	2.40	5.06	106.59	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/2004: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.AA.1.B Petroleum Refining/2004:1 A 1 c Petroleum Refining: CH4 and NMVOC emissions are included in "1 B 2 fugitive emissions from fuels".

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	Primary	Crude Oil	Gg	970.74	7 561.82			90.55	8 442.01	42.75	NCV	360 895.88	20.00	7 217.92		7 217.92	0.99	26 201.04
Fossil	Fuels	Orimulsion		NO	NO	NO		NO	NO		NCV	NO		NO		NO		NO
		Natural Gas Liquids	Gg	88.17					88.17	45.22	NCV	3 986.87	17.20	68.57		68.57	0.99	248.92
	Secondary	Gasoline	Gg		1 049.84	617.05		11.76	421.04	44.80	NCV	18 862.52	18.90	356.50	NO	356.50	0.99	1 294.10
	Fuels	Jet Kerosene	Gg		131.96	4.26	472.20	4.32	-348.81	44.59	NCV	-15 553.31	19.50	-303.29		-303.29	0.99	-1 100.94
		Other Kerosene	Gg		3.08	0.01		0.10	2.97	44.75	NCV	132.80	19.60	2.60		2.60	0.99	9.45
		Shale Oil			NO	NO		NO	NO		NCV	NO		NO		NO		NO
		Gas / Diesel Oil	Gg		4 882.28	580.31		204.56	4 097.41	43.33	NCV	177 540.96	20.20	3 586.33	NO	3 586.33	0.99	13 018.37
		Residual Fuel Oil	Gg		306.33	55.17		129.42	121.73	40.19	NCV	4 892.42	21.10	103.23		103.23	0.99	374.73
		Liquefied Petroleum Gas (LPG)	Gg		131.65	16.56		-5.01	120.10	47.31	NCV	5 681.90	17.20	97.73	1.63	96.10	0.99	348.85
		Ethane			IE	IE		IE	IE		NCV	IE		IE	IE	IE		IE
		Naphtha			IE	IE		IE	IE		NCV	IE		IE	IE	IE		IE
		Bitumen	Gg		295.46	81.08		1.55	212.83	40.19	NCV	8 553.83	22.00	188.18	571.43	-383.24	0.99	-1 391.17
		Lubricants	Gg		43.49	70.42		5.61	-32.53	40.19	NCV	-1 307.56	20.00	-26.15	30.16	-56.31	0.99	-204.42
		Petroleum Coke	Gg		111.70			12.53	99.17	31.00	NCV	3 074.29	27.50	84.54		84.54	0.99	306.89
		Refinery Feedstocks	Gg		222.34	5.23		-162.47	379.58	42.50	NCV	16 132.06	20.00	322.64		322.64	0.99	1 171.19
		Other Oil	Gg		72.94	163.44		-20.69	-69.81	40.19	NCV	-2 805.51	20.00	-56.11	451.07	-507.18	0.99	-1 841.05
Other Liquid Fossil												NA		NA	NA	NA		NA
Liquid Fossil Totals												580 087.14		11 642.70	1 054.28	10 588.42		38 435.95
Solid	Primary	Anthracite [(2)]		IE	IE	IE		IE	IE		NCV	IE		IE		IE		IE
Fossil	Fuels	Coking Coal	Gg		1 789.48			-115.42	1 904.90	28.00	NCV	53 337.20	25.80	1 376.10	60.90	1 315.20	0.98	4 725.96
		Other Bituminous Coal	Gg		2 588.92	21.06		219.96	2 347.90	28.00	NCV	65 741.24	25.80	1 696.12	0.47	1 695.66	0.98	6 093.06
		Sub-bituminous Coal		NO	NO	NO	NO	NO	NO		NCV	NO		NO		NO		NO
		Lignite	Gg	235.40	22.60	0.01		-970.15	1 228.14	10.90	NCV	13 386.72	27.60	369.47		369.47	0.98	1 327.64
		Oil Shale		NO	NO	NO		NO	NO		NCV	NO		NO		NO		NO
		Peat	Gg	0.50					0.50	8.80	NCV	4.40	28.90	0.13		0.13	0.98	0.46
	Secondary	BKB [(3)] and Patent Fuel	Gg		60.76	1.02			59.74	19.30	NCV	1 153.06	25.80	29.75		29.75	0.98	106.90
	Fuels	Coke Oven/Gas Coke	Gg		1 130.43	42.00		26.66	1 061.77	28.20	NCV	29 941.95	29.50	883.29	5.62	877.67	0.98	3 153.77
Other Solid Fossil												NA		NA	NA	NA		NA
Solid Fossil Totals												163 564.58		4 354.86	66.98	4 287.88		15 407.78
Gaseous Fossil		Natural Gas (Dry)	TJ	70 499.90	301 229.08	47 133.85		2 334.95	322 260.18	1.00	NCV	322 260.18	15.30	4 930.58	NO	4 930.58	1.00	17 988.40
Other Gaseous Fossil												NA		NA	NA	NA		NA
Gaseous Fossil Totals												322 260.18		4 930.58	NA,NO	4 930.58		17 988.40
Total												1 065 911.89		20 928.14	1 121.26	19 806.88		71 832.14
Biomass total												136 905.53		4 093.48		4 093.48		13 231.04
		Solid Biomass	TJ	135 121.03	7 682.81	7 785.76			135 018.08	1.00	NCV	135 018.08	29.90	4 037.04		4 037.04	0.88	13 026.18
		Liquid Biomass		IE	IE	IE		IE	IE		NCV	IE		IE		IE		IE
		Gas Biomass	TJ	1 887.45					1 887.45	1.00	NCV	1 887.45	29.90	56.43		56.43	0.99	204.86

(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)

Inventory 2004
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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)	580.09	NE	38 435.95	516.06	37 907.89	12.41	1.39
Solid Fuels (excluding international bunkers) [5]	163.56	NE	15 407.78	124.52	12 289.15	31.36	25.38
Gaseous Fuels	322.26	NE	17 988.40	306.17	16 962.03	5.25	6.05
Other [5]	NA	NE	NA	20.05	1 446.43	-100.00	-100.00
Total [5]	***1 065.91***	***NE***	***71 832.14***	***1 103.70***	***68 605.49***	***10.25***	***4.70***

(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/2004: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(d) SECTORAL BACKGROUND DATA FOR ENERGY
Feedstocks and Non-Energy Use of Fuels
(Sheet 1 of 1)

Additional information [(a)]

FUEL TYPE	ACTIVITY DATA AND RELATED INFORMATION		IMPLIED EMISSION FACTOR	ESTIMATE				
	Fuel quantity (TJ)	Fraction of carbon stored	Carbon emission factor (t C/TJ)	Carbon stored in non-energy use of fuels (Gg C)	CO_2 not emitted ($Gg\ CO_2$)	Subtracted from energy sector (*specify source category*)	Associated CO_2 emissions (Gg)	Allocated under (*Specify source category, e.g. Waste Incineration*)
Naphtha [(1)]	IE	NA	IE	IE	IE	NA	NE	NE
Lubricants	3 016.29	0.50	20.00	30.16	110.60	NA	NE	NE
Bitumen	25 973.89	1.00	22.00	571.43	2 095.23	NA	NE	NE
Coal Oils and Tars (from Coking Coal)	1 796.52	0.75	45.20	60.90	223.30	NA	NE	NE
Natural Gas[(1)]	10 253.10	0.00	NO	NO	NO	NA	NE	NE
Gas/Diesel Oil [(1)]	NO	0.50	NO	NO	NO	NA	NE	NE
LPG [(1)]	94.62	1.00	17.20	1.63	5.97	NA	NE	NE
Ethane [(1)]	IE	NA	IE	IE	IE	NA	NE	NE
Other *(please specify)*				457.15				
Coal	36.20	0.50	25.80	0.47	1.71	NA	NE	NE
Gasoline	NO	0.50	NO	NO	NO	NA	NE	NE
Butane	NO	0.75	NO	NO	NO	NA	NE	NE
Coke	27 191.65	0.01	29.50	5.62	20.59	NA	NE	NE
Other petroleum products	30 071.11	0.75	20.00	451.07	1 653.91	NA	NE	NE
Total				1 121.26	4 111.30			
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				997.82	3 658.69			

[(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 this 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

Inventory 2004

Fugitive Emissions from Solid Fuels

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(Sheet 1 of 1)

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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	0.24			NO	0.05	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)	0.24	0.21	IE	NO	0.05	IE,NA
Mining Activities		0.21	NA	NO	0.05	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)

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)							122.00	5.38	IE,NA
I. Exploration	*number of wells drilled*	number	NA	IE	IE	IE	IE	IE	IE
ii. Production (4)	*Oil throughput*	Mt	0.89	136 924 803.59	5 732 884.40		122.00	5.11	
iii. Transport	*oil loaded in tankers*	number	NA	IE	IE		IE	IE	
iv. Refining / Storage	*Oil refined (SNAP 0401)*	Mt	8 442.01	NA	31.66	NA	NA	0.27	NA
v. Distribution of Oil Products	*Gasoline Consumption (SNAP 0505)*	Mt	2.13	NA	NA		NA	NA	
vi. Other	*(specify)*		NO	NO	NO		NO	NO	
1. B. 2. b. Natural Gas							88.04	25.67	
i. Exploration	*(specify)*		NA	NA	IE		NA	IE	
ii. Production (4) / Processing	*Gas throughput (a)*	10^6 m^3	1 963.00	44 829.34	IE		88.00	IE	
iii. Transmission	*Pipelines length (km)*	km	1 430.00	24.50	2 900.00		0.04	4.15	
iv. Distribution	*Distribution network length*	km	33 800.00	NA	636.83		NA	21.52	
v. Other Leakage	*(e.g. PJ gas consumed)*	PJ	NE	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 2004
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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	21 055.26				1 531.80	0.03	0.05
Jet Kerosene	21 055.26	72.75	0.00	0.00	1 531.80	0.03	0.05
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	IE	IE	IE	IE	IE	IE

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)

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	8 085.80	0.70	0.91	1 927.01	904.39	320.26	114.72	0.03	0.02	1.22	23.82	15.35	1.22
A. Mineral Products	3 125.45	IE,NA	IE,NA							IE,NA	9.78	IE,NA	IE,NA
1. Cement Production	1 754.47												NA
2. Lime Production	599.46												
3. Limestone and Dolomite Use	297.46												
4. Soda Ash Production and Use	11.85												
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)*	462.21	IE,NA	IE,NA							IE,NA	IE,NA	IE,NA	IE,NA
Glass Production	IE	IE	IE							IE	IE	IE	IE
Sinter Production	328.53	NA	NA							NA	NA	NA	NA
Bricks and Tiles (decarbonizing)	133.68	NA	NA							NA	NA	NA	NA
B. Chemical Industry	528.84	0.70	0.91	NO	NO	NO	NO	NO	NO	0.56	11.11	12.34	0.77
1. Ammonia Production	468.48	0.06	NA							0.23	0.04	IE	NA
2. Nitric Acid Production			0.91							0.28			
3. Adipic Acid Production	NO		NO							NO	NO	NO	
4. Carbide Production	35.78	NA								NA	NA	NA	NA
5. Other *(as specified in table 2(I)A-G)*	24.59	0.64	NA,NO	NO	NA,NO	NO	NA,NO	NO	NO	0.05	11.07	12.34	0.77
Carbon Black		NO											
Ethylene	NA	0.35	NA										
Dichloroethylene		NO											
Styrene		NO											
Methanol		NO											
Other Chemical Industry	24.18	0.29	NA	NO	NO	NO	NO	NO	NO	0.05	11.07	12.34	0.77
CO2 from nitric acid production	0.41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	4 431.51	0.00	NA	NO	NO	NO	NO	NA,NO	NO	0.10	2.52	0.45	0.45
1. Iron and Steel Production	4 414.78	0.00								0.08	2.20	0.27	0.05
2. Ferroalloys Production	16.73	NA								NA	NA	NA	NA

TABLE 2(I) SECTORAL REPORT FOR INDUSTRIAL PROCESSES
(Sheet 2 of 2)

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									0.56	0.41	2.57	NA
1. Pulp and Paper										0.56	0.41	0.41	NA
2. Food and Drink[2]	NA											2.16	
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				1 927.01	904.39	320.26	114.72	0.03	0.02				
1. Refrigeration and Air Conditioning Equipment				NA	525.43	NA	NO	NA	NA				
2. Foam Blowing				NA	293.59	NA	NO	NA	NA				
3. Fire Extinguishers				NA	27.34	NA	0.35	NA	NA				
4. Aerosols/ Metered Dose Inhalers				NA	51.91	NA	NO	NA	NA				
5. Solvents				NA	1.85	NA	NO	NA	NA				
6. Other applications using ODS[3] substitutes				NA	NO	NA	NO	NA	NA				
7. Semiconductor Manufacture				NA	4.26	NA	114.37	NA	0.02				
8. Electrical Equipment				NA	NO	NA	NO	NA	0.00				
9. Other *(as specified in table 2(II)*				NA	NO	NA	NO	NA	0.00				
Double glaze windows				NA	NO	NA	NO	NA	0.00				
Research and other use				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.
2.A.7 Bricks and Tiles (decarbonizing)/2004:Activity data is in the unit of [m3].

