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AUSTRIA'S NATIONAL INVENTORY REPORT 2007

Submission under the United Nations Framework Convention on Climate Change

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Project management

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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 2005.

With decision 18/CP.8 (see document FCCC/CP/2002/8/Add.2) the Conference of the Parties (COP) adopted the UNFCCC guidelines on reporting and reviewing (FCCC/CP/2002/8). According to this decision Parties shall submit a National Inventory Report (NIR) containing detailed and complete information on their inventories, in order to ensure the transparency of the inventory (see paragraph 38 of FCCC/CP/2002/8). This is the seventh version of the National Inventory Report (NIR) submitted by Austria, it is an update of the NIR submitted in 2006[1]. This report is based on data submitted to the UNFCCC in the common reporting format (CRF submission 2007). 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 2007 and as submitted to the UNFCCC in the data submission 2007 replaces all previous versions of data submissions.

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

The underlying emission data for the year 2005 as reported in the tables of the common reporting format of the data submission 2007 to the convention are also included as well as abbreviations and references used. Furthermore detailed results from the key category analysis, detailed information on the methodology of emission estimates for the fuel combustion sector, the CO_2 reference approach and the National Energy Balance, as well as information on gas specific recalculations and the uncertainty assessment are presented in the Annexes.

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.

[1] Austria's National Inventory Report 2006 – Submission under the United Nations Framework Convention of Climate Change. REP-0016; Umweltbundesamt, Vienna.

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.

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ES.2 Summary of National Emission and Removal Related Trends

The most important GHG in Austria is carbon dioxide (CO_2), it contributed with 85.4% to total national GHG emissions expressed in CO_2 equivalents in 2005, followed by CH_4, 7.6% and N_2O, 5.6%. PFCs, HFCs and SF_6 amounted together to 1.4% of the overall GHG emissions in the country. The energy sector accounted for 77.8% of the total GHG emissions followed by Industrial Processes 11.0%, Agriculture 8.4% and Waste 2.4%.

Total GHG emissions (excluding land-use change and forestry (LULUCF)) amounted to 93 280 Gg CO_2 equivalents and increased by 18.0% from 1990 to 2005. The base year for all greenhouse gases is 1990.

Table 1 provides data on emissions by sector and Table 2 by gas from 1990 to 2005.

Table 1: Austria's greenhouse gas emissions by sector

GHG Source and Sink categories	[Gg CO_2 equivalent]	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*		67 151.16	**79 052.98**	55 654.41	10 110.82	515.17	9 123.86	-11 901.81	3 648.70
1991		65 452.12	**83 100.95**	59 541.51	10 152.82	469.27	9 297.98	-17 648.83	3 639.37
1992		63 762.86	**76 394.16**	54 620.06	8 999.19	420.24	8 813.92	-12 631.30	3 540.76
1993		59 908.94	**76 357.33**	55 101.38	8 750.66	419.85	8 583.93	-16 448.39	3 501.52
1994		62 045.46	**77 194.64**	55 118.17	9 274.86	404.04	9 049.11	-15 149.18	3 348.45
1995		65 584.96	**80 294.47**	57 823.33	9 729.28	422.38	9 134.98	-14 709.51	3 184.50
1996		73 904.85	**83 624.02**	61 856.28	9 601.28	405.31	8 718.22	-9 719.17	3 042.94
1997		64 402.19	**83 201.23**	60 982.30	10 192.60	422.59	8 687.06	-18 799.04	2 916.68
1998		65 483.58	**82 626.96**	61 031.61	9 674.44	404.74	8 690.53	-17 143.38	2 825.63
1999		59 073.07	**80 748.89**	59 726.88	9 391.20	390.87	8 503.84	-21 675.82	2 736.10
2000		64 771.70	**81 115.72**	59 679.15	10 034.30	413.52	8 332.69	-16 344.02	2 656.06
2001		65 947.14	**85 056.29**	63 882.63	9 908.19	414.32	8 268.92	-19 109.15	2 582.23
2002		71 216.16	**86 679.76**	64 993.08	10 592.72	398.57	8 155.34	-15 463.60	2 540.06
2003		76 018.03	**92 953.45**	71 334.29	10 664.20	382.82	8 002.32	-16 935.41	2 569.82
2004		74 215.33	**91 177.27**	70 562.22	9 976.20	367.07	7 855.33	-16 961.95	2 416.45
2005		76 252.98	**93 279.54**	72 527.89	10 294.78	351.00	7 823.37	-17 026.56	2 282.49

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

Over the period 1990-2005 CO_2 emissions increased by 28.6%, mainly due to increased emissions from transport. Methane emissions decreased during the same period by 23.1% mainly due to lower emissions from *Solid Waste Disposal* ; N_2O emissions decreased by 17.1% over the same period due to lower emissions from agricultural soils and from chemical industry. HFC emissions are 40 times higher in 2005 than in the base year, whereas PFC and SF_6 emissions decreased by 89% and 43% from the base year to 2005.

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]	**79 052.98**	61 930.34	9 180.67	6 337.12	23.03	1 079.24	502.58
1991		**83 100.95**	65 483.30	9 152.25	6 679.74	45.21	1 087.08	653.36
1992		**76 394.16**	60 041.64	8 859.08	6 284.25	48.68	462.67	697.85
1993		**76 357.33**	60 411.34	8 831.72	6 110.31	157.34	52.92	793.71
1994		**77 194.64**	60 763.27	8 638.61	6 541.59	206.83	58.65	985.70
1995		**80 294.47**	63 660.94	8 522.03	6 636.25	267.34	68.74	1 139.16
1996		**83 624.02**	67 327.21	8 334.90	6 330.75	346.84	66.27	1 218.05
1997		**83 201.23**	67 147.96	8 059.81	6 349.04	427.42	96.83	1 120.15
1998		**82 626.96**	66 811.89	7 938.25	6 429.18	494.89	44.75	907.99
1999		**80 748.89**	65 336.62	7 764.56	6 357.00	542.20	64.54	683.96
2000		**81 115.72**	65 960.13	7 604.98	6 248.71	596.26	72.33	633.31
2001		**85 056.29**	70 044.56	7 487.32	6 110.55	695.10	82.15	636.62
2002		**86 679.76**	71 709.42	7 356.12	6 104.10	782.41	86.87	640.83
2003		**92 953.45**	77 972.46	7 373.07	6 047.04	864.81	102.54	593.52
2004		**91 177.27**	77 139.93	7 221.97	5 288.51	899.62	114.72	512.51
2005		**93 279.54**	79 650.36	7 057.09	5 255.81	911.55	117.97	286.77

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

NOTE: Total without emissions from LULUCF

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

In 2005, 72 528 Gg CO_2 equivalents, that is 77.8% of total national emissions, arose from the sector *Energy*. In 2005, 98.8% of these emissions arose from fuel combustion activities. The most important *Fuel Combustion* sub-sector in 2005 was *1 A 3 Transport* with a share of 34%. From 1990 to 2005, emissions from the energy sector increased by 30.3%.

Industrial Processes was the second largest sector in Austria with 11.0% of total GHG emissions in 2005 (10 295 Gg CO_2 equivalents). The main source of greenhouse gas emissions in the industrial processes sector was *Metal Production*, which caused 49% of the emissions from this sector in 2005. From the base year to 2005, emissions from industrial processes increased by 1.8%.

In 2005, 0.4% of total GHG emissions in Austria (351 Gg CO_2 equivalent) arose from the sector *Solvent and Other Product Use*. From 1990 to 2005, emissions from this category decreased by 32%.

Emissions from *Agriculture* amounted to 7 823 Gg CO_2 equivalent in 2005, which corresponded to 8.4% of total national emissions. In 2005 the most important sub-sector *Enteric Fermentation* contributed with 41% to total greenhouse gas emissions from the agricultural sector. In 2005 emissions from this category were 14.3% below the level of the base year.

In 2005 the greenhouse gas emissions from the *Waste* sector amounted to 2 282 Gg CO_2 equivalents which corresponded to 2.4% of total national emissions. The main source of greenhouse gas emissions in this sector was *solid waste disposal on land*, which caused 82.3% of emissions. In 2005 emissions from this category were 37.4% 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 1990-2005

GHG		NOx	CO	NMVOC	SO_2
BY*	[Gg]	211.07	1 220.77	284.74	74.22
1991		222.34	1 241.05	271.99	71.35
1992		209.44	1 196.97	243.21	54.91
1993		202.33	1 154.12	238.79	53.32
1994		194.36	1 101.71	220.02	47.56
1995		192.07	1 010.05	218.19	46.81
1996		212.10	1 021.13	211.50	44.66
1997		199.32	954.60	197.37	40.35
1998		211.98	914.85	182.71	35.56
1999		199.83	865.91	170.47	33.74
2000		204.82	802.29	169.58	31.41
2001		213.78	789.35	172.40	33.02

GHG		NOx	CO	NMVOC	SO_2
2002		219.90	755.85	166.68	31.92
2003		229.28	760.81	162.71	32.63
2004		224.63	737.36	157.34	27.26
2005		225.06	720.31	154.14	26.41

Emissions of indirect greenhouse gases except NOx decreased in the period from 1990 to 2005: for NMVOCs by 45%, for CO by 40% and for SO_2 emissions by 63%. NOx emissions increased by 6% over the considered period.

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

1 INTRODUCTION

1.1 Background Information

Global Warming

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

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

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

Climate Change in Austria

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

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

The Convention, its Kyoto Protocol and the flexible mechanisms thereunder

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

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

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

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

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

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

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

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

National Greenhouse Gas Inventories

As a Party to the Convention, Austria is required to produce and regularly update National Greenhouse Gas Inventories. To date, National Greenhouse Gas Inventories have been produced for the years 1990 to 2005. 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]. The latest in-country review took place in February 2007 (in-country review of the initial report of Austria). This review combined the review of the submission 2006 and the so-called pre-commitment period review. The latter includes the review of the assigned amounts, the national inventory system and the national registry. The report of this review is expected to be published in July 2007.

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: Guide-

[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

lines for national systems under Article 5, paragraph 1, of the Kyoto Protocol; Decision 21/CP.7: Good practice guidance and adjustments under Article 5, paragraph 2, of the Kyoto Protocol; Decision 22/C.7: Guidance for the preparation of the information required under Article 7 of the Kyoto Protocol; Decision 23/CP.7: Guidelines for review under Article 8 of the Kyoto Protocol).

- Obligation under the Austrian Ambient Air Quality Law[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 designated as single national entity with overall responsibility for inventory preparation. This law regulates responsibilities of

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

environmental control in Austria and lists the tasks of the *Umweltbundesamt*. One task is the preparation of technical expertise and the data basis for fulfilment of the obligations under the UNFCCC and the UNECE LRTAP Convention. Thus the *Umweltbundesamt* prepares and annually updates the Austrian air emissions inventory ("Österreichische Luftschadstoff-Inventur OLI"), which covers greenhouse gases and emissions of other air pollutants as stipulated in the reporting obligations further explained in Chapter 1.2.5.

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

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

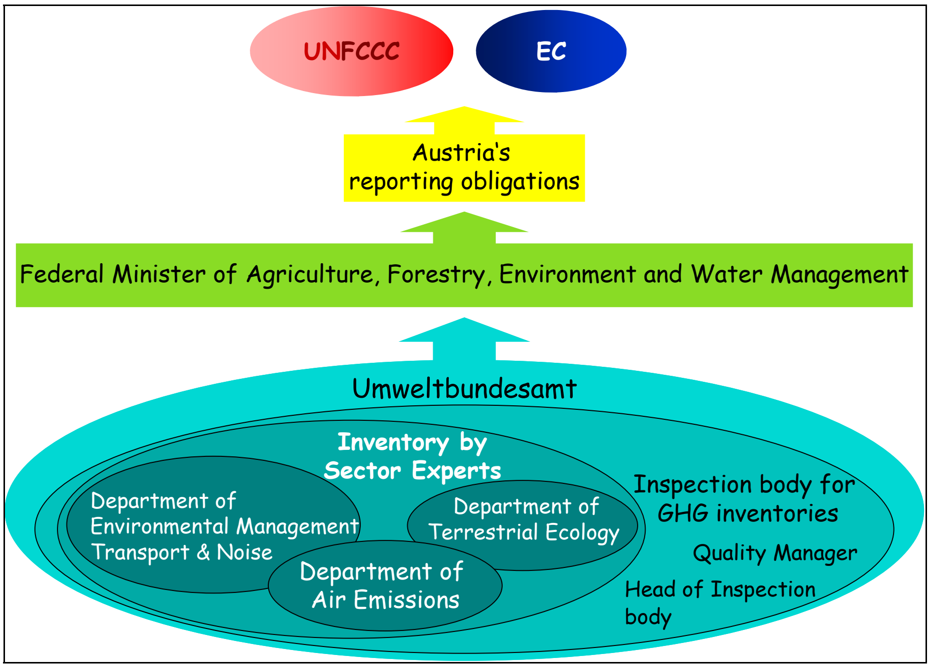

Figure 1: Responsibilities in the Austrian National System for Greenhouse Gas Inventories

1.2.4 Institutional arrangements in place

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

- Ordinance regarding Monitoring and Reporting of Greenhouse Gas Emissions[5]
  This ordinance pertains to the Austrian Emissions Certificate Trading Act[6] that regulates monitoring and reporting in the context of the EU Emissions Trading scheme in Austria. Paragraph 15 of this ordinance is designed to ensure consistency of emission trading data with the national inventory. It states that the *Umweltbundesamt* has to incorporate, as far as necessary, the emission reports of the emissions trading scheme into the national greenhouse gas inventory in order to comply with requirements of the EU Monitoring Mechanism Decision (280/2004/EC) and the UNFCCC. This is not only important for emissions from combustion of fuels, where more detailed information than provided in the national energy balance is available, but also for emissions from industrial processes, where the ordinance ensures data availability for most key sources (see Chapter 4 for details). First data from the EU Emissions Trading scheme were available for the year 2005; these data were considered in this submission.
- 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.

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[5] „*Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Überwachung und Berichterstattung betreffend Emissionen von Treibhausgasen*", Federal Law Gazette 458/2004

[6] "*Emissionszertifikate-Gesetz*", Federal Law Gazette 46/2004

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

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

- 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*). This data provide the main data basis for calculating emissions from the sector *Waste*.
- Since 2004 there is a reporting obligation to the BMLFUW under the Austrian Fluorinated Compounds (FC) Ordinance[10] for users of FCs for the following applications: refrigeration and air-conditioning, foam blowing, semiconductor manufacture, electrical equipment, fire extinguishers and aerosols. These data are used for estimating emissions from the consumption of fluorinated compounds (*IPCC sector 2 F*).

1.2.5 Adaptation of NISA according to the Kyoto Protocol

Regulations under the UNFCCC and the Kyoto Protocol define new standards for national emission inventories. These standards include more stringent requirements related to transparency, consistency, comparability, completeness and accuracy of inventories. Each Party shall have in place a national system, no later than one year prior to the start of the first commitment period; this means by the end of 2006. Also the European Community 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 was to set up a national system that fulfils all the requirements of the Kyoto Protocol and also works as an efficient system to fulfil all the other obligations regarding air emission inventories Austria has to comply with. The Austrian national system was lately reviewed during the in-country review of the initial report of Austria (February 2007). The final review report is expected to be published in July 2007.

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

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

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

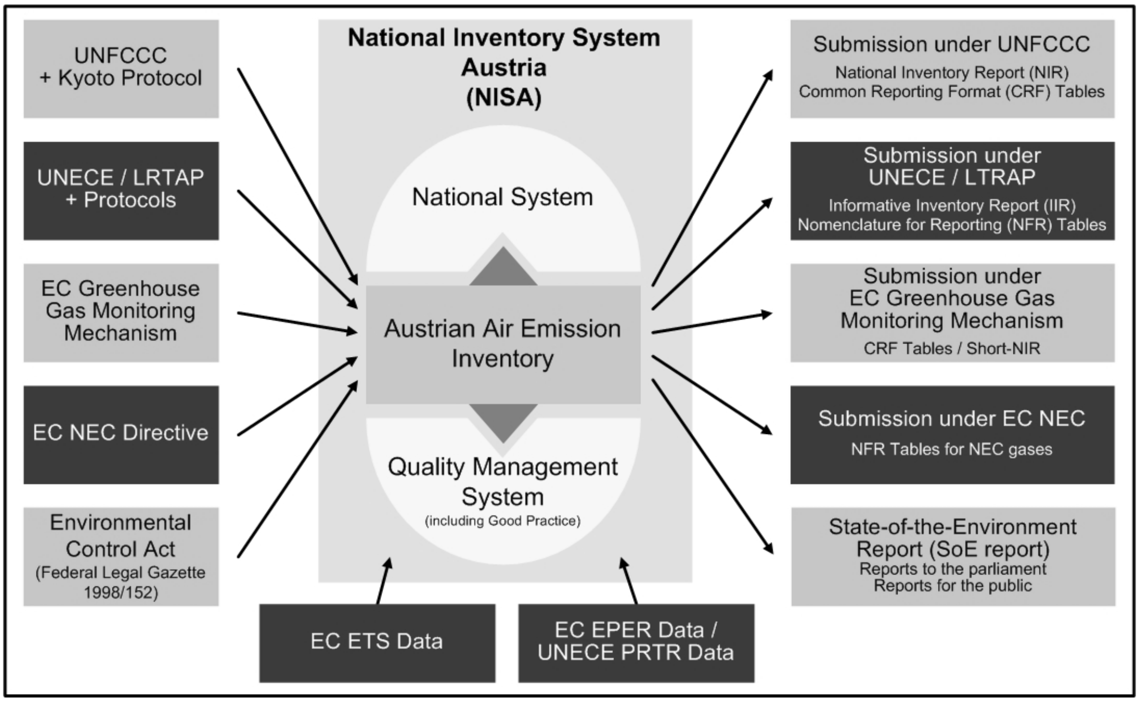

Figure 2: Structure of the emission inventory system in Austria (NISA)

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

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

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

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

The general functions are

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

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

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

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

- the *Umweltbundesamt* has been designated as single national entity with the overall responsibility for the national inventory by law: the Environmental Control Act ("Umweltkontrollgesetz"; Federal Law Gazette 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 pertains to data availability for the annual compilation of the GHG inventory. The main data source for the Austrian inventory preparation is the Austrian statistical office (*Statistik Austria*). The compilation of several statistics is regulated by law; the compilation of the national energy balance is regulated by contracts. Other data sources include reporting obligations under national and European regulations and reports of companies and associations.

- A process for official consideration and approval of the inventory prior to its submission is established. The inventory information is provided by the Umweltbundesamt to the Federal Ministry of Agriculture, Forestry, Environment and Water Management, where the National Focal Point for the UNFCCC is established. The inventory is then submitted by the Ministry to the UNFCCC secretariat.

1.3 Inventory Preparation Process

The present Austrian greenhouse gas inventory for the period 1990 to 2005 was compiled according to the recommendations for inventories set out in the UNFCCC reporting guidelines according to Decision 18/CP.8, the Common Reporting Format (CRF)[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) and the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC GPG-LULUCF, 2003).