TABLE 2(I).A-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO_2, CH_4 and N_2O
(Sheet 1 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)					
A. Mineral Products						3 125.45	IE,NO	IE,NA	NO	IE,NA	NO
1. Cement Production	*Clinker Production [kt]*	3 119.81	0.56			1 754.47	NO				
2. Lime Production	Lime Produced [kt]	788.79	0.76			599.46	NO				
3. Limestone and Dolomite Use	Limestone and Dolomite used [kt]	674.43	0.44			297.46	NO				
4. Soda Ash						11.85	IE,NO				
Soda Ash Production	Soda Ash Production	NA	IE			IE	IE				
Soda Ash Use	Soda Ash Used [kt]	28.56	0.41			11.85	NO				
5. Asphalt Roofing	Roofing Material Production [Mio m2]	27.95	IE			IE	NO				
6. Road Paving with Asphalt	Asphalt Production [kt]	1 201.57	IE			IE	NO				
7. Other *(please specify)*						462.21	NO	IE,NA	NO	IE,NA	NO
Glass Production	(specify)	NO	IE	IE	IE	IE	NO	IE	NO	IE	NO
Sinter Production	MgCO3 sintered [kt]	655.24	0.50	NA	NA	328.53	NO	NA	NO	NA	NO
Bricks and Tiles (decarbonizing)	Bricks Production [kt]	2 116.79	0.06	NA	NA	133.68	NO	NA	NO	NA	NO
B. Chemical Industry						528.84	NO	0.70	NO	0.91	NO
1. Ammonia Production[5]	Ammonia Production [kt]	510.02	0.92	0.00	NA	468.48	NO	0.06	NO	NA	NO
2. Nitric Acid Production	Nitric Acid Production [kt]	572.72			0.00					0.91	NO
3. Adipic Acid Production	Adipic Acid Production	NO	NO		NO	NO	NO			NO	NO
4. Carbide Production	Carbide Production	27.61	1.30	NA		35.78	NO	NA	NO		
Silicon Carbide	Silicon Carbide Production	NO	NO	NE		NO	NO	NE	NO		
Calcium Carbide	Calcium Carbide Production	27.61	1.30	NE		35.78	NO	NE	NO		
5. Other *(please specify)*						24.59	NO	0.64	NO	NA,NO	NO
Carbon Black	Carbon Black Production	NO		NO				NO	NO		
Ethylene	Ethylene Production [kt]	350.00	NA	0.00	NA	NA	NO	0.35	NO	NA	NO
Dichloroethylene	Dichloroethylene Production	NO		NO				NO	NO		
Styrene	Styrene Production [kt]	NO		NO				NO	NO		
Methanol	Methanol Production	NE		NO				NO	NO		
Other Chemical Industry	Other Chemical Products [kt]	NA	NA	NA	NA	24.18	NO	0.29	NO	NA	NO
CO2 from nitric acid production	(Specify)	NO	NO	NO	NO	0.41	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.

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						4 431.51	NO	0.00	NO	NA	NO
1. Iron and Steel Production			0.27	0.00		4 414.78	NO	0.00	NO		
Steel	Steel Production [kt]	6 515.17	0.10	IE		680.44	NO	IE	NO		
Pig Iron	Iron Production [kt]	4 860.63	0.76	IE		3 701.87	NO	IE	NO		
Sinter	Sinter Production [kt]	3 527.74	IE	IE		IE	NO	IE	NO		
Coke	Coke Production [kt]	1 400.10	IE	IE		IE		IE			
Other *(please specify)*						32.47	NO	0.00	NO		
Electric Furnace Steel production	Electric Furnace Steel Production	614.36	0.05	0.00		32.47	NO	0.00	NO		
Rolling mills	Product	5 900.81	NA	0.00		NA	NO	0.00	NO		
Foundries	Product	194.11	NA	NA		NA	NO	NA	NO		
2. Ferroalloys Production	Ferroalloys Production [kt]	12.30	1.36	NA		16.73	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]	131.09	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]	1 500.28	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.
2.A.7 Bricks and Tiles (decarbonizing)/2004:Activity data is in the unit of [m3].

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}	$c-C_4F_8$	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	2.27	4.84	NA,NO	1.43	47.78	NA,NO	351.40	526.98	NA,NO	39.11	1.76	NA,NO	NA,NO	54.80		6.19	6.97	1.44	0.05	NA,NO	NA,NO	NA,NO	NA,NO		21.44
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 emissions - Tier 2)	2.27	4.84	NO	1.43	47.78	NO	351.40	526.98	NO	39.11	1.76	NO	NO	54.80		6.19	6.97	1.44	0.05	NO	NO	NO	NO		21.44
1. Refrigeration and Air Conditioning Equipment	NO	4.84	NO	NO	47.78	NO	184.45	0.81	NO	39.11	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		NA
2. Foam Blowing	NO	NO	NO	NO	NO	NO	166.95	526.17	NO	NO	NO	NO	NO	2.89		NO	NO	NO	NO	NO	NO	NO	NO		NA
3. Fire Extinguishers	1.90	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.76	NO	NO	NO		NO	NO	NO	0.05	NO	NO	NO	NO		NA
4. Aerosols/Metered Dose Inhalers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	51.91		NO	NO	NO	NO	NO	NO	NO	NO		NA
5. Solvents	NO	NO	NO	1.43	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	0.36	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		6.19	6.97	1.44	0.00	NO	NO	NO	NO		15.85
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		1.41
9. Other *(as specified in table 2(II)F)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO			NO	NO	NO	NO	NO	NO	NO	NO		4.19
Double glaze windows	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO			NO	NO	NO	NO	NO	NO	NO	NO		3.33
Research and other use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO			NO	NO	NO	NO	NO	NO	NO	NO		0.86
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(I

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]	3.31	17.40	NE,NO	1.44	129.35	NE,NO	680.38	574.89	NE,NO	112.78	8.00	NE,NO	NE,NO	96.14	**1 927.01**	15.78	22.44	1.60	0.01	NO	NO	NO	NO	**320.26**	27.45
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	NO	NO
Import:	3.31	17.40	NE,NO	1.44	129.35	NE,NO	680.38	574.89	NE,NO	112.78	8.00	NE,NO	NE,NO	96.14	1 927.01	15.78	22.44	1.60	0.01	NO	NO	NO	NO	320.26	27.45
In bulk	3.31	17.40	NO	1.44	129.35	NO	680.38	574.89	NO	112.78	8.00	NO	NO	96.14	1 927.01	15.78	22.44	1.60	0.01	NO	NO	NO	NO	320.26	27.45
In products[6]	IE	IE	NE	NE	IE	NE	IE	IE	NE	IE	IE	NE	NE	NO	IE,NE,NO	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,NE,NO	IE,NO	IE,NO	IE,NO	IE,NO	NO	NO	NO	NO	IE,NO	IE
In bulk	IE	IE	NO	NO	IE	NO	IE	IE	NO	IE	IE	NO	NO	NO	IE,NO	IE	IE	IE	IE	NO	NO	NO	NO	IE,NO	IE
In products[6]	IE	IE	NE	NE	IE	NE	IE	IE	NE	IE	IE	NE	NE	NO	IE,NE,NO	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,NO	NE	NE	NE	NE	NO	NO	NO	NO	NE,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))	26.50	3.15	NA,NO	1.85	133.78	NA,NO	456.82	73.78	NA,NO	148.61	5.10	NA,NO	NA,NO	54.80	904.39	40.20	64.08	10.08	0.36	NA,NO	NA,NO	NA,NO	NA,NO	114.72	512.51
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	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	26.50	3.15	NO	1.85	133.78	NO	456.82	73.78	NO	148.61	5.10	NO	NO	54.80	904.39	40.20	64.08	10.08	0.36	NO	NO	NO	NO	114.72	512.51
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.)	26.50	3.15	NO	1.85	133.78	NO	456.82	73.78	NO	148.61	5.10	NO	NO	54.80	904.39	40.20	64.08	10.08	0.36	NO	NO	NO	NO	114.72	512.51
Potential emissions - F(p)[8] (Gg CO_2 eq.)	38.75	11.31	NE,NO	1.88	362.18	NE,NO	884.50	80.48	NE,NO	428.58	23.20	NE,NO	NE,NO	96.14	1 927.01	102.54	206.45	11.20	0.07	NO	NO	NO	NO	320.26	655.98
Potential/Actual emissions ratio	1.46	3.60	NE,NO	1.01	2.71	NE,NO	1.94	1.09	NE,NO	2.88	4.55	NE,NO	NE,NO	1.75	2.13	2.55	3.22	1.11	0.20	NO	NO	NO	NO	2.79	1.28

(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,

(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)

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)

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 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.
• 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)

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	64.37	NO	NA	1.50	NA	NA	0.97	NO
Commercial Refrigeration									
HFC-134a	4.00	40.79	3.44	NA	1.50	NE	NA	0.61	0.69
Transport Refrigeration									
HFC-134a	5.00	29.39	2.15	NA	10.00	20.00	NA	2.94	0.43
Industrial Refrigeration									
HFC-125	107.88	545.39	NO	NA	8.00	NA	NA	43.63	NO
HFC-152a	1.17	10.10	NO	NA	8.00	NA	NA	0.81	NO
HFC-134a	126.40	779.77	NO	NA	8.00	NA	NA	62.38	NO
HFC-143a	105.04	482.71	NO	NA	8.00	NA	NA	38.62	NO
HFC-32	3.68	17.55	NO	NA	8.00	NA	IE	1.40	NO
Stationary Air-Conditioning									
HFC-143a	7.74	14.10	NO	NA	3.48	NA	NA	0.49	NO
HFC-32	13.72	65.62	NO	NA	5.24	NA	NA	3.44	NO
HFC-125	21.47	83.26	NO	NA	4.98	NA	NA	4.15	NO
HFC-134a	54.07	309.88	NO	NA	5.02	NA	NA	15.57	NO
Mobile Air-Conditioning									
HFC-134a	158.67	730.88	7.52	NA	13.54	25.00	NA	98.99	1.88
2. Foam Blowing[(1)]									
Hard Foam									
HFC-152a	388.39	1 545.13	NO	NA	24.21	NA	NA	374.14	NO
HFC-134a	208.69	1 360.55	NO	NA	0.90	NA	NA	12.24	NO
Unspecified mix of HFCs	42 849.00	126 341.11	NO	NA	2.28	NA	NA	2 885.64	NO
Soft Foam									
HFC-134a	123.55	251.15	NO	NA	61.60	NO	NA	154.71	NO

TABLE 2(II).F SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Consumption of Halocarbons and SF_6
(Sheet 2 of 2)

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	35.14	NE	NE	5.00	NE	NE	1.76	NE
C4F10	NO	1.00	NE	NE	5.00	NE	NE	0.05	NE
HFC-23	1.90	38.03	NE	NE	5.00	NE	NE	1.90	NE
4. Aerosols [(1)]									
Metered Dose Inhalers									
Unspecified mix of HFCs	53 287.21	NA	NA	NA	NA	NA	NA	51 911.76	NA
Other									
5. Solvents [(1)]									
HFC-43-10 mee	1.44	NA	NA	NA	NA	NA	NA	1.43	NA
6. Other applications using ODS[(2)] substitutes [(1)]									
7. Semiconductors [(1)]									
HFC-23	C	NA	NA	C	NA	NA	0.36	NA	NA
C2F6	C	NA	NA	C	NA	NA	6.97	NA	NA
C3F8	C	NA	NA	C	NA	NA	1.44	NA	NA
C4F10	C	NA	NA	C	NA	NA	0.00	NA	NA
SF6	C	NA	NA	C	NA	NA	15.85	NA	NA
CF4	C	NA	NA	C	NA	NA	6.19	NA	NA
8. Electric Equipment[(1)]									
SF6	11.04	140.83	NE	NE	1.00	NE	NE	1.41	NE
9. Other *(please specify)* [(1)]									
Double glaze windows									
SF6	NO	291.10	NO	NO	1.14	NA	NO	3.33	NO
Research and other use									
SF6	0.02	0.64	NA	NA	NA	NA	NA	0.86	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:

TABLE 3 SECTORAL REPORT FOR SOLVENT AND OTHER PRODUCT USE
(Sheet 1 of 1)

Inventory 2004
Submission 2006 v1.3
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	N_2O	NMVOC
	(Gg)		
Total Solvent and Other Product Use	189.84	0.75	81.43
A. Paint Application	58.84		22.92
B. Degreasing and Dry Cleaning	24.57	NA	9.50
C. Chemical Products, Manufacture and Processing	**25.18**		11.75
D. Other	81.25	0.75	37.26
1. Use of N_2O for Anaesthesia		0.35	
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)*	81.25	NA	37.26
Other non-specified	81.25	NA	37.26

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]	48.16	1.22	
B. Degreasing and Dry Cleaning	Solvents used [kt]	17.75	1.38	NA
C. Chemical Products, Manufacture and Processing	Solvents used [kt]	96.61	0.26	
D. Other				
1. Use of N_2O for Anaesthesia	Use of N2O for Anaesthesia [kt]	0.35		1.00
2. N_2O from Fire Extinguishers	N2O from Fire Extinguishers	NE		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]	51.38	1.58	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)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4	N_2O	NO_x	CO	NMVOC
	(Gg)				
Total Agriculture	**198.34**	11.93	5.28	1.74	2.00
A. Enteric Fermentation	155.94				
1. Cattle [1]	146.29				
Option A:					
Dairy Cattle	61.88				
Non-Dairy Cattle	84.41				
Option B:					
Mature Dairy Cattle					
Mature Non-Dairy Cattle					
Young Cattle					
2. Buffalo	NO				
3. Sheep	2.62				
4. Goats	0.28				
5. Camels and Llamas	NO				
6. Horses	1.57				
7. Mules and Asses	IE				
8. Swine	4.69				
9. Poultry	0.17				
10. Other *(as specified in table 4.A)*	0.33				
Deer	0.33				
B. Manure Management	41.89	2.86			NE
1. Cattle [1]	22.33				
Option A:					
Dairy Cattle	10.95				
Non-Dairy Cattle	11.37				
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	18.35				
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.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4	N_2O	NO_x	CO	NMVOC
	(Gg)				
B. Manure Management (continued)					
11. Anaerobic Lagoons		NO			NE
12. Liquid Systems		0.07			NE
13. Solid Storage and Dry Lot		2.74			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)	0.42	9.07			1.85
1. Direct Soil Emissions	NA	4.83			1.85
2. Pasture, Range and Paddock Manure (3)		0.71			NA
3. Indirect Emissions	NA	3.50			NA
4. Other *(as specified in table 4.D)*	0.42	0.03			NE
Sewage sludge spreading	0.42	0.03			NE
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.09	0.00	0.05	1.74	0.15
1 . Cereals	0.07	0.00	0.05	1.52	0.10
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**	**5.23**	**NA**	**NA**
NOX from Agricultural Soils	NA	NA	5.23	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.

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	2 050.99			71.33
Option A:				
Dairy Cattle [4]	537.95	292.32	6.00	115.04
Non-Dairy Cattle	1 513.04	141.76	6.00	55.79
Option B:				
Mature Dairy Cattle				
Mature Non-Dairy Cattle				
Young Cattle				
2. Buffalo	NO	NO	NO	NO
3. Sheep	327.16	NE	NE	8.00
4. Goats	55.52	NE	NE	5.00
5. Camels and Llamas	NO	NO	NO	NO
6. Horses	87.07	NE	NE	18.00
7. Mules and Asses	IE	IE	IE	IE
8. Swine	3 125.36	NE	NE	1.50
9. Poultry	13 027.15	2.18	0.09	0.01
10. Other *(please specify)*				
Deer	41.19	NE	NE	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	426.82				NO	NE	NE	NO	NE	NE	NE	NE		NE
Feeding situation [c]		Stall/Pasture	Stall/Pasture				NO	NE	NE	NO	NE	NE	NE	NE		NE
Milk yield	(kg/day)	15.90	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	15.56	0.00	0.00	0.00	NO	NE	NE	NO	NE	NE	NE	NE		NE
Digestibility of feed	(%)	70.00	71.89	0.00	0.00	0.00	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)

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	2 050.99							10.89
Option A:								
Dairy Cattle (3)	537.95	100.00	NO	NO	700.00	1 544.04	0.24	20.36
Non-Dairy Cattle	1 513.04	100.00	0.00	0.00	426.82	705.40	0.17	7.52
Option B:								
Mature Dairy Cattle		0.00	0.00	0.00				
Mature Non-Dairy Cattle		0.00	0.00	0.00				
Young Cattle		0.00	0.00	0.00				
2. Buffalo	NO	NO	NO	NO	NO	NO	NO	NO
3. Sheep	327.16	0.00	0.00	0.00	43.00	146.00	0.19	0.19
4. Goats	55.52	0.00	0.00	0.00	30.00	102.20	0.17	0.12
5. Camels and Llamas	NO	NO	NO	NO	NO	NO	NO	NO
6. Horses	87.07	0.00	0.00	0.00	238.00	627.80	0.33	1.39
7. Mules and Asses	IE	IE	IE	IE	238.00	627.80	0.33	IE
8. Swine	3 125.36	0.00	0.00	0.00	82.00	147.18	0.45	5.87
9. Poultry	13 027.15	0.00	0.00	0.00	1.10	36.50	0.32	0.08
10. Other livestock *(please specify)*								
Deer	41.19	100.00	0.00	0.00	NA	NA	NA	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.

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	0.00	18,95	0.00	70,4	IE	10,65	0.00
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[(b)]	Cool	90.00	39.00	0.00	1.00		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	0.00	24,3	0.00	66,22	IE	9,48	0.00
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[(b)]	Cool	90.00	39.00	0.00	1.00		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							
		Temperate							
		Warm							
	MCF[(b)]	Cool							
		Temperate							
		Warm							
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							
		Temperate							
		Warm							
	MCF[(b)]	Cool	IE	IE	IE	IE	IE	IE	IE
		Temperate	IE	IE	IE	IE	IE	IE	IE
		Warm	IE	IE	IE	IE	IE	IE	IE
Swine	Allocation (%)	Cool	0.00	71,49	0.00	28,51	NO	0.00	0.00
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[(b)]	Cool	90.00	39.00	0.00	1.00		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	2 050.99		NO	26 177 955.81	NO	80 871 677.30	13 526 409.35	NO
Option A:								
Dairy Cattle	537.95	94.72	NO	9 681 228.13	NO	35 871 497.91	5 401 106.22	NO
Non-Dairy Cattle	1 513.04	46.01	NO	16 496 727.68	NO	45 000 179.39	8 125 303.13	NO
Option B:								
Mature Dairy Cattle								
Mature Non-Dairy Cattle								
Young Cattle								
Sheep	327.16	13.10	NO	NO	NO	85 716.71	3 728 676.71	471 441.88
Swine	3 125.36	14.34	NO	15 044 878.77	NO	6 123 641.83	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	55.52	12.30	NO	NO	NO	NO	655 615.58	27 317.32
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	NA	NA	NA	NA	NA	NA	NA
Other livestock *(please specify)*								
Deer	41.19	13.10	NO	NO	NO	NO	518 005.44	21 583.56
Total per AWMS			NA,NO	42 154 197.72	NA,NO	87 152 679.16	22 575 912.57	6 705 211.47

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.

TABLE 4.C SECTORAL BACKGROUND DATA FOR AGRICULTURE
Rice Cultivation
(Sheet 1 of 1)

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 Inventory 2004

Agricultural Soils Submission 2006 v1.3

(Sheet 1 of 2) AUSTRIA

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**			4.83
1. Synthetic Fertilizers	Nitrogen input from application of synthetic fertilizers	94 460 287.02	0.01	1.86
2. Animal Manure Applied to Soils	Nitrogen input from manure applied to soils	105 026 239.16	0.01	2.06
3. N-fixing Crops	Nitrogen fixed by N-fixing crops	20 538 127.20	0.01	0.40
4. Crop Residue	Nitrogen in crop residues returned to soils	25 725 746.90	0.01	0.51
5. Cultivation of Histosols [2]	Area of cultivated organic soils (ha/yr)	NO	NO	NO
6. Other direct emissions *(please specify)*				NA
2. Pasture, Range and Paddock Manure	**N excretion on pasture range and paddock**	22 575 912.57	0.02	0.71
3. Indirect Emissions				3.50
1. Atmospheric Deposition	Volatized N from fertilizers, animal manures and other	35 640 400.33	0.01	0.56
2. Nitrogen Leaching and Run-off	N from fertilizers, animal manures and other that is lost through leaching and run-off	74 884 363.62	0.02	2.94
4. Other *(please specify)*				0.03
Sewage sludge spreading	N from sewage sludge spreading (kg N/yr)	1 579 887.66	0.01	0.03

[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

Agricultural Soils[1]

(Sheet 2 of 2)

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	NO
$Frac_{GASF}$	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	0.20
$Frac_{GRAZ}$	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	0.02
$Frac_{NCRO}$	Fraction of residue dry biomass that is N	0.01
$Frac_{R}$	Fraction of total above-ground crop biomass that is removed from the field as a crop product	0.34
Other fractions *(please specify)*		0.00

[(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)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION					IMPLIED EMISSION FACTORS		EMISSIONS	
	Area of savanna burned	Average above-ground biomass density	Fraction of savanna burned	Biomass burned	Nitrogen fraction in biomass	CH_4	N_2O	CH_4	N_2O
	(k ha/yr)	(t dm/ha)		(Gg dm)		(kg/t dm)		(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	0.00	0.00
Fraction oxidized	0.00	0.00
Carbon fraction	0.00	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 4.F SECTORAL BACKGROUND DATA FOR AGRICULTURE
Field Burning of Agricultural Residues
(Sheet 1 of 1)

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											0.07	0.00
Wheat	5 294 967.39	1.30	0.86	0.00	NA	24.83	NA	NA	2.91	0.06	0.07	0.00
Barley	NA	NA	NA	NA	0.00	IE	0.00	NA	IE	IE	IE	IE
Maize	NA	NA	NA	NA	0.00	IE	IE	NA	IE	IE	IE	IE
Oats	NA	NA	NA	NA	0.00	IE	IE	NA	IE	IE	IE	IE
Rye	NA	NA	NA	NA	0.00	IE	IE	NA	IE	IE	IE	IE
Rice	NO	NO	NO	NO	0.00	NO	0.00	NO	NO	NO	NO	NO
Other *(please specify)*											NA	NA
2. Pulses											NA,NO	NA,NO
Dry bean	NO	NO	NO	NO	0.00	NO	0.00	NO	NO	NO	NO	NO
Peas	NO	NO	NO	NO	0.00	NO	0.00	NO	NO	NO	NO	NO
Soybeans	NO	NO	NO	NO	0.00	NO	0.00	NO	NO	NO	NO	NO
Other *(please specify)*											NA	NA
3 Tubers and Roots											NA,NO	NA,NO
Potatoes	NO	NO	NO	NO	0.00	NO	0.00	NO	NO	NO	NO	NO
Other *(please specify)*											NA	NA
4 Sugar Cane	NO	NO	NO	NO	0.00	NO	0.00	NO	NO	NO	NO	NO
5 Other *(please specify)*											0.02	0.00
Vine	NA	NA	NA	NA	NA	2.85	NA	NA	6.50	0.07	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 2004
Submission 2006 v1.3
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/ removals[(1), (2)]	CH_4	N_2O	NO_x	CO
	(Gg)				
Total Land-Use Categories	**-16 641.30**	**0.00**	**0.04**	**IE,NA,NE**	**IE,NA,NE**
A. Forest Land	**-17 047.22**	**0.00**	**0.00**	**NE**	**NE**
1. Forest Land remaining Forest Land	-16 935.51	0.00	0.00	NE	NE
2. Land converted to Forest Land	-111.71	NO	NO	NE	NE
B. Cropland	**-131.85**	**NA,NO**	**0.04**	**IE**	**IE**
1. Cropland remaining Cropland	-82.11	NA	NA	IE	IE
2. Land converted to Cropland	-139.96	NO	0.04	IE	IE
C. Grassland	**339.63**	**NO**	**NO**	**IE**	**IE**
1. Grassland remaining Grassland	13.17	NO	NO	IE	IE
2. Land converted to Grassland	326.46	NO	NO	IE	IE
D. Wetlands	**14.78**	**NO**	**NO**	**NA**	**NA**
1. Wetlands remaining Wetlands (3)	NE,NO	NO	NO	NA	NA
2. Land converted to Wetlands	14.78	NO	NO	NA	NA
E. Settlements	**72.36**	**NA,NO**	**NA,NO**	**NA**	**NA**
1. Settlements remaining Settlements (3)	NE,NO	NA	NA	NA	NA
2. Land converted to Settlements	72.36	NA	NA	NA	NA
F. Other Land	**110.99**	**NA,NO**	**NA,NO**	**NA**	**NA**
1. Other Land remaining Other Land (4)		NA	NA	NA	NA
2. Land converted to Other Land	110.99	NA	NA	NA	NA
G. Other *(please specify)* (5)	**NE**	**NA**	**NA**	**NA**	**NA**
Harvested Wood Products (6)	NE	NA	NA	NA	NA
Information items(7)					
Forest Land converted to other Land-Use Categories	445.00	NA	NA	NA	NA
Grassland converted to other Land-Use Categories	-162.86	NA	0.04	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 (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and by changing the sign for net CO_2 removals to be

(2) CO_2 emissions from liming and biomass burning are included in this column.