The preparation of the inventory includes the following three stages:

(i) inventory planning

(ii) inventory preparation and

(iii) inventory management

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

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

During the second stage, the inventory preparation process, sector experts collect activity data, emission factors and all relevant information needed for finally estimating emissions. The sector experts also have specific responsibilities regarding the choice of methods, data processing and archiving and for contracting studies, if needed. As part of the quality management system the head of the "Inspection body for GHG inventory" approves the methodological choices. Sector

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

experts are also responsible for performing Quality Control (QC) activities that are incorporated in the Quality Management System (QMS). All data collected together with emission estimates are fed into a database (see below), where data sources are well documented for future reconstruction of the inventory.

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

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, EU-ETS	*Umweltbundesamt*, plant operators
Industry	National production statistics, import/export statistics, direct information from industry or associations of industry, EU-ETS	*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*

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

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

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

The main sources for emission factors are:

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

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

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

Main Data Suppliers

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

The main data suppliers are also presented in Table 4.

Information about activity data and emissions of the industry sector is obtained from *Association of the Austrian Industries* or directly from individual plants. Activity data for some sources are obtained from STATISTIK AUSTRIA which provides statistics on production data[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 1998-2005 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 the EU Emission trading Scheme

The European emission trading scheme (EU-ETS) was established by Directive 2003/87/EC of the European Parliament and of the Council[13]. Emission trading concerns CO_2 emissions from energy activities and manufacturing industries. These include combustion installations, mineral oil refineries and coke ovens as well as production and processing of ferrous metals, mineral industries and some other production activities. For more detailed information on the included activities please refer to Annex I of the above mentioned directive.

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

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

General rules for reporting and verification of these emissions are defined in EU directive 2003/87/EG and specific rules can be found in Commission decision 2004/156/EC[14]. In Austria

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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 2005.

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

[14] *"Commission Decision of 29 January 2004 establishing guidelines for the monitoring and reporting of greenhouse gas*

member state specific regulations are defined in the Austrian Emissions Certificate Trading Act[6] and in its respective ordinance[5]. As mentioned already in chapter 1.2.4 this ordinance also states that the *Umweltbundesamt* has to incorporate, as far as necessary, the emission reports of the emissions trading scheme into the national greenhouse gas inventory. For a detailed description of the sectors covered and the incorporation of these emissions in the national inventory please refer to the chapters 3 Energy (CRF Sector 1) and 4 Industrial Processes (CRF Sector 2).

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

Data from EPER

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[15.]

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

However, data from EPER could not be used as a data source for the national inventory. On the one hand this is due to the high threshold for emission reporting, 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, but for verification purposes only, where plausible.

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emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council", OJ L 59/1

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

1.5 Key Category Analysis

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

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

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

The presented key category analysis was performed by the *Umweltbundesamt* with data for greenhouse gas emissions of the submission 2007 to the UNFCCC and comprises a level assessment for all years between 1990 and 2005 and a trend assessment for the trend of the year 2005 with respect to base year emissions. As stipulated in the IPCC-GPG-LULUCF key source categories were first identified for the inventory excluding LULUCF and then the key category analysis was repeated for the full inventory including LULUCF categories.

1.5.1 Austria's Key Categories

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

The identified key categories are listed in Table 5 and Table 6. The key source categories comprise 90 333.2 Gg CO_2e in the year 2005, which is a share of 96.8% of Austria's total greenhouse gas emissions (without LULUCF).

Table 5: Austrian key categories based on emission data submitted to the UNFCCC in 2007

IPCC Category Description		Gas	Emissions 2005 [Gg CO_2e]	Share in National Total Emissions 2005
1 A gaseous	Fuel Combustion (stationary)	CO_2	18 509.6	19.8%
1 A 3 b diesel oil	Road Transportation	CO_2	16 644.6	17.8%
1 A 4 stat-liquid	Other Sectors	CO_2	7 125.3	7.6%
1 A 3 b gasoline	Road Transportation	CO_2	6 392.7	6.9%
1 A 1 a solid	Public Electricity and Heat Production	CO_2	5 844.0	6.3%
1 A 2 solid	Manufacturing Industries and Construction	CO_2	5 601.5	6.0%
2 C 1	Iron and Steel Production	CO_2	4 995.0	5.4%
4 A 1	Cattle	CH_4	3 029.3	3.2%
1 A 1 b liquid	Petroleum refining	CO_2	2 151.0	2.3%
1 A 2 stat-liquid	Manufacturing Industries and Construction	CO_2	1 920.4	2.1%
6 A	SOLID WASTE DISPOSAL ON LAND	CH_4	1 879.6	2.0%
2 A 1	Cement Production	CO_2	1 797.5	1.9%
4 D 1	Direct Soil Emissions	N_2O	1 518.0	1.6%

IPCC Category Description		Gas	Emissions 2005 [Gg CO_2e]	Share in National Total Emissions 2005
1 A 4 mobile-diesel	Other Sectors	CO_2	1 410.2	1.5%
1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO_2	1 161.4	1.2%
4 D 3	Indirect Emissions	N_2O	1 086.3	1.2%
1 A 1 a liquid	Public Electricity and Heat Production	CO_2	1082.9	1.2%
2F1/2/3/4/5	ODS Substitutes	HFC	907.8	1.0%
1 A 2 other	Manufacturing Industries and Construction	CO_2	848.8	0.9%
4 B 1	Cattle	N_2O	789.1	0.8%
2 A 2	Lime Production	CO_2	578.7	0.6%
1 A 4 solid	Other Sectors	CO_2	562.2	0.6%
1 B 2 b	Natural gas	CH_4	551.9	0.6%
2 B 1	Ammonia Production	CO_2	503.1	0.5%
1 A 1 a other	Public Electricity and Heat Production	CO_2	490.0	0.5%
4 B 1	Cattle	CH_4	458.8	0.5%
4 B 8	Swine	CH_4	396.9	0.4%
2 A 7 b	Sinter Production	CO_2	309.5	0.3%
2 A 3	Limestone and Dolomite Use	CO_2	290.8	0.3%
2 F 7	Semiconductor Manufacture	FCs	290.6	0.3%
2 B 2	Nitric Acid Production	N_2O	274.2	0.3%
1 A 4 biomass	Other Sectors	CH_4	243.6	0.3%
1 A 3 a jet kerosene	Civil Aviation	CO_2	208.6	0.2%
3	SOLVENT AND OTHER PRODUCT USE	CO_2	177.4	0.2%
1 A 3 b gasoline	Road Transportation	N_2O	148.6	0.2%
2 F 9	Other Sources of SF_6	SF_6	81.7	0.1%
1 A 4 other	Other Sectors	CO_2	71.6	0.1%
2 C 3	Aluminium production	PFC	0.0	0.0%
2 C 4	SF_6 Used in Al and Mg Foundries	SF_6	0.0	0.0%
2 C 3	Aluminium production	CO_2	0.0	0.0%

Table 6: Austrian key categories based on emission and removal data submitted to the UNFCCC in 2007

IPCC Category Description		Gas	Emissions / Removals 2005 [Gg CO_2e]
5 A 1	Forest land remaining forest land	CO_2	-17 536.1
5 B 1	Cropland remaining cropland	CO_2	-155.4
5 C 2	Land converted to grassland	CO_2	362.8
5 E 2	Land converted to Settlements	CO_2	222.7

The key source category with the highest contribution to national total emissions is *1 A Fuel Combustion – gaseous fuels*, this source has not been further disaggregated for the key category analysis because the same emission factor is used for all sub categories. The contribution to national total emissions in the base year was 14.1% compared to 19.8% in 2005. It ranked number one in all level assessments, and number two in the trend assessment.

The second most important source for greenhouse gas emissions in Austria is *1 A 3 b Road Transportation - diesel oil (CO_2)* for the years since 1996 and *1 A 3 b Road Transportation – gasoline (CO_2)* for the years before 1996. The contribution to national total emissions in the base year was 5.1% for diesel and 10.0% for gasoline, whereas in the last year of the inventory, namely 2005, it was 17.8% (6.9%). 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 315% since the base year.

The third most important source in terms of its contribution to national total emissions is *1 A 4 stationary-liquid* (commercial and residential plants and plants in agriculture and forestry as well as off-road traffic associated with these sources); it is the third important source for all years. It was also rated a key source in the trend assessment (ranks: 7). In the year 2005 it contributed 7.6% of national total greenhouse gas emissions, emissions from this source decreased by 3% from 1990 to 2005.

The key category with the highest contribution to national removals is *5 A 1 Forest land remaining forest land (CO_2)*. In the key category analysis including LULUCF it is the most important category in the level assessment for all years except 2005, where it ranked position two. Removals from this category increased from 1990 to 2005 by 43%.

Comparison to last years' submission

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

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

- *2 C 3* *Aluminium production* (CO_2) in the trend assessment
- *5 E 2* *Land converted to Settlements (CO_2)* in the level assessment

This result is influenced by the adaptation of the trend assessment to the formula recommended in the IPCC-GPG-LULUCF concerning trend assessment with zero current year emissions, and by recalculations.

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

- *6 B* *Wastewater Handling (N_2O)*

Recalculations that resulted in a change of trend 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* and in the IPCC Good Practice Guidance for Land Use, Land-Use

Change and Forestry (IPCC-GPG-LULUCF, 2003), Chapter 5.4 *Methodological Choice – Identification of key categories*.

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

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

The identification of key categories consists of six steps:

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

Level of disaggregation and identification of key categories

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

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

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

Level Assessment excluding LULUCF

For the Level Assessment the contribution of GHG emissions (expressed in CO_2 equivalent emissions) of each source category to national total emissions was calculated. The calculation was performed for the years 1990 to 2005 according to Equation 7.1 of the GPG. Then the sources were ranked in descending order of magnitude according to the results of the level assessment and finally a cumulative total was calculated.

For the year 2005 29 source categories comprised > 95% of the cumulative total and were thus rated as key categories. For the year 1990 31 source categories were identified as key sources in the level assessment and for all other years 29-32 categories were identified as key categories. The result of each level assessment is presented in Annex 1.

Trend Assessment excluding LULUCF

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

For the Trend Assessment, emissions of the year 2005 were compared with base year emissions (1990 for all gases).

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

Level Assessment including LULUCF

The level assessment was repeated for the full inventory including the LULUCF categories for the years 1990 to 2005 according to Equation 5.4.1 of the GPG-LULUCF. Four LULUCF key categories were identified by this analysis additionally. The result of each level assessment is presented in Annex 1.

Trend Assessment including LULUCF

Also the trend assessment was repeated for the full inventory including the LULUCF categories for the years 1990 to 2005 according to Equation 5.4.2 of the GPG-LULUCF (Equation 5.4.3 for zero current year emissions). The result of the trend assessment is presented in Annex 1.

Qualitative criteria

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

According to the GPG-LULUCF countries should identify and sum up the emission estimates associated with forest conversion to any other land category. This was done and the sum was found to be larger than the smallest category considered key in the quantitative analysis, thus it should be identified as key. The GPG-LULUCF also recommends further examining which land conversions are significant. In this examination it was found that the category 5 C 2 Forest Land converted to Grassland with 46% has the highest contribution to deforestation. But CO_2 emissions from 5 C 2 is already identified as key category in the quantitative analysis (emissions from deforestation contribute with 64% to this category). There is no further guidance in the GPG how to handle this double accounting of emissions in two different categories. Thus CO_2 emissions from deforestation is not considered additionally as key category, because a big part of these emissions are considered key in the category 5 C 2.

Identification of key categories

Any category meeting the 95% threshold in any year of the Level Assessment or in the Trend Assessment is considered a key category. The key sources categories are presented in Table 5 in descending order of magnitude of contribution to total national GHG emissions in the year 2005 and the LULUCF key categories are presented in Table 6. In Annex 1 they are presented together with their ranking of all assessments where they are within the 95% threshold.

Consequences of key category selection

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

1.6 Quality Assurance and Quality Control (QA/QC)

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

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

Figure 3: Official emblem of an Austrian accredited inspection body

History of the Austrian QMS

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

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

Table 7: Timetable for the implementation of the Austrian QMS

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

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

1.6.1 The International Standard ISO 17020

The QMS was drawn up to meet requirements of the International Standard ISO 17020[16]. 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 supervi-

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

sory authorities. Inspection parameters may include, among others, matters of quantity and/or quality.

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

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

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

Accreditation Act

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

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

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

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

Accreditation and Certification

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

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

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

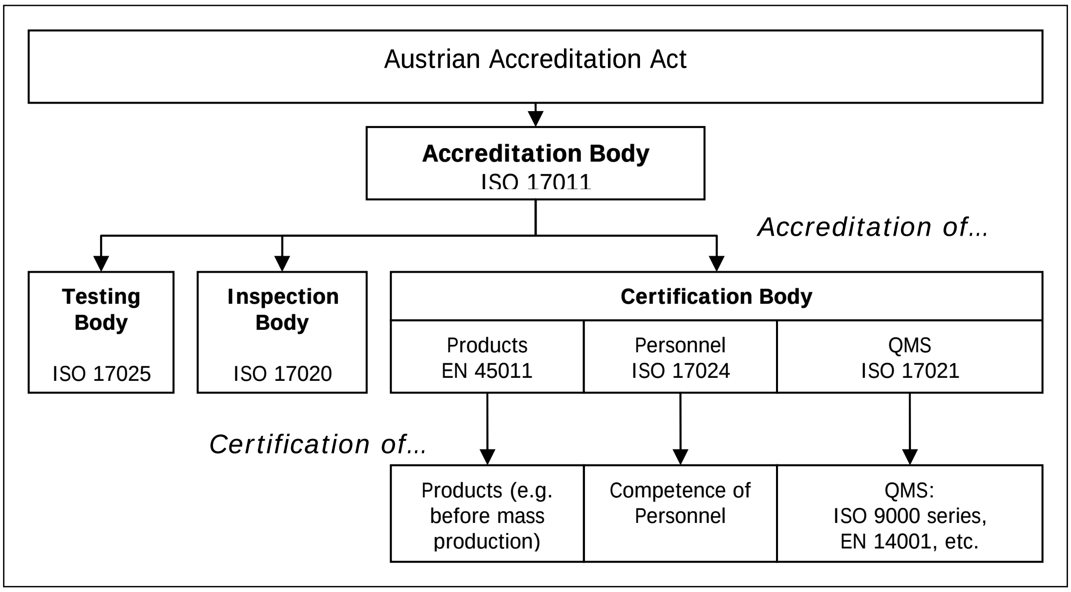

Figure 4: Inter-relationship between the Austrian Accreditation Act, the EN 45000/ISO 17000 and the ISO 9000 series.

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

Independence

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

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

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

Impartiality and Integrity

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

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

Inspection body in the context of National Greenhouse Gas Inventory

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

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

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

1.6.2 Design of the Austrian QMS

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

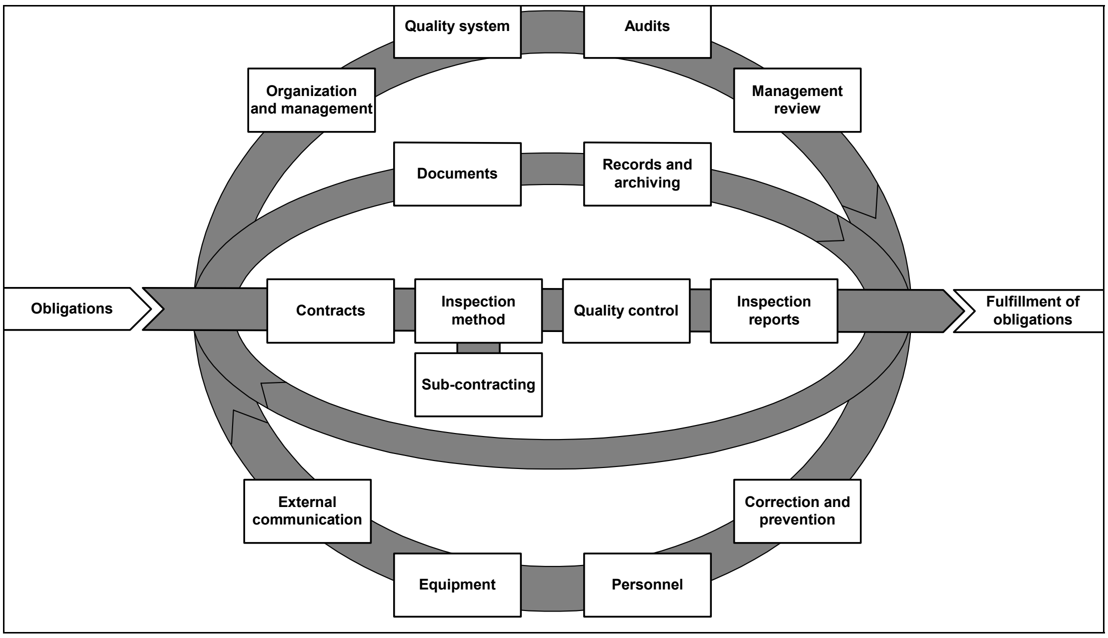

Figure 5: Process-based QMS (the outer circle corresponds to management processes, the straight line to realisation processes and the inner circle to supporting processes)

In the following the processes are explained:

1) **Realisation processes (horizontal bar)**

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

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

2) Management processes (outer circle)

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

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

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

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

3) Supporting processes (inner circle)

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

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

1.6.3 Elements of QA/QC System, and Austrian approach

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

- An inventory agency responsible for coordinating QA/QC activities
- A QA/QC plan
- General QC procedures (Tier 1)
- Source category-specific QC procedures (Tier 2)
- QA review procedures
- Reporting, documentation, and archiving procedures

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

Responsibilities

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

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

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

QA/QC Plan

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

- QC activities
- Procedures for country specific methodologies
- Internal audits (QM specific)
- Procedures for sub-contracting
- Inventory improvement plan
- Documentation and archiving
- Plan of methodologies (needs approval from the formal contracting body)
- treatment of confidential data
- etc.

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

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

QC Activities

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

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

The checklists cover questions like:

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

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

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

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

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

QA Activities

The following QA activities are performed:

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

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

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

Second party audits for work performed by sub-contractors:

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

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

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

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

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

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

Archiving and documentation

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

For each sector the documentation includes:

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

Focus of QA/QC activities in the year 2006

During the year 2006 QA/QC activities were focused on further improvements of the QMS. An external audit by the Accreditation Body took place in November 2006.

1.7 Uncertainty Assessment

1.7.1 Introduction

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

The respective sectoral uncertainties have been documented in detail in the last National Inventory Report NIR 2006. Specific uncertainty estimates are e.g. available for agricultural soil, for enteric fermentation from animal husbandry, for F-gases, for transport, and for land-use change and forestry. An assessment of the uncertainties of the energy balance is currently under way.

Because of the late finishing of this second comprehensive uncertainty analysis, it was not possible to include the results in the sector-specific chapters. Uncertainty information given in chapters 3-8 might therefore differ from information provided in this chapter and in Annex 6. This data and the underlying assumptions will be updated in the submission 2008 as far as necessary.

1.7.2 Theoretical background

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

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

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

1.7.3 Procedure

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

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

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

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

1.7.4 Random uncertainty vs. systematic uncertainty

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

Consequently here we did not perform a specific assessment of systematic uncertainty. Instead, we attempted to relate the result in terms of random uncertainty to the previous results, but only by way of an overall inventory result, as a specification into sectors does not reflect any real background.