(3) Parties do not have to prepare estimates for 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 and report in this row.

(4) Parties do not have to prepare estimates for this category contained in Chapter 3.7.1 of the IPCC good practice guidance for LULUCF, although they may do so if they wish and report in this row. This land-use category is to allow the total of identified land area to match the national area.

(5) May include other non-specified sources and sinks.

(6) Parties do not have 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.

Note: The totals for some land-use categories for N2O (5.A and 5.D), CO2 (5.B and 5.C) and CO2, CH4, N2O (5.E and 5.F) may not equal the summation of the subcategories included in this table, because these totals include data from tables 5(II), 5(IV) and 5(V), where the subcategories are not available. Emissions of CO2, CH4, N2O from 5.G Other are estimated based on the information provided in the background data tables.

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)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division[1]	Total area (kha)	Carbon stock change in living biomass per area [2,3]			Net carbon stock change in dead organic matter per area[3]	Net carbon stock change in soils per area [3]	Carbon stock change in living biomass[2,3]			Net carbon stock change in dead organic matter[3]	Net carbon stock change in soils [3]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
A. Total Forest Land		3 376.44	3.18	-1.81	1.37	0.00	0.01	10 742.53	-6 110.53	4 632.00	0.16	17.08
1. Forest Land remaining Forest Land		3 365.06	3.19	-1.82	1.37	0.00	NO	10 729.15	-6 110.53	4 618.62	0.16	NO
	Coniferous	2 483.41	3.18	-1.98	1.20	0.00	NO	7 896.33	-4 924.24	2 972.09	0.12	NO
	Deciduous	881.65	3.21	-1.35	1.87	0.00	NO	2 832.81	-1 186.29	1 646.52	0.04	NO
2. Land converted to Forest Land[4]		11.38	1.18	IE	1.18	NO	1.50	13.38	IE	13.38	NO	17.08
2.1 Cropland converted to Forest Land		1.82	1.18	IE	1.18	NO	2.01	2.14	IE	2.14	NO	3.66
	Total	1.82	1.18	IE	1.18	NO	2.01	2.14	IE	2.14	NO	3.66
2.2 Grassland converted to Forest Land		6.72	1.18	IE	1.18	NO	0.65	7.90	IE	7.90	NO	4.34
	Total	6.72	1.18	IE	1.18	NO	0.65	7.90	IE	7.90	NO	4.34
2.3 Wetlands converted to Forest Land		0.57	1.18	IE	1.18	NO	3.04	0.67	IE	0.67	NO	1.73
	Total	0.57	1.18	IE	1.18	NO	3.04	0.67	IE	0.67	NO	1.73
2.4 Settlements converted to Forest Land		1.59	1.18	IE	1.18	NO	3.32	1.87	IE	1.87	NO	5.28
	Total	1.59	1.18	IE	1.18	NO	3.32	1.87	IE	1.87	NO	5.28
2.5 Other Land converted to Forest Land		0.68	1.18	IE	1.18	NO	3.04	0.80	IE	0.80	NO	2.07
	Total	0.68	1.18	IE	1.18	NO	3.04	0.80	IE	0.80	NO	2.07

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

(2) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(3) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(4) 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)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division [1]	Total area (kha)	Carbon stock change in living biomass per area [2], [3]			Net carbon stock change in dead organic matter per area [3]	Net carbon stock change in soils per area [3]	Carbon stock change in living biomass [2], [3], [4]			Net carbon stock change in dead organic matter [3,5]	Net carbon stock change in soils [3]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
B. Total Cropland		1 455.45	0.05	-0.06	-0.01	NO	0.05	67.30	-83.40	-16.10	NO	76.66
1. Cropland remaining Cropland		1 420.77	IE	-0.05	-0.05	NO	0.07	IE	-77.68	-77.68	NO	100.07
	Annual remaining annual	1 419.89	IE	-0.04	-0.04	NO	0.07	IE	-53.54	-53.54	NO	100.04
	Annual converted to perennial	0.49	IE	-2.90	-2.90	NO	0.35	IE	-1.41	-1.41	NO	0.17
	Perennial converted to annual	0.39	IE	-58.00	-58.00	NO	-0.35	IE	-22.73	-22.73	NO	-0.14
2. Land converted to Cropland [6]		34.68	1.94	-0.16	1.78	NO	-0.68	67.30	-5.72	61.58	NO	-23.41
2.1 Forest Land converted to Cropland		0.27	IE	-21.17	-21.17	NO	-1.96	IE	-5.72	-5.72	NO	-0.53
	Total	0.27	IE	-21.17	-21.17	NO	-1.96	IE	-5.72	-5.72	NO	-0.53
2.2 Grassland converted to Cropland		34.41	1.96	IE	1.96	NO	-0.66	67.30	IE	67.30	NO	-22.88
	Total	34.41	1.96	IE	1.96	NO	-0.66	67.30	IE	67.30	NO	-22.88
2.3 Wetlands converted to Cropland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	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
	Total	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
	Total	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 zones or national land classification.

(2) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(3) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(4) For category 5.B.1 Cropland remaining Cropland this column only includes changes in perennial woody biomass.

(5) No reporting on dead organic matter pools is required for category 5.B.1. Cropland remaining Cropland.

(6) 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 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.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division (1)	Total area (kha)	Carbon stock change in living biomass per area (2), (3)			Net carbon stock change in dead organic matter per area (2)	Net carbon stock change in soils per area (2)	Carbon stock change in living biomass (2), (3), (4)			Net carbon stock change in dead organic matter (2), (5)	Net carbon stock change in soils (2)
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
C. Total Grassland		1 919.60	IE,NO	-0.05	-0.05	NO	0.00	IE,NO	-98.82	-98.82	NO	6.20
1. Grassland remaining Grassland		1 899.67	NO	NO	NO	NO	0.00	NO	NO	NO	NO	-3.59
	Total	1 899.67	NO	NO	NO	NO	0.00	NO	NO	NO	NO	-3.59
2. Land converted to Grassland (6)		19.93	NO	-4.96	-4.96	NO	0.49	IE,NO	-98.82	-98.82	NO	9.79
2.1 Forest Land converted to Grassland		2.81	IE	-21.17	-21.17	NO	-0.57	IE	-59.48	-59.48	NO	-1.60
	Total	2.81	IE	-21.17	-21.17	NO	-0.57	IE	-59.48	-59.48	NO	-1.60
2.2 Cropland converted to Grassland		17.12	IE	-2.30	-2.30	NO	0.66	IE	-39.34	-39.34	NO	11.39
	Total	17.12	IE	-2.30	-2.30	NO	0.66	IE	-39.34	-39.34	NO	11.39
2.3 Wetlands converted to Grassland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	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
	Total	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
	Total	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 zones or national land classification.

(2) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(3) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(4) For category 5.C.1 Grassland remaining Grassland this column only includes changes in perennial woody biomass.

(5) No reporting on dead organic matter pools is required for category 5.C.1 Grassland remaining Grassland.

(6) 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 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

Inventory 2004

Wetlands[1]

Submission 2006 v1.3

(Sheet 1 of 1)

AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division [2]	Total area (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]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
D. Total Wetlands		13.29	NE	-0.25	-0.25	NE	-0.05	IE,NE,NO	-3.39	-3.39	NE,NO	-0.65
1. Wetlands remaining Wetlands		13.13	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Total	13.13	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Land converted to Wetlands [5]		0.16	NO	-21.17	-21.17	NO	-4.03	IE,NO	-3.39	-3.39	NO	-0.65
2.1 Forest Land converted to Wetlands		0.16	IE	-21.17	-21.17	NO	-4.03	IE	-3.39	-3.39	NO	-0.65
	Total	0.16	IE	-21.17	-21.17	NO	-4.03	IE	-3.39	-3.39	NO	-0.65
2.2 Cropland converted to Wetlands		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.3 Grassland converted to Wetlands		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.4 Settlements converted to Wetlands		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Wetlands		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

(1) Parties do not have to prepare estimates for 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.

(2) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

(3) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(4) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(5) 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 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[1]

(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division [2]	Total area (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]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
E. Total Settlements		483.95	IE,NE,NO	-0.03	-0.03	NO	-0.01	IE,NE,NO	-16.93	-16.93	NO	-2.80
1. Settlements remaining Settlements		472.53	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE
	Total	472.53	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE
2. Land converted to Settlements [6]		11.43	NO	-1.48	-1.48	NO	-0.25	IE,NE,NO	-16.93	-16.93	NO	-2.80
2.1 Forest Land converted to Settlements		0.80	IE	-21.17	-21.17	NO	-3.50	IE	-16.93	-16.93	NO	-2.80
	Total	0.80	IE	-21.17	-21.17	NO	-3.50	IE	-16.93	-16.93	NO	-2.80
2.2 Cropland converted to Settlements		5.42	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE
	Total	5.42	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE
2.3 Grassland converted to Settlements		5.21	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE
	Total	5.21	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE
2.4 Wetlands converted to Settlements		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Settlements		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

(1) Parties do not have to prepare estimates for 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.

(2) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

(3) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(4) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(5) For category 5.E.1 Settlements remaining Settlements this column only includes changes in perennial woody biomass.

(6) 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 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.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS					EMISSIONS/REMOVALS				
Land-Use Category	Sub-division [2]	Total area (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]
			Increase	Decrease	Net change			Increase	Decrease	Net change		
			(Mg C/ha)					(Gg C)				
F. Total Other Land		1.27	IE,NO	-21.17	-21.17	NO	-2.67	IE,NO	-26.88	-26.88	NO	-3.39
1. Other Land remaining Other Land		NE										
2. Land converted to Other Land [5]		1.27	NO	-21.17	-21.17	NO	-2.67	IE,NO	-26.88	-26.88	NO	-3.39
2.1 Forest Land converted to Other Land		1.27	IE	-21.17	-21.17	NO	-2.67	IE	-26.88	-26.88	NO	-3.39
	Total	1.27	IE	-21.17	-21.17	NO	-2.67	IE	-26.88	-26.88	NO	-3.39
2.2 Cropland converted to Other Land		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	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
	Total	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
	Total	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
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

(1) Parties do not have to prepare estimates for this category contained in Chapter 3.7.1 of the IPCC good practice guidance for LULUCF, although they may do so if they wish. This land-use category is to allow the total of identified land area to match the national area.

(2) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zones or national land classification.

(3) CO_2 emissions and removals (carbon stock increase and decrease) should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on increases and decreases.

(4) The signs for estimates of increases in carbon stocks are positive (+) and of decreases in carbon stocks are negative (-).

(5) 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 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.

Direct N_2O emissions from N fertilization [1]
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS
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 [4], [5]	**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 amount of fertilizers applied to forest land. The indirect N_2O emissions from forest land are estimated as part of the total indirect emissions (Agriculture sector and Forest Land) in the Agriculture sector based on the total fertilizers used in the country.

(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) 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.

(5) A Party may report aggregate estimates for all N fertilization on forest land when data are not available to report forest land remaining forest land and land conversion 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.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS
Land-Use Category [2]	Sub-division [3]	Area of drained soils	N_2O-N per area drained [4]	N_2O
		(kha)	(kg N_2O-N/ha)	(Gg)
Total all Land-Use Categories		**NO**	**NO**	**NO**
A. Forest Land		**NO**	**NO**	**NO**
Organic Soil		NO	NO	NO
	Total	NO	NO	NO
Mineral Soil		NO	NO	NO
	Total	NO	NO	NO
D. Wetlands		**NO**	**NO**	**NO**
Organic Soil		NO	NO	NO
	Total	NO	NO	NO
Mineral Soil		NO	NO	NO
	Total	NO	NO	NO
G. Other (please specify)				

(1) Methodologies for estimating N_2O emissions from drainage of soils are not addressed in the Revised 1996 IPCC Guidelines, but are addressed for forest soils in Appendix 3a.2 of the IPCC good practice guidance for LULUCF (equation 3a.2.1) and for wetland soils in appendix 3a.3.