1.7.5 Data origin and changes to previous approaches

Many of the uncertainties included in the new tier 1 and tier 2 calculations have already been covered in the previous submission (NIR 2006). Nevertheless it is worthwhile to consider some of the input uncertainties in detail – especially those that contribute more to the overall uncertainty.

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

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

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

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

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

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

Nitrous oxide (N_2O): Very limited measurement data are available on nitrous oxide emissions. When trying to trace emission factors back to their origin, the large Austrian data collection on emission factors from combustion (STANZEL et al. 1995) refers virtually all N_2O factors back to

GEMIS. In line with an earlier assessment done in an Austrian N_2O balance (ORTHOFER et al. 1994), uncertainties by fuel in general and uncertainties in the domestic heating sector were considered independent. Also transport was considered independently, even separated between Diesel fuel and gasoline (as only the latter is equipped with catalysts, which are responsible for the larger share of emissions).

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

Fluorinated gases: The uncertainties related to emissions of fluorinated gases (PFC, HFC and SF6) have been investigated within the emission assessment (NIR 2006). Basically, emissions in areas where substances are specifically brought in, e.g. as solvents, are considered well understood, those that refer to release (refrigeration, electrodes during Al-production) are considered highly uncertain.

1.7.6 Results

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

Data are presented in Table 8 and Table 9 for the key source categories of the Austrian GHG inventory. Uncertainty is presented for each source category, and for the level of target year 2005 as well as for the trend in percentage points relative to the total base year (1990) emissions. One of the major problems in assigning uncertainty figures appears when introducing asymmetric distribution into Table 8, especially those that have a strong influence. Using the range of 0.3 to 3 times the emission factor for N_2O from soils, we chose to apply an uncertainty of 150%. If we would have taken 200% (consistent with the factor 3 increase), the overall uncertainties would have been 4.57 (level) and 3.11 (trend) instead of 3.66 and 2.84 as identified in Table 8.

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

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

IPCC Source category	Gas	AD	EF	Combined	Combined as % of total national emissions in 2005	Introduced into the trend in total national emissions
		Uncertainty [%]				
1 A 1 a liquid: Public Electricity and Heat Production	CO_2	0.5	0.5	0.7	0.01	0.01
1 A 1 a other: Public Electricity and Heat Production	CO_2	10.0	0.5	10.0	0.05	0.09
1 A 1 a solid: Public Electricity and Heat Production	CO_2	0.5	0.5	0.7	0.05	0.05
1 A 1 b liquid: Petroleum refining	CO_2	0.5	0.3	0.6	0.01	0.02
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO_2	1.0	0.5	1.1	0.01	0.02
1 A 2 other: Manufacturing Industries and Construction	CO_2	10.0	0.5	10.0	0.09	0.16
1 A 2 solid: Manufacturing Industries and Construction	CO_2	1.0	0.5	1.1	0.07	0.10
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO_2	1.0	0.5	1.1	0.02	0.04
1 A 3 a jet kerosene: Civil Aviation	CO_2	5.0	3.0	5.8	0.01	0.02
1 A 3 b diesel oil: Road Transportation	CO_2	5.0	3.0	5.8	1.07	1.61
1 A 3 b gasoline: Road Transportation	CO_2	5.0	3.0	5.8	0.41	0.60
1 A 3 b gasoline: Road Transportation	N_2O	5.0	70.0	70.2	0.12	0.10
1 A 4 biomass: Other Sectors	CH_4	10.0	50.0	51.0	0.14	0.10
1 A 4 mobile-diesel: Other Sectors	CO_2	1.0	0.5	1.1	0.02	0.03
1 A 4 other: Other Sectors	CO_2	10.0	0.5	10.0	0.01	0.01
1 A 4 solid: Other Sectors	CO_2	1.0	0.5	1.1	0.01	0.02
1 A 4 stat-liquid: Other Sectors	CO_2	1.0	0.5	1.1	0.09	0.13
1 A gaseous: Fuel Combustion (stationary)	CO_2	2.0	0.5	2.1	0.42	0.69
1 B 2 b: Natural gas	CH_4	6.0	25.0	25.7	0.16	0.10
2 A 1: Cement Production	CO_2	5.0	2.0	5.4	0.11	0.17
2 A 2: Lime Production	CO_2	20.0	5.0	20.6	0.13	0.21
2 A 3: Limestone and Dolomite	CO_2	19.6	2.0	19.7	0.06	0.11

IPCC Source category	Gas	AD	EF	Com-bined	Combined as % of total national emissions in 2005	Introduced into the trend in total national emissions
		Uncertainty [%]				
Use						
2 A 7 b: Sinter Production	CO_2	2.0	5.0	5.4	0.02	0.02
2 B 1: Ammonia Production	CO_2	2.0	4.6	5.0	0.03	0.02
2 B 2: Nitric Acid Production	N_2O	3.0	20.0	20.2	0.06	0.21
2 C 1: Iron and Steel Production	CO_2	0.5	0.5	0.7	0.04	0.05
2 C 3: Aluminium production	CO_2	2.0	0.5	2.1	0.00	0.00
2C3: Aluminium production	PFCs	0.0	50.0	50.0	0.00	0.81
2C4: SF6 Used in Al and Mg Foundries	SF6	0.0	5.0	5.0	0.00	0.02
2F1/2/3/4/5: ODS Substitutes	HFCs	0.0	54.0	54.0	0.54	0.62
2F7: Semiconductor Manufacture	FCs	0.0	11.2	11.2	0.04	0.02
2F9: Other Sources of SF6	SF6	0.0	56.0	56.0	0.05	0.05
3: Solvent and other product use	CO_2	5.0	10.0	11.2	0.02	0.03
4 A 1: Cattle	CH_4	10.0	20.0	22.4	0.75	0.64
4 B 1: Cattle	N_2O	10.0	100.0	100.5	0.88	0.40
4 B 1: Cattle	CH_4	10.0	70.0	70.7	0.36	0.23
4 B 8: Swine	CH_4	10.0	70.0	70.7	0.31	0.14
4 D 1: Direct Soil Emissions	N_2O	5.0	150.0	150.1	2.52	1.11
4 D 3: Indirect Emissions	N_2O	5.0	150.0	150.1	1.80	0.91
6 A: Solid waste disposal on land	CH_4	12.0	25.0	27.7	0.58	0.81
Total					**3.66**	**2.84**

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

IPCC Source category	Gas	Uncertainty in 2005 emissions as % of emissions in the category		Uncertainty introduced on national total in 2005	Uncertainty introduced into the trend in total national emissions
		% below (2.5)	% above (97.5)	%	
1 A 1 a liquid: Public Electricity and Heat Production	CO_2	0.7	0.7	0.01	0.01
1 A 1 a other: Public Electricity and Heat Production	CO_2	10.0	9.8	0.05	0.06
1 A 1 a solid: Public Electricity and Heat Production	CO_2	0.7	0.7	0.04	0.05
1 A 1 b liquid: Petroleum refining	CO_2	0.6	0.6	0.01	0.02
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO_2	1.1	1.1	0.01	0.02
1 A 2 other: Manufacturing Industries and Construction	CO_2	9.8	9.7	0.09	0.12
1 A 2 solid: Manufacturing Industries and Construction	CO_2	1.3	1.3	0.08	0.13
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO_2	1.0	1.0	0.02	0.04
1 A 3 a jet kerosene: Civil Aviation	CO_2	5.7	5.8	0.01	0.02
1 A 3 b diesel oil: Road Transportation	CO_2	5.7	5.8	1.04	1.19
1 A 3 b gasoline: Road Transportation	CO_2	5.7	5.8	0.40	0.65
1 A 3 b gasoline: Road Transportation	N_2O	30.3	72.6	0.09	0.05
1 A 4 biomass: Other Sectors	CH_4	13.5	14.3	0.04	0.05
1 A 4 mobile-diesel: Other Sectors	CO_2	1.1	1.1	0.02	0.03
1 A 4 other: Other Sectors	CO_2	9.8	9.7	0.01	0.03
1 A 4 solid: Other Sectors	CO_2	1.1	1.1	0.01	0.04
1 A 4 stat-liquid: Other Sectors	CO_2	1.1	1.1	0.08	0.13
1 A gaseous: Fuel Combustion (stationary)	CO_2	3.2	3.2	0.65	0.89
1 B 2 b: Natural gas	CH_4	14.4	14.6	0.09	0.06
2 A 1: Cement Production	CO_2	5.2	5.3	0.10	0.17
2 A 2: Lime Production	CO_2	19.8	20.8	0.13	0.18
2 A 3: Limestone and Dolomite Use	CO_2	19.3	19.4	0.06	0.09
2 A 7 b: Sinter Production	CO_2	5.2	5.2	0.02	0.02
2 B 1: Ammonia Production	CO_2	4.9	5.0	0.03	0.02
2 B 2: Nitric Acid Production	N_2O	20.0	19.8	0.06	0.16
2 C 1: Iron and Steel Production	CO_2	0.7	0.7	0.04	0.04
2 C 3: Aluminium production	CO_2			0.00	0.00
2C3: Aluminium production	PFC			0.00	0.66
2C4: SF6 Used in Al and Mg Foundries	SF_6			0.00	0.02

IPCC Source category	Gas	Uncertainty in 2005 emissions as % of emissions in the category		Uncertainty introduced on national total in 2005	Uncertainty introduced into the trend in total national emissions
		% below (2.5)	% above (97.5)	%	
2F1/2/3/4/5: ODS Substitutes	HFC	52.3	53.2	0.53	0.63
2F7: Semiconductor Manufacture	SF_6	11.1	10.8	0.02	0.03
2F9: Other Sources of SF6	SF_6	55.2	55.4	0.05	0.11
3: Solvent and other product use	CO_2	4.6	4.7	0.01	0.02
4 A 1: Cattle	CH_4	21.3	20.8	0.69	0.45
4 B 1: Cattle	CH_4	68.4	68.9	0.34	0.13
4 B 1: Cattle	N_2O	49.8	101.9	0.66	0.17
4 B 8: Swine	CH_4	68.1	69.2	0.30	0.07
4 D 1: Direct Soil Emissions	N_2O	70.0	203.2	2.55	0.51
4 D 3: Indirect Emissions	N_2O	70.0	203.2	1.82	0.46
6 A: Solid waste disposal on land	CH_4	26.5	27.7	0.56	0.75
National Total without LULUCF				**5.14**	**2.69**

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

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

IPCC Source category	Gas	Uncertainty in 2005 emissions as % of emissions in the category		Uncertainty introduced on national total in 2005	Uncertainty introduced into the trend in total national emissions
		% below (2.5)	% above (97.5)	%	
Non-Key Sources	CO_2	1.8	1.8	0.02	0.02
Non-Key Sources	CH_4	11.1	11.1	0.06	0.05
Non-Key Sources	N_2O	17.7	31.6	0.40	0.10
Non-Key Sources	PFC	11.2	10.9	0.01	0.02
Non-Key Sources	HFC	11.2	10.9	0.00	0.00
Non-Key Sources	SF_6	55.4	54.9	0.02	0.03

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

1.7.7 Conclusions

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

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

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

Figure 6 shows the resulting probability density distribution for Austria, 2005. The distribution is most strongly influenced by the lognormal distribution of the uncertainty in soil N_2O emissions. If the previous (WINIWARTER & RYPDAL 2001) assumption on "random" N_2O emission factor uncertainty is taken (triangular distribution between 50% and 200% of the given emission factor), the total level uncertainty of the Austrian inventory changes from 5.14% to 2.78%, and the trend uncertainty from 2.69% to 2.54%. This is again proof of the importance on assumptions taken on N_2O emissions on the overall uncertainty of a national GHG inventory.

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

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

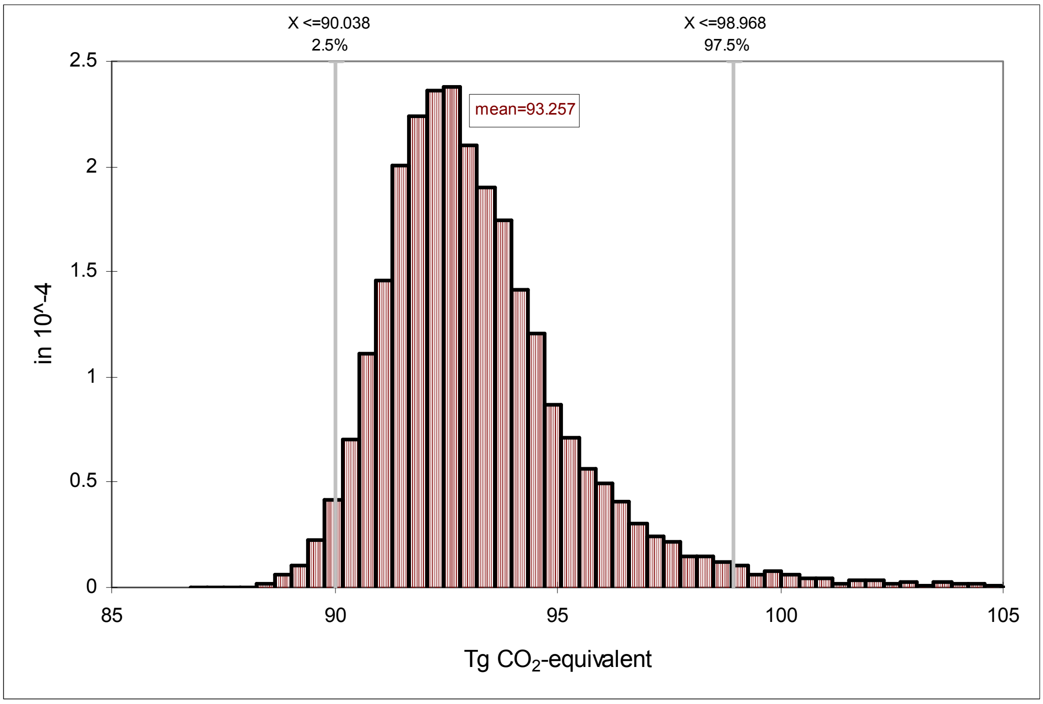

Figure 6: Austria's greenhouse gas emissions in 2005 without LULUCF – probability bins according to uncertainty analysis.

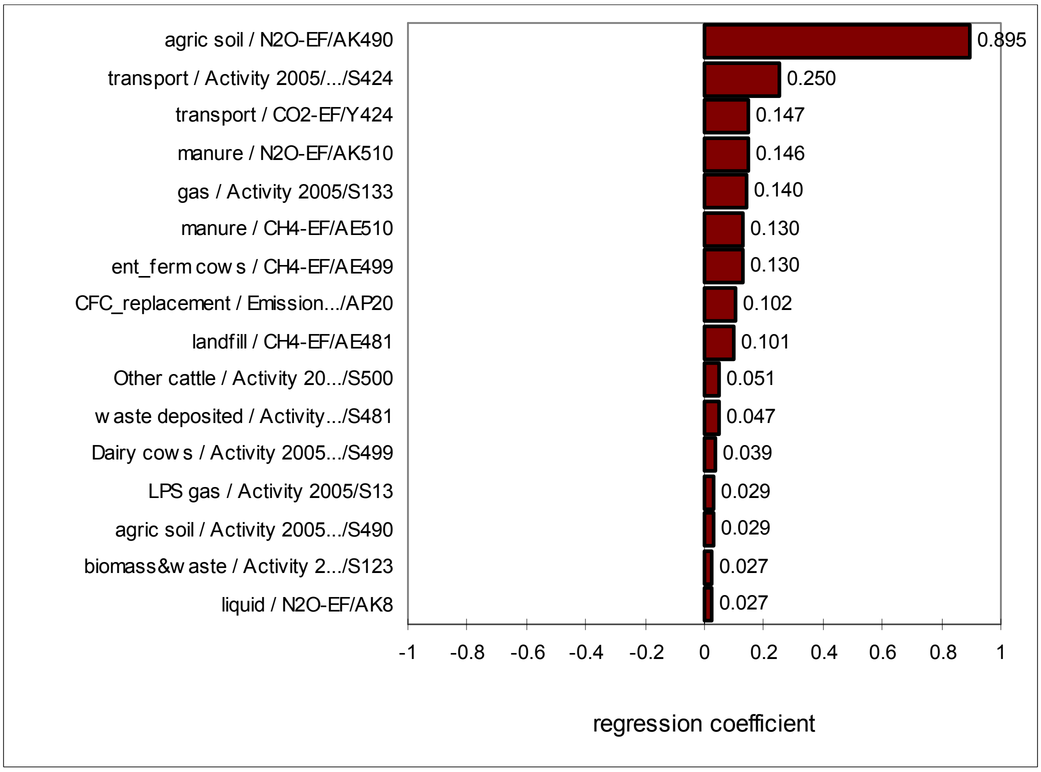

Figure 7: Sensitivity analysis: regression coefficients between total GHG emissions 2005 (without LULUCF) and input parameters

Table 11 and Table 12 present a comparison to the previous study on uncertainties of the Austrian GHG inventory (WINIWARTER & RYPDAL 2001). As is evident from the 1990 emission figures (mean value), methodical problems of the underlying inventory as of the late 1990s only allow for a limited evaluation (differences to the state-of-the-art compilation methods, then not implemented in the national inventory, were regarded as systematic error and are not included in this analysis). The low uncertainty for CO_2, the dominating greenhouse gas, could be sustained. Improved analysis lead to better understanding of CH_4 emissions, thus reducing uncertainty. For N_2O, as discussed above, some of the uncertainty considered systematic and method-relevant had to be included into the random uncertainty after adaptation of the method. This is also the main reason for the change in total uncertainty, which is mostly determined by the N2O uncertainty and hardly influenced by uncertainties from F-gases.

Differences also become obvious when comparing between years (1990 vs. 2005). This is not due to the method, but only due to shifts in activities. Abolishing Al-production in Austria stops the highly uncertain emissions and decreases PFC uncertainty. The increase in uncertainty on CO_2 is due to a shift of the activity into transport, which is considered more uncertain than most other parts of fossil fuel consumption. The increase in uncertainty for individual gas emissions still allows for a decrease of the overall inventory, as the weight of CO_2 emissions becomes larger, and N_2O emissions actually have been reduced in that period.

Table 11: Key results of the first comprehensive study on the Austrian GHG inventory uncertainty (Winiwarter & Rypdal 2001)

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

Table 12: Key results of the second comprehensive study on the Austrian GHG inventory uncertainty

Random uncertainty		CO_2	CH_4	N_2O	PFC	HFC	SF_6	Total GHG emissions
1990	Mean value	61.93	9.18	6.24	1.08	0.02	0.50	78.96
	Standard deviation	0.43	0.72	2.53	0.26	0.01	0.04	2.68
	2σ	**1.4%**	**15.8%**	**81.1%**	**48.7%**	**49.6%**	**16.8%**	**6.8%**
2005	Mean value	79.67	7.05	5.22	0.12	0.91	0.29	93.26
	Standard deviation	0.79	0.53	2.18	0.01	0.25	0.03	2.40
	2σ	**2.0%**	**15.1%**	**83.5%**	**11.3%**	**54.2%**	**24.1%**	**5.1%**

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

1.8 Completeness

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

Sources and sinks

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

Gases

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

Geographic coverage

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

Notation keys

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

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

- IE (included elsewhere):

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

- NE (not estimated):

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

- NA (not applicable):

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

- C (confidential):

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

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

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

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

In the following table transparency and completeness of submissions 2007 is compared to the values of 2006. As can be seen in the table, the completeness for the Sectors *Industrial Processes* and *LULUCF* increased: some sources previously reported as "NE" have been estimated. Furthermore, the use of correct notation keys has been checked and corrected where relevant, that's why the number of "IE" have slightly increased in these Sectors.