(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

(4) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

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

N_2O emissions from disturbance associated with land-use conversion to cropland [1]

(Sheet 1 of 1)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS
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 [4]	**34.41**	**0.69**	**0.04**
B. Cropland	**34.41**	**0.69**	**0.04**
2. Lands converted to Cropland [5]	34.41	0.69	0.04
Organic Soils	NO	NO	NO
Mineral Soils	34.41	0.69	0.04
2.1 Forest Land converted to Cropland	NE,NO	NO	NE,NO
Organic Soils	NO	NO	NO
Mineral Soils	NE	NE	NE
2.2 Grassland converted to Cropland	34.41	0.69	0.04
Organic Soils	NO	NO	NO
Mineral Soils	34.41	0.69	0.04
2.3 Wetlands converted to Cropland [6]	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) Parties can separate between organic and mineral soils, if they have data available.

(5) If activity data cannot be disaggregated to all initial land uses, Parties may report some initial land uses aggregated under other lands converted to cropland (indicate in the documentation box what this category includes).

(6) 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

Carbon emissions from agricultural lime application [1]

(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS
Land-Use Category	Total amount of lime applied	Carbon emissions per unit of lime	Carbon
	(Mg/yr)	(Mg C/Mg)	(Gg)
Total all Land-Use Categories [2], [3], [4]	**205 047.45**	**0.12**	**24.61**
B. Cropland [4]	**205 047.45**	**0.12**	**24.61**
Limestone $CaCO_3$	205 047.45	0.12	24.61
Dolomite $CaMg(CO_3)_2$	IE	IE	IE
C. Grassland [4]	**IE**	**IE**	**IE**
Limestone $CaCO_3$	IE	IE	IE
Dolomite $CaMg(CO_3)_2$	IE	IE	IE
G. Other *(please specify)* [4, 5]			

(1) Carbon emissions from agricultural lime application are addressed in equation 3.3.6 and 3.4.11 of the IPCC good practice guidance for LULUCF.

(2) 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 total.

(3) 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.

(4) A Party may report agregate estimates for total lime applications when data are not available for limestone and dolomite.

(5) 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.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA			IMPLIED EMISSION FACTOR			EMISSIONS		
	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			**NA**	**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	0.06	0.00	IE,NO	0.00	0.00
Controlled Burning	Area burned	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	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
B. Cropland			**NA**	**NA**	**NA**	**NA**	**NA,NO**	**NA,NO**	**NA,NO**
1. Cropland remaining Croplanc[5]			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[6]			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[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 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 [7]	Area burned	ha	NO	**NO**	**NO**	**NO**	NO	NO	NO
F. Other Land [8]	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] Field burning of agricultural residues is reported in the Agriculture sector.

[6] Only includes emissions from controlled biomass burning on grasslands outside the tropics (prescribed savanna burning is reported under the Agriculture sector).

[7] Parties do not have to prepare estimates for 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.

[8] Parties do not have to prepare estimates for this category contained in Chapter 3.7.1 of the IPCC good practice guidance for LULUCF, although they may do so if they wish. 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 cont
this table.

TABLE 6 SECTORAL REPORT FOR WASTE
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2[1]	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
	(Gg)						
Total Waste	**12.26**	**108.78**	**0.82**	**0.05**	**7.45**	**0.10**	**0.06**
A. Solid Waste Disposal on Land	**NA,NO**	**105.66**		**NA,NO**	**7.44**	**0.10**	
1. Managed Waste Disposal on Land	NA	105.66		NA	7.44	0.10	
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		**1.93**	**0.65**	**NA,NE**	**NA**	**NA,NE**	
1. Industrial Wastewater		IE,NA	0.15	NA	NA	NA	
2. Domestic and Commercial Waste Water		1.93	0.50	NE	NA	NE	
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**	**1.19**	**0.18**	**NA**	**NA**	**NA**	**NA**
Compost production	NA	1.19	0.18	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)

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	2 715.49	1.00	39.35	0.05	NA	105.66	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)]	**8 174.73**
Urban population (1000s)[(a)]	5 369.00
Waste generation rate (kg/capita/day)	0.91
Fraction of MSW disposed to SWDS	0.07
Fraction of DOC in MSW	0.12
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)]	55.00

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	9 142.10				12.26	0.00	0.00
a. Biogenic [(1)]	NA	NA	NA	NA	NA	NA	NA
b. Other (non-biogenic -*please specify*) [(1), (2)]					12.26	0.00	0.00
Incineration of corpses	9 136.00	NA	NA	NA	NA	NA	NA
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)

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	0.15
a. Waste Water	510.00	NA	0.29	NA	NA	0.15
b. Sludge	NA	IE	NA	IE	NA	IE
2. Domestic and Commercial Wastewater				1.93	NA	0.50
a. Waste Water	328.22	0.01	NA	1.93	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]	8 174.73	40.00	0.16	0.01	0.50

(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)

Additional information

	Domestic	Industrial
Total waste water (m^3):	1 060 650.00	1 050 000.00
Treated waste water (%):	100.00	100.00

Waste-water streams:	Waste-water output (m^3)	DC ($kgCOD/m^3$)
Industrial waste water	NA	NA
Iron and steel	NA	NA
Non-ferrous	NA	NA
Fertilizers	NA	NA
Food and beverage	NA	NA
Paper and pulp	NA	NA
Organic chemicals	NA	NA
Other (please specify)	NA	NA
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		

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 1 of 3)

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	**60 462.14**	**353.05**	**17.08**	**1 927.01**	**904.39**	**320.26**	**114.72**	**0.03**	**0.02**	**226.91**	**742.17**	**172.20**	**28.89**
1. Energy	**68 815.52**	**45.23**	**2.63**							**220.37**	**709.16**	**73.32**	**27.62**
A. Fuel Combustion — Reference Approach [2]	71 832.14												
Sectoral Approach [2]	68 605.49	14.13	2.63							220.37	709.16	70.05	27.47
1. Energy Industries	15 535.20	0.28	0.24							15.25	4.17	0.88	7.69
2. Manufacturing Industries and Construction	15 327.95	0.49	0.49							34.01	173.40	2.85	9.47
3. Transport	23 454.78	1.00	0.94							134.35	174.72	21.82	0.96
4. Other Sectors	14 180.97	12.37	0.96							36.57	356.24	44.47	9.32
5. Other	106.59	0.00	0.01							0.18	0.64	0.04	0.03
B. Fugitive Emissions from Fuels	210.04	31.10	IE,NA							IE,NA	IE,NA	3.27	0.14
1. Solid Fuels	IE,NA,NO	0.05	IE,NA							IE,NA	IE,NA	IE,NA	IE,NA
2. Oil and Natural Gas	210.04	31.05	IE,NA							IE,NA	IE,NA	3.27	0.14
2. Industrial Processes	**8 085.80**	**0.70**	**0.91**	**1 927.01**	**904.39**	**320.26**	**114.72**	**0.03**	**0.02**	**1.22**	**23.82**	**15.35**	**1.22**
A. Mineral Products	3 125.45	IE,NA	IE,NA							IE,NA	9.78	IE,NA	IE,NA
B. Chemical Industry	528.84	0.70	0.91	NO	NO	NO	NO	NO	NO	0.56	11.11	12.34	0.77
C. Metal Production	4 431.51	0.00	NA				NO		NO	0.10	2.52	0.45	0.45
D. Other Production [3]	NA									0.56	0.41	2.57	NA
E. Production of Halocarbons and SF_6					NA		NA		NA				
F. Consumption of Halocarbons and SF_6				1 927.01	904.39	320.26	114.72	0.03	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)

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	189.84		0.75							NA	NA	81.43	NA
4. Agriculture		198.34	11.93							**5.28**	**1.74**	**2.00**	**0.00**
A. Enteric Fermentation		155.94											
B. Manure Management		41.89	2.86									NE	
C. Rice Cultivation		NO										NO	
D. Agricultural Soils [4]		0.42	9.07									1.85	
E. Prescribed Burning of Savannas		NO	NO							NO	NO	NO	
F. Field Burning of Agricultural Residues		0.09	0.00							0.05	1.74	0.15	
G. Other		NA	NA							5.23	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	[5] **-16 641.30**	**0.00**	**0.04**							**IE,NA,NE**	**IE,NA,NE**		
A. Forest Land	[5] -17 047.22	0.00	0.00							NE	NE		
B. Cropland	[5] -131.85	NA,NO	0.04							IE	IE		
C. Grassland	[5] 339.63	NO	NO							IE	IE		
D. Wetlands	[5] 14.78	NO	NO							NA	NA		
E. Settlements	[5] 72.36	NA,NO	NA,NO							NA	NA		
F. Other Land	[5] 110.99	NA,NO	NA,NO							NA	NA		
G. Other	[5] NE	NA	NA							NA	NA		
6. Waste	12.26	108.78	0.82							**0.05**	**7.45**	**0.10**	**0.06**
A. Solid Waste Disposal on Land	[6] NA,NO	105.66								NA,NO	7.44	0.10	
B. Waste-water Handling		1.93	0.65							NA,NE	NA	NA,NE	
C. Waste Incineration	[6] 12.26	0.00	0.00							0.05	0.01	0.00	0.06
D. Other	NA	1.19	0.18							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)

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	**1 531.80**	**0.03**	**0.05**							**4.90**	**1.51**	**0.64**	**0.49**
Aviation	1 531.80	0.03	0.05							4.90	1.51	0.64	0.49
Marine	NA,NO	NA,NO	NA,NO							NO	NO	NO	NO
Multilateral Operations	**IE**	**IE**	**IE**							**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass	**14 456.04**												

(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)

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	**60 462.14**	**353.05**	**17.08**	**1 927.01**	**904.39**	**320.26**	**114.72**	**0.03**	**0.02**	**226.91**	**742.17**	**172.20**	**28.89**
1. Energy	**68 815.52**	**45.23**	**2.63**							**220.37**	**709.16**	**73.32**	**27.62**
A. Fuel Combustion — Reference Approach[2]	71 832.14												
Sectoral Approach[2]	68 605.49	14.13	2.63							220.37	709.16	70.05	27.47
B. Fugitive Emissions from Fuels	210.04	31.10	IE,NA							IE,NA	IE,NA	3.27	0.14
2. Industrial Processes	**8 085.80**	**0.70**	**0.91**	**1 927.01**	**904.39**	**320.26**	**114.72**	**0.03**	**0.02**	**1.22**	**23.82**	**15.35**	**1.22**
3. Solvent and Other Product Use	**189.84**		**0.75**							**NA**	**NA**	**81.43**	**NA**
4. Agriculture [3]		**198.34**	**11.93**							**5.28**	**1.74**	**2.00**	**0.00**
5. Land Use, Land-Use Change and Forestry	[4] **-16 641.30**	**0.00**	**0.04**							**IE,NA,NE**	**IE,NA,NE**		
6. Waste	**12.26**	**108.78**	**0.82**							**0.05**	**7.45**	**0.10**	**0.06**
7. Other	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items: [5]													
International Bunkers	**1 531.80**	**0.03**	**0.05**							**4.90**	**1.51**	**0.64**	**0.49**
Aviation	1 531.80	0.03	0.05							4.90	1.51	0.64	0.49
Marine	NA,NO	NA,NO	NA,NO							NO	NO	NO	NO
Multilateral Operations	**IE**	**IE**	**IE**							**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass	**14 456.04**												

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)