Table 13: Transparency and completeness in UNFCCC submissions 2006 and 2007

Sector	Submission 2007				Submission 2006			
	IE	NE	Trans-par-ency	Com-plete-ness	IE	NE	Trans-par-ency	Com-plete-ness
1 Energy	31	0	*91%*	*100%*	32	0	*91%*	*100%*
2 Industrial Processes	39	24	*93%*	*96%*	38	30	*93%*	*95%*
3 Solvents	0	0	*100%*	*100%*	0	0	*100%*	*100%*
4 Agriculture	2	0	*96%*	*100%*	2	0	*96%*	*100%*
5 LULUCF	20	8	*92%*	*97%*	19	13	*92%*	*94%*
6 Waste	4	0	*89%*	*100%*	4	0	*89%*	*100%*
Total	**96**	**32**	***92%***	***97%***	**95**	**43**	***92%***	***97%***
Total number of estimates*	**1236**				**1236**			

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

Remark: values reported in NIR2006 have been revised due to errors that have been identified

2 TREND IN TOTAL EMISSIONS

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

2.1 Emission Trends for Aggregated GHG Emissions

Under the burden sharing agreement of the European Union, Austria is committed to a reduction of its greenhouse gases by 13% below 1990 levels by 2008-2012. Table 14 gives a summary of Austria's anthropogenic greenhouse gas emissions 1990-2005.

Table 14: Summary of Austria's anthropogenic greenhouse gas emissions from 1990-2005

GHG		**Total**	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
BY*	[Gg CO_2 equivalent]	**79 052.98**	61 930.34	9 180.67	6 337.12	23.03	1 079.24	502.58
1991		**83 100.95**	65 483.30	9 152.25	6 679.74	45.21	1 087.08	653.36
1992		**76 394.16**	60 041.64	8 859.08	6 284.25	48.68	462.67	697.85
1993		**76 357.33**	60 411.34	8 831.72	6 110.31	157.34	52.92	793.71
1994		**77 194.64**	60 763.27	8 638.61	6 541.59	206.83	58.65	985.70
1995		**80 294.47**	63 660.94	8 522.03	6 636.25	267.34	68.74	1 139.16
1996		**83 624.02**	67 327.21	8 334.90	6 330.75	346.84	66.27	1 218.05
1997		**83 201.23**	67 147.96	8 059.81	6 349.04	427.42	96.83	1 120.15
1998		**82 626.96**	66 811.89	7 938.25	6 429.18	494.89	44.75	907.99
1999		**80 748.89**	65 336.62	7 764.56	6 357.00	542.20	64.54	683.96
2000		**81 115.72**	65 960.13	7 604.98	6 248.71	596.26	72.33	633.31
2001		**85 056.29**	70 044.56	7 487.32	6 110.55	695.10	82.15	636.62
2002		**86 679.76**	71 709.42	7 356.12	6 104.10	782.41	86.87	640.83
2003		**92 953.45**	77 972.46	7 373.07	6 047.04	864.81	102.54	593.52
2004		**91 177.27**	77 139.93	7 221.97	5 288.51	899.62	114.72	512.51
2005		**93 279.54**	79 650.36	7 057.09	5 255.81	911.55	117.97	286.77
Trend BY*-2005		**18.0%**	28.6%	-23.1%	-17.1%	3857.9%	-89.1%	-42.9%

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;

[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

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

Austria's total greenhouse gases showed an increase of 18.0% from the base year to 2005 (CO_2: +28.6%).

In the period from 2004 to 2005 Austria's total greenhouse gases increased by 2.3%, CO_2 emissions increased by 3.3%. The following figure presents the trend in total GHG emissions 1990-2005 in comparison to Austria's Kyoto reduction target of 13% from the base year 1990 (BY). This figure excludes emissions and removals from land use, land-use change and forestry (LULUCF).

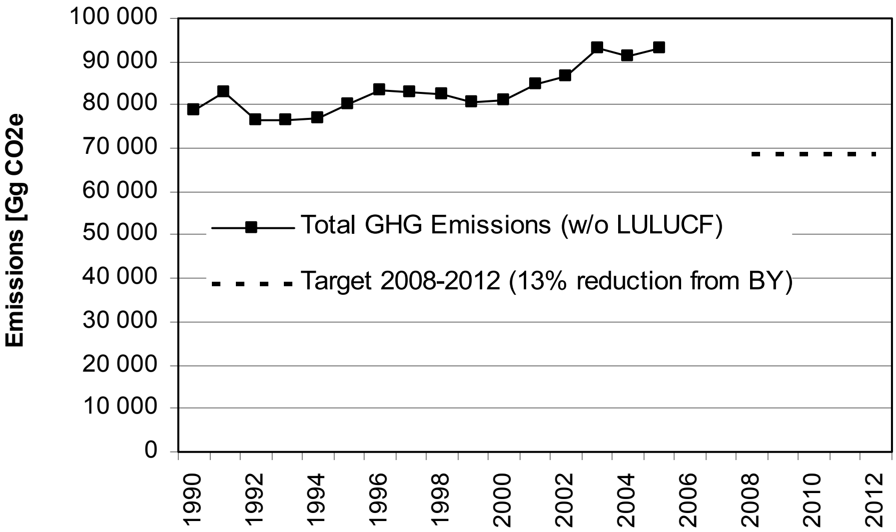

Figure 8: Trend in total GHG emissions 1990-2005

2.2 Emission Trends by Gas

Table 15 presents greenhouse gas emissions of the base year and 2005 as well as their share in total greenhouse gas emissions.

Table 15: Austria's greenhouse gas emissions by gas in the base year and in 2005

GHG	BY 1990	2005	BY 1990	2005
	CO_2 equivalent [Gg]		[%]	
Total	**79 053**	**93 280**	**100.0%**	**100.0%**
CO_2	61 930	79 650	78.3%	85.4%
CH_4	9 181	7 057	11.6%	7.6%
N_2O	6 337	5 256	8.0%	5.6%
F-Gases	1 605	1 316	2.0%	1.4%

Emissions without LULUCF

The greenhouse gas most emitted in Austria is CO_2, which represented 85.4% of total greenhouse gas emissions in 2005 compared to 78.3% in the base year, followed by CH_4 (7.6% in 2005 and 11.6% in the base year), N_2O (5.6% in 2005 and 8.0% in the base year) and finally fluorinated hydrocarbons with a share of 1.4% compared to 2.0% in the base year.

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

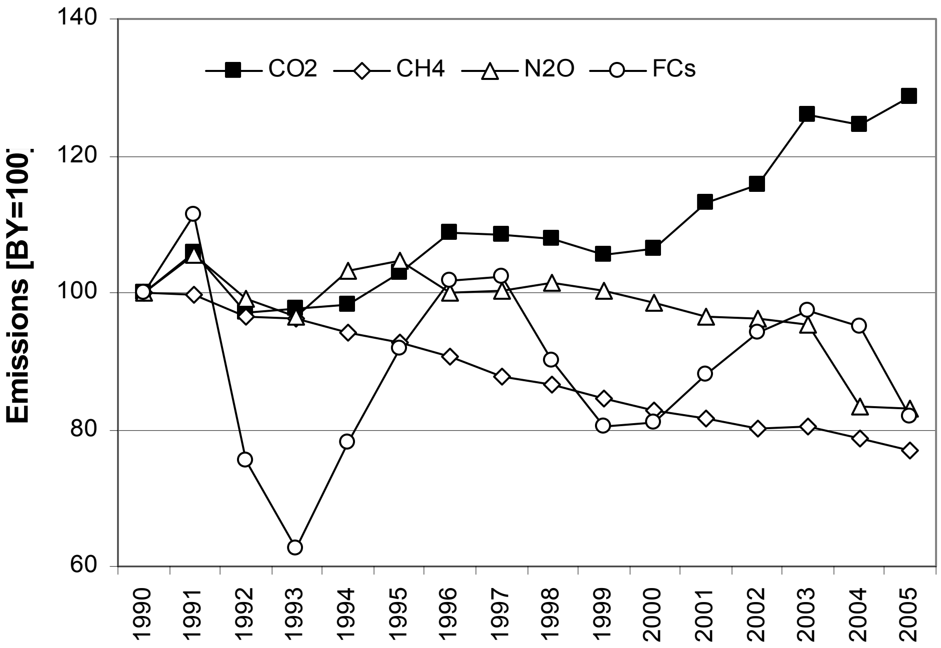

Figure 9: Trend in greenhouse gas emissions 1990-2005 by gas in index form (base year = 100)

CO_2

CO_2 emissions fluctuated at the beginning of the 1990s, with an increasing trend until 1996; this was followed by a slight decrease until 1999. Since 2000 emissions have strongly increased, from 2000 to 2005 by 22%. From 2004 to 2005 emissions increased by 3.3%.

This results in a total increase of 28.6% from 1990 to 2005. In absolute figures, CO_2 emissions increased from 61 930 to 79 650 Gg (see Table 14) during the period from 1990 to 2005 mainly due to higher emissions from transport, which increased by 94%.

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 2005 from 9 181 to 7 057 Gg CO_2 equivalents (see Table 14). In 2005 CH_4 emissions were 23.1% below the level of the base year, mainly due to lower emissions from solid waste disposal sites.

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

N_2O

N_2O emissions in Austria fluctuated between 1990 and 1998, increasing by 2% over this period. Since then emissions have shown a decreasing trend, resulting in 5 256 Gg CO_2 equivalents in 2005 compared to 6 337 in the base year (minus 17.1%). The general decrease is mainly due to lower N_2O emissions from agricultural soils; the strong decrease 2003-2004 was due to emission reduction measures in the chemical industry.

The main source of N_2O emissions are agricultural soils with a share of 54% in national total N_2O emissions. Manure management has a share of 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 2005 from 23 to 912 Gg CO_2 equivalents. HFCs are used as substitutes for HCFCs (Hydro Chloro Fluoro Carbons; these are ozone depleting substances), the use of which has been banned for most applications.

PFCs

PFC emissions show an inverse trend of HFC emissions. PFC emissions decreased remarkably during the period from 1990 to 2005, from 1079 to 118 Gg CO_2 equivalents. PFCs were in the base year mainly emitted as side-products of primary aluminium production, which closed down in Austria in 1992; in 2005 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 2005 SF_6 emissions amounted to 287 Gg CO_2 equivalents, which was 43% below the level of the base year (1990).

The main sources of SF_6 emissions in 2005 were semiconductor manufacture and filling of noise insulating windows.

2.3 Emission Trends by Source

Table 16 presents a summary of Austria's anthropogenic greenhouse gas emissions by sector for the period from 1990 to 2005:

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

Table 16: Summary of Austria's anthropogenic greenhouse gas emissions from 1990-2005

	[Gg CO_2 equivalent]	**Total**	Energy	Industrial Processes	Solvents	Agriculture	LULUCF	Waste
1990		**79 052.98**	55 654.41	10 110.82	515.17	9 123.86	-11 901.81	3 648.70
1991		**83 100.95**	59 541.51	10 152.82	469.27	9 297.98	-17 648.83	3 639.37
1992		**76 394.16**	54 620.06	8 999.19	420.24	8 813.92	-12 631.30	3 540.76
1993		**76 357.33**	55 101.38	8 750.66	419.85	8 583.93	-16 448.39	3 501.52
1994		**77 194.64**	55 118.17	9 274.86	404.04	9 049.11	-15 149.18	3 348.45
1995		**80 294.47**	57 823.33	9 729.28	422.38	9 134.98	-14 709.51	3 184.50
1996		**83 624.02**	61 856.28	9 601.28	405.31	8 718.22	-9 719.17	3 042.94
1997		**83 201.23**	60 982.30	10 192.60	422.59	8 687.06	-18 799.04	2 916.68
1998		**82 626.96**	61 031.61	9 674.44	404.74	8 690.53	-17 143.38	2 825.63
1999		**80 748.89**	59 726.88	9 391.20	390.87	8 503.84	-21 675.82	2 736.10
2000		**81 115.72**	59 679.15	10 034.30	413.52	8 332.69	-16 344.02	2 656.06
2001		**85 056.29**	63 882.63	9 908.19	414.32	8 268.92	-19 109.15	2 582.23
2002		**86 679.76**	64 993.08	10 592.72	398.57	8 155.34	-15 463.60	2 540.06
2003		**92 953.45**	71 334.29	10 664.20	382.82	8 002.32	-16 935.41	2 569.82
2004		**91 177.27**	70 562.22	9 976.20	367.07	7 855.33	-16 961.95	2 416.45
2005		**93 279.54**	72 527.89	10 294.78	351.00	7 823.37	-17 026.56	2 282.49

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 2005 as well as their share and trends are presented in the following table.

Table 17: Austria's greenhouse gas emissions by sector in the base year and in 2005 as well as their share and trends

GHG	Base year*	2005	Trend BY*-2005	Base year*	2005
	Emissions [Gg CO_2e]			Share [%]	
Total	**79 053**	**93 280**	**18.0%**	**100.0%**	**100.0%**
1 Energy	55 654	72 528	30.3%	70.4%	77.8%
2 Industry	10 111	10 295	1.8%	12.8%	11.0%
3 Solvent	515	351	-31.9%	0.7%	0.4%
4 Agriculture	9 124	7 823	-14.3%	11.5%	8.4%
5 LULUCF	-11 902	-17 027	43.1%	-15.1%	-18.3%
6 Waste	3 649	2 282	-37.4%	4.6%	2.4%

Total emissions without LULUCF

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

The dominant sector is the energy sector, which caused 78% of total greenhouse gas emissions in Austria in 2005 (70% in 1990), followed by the Sector Industrial Processes, which caused 11% of greenhouse gas emissions in 2005 (13% in 1990).

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

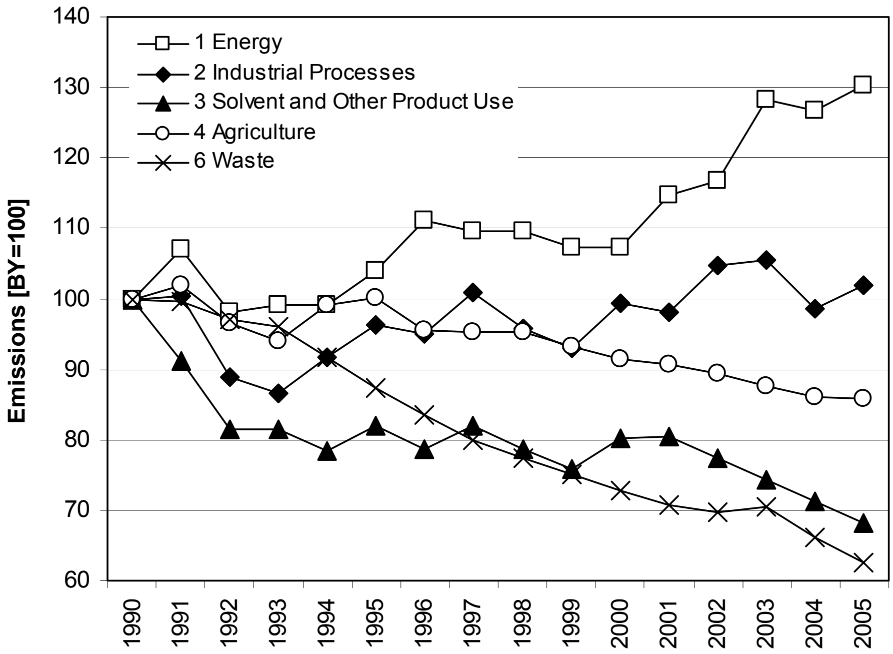

Figure 10: Trend in emissions 1990-2005 by Sector in index form (base year = 100)

2.3.1 Energy (IPCC Category 1)

The trend for greenhouse gas emissions from IPCC Category 1 (Energy) shows that emissions increased between 1990 and 1995 and then slightly decreased between 1996 and 2000. The strong increase between 2000 and 2003 was followed by a lower increase of emissions until 2005 (+1.7%). In 2005 greenhouse gas emissions from Category *1 Energy* amounted to 72 528 Gg CO_2 equivalents, which corresponds to 77.8% of total national emissions.

In 2005, 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 97.6% to total GHG emissions from *Energy*, CH_4 1.3% and N_2O 1.1%.

The most important energy sub-sectors in 2005 were *1 A 3 Transport* with a share of 33.5%, followed by *1 A 1 Energy Industries* (21.9%), *1 A 2 Manufacturing Industries and Construction* (21.7%) and *1 A 4 Other Sectors* (21.5%).

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 2005 with +91%. Apart from an increase of road performance (kilometres driven) in Austria, another main reason for this strong increase is the so-called 'fuel tourism'. In the early 1990s fuel prices in Austria were higher compared to neighbouring countries, whereas since the middle of the 1990s it has been the other way round.

Emissions from sub-sector *1 A 1 Energy Industries* show an increase of 16% from the base year to 2005. The main drivers for emissions from this sector are total electricity production (which increased by about 32% from 1990 to 2005) and an increase in heat production, which doubled over this period due to an increase in the demand for district heating in the residential and commercial sector. Furthermore, the share of biomass used as a fuel in this sector and the contribution of hydro plants to total electricity production, which is generally about 73% and varied from 65% to 78% in the period under observation (depending on the annual water situation), are important drivers. Also the climatic circumstances influence emissions from this sector: a cold winter leads to an increase of heat production.

Emissions from *1 A 2 Manufacturing Industries and Construction* increased by 14% from 1990 to 2005, mainly due to the increase in fuel consumption (increase of natural gas and fuel waste consumption, whereas consumption of liquid fossil fuels decreased). The increase of emissions between 2004 and 2005 is due to increasing industrial production.

The increase of heated area, demand for hot water generation, climatic circumstances and the change of fuel mix are the most important drivers for emissions from *1 A 4 Other Sectors*. Emissions in 2005 were 4% higher than in the base year, and 7% higher than in 2004.

2.3.2 Industrial Processes (IPCC Category 2)

Greenhouse gas emissions from the industrial processes sector fluctuated during the period 1990-2005 and were at a minimum level in 1993. In 2005 they were 1.8% above the level of the base year. In 2005 greenhouse gas emissions from Category *2 Industrial Processes* amounted to 10 295 Gg CO_2 equivalents, which corresponds to 11.0% of total national emissions.

The main sources of greenhouse gas emissions in the industrial processes sector are *Metal Production* and *Mineral Products*, which caused 49% and 30% of the emissions from this sector in 2005. The emission trend in this sector follows more or less production figures.

The most important GHG of the industry sector is carbon dioxide with 84.4% of emissions from this category, followed by HFCs with 8.9%, SF_6 with 2.8%, N_2O with 2.7%, PFCs with 1.1% and finally CH_4 with 0.2%.

2.3.3 Solvent and Other Product Use (IPCC Category 3)

In the year 2005, 0.4% of total GHG emissions in Austria (351 Gg CO_2 equivalents) originated from *Solvent and Other Product Use*.

Greenhouse gas emissions in this sector decreased by almost 20% between 1990 and 2005, due to decreasing solvent and N_2O use.

51% of these emissions were indirect CO_2 emissions, 49% were accounted for by N_2O emissions.

2.3.4 Agriculture (IPCC Category 4)

Greenhouse gas emissions from the agricultural sector fluctuated in the early 1990s, since 1995 they have shown a steady downward trend. In 2005 emissions from this category were 14.3% below the base year. The decrease is mainly due to decreasing livestock numbers. The fluctuations result from changes in mineral fertilizer sales data which were used as activity data for calculating N_2O emissions from agricultural soils, which is an important sub-source.

Emissions from Agriculture amounted to 7 823 Gg CO_2 equivalents in 2005, which corresponds to 8.4% of total national emissions. In 2005 the most important sub-sector *Enteric Fermentation* contributed 41% to total greenhouse gas emissions from the agricultural sector; the second largest sub-source *Agricultural Soils* had a share of 36%.

In the Austrian GHG inventory Agriculture is the largest source for both N_2O and CH_4 emissions: in 2005 71% of total N_2O emissions and 58% (196.3 Gg) of total CH_4 emissions in Austria originated from this sector. N_2O emissions from *Agriculture* amounted to 11.9 Gg in 2005 (3 700 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)

The category Land Use, Land-Use Change and Forestry is a net sink in Austria. Net removals from this category amounted to 11 902 Gg CO_2 equivalents in the base year, which corresponds to 15% of national total GHG emissions (without LULUCF) compared to 18% in the year 2005. The trend in net removals from LULUCF is plus 43% over the observed period.

The main sink is subcategory *5 A Forest Land* with net removals of 17 640 Gg CO_2 in 2005. Small CO_2 and N_2O emissions arise from the other subcategories, where total net emissions amounted to 613 Gg CO_2 equivalents in 2005.

2.3.6 Waste (IPCC Category 6)

Greenhouse gas emissions from Category *6 Waste* decreased steadily during the period 1990–2002, mainly as a result of waste management policies: the amount of landfilled waste has decreased and methane recovery improved. The slight increase from 2002 to 2003 was followed by a decrease until 2005. The trend between 2002 and 2005 is influenced by the amount of deposited waste. In 2005 emissions from this category were 37.4% below the base year level.

In 2005 the greenhouse gas emissions from the waste sector amounted to 2 282 Gg CO_2 equivalents, which corresponds to 2.4% of total national emissions

The main source of greenhouse gas emissions in the waste sector is *solid waste disposal on land*, which caused 82.3% of the emissions from this sector in 2005; the second largest source is *waste water handling* with 12.7%.

In 2005 the most important GHG of the Sector Waste was CH_4 with 85.6% of emissions from this category, followed by N_2O with 13.9%, 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. This chapter summarizes the trends for these gases.

A detailed description of the methodology used to estimate these emissions will be provided in *Austria's Informative Inventory Report (IIR) 2007, Submission under the UNECE/CLRTAP Convention*, which will be published by the end of 2007.

Table 18 presents a summary of emission estimates for indirect greenhouse gases and SO_2 for the period from 1990 to 2005. The "National Emission Ceilings" (NEC) as set out in the 1999 *Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone* are also presented in Table 18. These reduction targets should be met by 2010 by parties to the UNECE/CLRTAP convention who signed this protocol.

Table 18: Emissions of indirect GHGs and SO_2 1990-2005

GHG		NOx	CO	NMVOC	SO_2
1990	[Gg]	211.1	1 220.8	284.7	74.2
1991		222.3	1 241.1	272.0	71.3
1992		209.4	1 197.0	243.2	54.9
1993		202.3	1 154.1	238.8	53.3
1994		194.4	1 101.7	220.0	47.6
1995		192.1	1 010.1	218.2	46.8
1996		212.1	1 021.1	211.5	44.7
1997		199.3	954.6	197.4	40.4
1998		212.0	914.9	182.7	35.6
1999		199.8	865.9	170.5	33.7
2000		204.8	802.3	169.6	31.4
2001		213.8	789.3	172.4	33.0
2002		219.9	755.8	166.7	31.9
2003		229.3	760.8	162.7	32.6
2004		224.6	737.4	157.3	27.3
2005		225.1	720.3	154.1	26.4
NEC		107.0	---	159.0	39.0

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

Emissions of indirect greenhouse gases except NOx decreased in the period from 1990 to 2005: for NMVOCs by 45%, for CO by 40% and for SO_2 emissions by 63%. NOx emissions increased by 6% over the considered period.

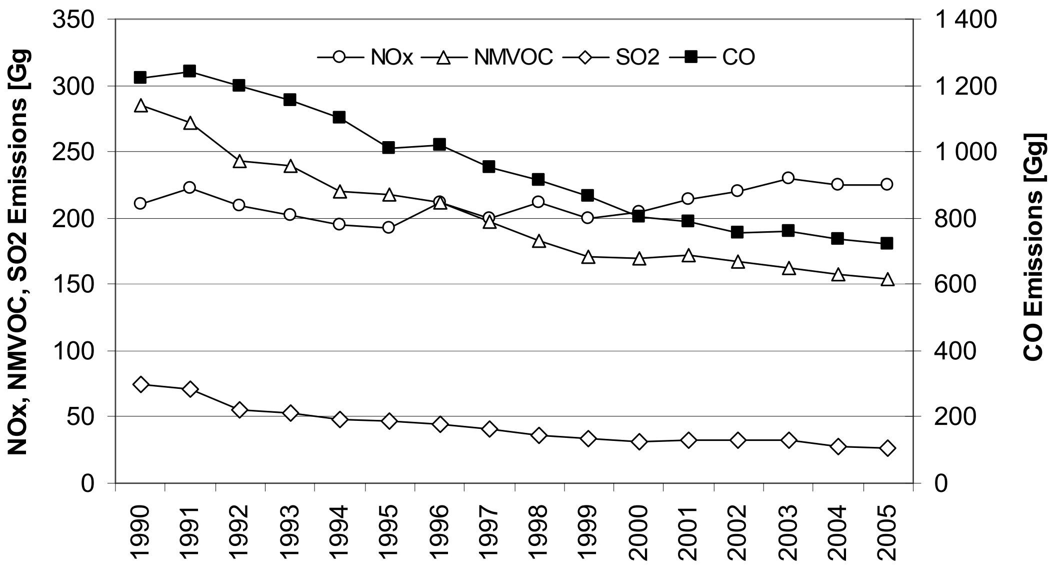

Figure 11: Emissions of indirect GHGs and SO_2 1990-2005

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

NO_X

NO_X emissions increased from 211 to 225 Gg during the period from 1990 to 2005. In 2005 the NO_X emissions were 6% 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 – road transport.

CO

CO emissions decreased from 1 221 to 720 Gg during the period from 1990 to 2005. In 2005 CO emissions were 41% below the level of 1990.

In the year 2005, 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 285 to 159 Gg during the period from 1990 to 2005. In 2005 NMVOC emissions were 46% below the level of 1990.

The most important emission sources for NMVOC emissions are *Solvent Use* and fossil fuel combustion, contributing 49% and 45% respectively of national total emissions in 2005.

SO_2

SO_2 emissions decreased from 74 to 26 Gg during the period from 1990 to 2005. In 2005 SO_2 emissions were 64% below the level of 1990.

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

3 ENERGY (CRF SECTOR 1)

3.1 Sector Overview

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

CO_2 emissions from fossil fuel combustion are the main source of GHGs in Austria. In the year 2005 about 76.8% of national total GHGs emissions and 88.9% of national total anthropogenic CO_2 emissions from Austria were caused by fossil fuel combustion in road traffic, in the energy and manufacturing industry and in the commercial, agricultural and residential sector.

3.1.1 Emission Trends

Figure 12 presents the trend for emission from IPCC Sector *1 Energy* in Gg CO_2 equivalent. The trend shows an increase by 26.8% from 55.65 Tg CO_2 equivalents in 1990 to 72.53 Tg CO_2 equivalents in 2005, which is mainly caused by increasing emissions from the transport sector.

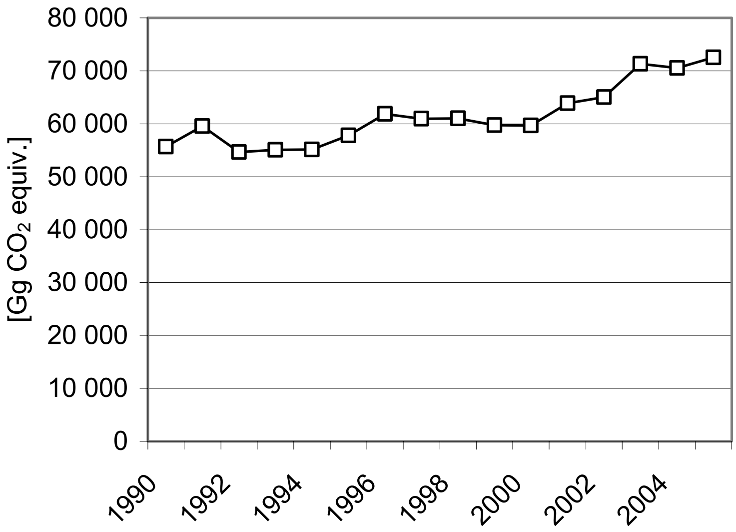

Figure 12: Trend of GHG emissions from 1990-2005 for Sector 1 Energy.

Table 19 presents the emission trend by GHG. The increase of CO_2 and N_2O emissions is mainly caused by the increasing activity of the transport sector. The strong increase of CO_2 emissions from 2002 to 2003 was additionally caused by public electricity plants. The increase of CH_4 emissions from 1998 onwards has been due to increasing fugitive emissions from natural gas distribution networks.

Table 19: Emissions of greenhouse gases and their trend from 1990-2005 from category 1 Energy

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1990	54 042	40.29	2.47
1991	57 798	42.47	2.75
1992	52 905	41.24	2.74
1993	53 360	41.59	2.80
1994	53 398	40.40	2.81
1995	56 078	41.94	2.79
1996	60 062	44.08	2.80
1997	59 275	40.53	2.76
1998	59 313	40.44	2.80
1999	58 004	41.51	2.75
2000	58 001	41.25	2.62
2001	62 145	42.61	2.72
2002	63 247	42.79	2.73
2003	69 569	43.36	2.76
2004	68 792	44.98	2.66
2005	70 772	45.95	2.55
Trend 1990-2005	31.0%	14.1%	3.1%

Emission trends by sectors

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

Table 20: Total GHG emissions in [Gg CO_2 equivalent] from 1990–2005 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	55 654	55 168	13 710	13 749	12 725	14 947	36	487	11	476
1991	59 542	59 032	14 511	14 025	14 386	16 073	38	510	9	500
1992	54 620	54 083	11 361	12 870	14 339	15 478	35	537	8	529
1993	55 101	54 554	11 401	13 217	14 528	15 368	40	547	8	540
1994	55 118	54 541	11 661	14 205	14 486	14 146	43	577	6	571
1995	57 823	57 224	12 691	14 384	14 854	15 262	33	599	6	593
1996	61 856	61 287	13 789	14 446	16 409	16 603	40	570	5	565
1997	60 982	60 345	13 884	16 031	15 318	15 074	38	638	5	633
1998	61 032	60 362	12 909	14 925	17 533	14 952	43	670	5	665
1999	59 727	59 007	12 508	13 880	16 924	15 652	43	720	5	715
2000	59 679	58 949	12 349	14 498	18 053	14 004	46	730	6	724
2001	63 883	63 126	13 716	14 531	19 213	15 623	44	756	5	751
2002	64 993	64 229	13 497	14 683	21 086	14 920	43	764	6	757
2003	71 334	70 493	16 056	15 045	23 009	16 291	91	842	5	836
2004	70 562	69 699	16 124	15 286	23 596	14 584	109	863	1	862
2005	72 528	71 656	15 902	15 708	24 321	15 602	123	872	NO	872
Trend 1990-2005	30.3%	29.9%	16.0%	14.2%	91.1%	4.4%	241.2%	79.2%	-100%	83.3%

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 2005 the most important source of GHGs was the transport sector (sub-category *1 A 3 Transport*), with a share of 26.1% in national total GHG emissions. 13.9% of national GHG emissions were released by passenger cars, 1.9% by light duty vehicles, 9% 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 2005 was category *1 A 1 Energy Industries*, were fossil fuels are used for electrical power and district heating production. In the year 2005 overall gross public electricity production was 57 468[18] GWh of which 37 379 GWh (65%) were generated by hydro plants, 18 745 GWh (32.6%) by thermal power plants and 1344 GWh (2.3%) by solar, geothermal and wind power plants. Industrial auto producers generated 8250 GWh of electricity in the year 2005. There are no operating nuclear plants in Austria. Due to the importance of hydropower the seasonal water situation in Austria has a high influence on the need for electric power generation by fossil fuels. In category *1 A 1* biomass is mainly used by smaller district heating plants. The refinery industry which consists of only one plant in Austria is also included in this category (sub-category *1 A 1 b Petroleum refining*).

Combustion in Industry (sub-category *1 A 2 Manufacturing Industries and Construction*) was the third largest sub-category with a share of 16.8% in 2005 total GHG emissions. This sector also includes mobile 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 16.7% in 2005 total GHG emissions. Emissions of this category are very dependent on the climatic circumstances and on the economic trend. E.g. a "cold winter" in combination with an economic uptrend may increase emissions from space heatings significantly. In Austria the main share of solid biomass consumption is used for space and water heating. Category *1 A 4* also includes emissions from mobile machinery mainly used in agriculture and forestry.

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

3.2.1.1 Key Sources

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

Table 21: Key sources of Category 1 Energy

IPCC Category	Category Name	GHG	Keysource Assessment
1 A gaseous	Fuel Combustion (stationary)	CO_2	LA; TA
1 A 1 a liquid	Public Electricity and Heat Production	CO_2	LA; TA
1 A 1 a other	Public Electricity and Heat Production	CO_2	LA 2001-2005; 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
1 A 2 mob-liquid	Manufacturing Industries and Constr.	CO_2	LA
1 A 2 other	Manufacturing Industries and Constr.	CO_2	LA; TA
1 A 2 solid	Manufacturing Industries and Constr.	CO_2	LA; 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 and 1999; TA
1 A 4 mob-diesel	Other Sectors	CO_2	LA; TA
1 A 4 solid	Other Sectors	CO_2	LA; TA
1 A 4 stat-liquid	Other Sectors	CO_2	LA; TA
1 A 4 other	Other Sectors	CO_2	LA 1997 and 1999; TA

LA = Level Assessment

TA = Trend Assessment

3.2.1.2 Completeness

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

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

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

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

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
1 A 2 c Other Fuels		✓	✓	✓
1 A 2 d Pulp, Paper and Print	**0301 Comb. in boilers, gas turbines and stationary engines (Pulp, Paper and Print Industry)**			
1 A 2 d Liquid Fuels		✓	✓	✓
1 A 2 d Solid Fuels		✓	✓	✓
1 A 2 d Gaseous Fuels		✓	✓	✓
1 A 2 d Biomass		✓	✓	✓
1 A 2 d Other Fuels		✓	✓	✓
1 A 2 e Food Processing, Beverages and Tobacco	**0301 Comb. in boilers, gas turbines and stationary engines (Food Processing, Beverages and Tobacco Industry)**			
1 A 2 e Liquid Fuels		✓	✓	✓
1 A 2 e Solid Fuels		✓	✓	✓
1 A 2 e Gaseous Fuels		✓	✓	✓
1 A 2 e Biomass		✓	✓	✓
1 A 2 e Other Fuels		✓	✓	✓
1 A 2 f Other	**0301 Comb. in boilers, gas turbines and stationary engines (Other Industry+ Electricity and Heat Production in Industry)** **030311 Cement** **030317 Glass** **030312 Lime** **030319 Bricks and Tiles** **030323 Magnesium production (dolomite treatment)** **0808 Other Mobile Sources and Machinery-Industry**			
1 A 2 f Liquid Fuels		✓	✓	✓
1 A 2 f Solid Fuels		✓	✓	✓
1 A 2 f Gaseous Fuels		✓	✓	✓
1 A 2 f Biomass		✓	✓	✓
1 A 2 f Other Fuels		✓	✓	✓
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**			
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 aquacul-ture** **0806 Other Mobile Sources and Machinery-Agriculture** **0807 Other Mobile Sources and Machinery-Forestry**			
1 A 4 c Liquid Fuels		✓	✓	✓
1 A 4 c Solid Fuels		✓	✓	✓
1 A 4 c Gaseous Fuels		✓	✓	✓
1 A 4 c Biomass		✓	✓	✓
1 A 4 c Other Fuels		NO	NO	NO
1 A 5 Other	**0801 Other Mobile Sources and Machinery-Military**			
1 A 5 Liquid Fuels		✓	✓	✓
1 A 5 Solid Fuels		NO	NO	NO

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
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		NO	NO	NO

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

3.2.2 Methodological Issues

Choice of Methodology

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

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

Tier 2 methodology

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

- *1 A 1 a Public Electricity and Heat Production, plants >= 50 MW_{th}:* CO_2, CH_4, N_2O, NMVOC.
- *1 A 1 a Public Electricity and Heat Production, plants < 50 MW_{th}*: All Pollutants.
- *1 A 1 b Petroleum Refining:* CO_2, CH_4, N_2O.
- *1 A 1 c Manufacture of Solid Fuels and Other Energy Industries*: All Pollutants
- *1 A 2 Manufacturing Industries and Construction-Stationary sources:* All Pollutants.
- *1 A 3 c Railways:* All Pollutants
- *1 A 3 d Navigation:* All Pollutants
- *1 A 3 e Other Transportation-Pipeline compressors:* All Pollutants
- *1 A 4 Other Sectors-Stationary sources:* All Pollutants

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

Activity data are taken from official energy statistics.

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

Emissions factors are country specific, fuel and technology dependent.

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

Tier 3 methodology

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

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

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

Emissions factors are fuel and technology dependent.

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

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

Consideration of point source emissions

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

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

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

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

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

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

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

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

Description of received ETS data

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

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

- Activity data: mass or volume of fuel consumption/process input material.

- Net calorific value of fuel
- Oxidation factor of fuel / conversion factor of process material
- CO_2 emission factor of fuel or process material
- Share of non fossil CO_2 in case of "non-traded fuels"

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

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

Direct CO_2 measurements have not been submitted.

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

Methodology of ETS data consideration

ETS "bottom up" data 2005 are used for calculation of emission data in categories *1 A 1*, *1 A 2* and *1 A 4 a*. Total reported emissions 2005 are 33 373 Gg CO_2 of which 8 090 Gg are reported under category *2 Industrial Processes*. About 200 plants reported 800 fuel and material flows which have been considered in the inventory.