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)	**60 462.14**	**7 414.15**	**5 295.11**	**904.39**	**114.72**	**512.51**	**74 703.02**
1. Energy	**68 815.52**	**949.83**	**816.68**				**70 582.03**
A. Fuel Combustion (Sectoral Approach)	68 605.49	296.78	816.68				69 718.95
1. Energy Industries	15 535.20	5.78	74.24				15 615.21
2. Manufacturing Industries and Construction	15 327.95	10.25	152.89				15 491.10
3. Transport	23 454.78	20.99	290.17				23 765.94
4. Other Sectors	14 180.97	259.68	297.09				14 737.74
5. Other	106.59	0.07	2.30				108.96
B. Fugitive Emissions from Fuels	210.04	653.05	IE,NA				863.08
1. Solid Fuels	IE,NA,NO	1.06	IE,NA				1.06
2. Oil and Natural Gas	210.04	651.99	IE,NA				862.03
2. Industrial Processes	**8 085.80**	**14.74**	**280.86**	**904.39**	**114.72**	**512.51**	**9 913.02**
A. Mineral Products	3 125.45	IE,NA	IE,NA				3 125.45
B. Chemical Industry	528.84	14.66	280.86	NO	NO	NO	824.37
C. Metal Production	4 431.51	0.08	NA	NO	NO	NA,NO	4 431.59
D. Other Production	NA						NA
E. Production of Halocarbons and SF_6				NA	NA	NA	NA
F. Consumption of Halocarbons and SF_6 (2)				904.39	114.72	512.51	1 531.62
G. Other	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	**189.84**		**232.50**				**422.34**
4. Agriculture		**4 165.08**	**3 698.11**				**7 863.19**
A. Enteric Fermentation		3 274.66					3 274.66
B. Manure Management		879.66	885.98				1 765.65
C. Rice Cultivation		NO					NO
D. Agricultural Soils (3)		8.85	2 811.62				2 820.47
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		1.91	0.50				2.41
G. Other		NA	NA				NA
5. Land Use, Land-Use Change and Forestry (1)	**-16 641.30**	**0.09**	**11.63**				**-16 629.58**
A. Forest Land	-17 047.22	0.09	0.02				-17 047.11
B. Cropland	-131.85	NA,NO	11.61				-120.24
C. Grassland	339.63	NO	NO				339.63
D. Wetlands	14.78	NO	NO				14.78
E. Settlements	72.36	NA,NO	NA,NO				72.36
F. Other Land	110.99	NA,NO	NA,NO				110.99
G. Other		NA	NA				NA,NE
6. Waste	**12.26**	**2 284.42**	**255.33**				**2 552.01**
A. Solid Waste Disposal on Land	NA,NO	2 218.79					2 218.79
B. Waste-water Handling		40.62	201.04				241.66
C. Waste Incineration	12.26	0.01	0.03				12.30
D. Other	NA	25.00	54.25				79.25
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: (4)							
International Bunkers	1 531.80	0.55	16.95				1 549.30
Aviation	1 531.80	0.55	16.95				1 549.30
Marine	NA,NO	NA,NO	NA,NO				NA,NO
Multilateral Operations	**IE**	**IE**	**IE**				**IE**
CO_2 Emissions from Biomass	**14 456.04**						**14 456.04**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry (5)	91 332.60
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry (5)	74 703.02

(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.

(5) These totals will differ from the totals reported in table 10, sheet 5 if Parties report non-CO_2 emissions from LULUCF.

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	CS,M,T2	CS	CS,M,T2	CS						
1. Energy Industries	T2	CS	T2	CS	T2	CS						
2. Manufacturing Industries and Construction	T2	CS	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)

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	T1,T3	CS,D	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						
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	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	N20						
1 A 4 biomass	CH4						
1 A 4 mobile, diesel	CO2	x			x	x	
1 A 4 other	CO2						
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	CH4	x	x		x	x	
2 A 1	CO2	x	x		x	x	
2 A 2	CO2	x	x		x	x	
2 A 3	CO2						
2 A 7 b	CO2	x	x		x	x	
2 B 1	CO2	x			x	x	
2 B 2	N20		x		x	x	
2 C 1	CO2	x	x		x	x	
2 C 3	PFC						
2 C 4	SF6						
2 F 1 to 2 F 5	HFC	x	x		x	x	
2 F 6	HFC, PFC, SF6	x	x		x	x	
2 F 8	SF6						
3	CO2		x		x	x	
4 A 1	CH4	x	x		x	x	
4 B 1	N20	x	x		x	x	
4 B 1	CH4	x	x		x	x	
4 B 8	CH4	x	x		x	x	
4 D 1	N20	x	x		x	x	
4 D 3	N20	x	x		x	x	
5 A 1	CO2	x	x			x	
5 B 1	CO2		x			x	
5 C 2	CO2	x	x			x	
6 A	CH4	x	x		x	x	
6 B	N20		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 table Summary 1.A of the common reporting format or any other disaggregation level that the Party used to determine its key categories.

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 the IPCC good practice guidance for LULUCF) in Annex 1 to the NIR.

TABLE 8(a) RECALCULATION - RECALCULATED DATA
(Sheet 1 of 2) **Recalculated year:**

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(2)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions(2)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions(2)
	CO_2 equivalent (Gg)			(%)	(%)	CO_2 equivalent (Gg)			(%)	(%)	CO_2 equivalent (Gg)			(%)	(%)
Total National Emissions and Removals		**60 462.14**					7 414.15					5 295.11			
1. Energy		**68 815.52**					949.83					816.68			
1.A. Fuel Combustion Activities		68 605.49					296.78					816.68			
1.A.1. Energy Industries		15 535.20					5.78					74.24			
1.A.2. Manufacturing Industries and Construction		15 327.95					10.25					152.89			
1.A.3. Transport		23 454.78					20.99					290.17			
1.A.4. Other Sectors		14 180.97					259.68					297.09			
1.A.5. Other		106.59					0.07					2.30			
1.B. Fugitive Emissions from Fuels		210.04					653.05					IE,NA			
1.B.1. Solid fuel		IE,NA,NO					1.06					IE,NA			
1.B.2. Oil and Natural Gas		210.04					651.99					IE,NA			
2. Industrial Processes		**8 085.80**					**14.74**					**280.86**			
2.A. Mineral Products		3 125.45					IE,NA					IE,NA			
2.B. Chemical Industry		528.84					14.66					280.86			
2.C. Metal Production		4 431.51					0.08					NA			
2.D. Other Production		NA													
2.G. Other		NA					NA					NA			
3. Solvent and Other Product Use		**189.84**										**232.50**			
4. Agriculture							**4 165.08**					**3 698.11**			
4.A. Enteric Fermentation							3 274.66								
4.B. Manure Management							879.66					885.98			
4.C. Rice Cultivation							NO								
4.D. Agricultural Soils (3)							8.85					2 811.62			
4.E. Prescribed Burning of Savannas							NO					NO			
4.F. Field Burning of Agricultural Residues							1.91					0.50			
4.G. Other							NA					NA			
5. Land Use, Land-Use Change and Forestry (net)(4)		**-16 641.30**					0.09					11.63			
5.A. Forest Land		-17 047.22					0.09					0.02			
5.B. Cropland		-131.85					NA,NO					11.61			
5.C. Grassland		339.63					NO					NO			
5.D. Wetlands		14.78					NO					NO			
5.E. Settlements		72.36					NA,NO					NA,NO			
5.F. Other Land		110.99					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:**

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 [2]	Previous submission	Latest submission	Difference	Difference[1]	Impact of recalculation on total emissions [2]	Previous submission	Latest submission	Difference	Difference[1]	Impact of recalculation on total emissions [2]
	CO_2 equivalent (Gg)			(%)	(%)	CO_2 equivalent (Gg)			(%)	(%)	CO_2 equivalent (Gg)			(%)	(%)
6. Waste		**12.26**					2 284.42					255.33			
6.A. Solid Waste Disposal on Land		NA,NO					2 218.79								
6.B. Waste-water Handling							40.62					201.04			
6.C. Waste Incineration		12.26					0.01					0.03			
6.D. Other		NA					25.00					54.25			
7. Other *(as specified in Summary 1.A)*		NA					NA					NA			
Memo Items:															
International Bunkers		**1 531.80**					**0.55**					**16.95**			
Multilateral Operations		**IE**					**IE**					**IE**			
CO_2 Emissions from Biomass															

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs					PFCs					SF_6				
	Previous submission	Latest submission	Difference	Difference[1]	Impact of recalculation on total emissions [2]	Previous submission	Latest submission	Difference	Difference[1]	Impact of recalculation on total emissions [2]	Previous submission	Latest submission	Difference	Difference[1]	Impact of recalculation on total emissions [2]
	CO_2 equivalent (Gg)			(%)	(%)	CO_2 equivalent (Gg)			(%)	(%)	CO_2 equivalent (Gg)			(%)	(%)
Total Actual Emissions		**904.39**					**114.72**					**512.51**			
2.C.3. Aluminium Production							NO								
2.E. Production of Halocarbons and SF_6		NA					NA					NA			
2.F. Consumption of Halocarbons and SF_6		904.39					114.72					512.51			
2.G. Other		NA					NA					NA			
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**1 927.01**					**320.26**					**655.98**			

	Previous submission	Latest submission	Difference	Difference[1]
	CO_2 equivalent (Gg)			(%)
Total CO2 Equivalent Emissions with Land Use, Land-Use Change and Forestry[5]		74 703.02		
Total CO2 Equivalent Emissions without Land Use, Land-Use Change and Forestry[5]		91 332.60		

[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] Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

[4] Net CO_2 emissions/removals to be reported.

[5] The information in these rows is requested to facilitate comparison of data, because Parties differ in the way they report emissions and removals from Land Use, Land-Use Change and Forestry.

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)

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 - 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.
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	2 Industrial Processes	2.B.4.1 Silicon Carbide	Should be "NA". Software Problems.
CH4	2 Industrial Processes	2.B.4.2 Calcium Carbide	Should be "NA" (Software Problems).
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	
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	
SF6	2 Industrial Processes	2.F.P4 Destroyed amount	

Sources and sinks reported elsewhere (IE)[3]

GHG	Source/sink category	Allocation as per IPCC Guidelines	Allocation used by the Party	Explanation
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 4 Settlements 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	5 B 2 2 Grassland converted to Cropland -Total - Decrease	and converted to Cropland -Total - Increase	only net figures are reported.
Carbon	Perennial converted to annual	Increase	Decrease	only net figures are reported.
Carbon	Total	5 B 2 1 Forest Land converted to Cropland -Total - Decrease	and converted to Cropland -Total - Increase	only net figures are reported.
Carbon	Total	5 C 2 1 Forest Land converted to Grassland -Total - Decrease	nd converted to Grassland -Total - Increase	only net figures are reported.
Carbon	Total	5 C 2 2 Cropland converted to Grassland -Total - Decrease	nd converted to Grassland -Total - Increase	only net figures are reported.
Carbon	Total	5 D 2 1 Forest Land converted to Wetlands -Total - Decrease	and converted to Wetlands -Total - Increase	only net figures are reported.
Carbon	Total	5 E 2 1 Forest Land converted to Settlements -Total - Decrease	d converted to Settlements -Total - Increase	only net figures are reported.
Carbon	Total	5 F 2 1 Forest Land converted to Other Land -Total - Decrease	d converted to Other Land -Total - Increase	only net figures are reported.
Carbon	Annual remaining annual	Increase	Decrease	only net figures are reported.
Carbon	Annual converted to perennial	B 1 Cropland remaining Cropland-Carbon Stock Change - Annual converted to perennial - Decrease	hange - Annual remaining annual - Increase	only net figures are reported.
Carbon	5.B Cropland	5 B Cropland / lime application / Dolomite	5 B Cropland / lime application / Limestone	Emissions from dolomite liming include emissions from limestone liming
Carbon	5.C Grassland	5 C Grassland / lime application	5 B Cropland / lime application / Limestone	Emissions from cropland dolomite liming include emissions from grassland liming.
Carbon	5.C Grassland	5 C Grassland / lime application	5 B Cropland / lime application / Limestone	Emissions from cropland dolomite liming include emissions from grassland liming.
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).

TABLE 9(a) COMPLETENESS - INFORMATION ON NOTATION KEYS
(Sheet 1 of 1)

Sources and sinks reported elsewhere (IE)(3)				
GHG	Source/sink category	Allocation as per IPCC Guidelines	Allocation used by the Party	Explanation
CH4	1.B.2.C.1 Venting			
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			
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 Barlay	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.
CH4	1.C2 Multilateral Operations	1 C 2 Multilateral Operations	1 A 4 a Commercial /Institutional	the emissions of this sector are very low they are included in the residential/commercial sector.
CO2	.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	.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	duction 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	duction fields are reported here (total figures are reported from the Association of Oil Industry).
CO2	1.B.2.C.1 Venting			
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			
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	tor (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	tor (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	rom 2A5 Asphalt Roofing and 2A6 Road Paving with Asphalt are included in the Solvent Sector.
CO2	.A.6 Road Paving with Asphalt	2 A 6 Road Paving	3 Solvent Use	rom 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	1.C2 Multilateral Operations	1 C 2 Multilateral Operations	1 A 4 a Commercial /Institutional	the emissions of this sector are very low they are included in the residential/commercial sector.
CO2	est Land remaining Forest Land	5 A 1 Widfires	Forest Land remaining Forest land	rbon stock change due to wildfires at forest land is included in figures of table 5.A Sektor 5.A.1.
N2O	.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	duction fields are reported here (total figures are reported from the Association of Oil Industry).
N2O	1.B.2.C.2 Flaring			
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 Barlay	4 F 1 2 Barlay	4 F 1 1 Wheat	Wheat includes cereals total

TABLE 9(a) COMPLETENESS - INFORMATION ON NOTATION KEYS
(Sheet 1 of 1)

Sources and sinks reported elsewhere (IE)[3]				
GHG	Source/sink category	Allocation as per IPCC Guidelines	Allocation used by the Party	Explanation
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
N2O	1.C2 Multilateral Operations	1 C 2 Multilateral Operations	1 A 4 a Commercial /Institutional	the emissions of this sector are very low they are included in the residential/commercial sector.
SF6	2.F.P2.2 In products	2 F P 2 2 Import in Products	2 F P 2 1 Import in Bulk	alculation 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	alculation 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	alculation 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

(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

TABLE 9(b) COMPLETENESS - INFORMATION ON ADDITIONAL GREENHOUSE GASES
(Sheet 1 of 1)

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

[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 EMISSIONS TRENDS (CO_2)
(Sheet 1 of 5)
(Part 1 of 2)

Inventory 2004
Submission 2006 v1.3
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	**54 043.98**	**57 800.73**	**52 907.13**	**53 363.29**	**53 399.77**	**56 080.09**	**60 064.39**	**59 281.94**	**59 337.49**	**58 110.22**
A. Fuel Combustion (Sectoral Approach)	53 941.96	57 689.70	52 787.10	53 251.27	53 272.25	55 953.06	59 993.36	59 161.43	59 195.66	57 939.69
1. Energy Industries	13 662.77	14 456.60	11 318.07	11 356.34	11 614.62	12 640.16	13 739.10	13 836.36	12 855.01	12 479.51
2. Manufacturing Industries and Construction	13 452.56	13 721.55	12 583.18	12 958.60	13 962.89	14 145.86	14 207.64	16 003.89	14 948.22	13 973.17
3. Transport	12 400.34	13 993.27	13 937.17	14 115.58	14 078.36	14 462.60	16 038.79	14 975.68	17 170.95	16 596.83
4. Other Sectors	14 391.26	15 481.17	14 914.98	14 781.30	13 574.77	14 671.84	15 968.89	14 308.37	14 179.03	14 848.56
5. Other	35.02	37.11	33.70	39.43	41.60	32.60	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	**7 579.85**	**7 424.94**	**6 938.18**	**6 854.08**	**7 184.39**	**7 383.41**	**7 082.17**	**7 671.75**	**7 315.61**	**7 163.26**
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	585.85	610.08	633.23	606.73	555.99	584.64	591.16	583.86	580.68	583.94
C. Metal Production	3 724.95	3 687.63	3 157.71	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)]	**-11 972.35**	**-17 901.38**	**-12 710.20**	**-16 532.60**	**-15 437.71**	**-14 422.57**	**-9 706.64**	**-18 794.43**	**-16 911.47**	**-21 385.88**
A. Forest Land	-12 146.22	-18 071.93	-12 892.08	-16 722.11	-15 620.14	-14 783.72	-10 035.26	-19 136.07	-17 284.29	-21 776.74
B. Cropland	-524.77	-529.18	-517.95	-454.48	-461.64	-281.52	-259.51	-246.21	-214.31	-196.26
C. Grassland	449.87	450.96	451.06	420.55	420.61	419.21	389.99	389.70	389.00	388.98
D. Wetlands	18.48	18.48	18.48	16.63	16.63	16.63	14.78	14.78	14.78	14.78
E. Settlements	90.45	90.45	90.45	81.41	81.41	81.41	72.36	72.36	72.36	72.36
F. Other Land	139.83	139.83	139.83	125.41	125.41	125.41	110.99	110.99	110.99	110.99
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 CO2 emissions including net CO2 from LULUCF[(3)]	**49 961.04**	**47 584.45**	**47 333.70**	**43 882.72**	**45 328.64**	**49 241.78**	**57 624.02**	**48 360.96**	**49 925.82**	**44 058.24**
Total CO2 emissions excluding net CO2 from LULUCF[(3)]	**61 933.39**	**65 485.82**	**60 043.91**	**60 415.32**	**60 766.35**	**63 664.36**	**67 330.66**	**67 155.39**	**66 837.28**	**65 444.12**
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	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
CO_2 Emissions from Biomass	9 750.24	10 612.42	10 345.66	10 897.74	10 528.76	11 192.76	11 915.67	11 996.42	11 409.13	12 727.22

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSIONS TRENDS (CO_2)
(Sheet 1 of 5)
(Part 2 of 2)

Inventory 2004
Submission 2006 v1.3
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	**58 225.76**	**62 278.63**	**63 477.08**	**69 154.62**	**68 815.52**	**27.33**
A. Fuel Combustion (Sectoral Approach)	58 061.23	62 095.90	63 310.05	68 921.58	68 605.49	27.18
1. Energy Industries	12 401.82	13 660.15	13 440.89	16 165.18	15 535.20	13.70
2. Manufacturing Industries and Construction	14 525.89	14 089.85	14 750.13	14 558.85	15 327.95	13.94
3. Transport	17 734.54	19 037.45	20 986.18	22 849.66	23 454.78	89.15
4. Other Sectors	13 354.02	15 185.57	14 091.83	15 258.58	14 180.97	-1.46
5. Other	44.95	122.88	41.02	89.31	106.59	204.34
B. Fugitive Emissions from Fuels	164.53	182.73	167.03	233.04	210.04	105.87
1. Solid Fuels	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	105.87
2. Industrial Processes	**7 766.91**	**7 694.53**	**8 261.52**	**8 203.85**	**8 085.80**	**6.68**
A. Mineral Products	2 958.13	2 976.77	3 085.41	3 070.77	3 125.45	-4.39
B. Chemical Industry	588.08	540.28	552.17	593.25	528.84	-9.73
C. Metal Production	4 220.70	4 177.48	4 623.93	4 539.83	4 431.51	18.97
D. Other Production	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	0.00
3. Solvent and Other Product Use	181.02	193.60	192.35	191.10	189.84	-32.84
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)	**-16 036.72**	**-18 775.35**	**-15 135.72**	**-16 606.38**	**-16 641.30**	**39.00**
A. Forest Land	-16 436.67	-19 211.48	-15 493.50	-17 047.22	-17 047.22	40.35
B. Cropland	-187.47	-192.35	-198.95	-136.14	-131.85	-74.87
C. Grassland	389.28	430.34	358.59	378.84	339.63	-24.50
D. Wetlands	14.78	14.78	14.78	14.78	14.78	-20.00
E. Settlements	72.36	72.36	72.36	72.36	72.36	-20.00
F. Other Land	110.99	110.99	110.99	110.99	110.99	-20.62
G. Other	NE	NE	NE	NE	NE	0.00
6. Waste	**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	0.00
B. Waste-water Handling						
C. Waste Incineration	12.26	12.26	12.26	12.26	12.26	-54.39
D. Other	NA	NA	NA	NA	NA	0.00
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total CO2 emissions including net CO2 from LULUCF(3)	**50 149.24**	**51 403.67**	**56 807.50**	**60 955.45**	**60 462.14**	**21.02**
Total CO2 emissions excluding net CO2 from LULUCF(3)	**66 185.96**	**70 179.02**	**71 943.21**	**77 561.83**	**77 103.43**	**24.49**
Memo Items:						
International Bunkers	**1 674.93**	**1 409.06**	**1 526.13**	**1 305.01**	**1 531.80**	**72.89**
Aviation	1 674.93	1 409.06	1 526.13	1 305.01	1 531.80	72.89
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Multilateral Operations	IE	IE	IE	IE	IE	0.00
CO_2 Emissions from Biomass	11 911.28	13 199.37	12 758.54	14 360.55	14 456.04	48.26

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSIONS TRENDS (CH_4)

(Sheet 2 of 5)

(Part 1 of 2)

Inventory 2004

Submission 2006 v1.3

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)
Total CH_4 emissions	**437.10**	**435.74**	**421.78**	**420.48**	**411.28**	**405.72**	**396.81**	**383.68**	**377.93**	**369.51**
1. Energy	40.28	42.46	41.23	41.58	40.39	41.94	44.07	40.49	40.44	41.36
A. Fuel Combustion (Sectoral Approach)	21.96	23.47	21.40	20.85	19.00	19.45	20.33	15.87	15.29	15.19
1. Energy Industries	0.16	0.18	0.15	0.16	0.15	0.15	0.18	0.19	0.18	0.16
2. Manufacturing Industries and Construction	0.41	0.43	0.44	0.42	0.45	0.45	0.46	0.49	0.47	0.46
3. Transport	2.91	2.87	2.61	2.40	2.19	1.99	1.81	1.62	1.56	1.39
4. Other Sectors	18.48	19.98	18.19	17.87	16.21	16.86	17.88	13.57	13.08	13.16
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	162.84
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	**166.08**	**165.78**	**161.54**	**159.38**	**151.05**	**142.95**	**135.23**	**128.69**	**123.83**	**118.63**
A. Solid Waste Disposal on Land	160.71	160.40	156.19	154.00	145.68	137.71	130.27	124.08	119.52	114.52
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**
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
CO_2 Emissions from Biomass										

Note: All footnotes for this table are given at the end of the table on sheet 5

TABLE 10 EMISSIONS TRENDS (CH_4)
(Sheet 2 of 5)
(Part 2 of 2)

Inventory 2004
Submission 2006 v1.3
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
Total CH_4 emissions	**361.85**	**356.08**	**349.35**	**350.69**	**353.05**	**-19.23**
1. Energy	41.07	42.28	41.96	43.17	45.23	12.28
A. Fuel Combustion (Sectoral Approach)	14.14	14.95	13.54	14.18	14.13	-35.65
1. Energy Industries	0.16	0.18	0.20	0.25	0.28	74.91
2. Manufacturing Industries and Construction	0.47	0.47	0.48	0.49	0.49	19.84
3. Transport	1.28	1.20	1.14	1.08	1.00	-65.68
4. Other Sectors	12.23	13.11	11.72	12.35	12.37	-33.10
5. Other	0.00	0.00	0.00	0.00	0.00	192.90
B. Fugitive Emissions from Fuels	26.93	27.32	28.42	28.98	31.10	69.74
1. Solid Fuels	0.27	0.26	0.30	0.25	0.05	-90.38
2. Oil and Natural Gas	26.66	27.07	28.11	28.74	31.05	74.46
2. Industrial Processes	**0.70**	**0.67**	**0.71**	**0.70**	**0.70**	**-0.64**
A. Mineral Products	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	-0.84
C. Metal Production	0.00	0.00	0.00	0.00	0.00	63.28
D. Other Production						
E. Production of Halocarbons and SF_6						
F. Consumption of Halocarbons and SF_6						
G. Other	NA	NA	NA	NA	NA	0.00
3. Solvent and Other Product Use						
4. Agriculture	**206.62**	**204.44**	**200.09**	**199.20**	**198.34**	**-13.77**
A. Enteric Fermentation	161.87	159.48	156.59	155.55	155.94	-12.95
B. Manure Management	44.23	44.46	43.05	43.18	41.89	-17.04
C. Rice Cultivation	NO	NO	NO	NO	NO	0.00
D. Agricultural Soils	0.45	0.43	0.38	0.41	0.42	28.29
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	0.00
F. Field Burning of Agricultural Residues	0.06	0.07	0.07	0.06	0.09	36.55
G. Other	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**	**-64.94**
A. Forest Land	0.00	0.00	0.01	0.00	0.00	-64.94
B. Cropland	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
C. Grassland	NO	NO	NO	NO	NO	0.00
D. Wetlands	NO	NO	NO	NO	NO	0.00
E. Settlements	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	0.00
G. Other	NA	NA	NA	NA	NA	0.00
6. Waste	**113.47**	**108.68**	**106.59**	**107.62**	**108.78**	**-34.50**
A. Solid Waste Disposal on Land	109.63	105.09	103.23	104.50	105.66	-34.26
B. Waste-water Handling	2.68	2.42	2.18	1.93	1.93	-60.12
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	-90.13
D. Other	1.16	1.17	1.17	1.19	1.19	130.22
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
	NA	NA	NA	NA	NA	0.00
Memo Items:						
International Bunkers	0.03	0.02	0.03	0.02	0.03	81.40
Aviation	0.03	0.02	0.03	0.02	0.03	81.40
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Multilateral Operations	IE	IE	IE	IE	IE	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 EMISSIONS TRENDS (N_2O)
(Sheet 3 of 5)
(Part 1 of 2)