1. In accordance with STATISTIK AUSTRIA each plant is allocated to a NACE category of the energy balance.
2. In accordance with STATISTIK AUSTRIA each reported fuel is allocated to a fuel type according to the energy statistics system. For "non-traded fuels" systematic errors of allocation have to be avoided as far as possible.
3. ETS fuel masses/volumes and NCVs are used for activity data calculation. The remaining activity data is calculated by means of remaining fuel masses/volumes and averaged NCVs from the energy balance:

   $Activity_{category,\ fuel} = (Energy\_Balance\_Activity_{category,\ fuel} - \Sigma i(ETS\_Activity_{plant\ i,\ fuel})) \times Energy\_Balance\_NCV_{fuel} + \Sigma i(ETS\_Activity_{plant\ i,\ fuel} \times ETS\_NCV_{plant\ i,\ fuel})$

4. ETS CO_2 emissions are considered by fuel. The remaining CO_2 emissions are calculated by remaining activity data and "national default" emission factors:

   $CO2_{category,\ fuel} = (Energy\_Balance\_Activity_{category,\ fuel} - \Sigma i(ETS\_Activity_{plant\ i,\ fuel})) \times Energy\_Balance\_NCV_{fuel} \times Default\_EF_{fuel} + \Sigma i(ETS\_CO2_{plant\ i,\ fuel})$

Choice of emission factors for stationary sources

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

Emission factors may vary over time for the following reasons:

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

References for CO_2 and CH_4 emission factors are national studies (BMWA-EB 1990), (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.

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.

[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.

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 a net calorific value of 15.76 GJ/t (which is the value used by STATISTIK AUSTRIA for preparing the energy balance) this leads to an emission factor of 104.17 t CO_2/TJ Waste.

Sewage Sludge (non fossil)

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

Black Liquor (non fossil)

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

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

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

CO_2 emission factors reported within the ETS

Table 23 and Table 24 show the implied CO_2 emisson factors reported within the ETS by fuel and SNAP category. In some cases rather small fuel consumption was reported for specific categories. This may lead to significant errors in implied emission factor calculation (e.g. diesel, gasoil) because within the ETS CO_2 emissions are rounded to nearest ton wheras reported fuel consumption is not rounded.

Table 23: 2005 CO_2 implied emission factors reported by ETS. Coal, Petrol Coke, Waste and Natural Gas.

SNAP	102A Hard Coal	105A Brown Coal	107A Coke Oven Coke	110A Petrol Coke	115A Ind. Waste	301A Natural Gas
Weighted average	**93.21**	**101.63**	**104.00**	**94.02**	**60.80**	**55.03**
010101 Public Power plants >= 300 MW_{th}	93.26	102.63	-	-	-	55.00
010102 Public Power plants >= 50 MW_{th} < 300 MW_{th}	93.55	-	-	-	-	55.00
010103 Public Power plants <= 50 MW_{th}	-	-	-	-	-	-

SNAP	102A Hard Coal	105A Brown Coal	107A Coke Oven Coke	110A Petrol Coke	115A Ind. Waste	301A Natural Gas
010201 Public District Heating plants >= 300 MW_{th}	-	-	-	-	-	55.00
010202 Public District Heating plants >= 50 MW_{th} < 300 MW_{th}	-	-	-	-	-	55.00
010203 Public District Heating plants < 50 MW_{th}	-	-	-	-	-	55.00
010301 Refinery	-	-	-	-	-	55.27
010504 Other Energy Industries-Gas Turbines	-	-	-	-	-	55.00
020103 Commercial plants < 50 MW_{th}	-	-	-	-	-	55.00
0301 Industry-steel	-	-	104.00	-	-	55.00
0301 Industry-Non ferrous metals	-	-	-	-	-	-
0301 Industry-Chemicals	93.09	-	104.01	-	70.62	55.00
0301 Industry-Pulp and Paper	91.91	97.00	-	-	64.29	55.00
0301 Industry-Food and Beverages	98.29	-	104.01	-	-	55.00
03010 Industry-Other	-	-	-	-	28.56	55.00
030311 Cement kilns	93.91	96.88	-	93.93	68.92	55.00
030312 Lime kilns	-	-	-	-	-	55.00
030317 Glass	-	-	-	-	-	55.00
030319 Bricks and Tiles	-	113.51	104.01	100.68	7.30	55.00
030323 Dolomite Treatment	-	-	-	93.44	-	55.00
030326 Integrated Iron & Steel works	-	-	NA	-	-	55.05

Table 24: 2005 CO_2 implied emission factors reported by ETS. Oil products.

SNAP	203B light fel oil	203C Medium fuel oil	203D Heavy fuel oil	204A Gasoil	2050 Diesel	224A other liquid	303A LPG
Weighted average	**77.69**	**78.00**	**79.52**	**74.99**	**73.03**	**79.97**	**64.01**
010101 Public Power plants >= 300 MW_{th}	76.96	-	79.92	75.04	69.99	-	-
010102 Public Power plants >= 50 MW_{th} < 300 MW_{th}	76.99	-	-	75.15	-	75.00	-
010103 Public Power plants <= 50 MW_{th}	-	-	-	-	-	-	-
010201 Public District Heating plants >= 300 MW_{th}	77.10	-	80.00	74.97	54.76	-	-
010202 Public District Heating plants >= 50 MW_{th} < 300 MW_{th}	77.00	78.00	80.00	-	69.83	-	-
010203 Public District Heating plants < 50 MW_{th}	77.08	-	78.00	74.99	73.58	-	64.03
010301 Refinery	-	-	-	-	-	80.02	-

SNAP	203B light fel oil	203C Medi-um fuel oil	203D Heavy fuel oil	204A Gasoil	2050 Diesel	224A other liquid	303A LPG
010504 Other Energy Industries-Gas Turbines	-	-	-	-	-	-	-
020103 Commercial plants < 50 MW_{th}	-	-	-	75.80	61.81	-	-
0301 Industry-steel	-	-	-	-	-	-	-
0301 Industry-Non ferrous metals	-	-	-	-	-	-	-
0301 Industry-Chemicals	-	-	79.43	76.08	74.85	-	-
0301 Industry-Pulp and Paper	77.95	-	78.00	74.77	73.64	-	-
0301 Industry-Food and Bevera-ges	77.58	-	80.43	74.82	-	-	-
03010 Industry-Other	78.03	-	78.04	75.04	72.44	-	-
030311 Cement kilns	78.00	78.00	77.96	74.87	-	-	-
030312 Lime kilns	-	-	77.71	74.16	73.20	-	-
030317 Glass	78.00	-	-	71.27	76.04	-	-
030319 Bricks and Tiles	78.03	-	78.00	74.99	-	-	64.00
030323 Dolomite Treatment	77.88	-	-	-	71.67	-	64.75
030326 Integrated Iron & Steel works	-	-	79.69	-	-	-	-

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, 2006) and presented in Annex 4. The net calorific values (NCV) used for converting mass or volume units of the fuel quantities into energy units [TJ] are provided by STATISTIK AUSTRIA and presented in Annex 4.

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

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

3.2.2.1 1 A 1 a Public Electricity and Heat Production

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

Category *1 A 1 a Public Electricity and Heat Production* covers emissions from fuel combustion in public power and heat plants. The share in total GHG emissions from sector *1 A* is 19.8% for the year 1990 and 17.9% for the year 2005. 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

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

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

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 2005 are listed in the following table. The CO_2 emission factor for municipal solid waste is taken from (ABFALLWIRTSCHAFT, 2003). The following table shows the national default emission factors.

Table 25: Emission factors of Category 1 A 1 a for the year 2005.

Fuel	Default CO_2 [t / TJ]	CH_4 [kg / TJ]	N_2O [kg / TJ]
Light Fuel Oil in plants >= 50 MW_{th}	77.00	1.00	1.00
Light Fuel Oil in plants <= 50 MW_{th}	78.00	0.80	0.60
Medium Fuel Oil	78.00	1.00	1.00
Heavy Fuel Oil in plants >= 50 MW_{th}	80.00	0.60 - 1.00	1.80
Heavy Fuel Oil in plants <= 50 MW_{th}	78.00	2.00	1.00
Gasoil	75.00	1.20	1.00
Diesel oil	75.00	0.20	0.60
Liquified Petroleum Gas	64.00	1.50	1.00
Hard coal in power and CHP plants	95.00	0.10	0.50
Hard coal in district heating plants.	93.00	0.30	5.00
Lignite and brown coal in power and CHP plants >= 50 MW_{th}	110.00	0.10	0.50
Lignite and brown coal in district heating plants >= 50 MW_{th}	108.00	0.20	2.00
Lignite, brown coal and brown coal briquettes in plants < 50 MW_{th}	97.00	7.00	1.40
Natural Gas in power and CHP plants >= 50 MW_{th}	55.40	0.18	0.50
Natural Gas in district heating plants >= 50 MW_{th}	55.40	1.50	1.00
Natural Gas in plants <= 50 MW_{th}	55.40	1.50	0.10
Fuel Wood	(1)100.00	21.00	3.00
Wood Waste	(1)110.00	2.00	4.00

Fuel	Default CO_2 [t / TJ]	CH_4 [kg / TJ]	N_2O [kg / TJ]
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

1 A 1 a total fuel consumption is taken from (IEA JQ 2006) prepared by STATISTIK AUSTRIA (see Annex 4).

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

The following Table 26 shows the gross electricity and heat production of public power and district heating plants.

Table 26: Public gross electricity and heat production.

	Gross electricity production [GWh]						Heat Production [TJ] by Combustible Fuels
	Total	Hydro	Combustible Fuels	Geothermal	Solar	Wind	
1990	43 404	30 111	13 293	0	0	0	24 418
1991	43 497	30 268	13 229	0	0	0	29 032
1992	42 838	33 530	9 308	0	0	0	27 601
1993	45 063	35 334	9 728	0	1	0	30 389
1994	44 981	34 243	10 737	0	1	0	30 685
1995	47 944	35 794	12 148	0	1	1	34 351
1996	46 011	32 950	13 055	0	1	5	44 437
1997	47 695	34 701	12 972	0	2	20	40 531
1998	48 250	36 058	12 145	0	2	45	43 341
1999	51 609	39 593	11 963	0	2	51	44 711
2000	53 157	41 410	11 677	0	3	67	41 822
2001	53 655	39 681	13 798	0	4	172	47 627
2002	54 855	40 581	14 061	3	7	203	45 345
2003	52 483	34 230	17 873	3	11	366	46 294
2004	56 035	37 700	17 395	2	14	924	50 992
2005	57 468	37 379	18 745	2	14	1 328	52 372

Source: STATISTIK AUSTRIA.

Recalculations

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

Sector specific QA/QC procedures

Large point source data are used for validation of energy consumption. The *Umweltbundesamt* operates a database to store 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.

3.2.2.2 1 A 1 b Petroleum Refining

Key Sources: CO_2 from gaseous and liquid fuels

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

The share in total GHG emissions from sector *1 A* is 4.5% for the year 1990 and 4% for the year 2005. Crude oil input which was 8 Mio t in 1990 and 8.8 Mio t in 2005.

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 27: Carbon content per fuel group for petroleum refining

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

1990 to 2001 CO_2 emissions are calculated by multiplying activity data from the energy balance by the emission factors in Table 27. CO_2 emissions 2002 to 2005 are reported by the Austrian Association of Mineral Oil Industries and consistent with ETS 2005 data.

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 29, 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 28.

Table 28: Implied emission factors for refinery gas.

	t CO_2/ TJ
1990	51.5
1991	50.7
1992	50.8
1993	48.9
1994	50.2
1995	52.1
1996	51.6
1997	50.8
1998	51.0
1999	55.2
2000	50.7
2001	50.6
2002	50.7
2003	61.0
2004	66.1
2005	65.0

N_2O emissions are calculated by multiplying fuel consumption by the emission factors presented in Table 29 (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 29: Emission factors of Category 1 A 1 b.

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

Activity data

Fuel consumption is taken from (IEA JQ 2006) as presented in Annex 4 except for the years 1999 to 2005, where *petrol coke* is additionally counted in *other oil products* (1999: + 63 kt, 2004: + 59 kt) to reach consistency with plant specific activity data reported in (DKDB 2005).

Recalculations

Since 2002 CO_2 emissions reported by plant operators are used instead of the Tier 2 approach.

Sector specific QA/QC procedures

A simple mass balanced input/output validation of energy balance data has been performed which shows a plausible and time series consistent correlation of the input and output material flows.

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

Key Source: CO_2 from gaseous fuels

Category *1 A 1 c Manufacture of Solid Fuels and Other Energy Industries* enfolds emissions from fuel combustion in the oil and gas extraction sector and compressors used for natural gas storage tanks. For 1990 to 1995 transformation losses/own use in gas works are included too. The share in sector *1 A* overall GHG emissions is 0.6% for the year 1990 and 0.4% for the year 2005.

Methodology

The CORINAIR simple methodology is applied.

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

Emission factors

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

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

The emission factors are presented in Table 30.

Table 30: 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 2006) 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 2006) 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 2006).

Recalculations

Revision of natural gas consumption for single years from 2003 onwards according to the revised energy balance as described in Annex 2.

3.2.2.4 1 A 2 a Iron and Steel

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

Category *1 A 2 a Iron and Steel* enfolds emissions from fuel combustion in iron and steel industry. CO_2 emissions from ore reduction in blast furnaces are included in category *2 C 1*. The share in total GHG emissions from sector 1 A is 9% for the year 1990 and 9% for the year 2005.

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 2006). The complex carbon fluxes in iron and steel plants can not be well modelled within the energy balance which leads to a fluctuation of implied CO_2 emission factors for *1 A 2 a* solid fuels over time. CO_2 emissions 2005 are reported from plant operators. The emissions declaration includes emissions from natural gas consumption not inluded in the ETS.

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

CH_4 emissions are calculated under the assumption that the ratio of CH_4 emissions to the reported NMVOC emissions is equal to the ratio of CH_4 and NMVOC emissions if calculated with the CORINAIR simple method. For the year 2005 this ratio is 245/350; the plant reported 245 t NMVOC and by applying the ratio obtained from the CORINAIR simple methodology, total CH_4 emissions were estimated to be 74 t. In a last step CH_4 emissions were allocated to the different fuel types.

Point source CO_2 emissions 2003 and 2004

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

Emissions

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

Table 31: 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	189	0.005	0.001	4 753	0.020	0.042
1991	248	0.007	0.001	4 366	0.016	0.042
1992	200	0.005	0.001	3 732	0.014	0.036
1993	220	0.006	0.002	3 969	0.016	0.037
1994	232	0.006	0.002	4 207	0.020	0.040
1995	289	0.007	0.002	4 483	0.019	0.045
1996	445	0.012	0.003	4 221	0.019	0.041
1997	465	0.012	0.002	4 822	0.022	0.046
1998	424	0.011	0.002	4 481	0.022	0.047
1999	330	0.009	0.001	4 521	0.022	0.048
2000	409	0.011	0.002	4 897	0.027	0.054
2001	279	0.007	0.001	4 889	0.028	0.052
2002	380	0.010	0.001	5 118	0.027	0.052
2003	365	0.010	0.001	5 316	0.068	0.053
2004	266	0.007	0.001	5 589	0.072	0.054
2005	360	0.009	0.002	6 034	0.074	0.058

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 2005 are presented in Table 32 and Table 33.

Table 32: Emission factors of Category 1 A 2 a for 2005, 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 33: Emission factors of Category 1 A 2 a for 2005, 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 2006) as presented in Annex 4.

Point source activity data are reported by plant operators which are widely consistent with (IEA JQ 2006).

Recalculations

Update of activity data according to the revised energy balance as described in Annex 2 implies updated GHG emissions for the years 2003 and 2004.

3.2.2.5 1 A 2 b Non-Ferrous Metals

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

Category *1 A 2 b Non-Ferrous Metals* enfolds emissions from fuel combustion in non ferrous metal industry. The share in total GHG emissions from sector *1 A* is 0.2% for the year 1990 and 0.6% for the year 2005.

Methodology

CORINAIR simple methodology is applied. Fuel consumption is taken from (IEA JQ 2006) 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 2005 are presented in Table 34.

Table 34: Emission factors of Category 1 A 2 b for 2005.

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 2006] 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: CO_2 from 1 A 2 gaseous, solid and liquid-stationary fuels

Category *1 A 2 c Chemicals* enfolds emissions from fuel combustion in chemical industry. The share in total GHG emissions from sector *1 A* is 1.8% for the year 1990 and 1.9% for the year 2005. Larger fluctuations in emission trends occur because economic main activity of combined pulp and viscose manufacturing plants is changing over time and therefore allocated either to sector *1 A 2 c* or *1 A 2 d* by energy statistics.

Methodology

CORINAIR simple methodology is applied. For the year 2005 CO_2 ETS data are considered.

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 2005 are presented in Table 35.

Table 35: Emission factors of Category 1 A 2 c for 2005.

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 2006) 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: CO_2 from 1 A 2 gaseous, solid and liquid-stationary fuels

Category *1 A 2 d Pulp, Paper and Print* enfolds emissions from fuel combustion in pulp, paper and print industry. The share in total GHG emissions from sector *1 A* is 4.1% for the year 1990 and 3.2% for the year 2005.

Methodology

The CORINAIR simple methodology is applied. For the year 2005 CO_2 ETS data are considered.

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 2005 are presented in Table 36.

Table 36: Emission factors of Category 1 A 2 d for 2005

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 2006) 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: CO_2 from 1 A 2 gaseous, solid and liquid-stationary fuels

Category *1 A 2 e Food Processing, Beverages and Tobacco* enfolds emissions from fuel combustion in food processing, beverages and tobacco industry. The share in total GHG emissions from sector *1 A* is 1.6% for the year 1990 and 1.1% for the year 2005.

Methodology

CORINAIR simple methodology is applied. For the year 2005 CO_2 ETS data are considered.

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 2005 are presented in Table 37.

Table 37: Emission factors of Category 1 A 2 e for 2005.

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 2006) 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: CO_2 from 1 A 2 gaseous , solid and liquid-stationary fuels

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

The share in total GHG emissions from sector *1 A* is 8.2% for the year 1990 and 6.2% for the year 2005. 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 6.2% for the year 1990 and 4.5% for the year 2005.

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

This category enfolds emissions from fuel combustion in cement clinker kilns. The yearly production capacity of the 10 Austrian plants is about 4 mio t cement clinker. Yearly clinker production is about 80% of total capacity. Further information about yearly clinker production is provided in the methodology chapter of category *2 A 1 cement production*.

Methodology

Information about CO_2 emissions due to fuel combustion for cement production is taken from four studies of the Austrian cement industry (HACKL & MAUSCHITZ, 1995, 1997, 2001, 2003) 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 to 2005 are taken from the ETS allocation plan survey and ETS data.

CH_4 and N_2O emissions

Are calculated with the simple CORINAIR methodology.

Activity data

Hard Coal, Brown Coal, Petrol Coke and Industrial Waste

In (IEA JQ 2006) 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 2006) 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 *other fuels*-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 2006).

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 2006).

Activity data 2004

Activity data 2004 is mainly taken from (IEA JQ 2006) according to the historical share of cement industry on total *Non-metallic Mineral Products* final energy consumption of (IEA JQ 2006): 100% of coal, petrol coke and industrial waste. Fuel oil and natural gas consumption are taken from the ETS allocation plan survey.

Activity data 2005

For the year 2005 ETS data are taken.

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 2004 are now taken from the ETS allocation plan survey. Activity data 2004 is accordingly updated.

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

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

Methodology

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

Activity data

Fuel consumption is taken from (IEA JQ 2006) as presented in Annex 4. Fuel consumption of cement industry is subtracted as it is considered separately (see above).

Since the energy balance (IEA JQ 2006) 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 2006).

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 2005 are presented in Table 38.

Table 38: Emission factors of Category 1 A 2 f stationary sources for 2005.

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

Fuel	CO_2 [t / TJ]	CH_4 [kg / TJ]	N_2O [kg / TJ]
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 96

Recalculations

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

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

In the following the methodology of estimating emissions from mobile sources of category *1 A 2 f Other* is described. The share in total GHG emissions from sector *1 A* is 2.0% for the year 1990 and 1.7% for the year 2005. All GHGs emissions originate from liquid fossil fuel combustion.

Table 39: 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
2005	1 161.44	0.05	0.28	1 247.99
Trend 1990 - 2005	14%	-33%	-22%	10%

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 40 to Table 43. 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 40: Emission Factors for diesel engines > 80 kW

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

Table 41: Emission Factors for diesel engines < 80 kW

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

Table 42: Emission Factors for 4-stroke-petrol engines

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

Table 43: Emission Factors for 2-stroke-petrol engines

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

Activity data

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

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

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

Table 44: Implied emission factors and activities for industrial off-road traffic 1990–2005

	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	15 522	73.73	3.23	18.55
2005	16 009	72.55	3.14	17.23

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 2005. However, the trend for the different GHGs varies due to different methodologies of emission estimation.

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

Table 45: CO_2 and N_2O emissions from 1 A 3 a Civil Aviation by subcategories 1990-2005

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

Methodological Issues

IFR

A country-specific methodology was applied.

The calculations are based on a study commissioned by the *Umweltbundesamt* finished in 2002 (KALIVODA ET. AL 2002).

For the air transport class IFR (Instrument Flight Rules) the very detailed methodology from the CORINAIR guidebook in an advanced version (based on the (MEET 1999) model) has been used. It is based on air traffic movement data[20] (flight distance and destination per aircraft type), aircraft/ engine performance data and emission factors.

VFR

CORINAIR, simple methodology was applied

Activity Data

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

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

ence was observed (lower fuel consumption in the energy balance).

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

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

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

The study only delivers values until 2000. The splitting of the energy data of 2001 to 2005 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 2005 was done according to the shares for 2000 of the study.

Table Table 46 shows the remarkable increase by up to 100% of national jet kerosene between 2002 and 2003. This increase is due to reported fuel sold data from the Austrian statistics.

Table 46: Number of national LTO cycles and fuel consumptions as obtained from the MEET model 1990-2005

		Activity		national
	nat. LTO	VFR	nat. cruise	
	Kerosene	Gasoline	Kerosene	LTO
	[Mg]	[Mg]	[Mg]	[no.]
1990	3 164	2 487	4 508	6 220
1991	3 417	2 563	5 929	6 644
1992	3 670	2 641	7 351	7 450
1993	3 924	2 722	8 773	7 947
1994	4 177	2 805	10 195	8 219
1995	4 430	2 241	11 616	8 923
1996	5 128	2 153	12 877	10 233
1997	5 827	2 417	14 137	11 013
1998	6 525	2 602	15 398	12 025
1999	6 697	2 771	16 279	12 210
2000	6 868	2 039	17 161	13 551
2001	6 568	1 868	16 412	12 853
2002	6 386	2 389	15 956	13 325
2003	13 982	2 596	34 936	30 786
2004	16 753	2 405	41 861	34 712
2005	18 929	2 787	47 297	35 619
Trend 1990 - 2005	*498%*	*12%*	*949%*	*473%*

CO_2

IFR/VFR:

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

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

N_2O

CORINAIR simple methodology was used.

IFR:

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

VFR:

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

CH_4

National/international cruise:

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

National/international LTO:

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

Recalculations

The splitting of the energy data into national and international aviation for the years 2001 – 2005 has been updated according to the energy balance

Planned improvements

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

3.2.2.11 1 A 3 b Road Transport

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

Emissions from road transportation are covered in this category.

Table 47: 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	2.89	0.81	12 237
1991	13 509	2.85	1.04	13 889
1992	13 454	2.59	1.08	13 844
1993	13 636	2.37	1.13	14 037
1994	13 588	2.16	1.13	13 984
1995	13 965	1.97	1.09	14 345
1996	15 544	1.78	1.04	15 903
1997	14 466	1.59	0.96	14 796
1998	16 537	1.52	1.03	16 887
1999	15 843	1.36	0.93	16 158
2000	16 877	1.24	0.90	17 183
2001	18 112	1.15	0.90	18 415
2002	20 148	1.10	0.95	20 466
2003	21 881	1.04	0.96	22 199
2004	22 390	0.95	0.90	22 689
2005	23 037	0.87	0.84	23 316
Trend 1990 - 2005	93%	-70%	3%	91%

Table 48: GHG emissions from Road Transport, differentiated by means of transportation

	Passenger cars		light duty vehicles	heavy duty vehicles	moped	motorcycle
	petrol	diesel				
	[Gg CO_2e]	[Gg CO_2e]	[Gg CO_2e]	[Gg CO_2e]	[Gg CO_2e]	[Gg CO_2e]
1990	7 560.1	1 464.88	1 304.93	1 852.42	30.76	23.97
1991	8 421.0	1 682.76	1 347.91	2 383.30	28.72	25.57
1992	8 079.2	1 796.44	1 389.66	2 523.44	27.23	28.46
1993	7 780.5	1 939.76	1 411.65	2 847.96	25.81	31.44
1994	7 509.8	2 192.56	1 466.67	2 754.69	24.68	35.14
1995	7 258.9	2 417.55	1 487.88	3 116.81	23.74	39.87
1996	6 696.6	2 663.86	1 505.78	4 970.12	22.92	44.23
1997	6 339.6	2 925.75	1 541.42	3 918.79	22.21	48.60
1998	6 671.1	3 381.83	1 585.72	5 172.70	21.68	54.30
1999	6 176.4	3 588.27	1 637.11	4 675.23	21.03	60.15
2000	5 968.7	3 939.53	1 685.62	5 504.67	20.30	63.90
2001	6 028.5	4 430.24	1 697.98	6 171.47	19.62	67.39
2002	6 528.6	5 252.00	1 694.40	6 900.93	18.98	71.09
2003	6 690.2	5 938.19	1 713.00	7 764.51	18.49	74.29
2004	6 501.4	6 416.32	1 738.41	7 937.96	17.93	76.81
2005	6 285.9	6 721.12	1 805.82	8 405.78	17.80	79.41
Trend 1990 - 2005	-16%	360%	38%	354%	-42%	231%

In 2005 even more than a third of the greenhouse gas emissions of the road sector are caused by heavy duty vehicles. In comparison with the emissions of 1990 the emissions of diesel cars and heavy duty vehicles nearly quadrupled.

Methodology

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

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

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

Model input is:

1. the vehicle stock of each category split into layers according to the propulsion system (SI,CI,..), cylinder capacity classes or vehicle mass,
2. the emission factors of the vehicles according to the year of first registration and the layers from 1)
3. The passengers per vehicle and tons payload per vehicle
4. Optional either

   a) the total gasoline and diesel consumption of the area under consideration

   b) the average km per vehicle and year

Following data is calculated:

a) km driven per vehicle and year or total fuel consumption

b) total vehicle mileages

c) total passenger-km and ton-km

d) specific emission values for the vehicle fleets [g/km], [g/t-km], [g/pass-km]

e) total emissions and energy consumption of the traffic (fc, CO, HC, NOx, particulate matter, CO2, SO2 and several unregulated pollutants among them CH_4 and N_2O)

Figure 13 shows a schematic picture of GLOBEMI.

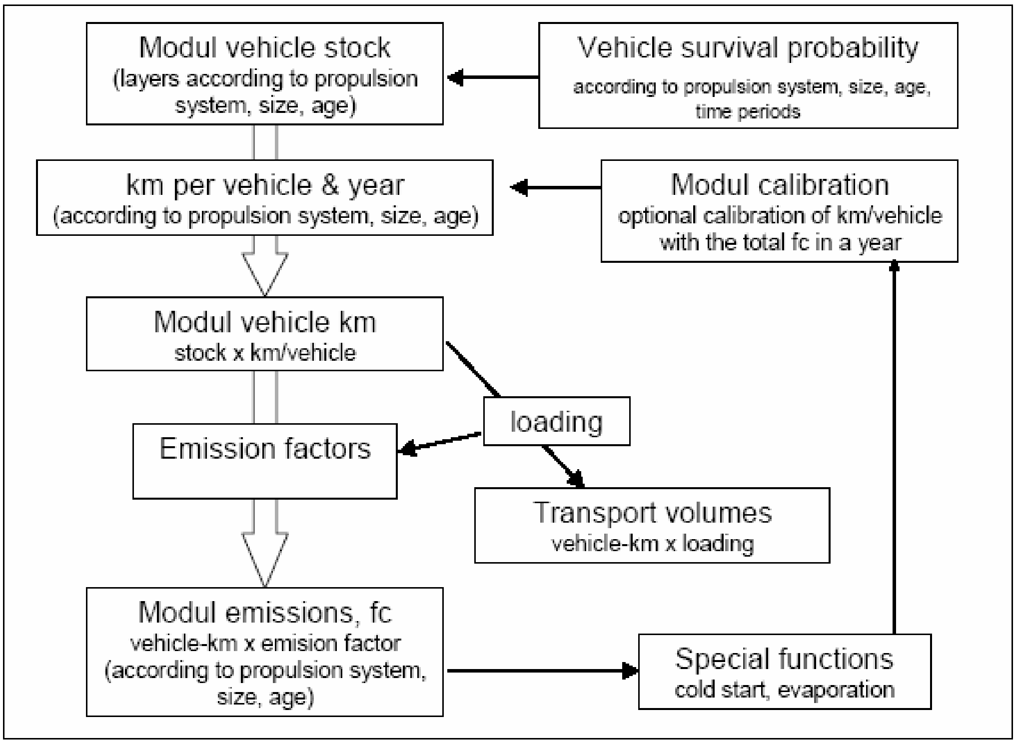

Figure 13: Schematic picture of the model GLOBEMI

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

(1) Assessment of the vehicle stock split into layers according to the propulsion system (SI, CI,..), cylinder capacity classes (or vehicle mass for HDV) and year of first registration using the vehicle survival probabilities and the vehicle stock of the year before.

(2) Assessment of the km per vehicle for each vehicle layer using age and size dependent functions of the average mileage driven. If option switched on, iterative adaptation of the km per vehicle to meet the total fuel consumption targets.

(3) Calculation of the total mileage of each emission category (e.g. passenger car diesel, <1500ccm, EURO 3)

(4) Calculation of the total fuel consumption and emissions of each emission category

(5) Calculation of the total fuel consumption and emissions of each vehicle category

(6) Calculation of the total passenger-km and ton-km

(7) Summation over all vehicle categories

(8) Calibration with total amount of fuel sold (Austrian Statistics)

(9) Adaption of vehicle km/year

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

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

Emission factors

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

Table 49: Implied emission factors of passenger cars 1990 - 2005

		Implied Emission Factors		
	Activity	CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	115 873	75.49	18.84	6.45
1991	129 317	75.48	16.86	7.40
1992	126 214	75.45	15.54	7.95
1993	126 210	74.15	14.14	8.28
1994	126 023	74.15	12.80	8.30
1995	125 985	74.10	11.47	7.96
1996	122 163	74.09	10.33	7.48
1997	121 184	74.08	9.27	7.05
1998	131 654	74.07	8.07	6.84
1999	128 327	73.99	7.25	6.28
2000	130 479	73.98	6.32	5.89
2001	138 034	73.95	5.45	5.50
2002	155 704	73.96	4.59	5.16
2003	167 233	73.95	3.95	4.77
2004	171 555	73.88	3.45	4.33
2005	174 354	73.33	3.01	3.89

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 50: Implied emission factors of light duty vehicles 1990 – 2005

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	17 306	74.73	7.86	1.64
1991	17 897	74.67	6.98	1.61
1992	18 473	74.61	6.12	1.58
1993	18 908	74.07	5.35	1.54
1994	19 651	74.06	4.70	1.54
1995	19 975	73.93	4.11	1.52

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
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	1.50
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
2003	23 093	73.73	1.30	1.36
2004	23 473	73.63	1.12	1.32
2005	24 703	72.69	0.98	1.26

Table 51: Implied emission factors of heavy duty vehicles 1990 – 2005

		Implied Emission Factors		
	Activity	CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	24 838	74.05	2.49	1.55
1991	31 963	74.04	2.21	1.54
1992	33 847	74.04	2.09	1.52
1993	38 214	74.02	1.95	1.51
1994	36 971	74.02	1.92	1.46
1995	41 937	73.84	1.81	1.42
1996	66 882	73.84	1.56	1.41
1997	52 741	73.84	1.51	1.38
1998	69 624	73.84	1.35	1.37
1999	63 081	73.67	1.28	1.35
2000	74 277	73.67	1.18	1.34
2001	83 292	73.67	1.12	1.30
2002	93 158	73.67	1.06	1.25
2003	104 838	73.67	1.02	1.20
2004	107 250	73.63	1.00	1.17
2005	115 294	72.54	0.96	1.12

Table 52: Implied emission factors of Mopeds 1990 – 2005

	Activity	Implied Emission Factors CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	271	75.75	1 791	0.75
1991	253	75.87	1 774	0.74
1992	243	75.78	1 717	0.72
1993	237	74.29	1 635	0.68
1994	230	74.14	1 571	0.65
1995	224	74.29	1 510	0.63
1996	219	74.21	1 444	0.60
1997	215	74.29	1 381	0.57
1998	213	74.18	1 308	0.54
1999	210	74.12	1 249	-
2000	204	74.23	1 204	-
2001	199	74.09	1 157	-
2002	194	74.34	1 115	-
2003	192	74.21	1 062	-
2004	188	74.13	1 015	-
2005	189	74.21	949	-

Table 53: Implied emission factors of Motorcycles 1990 – 2005

	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
2005	1 057	74.23	33.1	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.

For the year 2005 biodiesel was considered for the first time. Based on the results of investigations on biodiesel in the transport sector in Austria (UMWELTBUNDESAMT 2006), for the year 2005 a consumption of 96 000 t biodiesel is used as input data for the calculation model.

Uncertainties

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

- the uncertainty of activity data (total fuel sold) for road transport is considered to be low (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

- Update of statistical energy data, particularly the biodiesel consumption
- Update of EURO 4 Diesel PC EF for 2005 (new CADC measurements). Minor influence on the 2005 inventory

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 54: 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
2000	177	0.01	0.02
2001	177	0.01	0.02
2002	174	0.01	0.02
2003	179	0.01	0.02
2004	182	0.01	0.02
2005	148	0.00	0.02
Trend 1990 - 2005	-11.5%	-41.4%	-29.6%

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 55: Emission factors and activity data for railway 1990–2005

		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	72.1	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

		Implied Emission Factors		
	Activity	CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
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	2 450	73.0	2.3	7.8
2004	2 497	73.0	2.2	7.7
2005	2 069	71.7	2.1	7.4

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

	CO_2	CH_4	N_2O
	Gg	Gg	Gg
1990	52	0.01	0.01
1991	47	0.01	0.01
1992	46	0.01	0.01
1993	47	0.01	0.01
1994	56	0.01	0.01
1995	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	87	0.01	0.02
2004	77	0.01	0.02
2005	81	0.01	0.02
Trend 1990 - 2005	56%	-7%	35%

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 57: Emission factors and activity data for the sector Navigation 1990–2005

	Activity	Implied Emission Factors		
		CO_2	CH_4	N_2O
	TJ	T/TJ	kg/TJ	kg/TJ
1990	701	74.51	18.44	17.76
1991	636	74.53	20.10	17.52
1992	622	74.54	20.45	17.19
1993	630	74.21	20.18	16.89
1994	750	74.19	17.17	17.19
1995	730	74.06	17.46	16.84
1996	730	74.06	17.31	16.60
1997	836	73.98	15.21	16.71
1998	845	73.97	14.91	16.49
1999	855	73.82	14.57	16.22
2000	863	73.81	14.25	16.00
2001	986	73.79	12.50	16.02
2002	1 079	73.79	11.42	15.93
2003	1 181	73.78	10.45	15.82
2004	1 040	73.78	11.55	15.38
2005	1 117	72.72	10.72	15.03

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 0.8% for the year 2005. 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 are presented in Table 58.

Table 58: Emission factors of Category 1 A 2 e for all years.

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

Recalculations

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

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 27.1% for the year 1990 and 21.8% for the year 2005.

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

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

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

The share in total GHG emissions from sector *1 A* is 24.1% for the year 1990 and 19.4% for the year 2005.

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)

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

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 2006) is combusted in devices similar to central heatings.

<u>1 A 4 b Residential</u>

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 59. 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 59: 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 2005 are presented in Table 60.

Table 60: Emission factors of Category 1 A 4 conventional boilers for the year 2005.

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 61: Emission factors of Category 1 A 4 new biomass boilers for the year 2005.

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 2006) as presented in Annex 4.

Since (IEA JQ 2006) 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 2006).

Table 62 shows the selected share of each heating type for category *1 A 4 b.*

Table 62: Share of 1 A 4 b heating type on fuel category for the year 2005.

	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.

<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 Table 64.