Inventory 2004
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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)
Total N_2O emissions	**20.17**	**21.25**	**20.01**	**19.46**	**20.87**	**21.25**	**20.27**	**20.32**	**20.63**	**20.38**
1. Energy	**2.47**	**2.71**	**2.72**	**2.80**	**2.82**	**2.80**	**2.81**	**2.76**	**2.80**	**2.72**
A. Fuel Combustion (Sectoral Approach)	2.47	2.71	2.72	2.80	2.82	2.80	2.81	2.76	2.80	2.72
1. Energy Industries	0.15	0.17	0.13	0.14	0.14	0.16	0.15	0.15	0.16	0.17
2. Manufacturing Industries and Construction	0.52	0.54	0.54	0.54	0.56	0.55	0.54	0.59	0.57	0.58
3. Transport	0.85	1.04	1.11	1.17	1.18	1.14	1.09	1.00	1.06	0.96
4. Other Sectors	0.94	0.95	0.94	0.95	0.93	0.94	1.03	1.02	1.00	1.01
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	**13.85**	**14.63**	**13.64**	**12.86**	**14.34**	**14.55**	**13.44**	**13.54**	**13.61**	**13.29**
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	10.60	11.42	10.55	9.77	11.25	11.39	10.33	10.47	10.55	10.27
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	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**
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	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
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	**0.13**	**0.14**	**0.16**	**0.18**	**0.26**	**0.34**	**0.42**	**0.45**	**0.54**	**0.61**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0.05	0.06	0.06	0.06	0.12	0.19	0.26	0.30	0.38	0.44
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	0.10	0.12	0.14	0.15	0.16	0.15	0.16	0.17
7. Other ***(as specified in Summary 1.A)***	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
CO_2 Emissions from Biomass										

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSIONS TRENDS (N_2O)
(Sheet 3 of 5)
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Inventory 2004
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
Total N_2O emissions	**20.01**	**19.64**	**19.61**	**19.51**	**17.08**	**-15.33**
1. Energy	**2.59**	**2.69**	**2.68**	**2.73**	**2.63**	**6.81**
A. Fuel Combustion (Sectoral Approach)	2.59	2.69	2.68	2.73	2.63	6.81
1. Energy Industries	0.17	0.20	0.19	0.23	0.24	61.24
2. Manufacturing Industries and Construction	0.56	0.55	0.55	0.54	0.49	-5.25
3. Transport	0.93	0.94	0.98	0.99	0.94	10.04
4. Other Sectors	0.92	0.99	0.95	0.97	0.96	1.52
5. Other	0.00	0.01	0.00	0.01	0.01	163.49
B. Fugitive Emissions from Fuels	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	0.00
2. Oil and Natural Gas	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**	**-69.20**
A. Mineral Products	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	-69.20
C. Metal Production	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	0.00
3. Solvent and Other Product Use	0.75	0.75	0.75	0.75	0.75	0.00
4. Agriculture	**12.89**	**12.83**	**12.76**	**12.33**	**11.93**	**-13.84**
A. Enteric Fermentation						
B. Manure Management	2.98	2.95	2.89	2.87	2.86	-11.84
C. Rice Cultivation						
D. Agricultural Soils	9.91	9.87	9.87	9.46	9.07	-14.46
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	0.00
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	45.26
G. Other	NA	NA	NA	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**0.04**	**0.04**	**0.03**	**0.03**	**0.04**	**2.15**
A. Forest Land	0.00	0.00	0.00	0.00	0.00	-66.27
B. Cropland	0.04	0.04	0.03	0.03	0.04	2.51
C. Grassland	NO	NO	NO	NO	NO	0.00
D. Wetlands	NO	NO	NO	NO	NO	0.00
E. Settlements	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	0.00
G. Other	NA	NA	NA	NA	NA	0.00
6. Waste	**0.68**	**0.79**	**0.79**	**0.82**	**0.82**	**521.30**
A. Solid Waste Disposal on Land						
B. Waste-water Handling	0.51	0.62	0.62	0.64	0.65	1 079.93
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	-74.43
D. Other	0.17	0.17	0.17	0.18	0.18	126.76
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
	NA	NA	NA	NA	NA	0.00
Memo Items:						
International Bunkers	**0.06**	**0.05**	**0.05**	**0.05**	**0.05**	**76.97**
Aviation	0.06	0.05	0.05	0.05	0.05	76.97
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Multilateral Operations	IE	IE	IE	IE	IE	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)

(Sheet 4 of 5)

(Part 1 of 2)

Inventory 2004

Submission 2006 v1.3

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[(4)] - (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	0.00	0.00	0.00	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	NA,NO	NA,NO	NA,NO	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	NA,NO	NA,NO	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	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00	0.00	0.01	0.01	0.01
HFC-227ea	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,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[(5)] - (Gg CO_2 equivalent)	18.88	38.44	39.58	40.11	40.71	41.64	42.58	43.53	44.71	46.25
Emissions of PFCs[(4)] - (Gg CO_2 equivalent)	**1 079.24**	**1 087.08**	**462.67**	**52.92**	**58.65**	**68.74**	**66.27**	**96.83**	**44.75**	**64.54**
CF_4	0.14	0.14	0.06	0.01	0.01	0.01	0.01	0.01	0.00	0.00
C_2F_6	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C_3F_8	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_4F_{10}	NA,NO	NA,NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$c\text{-}C_4F_8$	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	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[(5)] - (Gg CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Emissions of SF6[(4)] - (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)
(Sheet 4 of 5)
(Part 2 of 2)

Inventory 2004
Submission 2006 v1.3
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
Emissions of HFCs[(4)] - (Gg CO_2 equivalent)	**596.26**	**695.10**	**782.44**	**864.92**	**904.39**	**3 826.79**
HFC-23	0.00	0.00	0.00	0.00	0.00	1 275.44
HFC-32	0.00	0.00	0.00	0.00	0.00	100.00
HFC-41	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	299.44
HFC-125	0.02	0.03	0.03	0.04	0.05	100.00
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-134a	0.31	0.33	0.35	0.37	0.35	25 860.64
HFC-152a	0.11	0.24	0.35	0.43	0.53	100.00
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-143a	0.01	0.02	0.03	0.03	0.04	100.00
HFC-227ea	0.00	0.00	0.00	0.00	0.00	100.00
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Unspecified mix of listed HFCs[(5)] - (Gg CO_2 equivalent)	47.79	49.91	51.53	52.57	54.80	190.23
Emissions of PFCs[(4)] - (Gg CO_2 equivalent)	**72.33**	**82.15**	**86.87**	**102.54**	**114.72**	**-89.37**
CF_4	0.01	0.01	0.01	0.01	0.01	-95.61
C_2F_6	0.00	0.00	0.00	0.01	0.01	-60.67
C_3F_8	NA,NO	NA,NO	0.00	0.00	0.00	100.00
C_4F_{10}	0.00	0.00	0.00	0.00	0.00	100.00
$c\text{-}C_4F_8$	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
C_5F_{12}	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	0.00
Unspecified mix of listed PFCs[(5)] - (Gg CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Emissions of SF6[(4)] - (Gg CO_2 equivalent)	**633.31**	**636.62**	**640.83**	**593.52**	**512.51**	**1.97**
SF_6	0.03	0.03	0.03	0.02	0.02	1.97

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS (SUMMARY)
(Sheet 5 of 5)
(Part 1 of 2)

Inventory 2004
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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)
CO2 emissions including net CO_2 from LULUCF(3)	49 961.04	47 584.45	47 333.70	43 882.72	45 328.64	49 241.78	57 624.02	48 360.96	49 925.82	44 058.24
CO2 emissions excluding net CO_2 from LULUCF(3)	61 933.39	65 485.82	60 043.91	60 415.32	60 766.35	63 664.36	67 330.66	67 155.39	66 837.28	65 444.12
CH_4	9 179.07	9 150.45	8 857.36	8 829.98	8 636.85	8 520.17	8 333.06	8 057.21	7 936.59	7 759.63
N_2O	6 253.73	6 587.13	6 201.89	6 032.89	6 470.10	6 586.02	6 283.69	6 300.44	6 394.89	6 316.75
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	52.92	58.65	68.74	66.27	96.83	44.75	64.54
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 net CO_2 from LULUCF)(3)	**66 998.69**	**65 107.68**	**63 602.16**	**59 749.55**	**61 686.76**	**65 823.21**	**73 871.93**	**64 363.03**	**65 704.93**	**59 425.32**
Total (excluding net CO_2 from LULUCF)(3), (6)	**78 971.04**	**83 009.06**	**76 312.36**	**76 282.14**	**77 124.47**	**80 245.78**	**83 578.57**	**83 157.46**	**82 616.40**	**80 811.20**

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	55 654.51	59 531.71	54 617.66	55 103.30	55 122.59	57 827.98	61 860.80	60 988.53	61 053.67	59 820.92
2. Industrial Processes	10 111.56	10 152.50	8 998.84	8 751.45	9 275.76	9 730.26	9 602.19	10 193.59	9 675.43	9 392.02
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	9 122.44	9 296.60	8 812.64	8 582.84	9 048.22	9 134.47	8 718.11	8 687.43	8 691.32	8 504.96
5. Land Use, Land-Use Change and Forestry(7)	-11 960.71	-17 889.88	-12 698.62	-16 521.14	-15 426.33	-14 411.36	-9 695.44	-18 783.25	-16 900.22	-21 374.77
6. Waste	3 555.73	3 547.49	3 451.39	3 413.25	3 262.48	3 119.48	2 980.97	2 854.14	2 779.99	2 691.31
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)(7)	**66 998.69**	**65 107.68**	**63 602.16**	**59 749.55**	**61 686.76**	**65 823.21**	**73 871.93**	**64 363.03**	**65 704.93**	**59 425.32**

TABLE 10 EMISSION TRENDS (SUMMARY)
(Sheet 5 of 5)
(Part 2 of 2)

Inventory 2004
Submission 2006 v1.3
AUSTRIA

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	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)	(%)
CO2 emissions including net CO_2 from LULUCF[3]	50 149.24	51 403.67	56 807.50	60 955.45	60 462.14	21.02
CO2 emissions excluding net CO_2 from LULUCF[3]	66 185.96	70 179.02	71 943.21	77 561.83	77 103.43	24.49
CH_4	7 598.93	7 477.65	7 336.35	7 364.52	7 414.15	-19.23
N_2O	6 203.14	6 087.97	6 080.01	6 048.70	5 295.11	-15.33
HFCs	596.26	695.10	782.44	864.92	904.39	3 826.79
PFCs	72.33	82.15	86.87	102.54	114.72	-89.37
SF_6	633.31	636.62	640.83	593.52	512.51	1.97
Total (including net CO_2 from LULUCF)[3]	**65 253.20**	**66 383.15**	**71 734.01**	**75 929.65**	**74 703.02**	**11.50**
Total (excluding net CO_2 from LULUCF)[3], [6]	**81 289.92**	**85 158.51**	**86 869.72**	**92 536.02**	**91 344.32**	**15.67**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	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)	(%)
1. Energy	59 890.31	63 999.09	65 187.51	70 907.99	70 582.03	26.82
2. Industrial Processes	10 035.10	9 908.97	10 593.70	10 662.86	9 913.02	-1.96
3. Solvent and Other Product Use	413.52	426.10	424.85	423.60	422.34	-18.02
4. Agriculture	8 333.92	8 270.44	8 157.15	8 006.61	7 863.19	-13.80
5. Land Use, Land-Use Change and Forestry[7]	-16 025.63	-18 762.22	-15 124.79	-16 596.94	-16 629.58	39.04
6. Waste	2 605.97	2 540.77	2 495.60	2 525.53	2 552.01	-28.23
7. Other	NA	NA	NA	NA	NA	0.00
Total (including LULUCF)[7]	**65 253.20**	**66 383.15**	**71 734.01**	**75 929.65**	**74 703.02**	**11.50**

[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] The information in these rows is requested to facilitate comparison of data, because Parties differ in the way they report CO_2 emissions and removals from LULUCF.

[4] 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.

[5] 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.

[6] These totals will differ from the totals reported in table Summary 2 if Parties report non-CO_2 emissions from LULUCF.

[7] 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

• Use the documentation box to provide explanations if potential emissions are reported.

ANNEX 8: 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.

Anlage

(§ 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

BGBI 1994/ 498 Verordnung für Anlagen zur Glaserzeugung

§ 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, BGBI 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

BGBI II 1997/ 160 Verordnung für Anlagen zur Erzeugung von Eisen und Stahl

§ 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, 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 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.

Anlage

(§ 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

BGBl II 1997/ 163 Verordnung für Anlagen zum Sintern von Eisenerzen

§ 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

BGBl II 1997/ 331 Feuerungsanlagen-Verordnung

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

<u>BGBl II 1998/ 1 Verordnung zur Erzeugung von Nichteisenmetallen</u>

§ 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.