Table 63: Greenhouse gas emissions from mobile sources of household and gardening 1990–2005

	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
2001	140.54	0.08	0.02
2002	140.60	0.07	0.02
2003	140.33	0.06	0.02

	CO_2 Gg	CH_4 Gg	N_2O Gg
2004	140.16	0.05	0.02
2005	139.96	0.05	0.02
Trend 1990 - 2005	-2%	-57%	-27%

Table 64: Emission factors and activity data for mobile sources of household and gardening 1990–2005

	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	74.03	0.037	0.011
2003	1 895.6	74.03	0.033	0.010
2004	1 893.8	74.01	0.028	0.010
2005	1 905.2	73.46	0.024	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 65: 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
1992	835	0.12	0.27	427	0.06	0.14

	Agriculture			Forestry		
	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
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
2005	870	0.08	0.24	583	0.05	0.17
Trend 1990 - 2005	6%	-28%	-12%	9%	-35%	-2%

Table 66: Emission factors and activity data for mobile sources of Agriculture and Forestry 1990–2005

	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	11 779	73.7	7.4	20.8	8 651	73.7	6.7	22.5
2005	11 991	72.6	7.0	19.8	8 037	72.6	6.1	21.4

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 67: Greenhouse gas emissions from military aviation

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

Methodological Issues

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

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

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

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

Military Off-Road (without aviation)

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

Emission estimates for military activities were taken from (PISCHINGER 2000). Information on the fleet composition was taken from official data presented in the internet as no other data were available. Also no information on the road performance of military vehicles was available, that's why emission estimates only present rough estimations, which were obtained making the following assumptions: for passenger cars and motorcycles the yearly road performance as calculated for civil cars was used. For tanks and other special military vehicles the emission factors for diesel engines > 80kW was used (see Table 40; for these vehicles a 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 68: 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	27.0
2005	1.97	0.0001	0.0005	27.2
Trend 1990-2005	-8%	-42%	-37%	-6%

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 69: Emissions and Activity from International Aviation 1990-2005

	CO_2 [Gg]		N_2O [Gg]		CH_4 [Gg]	Activity [TJ]
	int. LTO	int. cruise	int. LTO	int. cruise	int. LTO	int. cruise
	Kerosene	Kerosene	Kerosene	Kerosene	Kerosene	Kerosene
1990	90.3	795.7	0.006	0.025	0.015	11 014
1991	103.0	890.8	0.006	0.028	0.016	12 330
1992	115.8	961.6	0.007	0.031	0.017	13 310
1993	128.6	1 011.4	0.008	0.032	0.018	13 998

	CO_2 [Gg]		N_2O [Gg]		CH_4 [Gg]	Activity [TJ]
	int. LTO	int. cruise	int. LTO	int. cruise	int. LTO	int. cruise
	Kerosene	Kerosene	Kerosene	Kerosene	Kerosene	Kerosene
1994	141.4	1 044.2	0.009	0.033	0.019	14 453
1995	154.2	1 173.2	0.010	0.037	0.020	16 127
1996	164.8	1 301.6	0.010	0.041	0.023	17 927
1997	175.4	1 350.2	0.011	0.043	0.027	18 605
1998	186.0	1 392.3	0.011	0.044	0.030	19 187
1999	190.1	1 351.6	0.011	0.043	0.029	18 583
2000	194.2	1 480.8	0.012	0.047	0.029	20 356
2001	188.8	1 439.8	0.012	0.046	0.028	19 791
2002	176.9	1 349.2	0.012	0.043	0.026	18 547
2003	151.3	1 153.7	0.011	0.037	0.022	15 858
2004	177.6	1 354.2	0.012	0.043	0.026	18 614
2005	200.6	1 530.1	0.012	0.049	0.030	21 031

Methodological Issues

Emissions have been calculated using the methodology and emission factors as described in Chapter *1 A 3 a Civil Aviation*.

3.2.3 Quality Assurance / Quality Control and Verification

For general QA/QC see Chapter 1.6.

At present STATISTIK AUSTRIA works on a written documentation for the national energy balance. Additionally a document which covers a more actual quantification of uncertainty is expected. Both documents will be presented to the *Umweltbundesamt* in 2007.

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 8.

3.2.4 Recalculations of Category 1 A

The revision of the national energy statistics for the time series 1990-2004 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 70 shows the recalculations of CO_2 emissions for the subcategories of sector *1 A Fuel Combustion.*

Table 70: 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	-2.32	-3.71	126.36	0.02	-124.99	0.00
1991	-2.84	-4.24	124.99	-0.02	-123.56	0.00
1992	-2.62	-3.85	111.28	0.00	-110.05	0.00
1993	-3.19	-4.02	83.02	-0.01	-82.17	0.00
1994	-2.19	-2.77	58.63	0.02	-58.07	0.00
1995	-2.43	-2.96	57.56	0.02	-57.05	0.00
1996	-2.54	-3.36	61.37	0.04	-60.59	0.00
1997	-6.44	-3.62	-164.05	-0.02	161.25	0.00
1998	-24.41	-3.21	-210.22	0.03	189.00	0.00
1999	-106.67	-29.54	-287.31	-0.62	210.80	0.00
2000	-225.03	-111.39	-213.96	-0.06	100.39	0.00
2001	-133.67	-11.41	252.74	-140.89	-154.30	-79.81
2002	-230.12	-10.37	-252.90	-231.59	263.86	0.89
2003	414.62	-186.45	308.53	-173.16	465.70	0.00
2004	-23.28	505.11	-211.54	-172.05	-144.81	0.00

CH_4 emissions

Table 71 shows the recalculations of CH_4 emissions for the subcategories of sector *1 A Fuel Combustion.*

Table 71: 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	0.01	0.00	0.00	0.00	0.00	0.00
1991	0.01	0.00	0.00	0.00	0.00	0.00
1992	0.01	0.00	0.00	0.00	0.00	0.00
1993	0.01	0.00	0.00	0.00	0.00	0.00
1994	0.00	0.00	0.00	0.00	0.00	0.00
1995	0.01	0.00	0.00	0.00	0.00	0.00
1996	0.01	0.00	0.00	0.00	0.01	0.00
1997	0.04	0.00	0.00	0.00	0.04	0.00
1998	0.00	0.00	0.00	0.00	0.00	0.00
1999	0.15	0.00	0.00	0.00	0.15	0.00
2000	0.18	0.00	-0.01	0.00	0.19	0.00
2001	0.33	0.00	0.03	-0.01	0.33	0.00

	1 A	1 A 1	1 A 2	1 A 3	1 A 4	1 A 5
2002	0.84	0.00	0.02	-0.01	0.83	0.00
2003	0.19	-0.02	0.05	-0.01	0.17	0.00
2004	-0.25	-0.01	0.07	-0.01	-0.30	0.00

N_2O emissions

Table 72 shows the recalculations of N_2O emissions for the subcategories of sector *1 A Fuel Combustion.*

Table 72: 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	0.01	0.01	0.00	0.00	0.00	0.00
1991	0.04	0.01	0.00	0.03	0.00	0.00
1992	0.02	0.01	0.00	0.01	0.00	0.00
1993	0.00	0.01	0.00	-0.01	0.00	0.00
1994	-0.01	0.01	0.00	-0.01	0.00	0.00
1995	-0.01	0.01	0.00	-0.02	0.00	0.00
1996	-0.01	0.01	0.00	-0.01	0.00	0.00
1997	0.00	0.01	0.00	-0.01	0.00	0.00
1998	0.01	0.01	0.00	0.00	0.00	0.00
1999	0.03	0.01	0.01	0.00	0.00	0.00
2000	0.03	0.01	0.01	0.01	0.01	0.00
2001	0.03	0.01	0.02	0.00	0.01	0.00
2002	0.06	0.01	0.02	0.01	0.02	0.00
2003	0.02	0.00	-0.01	0.01	0.01	0.00
2004	0.03	0.01	0.02	0.01	-0.01	0.00

Emissions in Gg CO_2 equivalent

Table 73 shows the recalculations in [Gg CO_2 equivalent] for the subcategories of sector *1 A Fuel Combustion.*

Table 73: 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	-0.09	-1.90	126.81	-0.19	-124.82	0.00
1991	9.81	-2.19	125.77	9.56	-123.34	0.00
1992	2.40	-1.71	111.89	2.00	-109.78	0.00
1993	-1.92	-1.96	83.80	-1.92	-81.85	0.00
1994	-4.42	-1.10	59.04	-4.34	-58.02	0.00
1995	-4.65	-1.22	57.75	-4.61	-56.57	0.00
1996	-4.52	-1.44	61.46	-4.49	-60.06	0.00
1997	-6.23	-1.72	-164.24	-3.32	163.05	0.00

	1 A	1 A 1	1 A 2	1 A 3	1 A 4	1 A 5
1998	-22.06	-1.16	-211.19	0.90	189.39	0.00
1999	-94.04	-25.83	-284.00	0.26	215.53	0.00
2000	-211.16	-109.66	-210.25	2.31	106.43	0.00
2001	-116.45	-9.12	259.49	-139.73	-145.84	-81.25
2002	-194.43	-8.44	-247.85	-227.62	288.58	0.91
2003	426.30	-186.74	308.00	-168.75	473.78	0.00
2004	-19.81	508.80	-204.89	-170.21	-153.50	0.00

3.2.5 Planned Improvements

At current no relevant improvements are planned.

3.3 Comparison of the Sectoral Approach with the Reference Approach

3.3.1 Comparison of CO_2 emissions

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

Table 74 compares the results of the two approaches.

Table 74: 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	28 416	15 914	12 238	**56 568**	28 117	13 922	11 169	732	**53 940**
1991	30 956	16 773	12 939	**60 667**	30 593	14 517	11 771	805	**57 687**
1992	30 038	12 954	12 705	**55 698**	29 328	10 665	11 834	956	**52 784**
1993	31 077	11 649	13 399	**56 126**	30 741	9 493	12 340	675	**53 248**
1994	30 293	11 808	13 782	**55 883**	30 111	9 377	12 962	820	**53 270**
1995	30 903	13 496	15 048	**59 447**	30 313	10 740	14 059	839	**55 951**
1996	33 365	13 504	16 017	**62 886**	32 939	10 759	15 219	1 073	**59 991**
1997	32 845	14 316	15 437	**62 597**	32 141	11 319	14 679	1 017	**59 155**
1998	35 097	12 548	15 848	**63 493**	34 263	9 095	14 995	818	**59 171**
1999	33 136	12 503	16 125	**61 764**	32 518	9 174	15 147	994	**57 833**
2000	32 268	14 094	15 388	**61 751**	31 825	10 682	14 566	763	**57 836**
2001	34 683	14 584	16 309	**65 575**	34 202	11 262	15 483	1 016	**61 962**
2002	35 803	14 835	16 494	**67 132**	35 314	11 134	15 451	1 181	**63 080**
2003	38 735	15 962	17 833	**72 530**	38 458	12 660	16 899	1 319	**69 336**
2004	38 276	15 523	17 492	**71 290**	38 213	12 359	16 473	1 537	**68 582**
2005	38 899	15 643	19 507	**74 049**	38 637	12 010	18 510	1 410	**70 567**

Table 75 presents the difference of the two approaches in percent.

Table 75: Deviation between CO_2 emissions from the two approaches.

Year	Liquid	Solid	Gaseous	Total
1990	1.06%	14.31%	9.57%	**4.87%**
1991	1.18%	15.54%	9.92%	**5.17%**
1992	2.42%	21.46%	7.36%	**5.52%**
1993	1.09%	22.72%	8.59%	**5.40%**
1994	0.60%	25.93%	6.33%	**4.91%**
1995	1.95%	25.67%	7.04%	**6.25%**
1996	1.29%	25.51%	5.24%	**4.83%**
1997	2.19%	26.48%	5.16%	**5.82%**
1998	2.44%	37.96%	5.69%	**7.30%**
1999	1.90%	36.28%	6.45%	**6.80%**
2000	1.39%	31.94%	5.65%	**6.77%**

Year	Liquid	Solid	Gaseous	Total
2001	1.41%	29.50%	5.33%	**5.83%**
2002	1.39%	33.25%	6.75%	**6.42%**
2003	0.72%	26.08%	5.53%	**4.61%**
2004	0.16%	25.60%	6.18%	**3.95%**
2005	0.68%	30.25%	5.39%	**4.93%**

Positive numbers indicate that CO2 emissions from the reference approach are higher than emissions from the sectoral approach.

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, especially for coal.
- *Liquid Fuels:* Energy balance is mass-balanced but not carbon balanced. Fuel category *Other Oil* is an aggregation of several fuel types and therefore it is difficult to quantify a reliable carbon emission factor for the reference approach. The reference approach takes a share of feedstocks used for plastics and solvent production as non-carbon stored. In the sectoral approach a share of emissions from the waste incineration of plastics is included in category *1 A 1 a Public Electricity and Heat Production*. Emissions from solvent use are included in category *3 Solvent and Other Products Use*. In the sectoral approach a share of municipal solid waste without energy recovery is considered in category 6C for 1990 and 1991.
- *Diesel:* In the Reference Approach CO_2 emissions from diesel are fully accounted as fossil emissions while in the sectoral the share of mixed biofuels is accounted as biogenic.
- *Solid fuels:* The reference Approach includes process emissions from blast furnaces and steel production which are included in category *2 C Metal Production* as well as process emissions from carbide production which are included in category *2 B 4 Carbide Production*.
- *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 as 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 is between -0.7 to 1.7 %. Note that this may be interpreted as emissions according to the sectoral approach (plus process emissions) being even higher than emissions according to the reference approach.
- At current it is not possible to quantify the amount of solvents and plastic products which are imported or exported by products, bulk or waste.

Table 76: 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]	Other Fuels [Gg CO_2]	Biofuels[(5)] [Gg CO_2]	Total [Gg CO_2]	Remaining total deviation[(2)]
1990	239	826	2 704	-732	0	3 038	-0.7%
1991	277	884	2 722	-805	0	3 079	-0.2%
1992	273	595	2 458	-956	0	2 369	1.0%
1993	223	831	2 526	-675	0	2 906	-0.1%
1994	261	556	2 767	-820	0	2 764	-0.3%
1995	404	583	3 136	-839	0	3 284	0.4%
1996	197	597	2 918	-1 073	0	2 639	0.4%
1997	163	591	3 316	-1 017	0	3 053	0.6%
1998	265	585	3 214	-818	0	3 245	1.7%
1999	385	590	3 102	-994	0	3 083	1.4%
2000	237	582	3 489	-763	0	3 544	0.6%
2001	272	551	3 449	-1 016	0	3 256	0.5%
2002	467	573	3 879	-1 181	0	3 738	0.5%
2003	518	625	3 721	-1 319	0	3 544	-0.5%
2004	335	568	3 650	-1 537	0	3 016	-0.4%
2005	304	598	4 128	-1 410	306	3 924	-0.6%

(1) Deviation due to the use of different carbon emissions factors, losses and statistical differences.

(2) Negative numbers indicate that CO_2 emissions from the reference approach are lower than emissions from the sectoral approach.

(3) Process emissions of natural gas used for ammonia production.

(4) Process emissions of coke oven coke used in blast furnaces. Emissions are allocated to 2 C 1 Iron and Steel Production.

(5) Share of biofuels in diesel.

3.3.2 Comparison of energy consumption

Table 77 compares the energy consumption of the two approaches.

Table 77: 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	432 368	168 733	219 239	820 341	377 044	139 830	201 599	8 990	727 463
1991	466 621	177 312	231 794	875 727	409 399	146 113	212 477	10 079	778 067
1992	456 953	137 577	227 610	822 139	393 087	108 279	213 616	12 010	726 993
1993	465 289	123 581	240 044	828 913	413 982	96 234	222 735	9 775	742 726
1994	456 363	125 300	246 908	828 571	406 117	95 011	233 968	10 527	745 623
1995	462 024	142 850	269 583	874 457	408 590	108 449	253 771	10 916	781 726

Year	Reference Approach				Sectoral Approach				
	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Total [TJ]	Liquid [TJ]	Solid [TJ]	Gaseous [TJ]	Other [TJ]	Total [TJ]
1996	500 801	143 598	286 941	931 339	444 867	109 184	274 712	14 015	842 778
1997	500 070	152 305	276 551	928 926	433 450	114 941	264 963	13 122	826 476
1998	529 397	133 764	283 920	947 082	461 936	92 314	270 664	12 284	837 198
1999	501 940	132 887	288 876	923 702	437 718	91 985	273 414	13 035	816 153
2000	490 504	149 434	275 681	915 619	430 629	107 962	262 921	11 224	812 736
2001	526 408	154 757	292 169	973 333	462 483	113 974	279 473	14 422	870 351
2002	541 016	157 061	295 485	993 562	477 550	112 555	278 907	16 466	885 478
2003	582 042	169 319	319 481	1 070 842	517 509	128 417	305 039	18 255	969 222
2004	579 354	164 905	313 362	1 057 621	513 567	126 026	297 355	22 016	958 963
2005	583 136	165 638	349 470	1 098 245	524 954	123 581	334 189	20 290	1 003 014

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: indirect CO_2 emissions from the use of bitumen for road paving and roofing that should be reported in categories *2 A 5* and *2 A 6* are included in sector *3 solvent and other product use*.

disposal: CO_2 emissions from the disposal from bitumen are assumed to be negligible. Recycling is not considered.

Natural Gas:

manufacture: emissions from the use of natural gas as a feedstock in ammonia production are accounted for in the industrial processes sector (category *2 B 1*).

use/disposal: not applicable, no CO_2 emissions result from the use or disposal of ammonia.

Coke oven coke:

manufacture: emissions from the production of coke are considered in category *1 A 2 a*.

use: CO_2 emissions from coke used in iron and steel industry are reported under *2 C*.

disposal: not applicable.

Other bituminous coal:

In [IEA JQ 2006] 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 2005 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 78presents GHG emissions arising from this category, their share and trend from 1990 to 2005.

Table 78: Greenhouse gas emissions from Category 1 B Fugitive Emissions

	GHG emissions [Gg CO_2 equivalent]		
	Total	CO_2	CH_4
1990	486.75	102.03	384.72
1991	509.76	111.03	398.73
1992	536.56	120.03	416.54
1993	547.40	112.03	435.38
1994	576.71	127.53	449.19
1995	599.16	127.03	472.14
1996	569.60	71.03	498.57
1997	637.63	120.51	517.12
1998	670.08	141.83	528.25
1999	720.15	170.53	549.62
2000	730.01	164.53	565.48
2001	756.49	182.73	573.76
2002	763.78	167.03	596.75
2003	841.67	233.04	608.63
2004	863.08	210.04	653.05
2005	872.27	205.04	667.24
Share 2005	100%	24%	76%
Trend 1990-2005	79%	101%	73%

3.5.1.2 Completeness

Table 79 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 79: Overview of subcategories of Category 1 B Fugitive Emissions: transformation into SNAP Codes and status of estimation

IPCC Category	SNAP	Status CO_2	Status CH_4
1 B 1 a Coal Mining and Handling			
i Underground Mines	050102 Underground mining	NO	NO
ii Surface Mines	050101 Open cast mining	NA	✓
1 B 1 b Solid Fuel Transformation		IE(1)	IE(1)
1 B 2 a Oil			
i Exploration	0502 Extraction, 1st treatment and loading of liquid fossil fuels	IE(2)	IE(2)
ii Production		✓	✓
iii Transport	050502 Transports and Depots	IE(2)	IE(2)
iv Refining/ Storage	0401 Processes in Petroleum Industries	NA(3)	✓
v Distribution of oil products	0504 Liquid fuel distribution 0505 Petrol distribution	NA	NA(4)
1 B 2 b Natural Gas			
i Exploration	0503 Extraction, 1st treatment and loading of gaseous fossil fuels	NA	IE(2)
ii Production/Processing		✓(2)	
iii Transmission	050601 Pipelines / Storage	✓	✓
iv Distribution	050603 Distribution Networks	NA	✓
v Other Leakage		NO	NO
1 B 2 c Venting/Flaring		IE(5)	IE(6)

(1) included in 1 A 2 a Iron and Steel

(2) 1 B 2 a i Oil Exploration, 1 B 2 a iii Transport, 1 B 2 b Natural Gas Exploration and 1 B 2 b I Natural Gas Production/Processing, except 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

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 80). Activity was reported to be 0 for 2005, thus the overall trend from the base year to 2004 is minus 100%.

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 80: Activity data (brown coal produced) and CH_4 emissions for Fugitive Emissions from Fuels- Coal Mining 1990-2005

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
2005	0	0

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

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

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 81).

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 81).

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 81: Activity data (Crude Oil Refined and Gas Produced, respectively) and emissions for Fugitive Emissions from Fuels- Oil Refining and Production 1990-2005

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
1991	8 273	0.26	1 326	4.56	3.44	43	32
1992	8 732	0.28	1 437	4.56	3.17	40	28
1993	8 522	0.27	1 488	4.54	3.05	37	25
1994	8 898	0.28	1 355	4.50	3.32	48	35
1995	8 619	0.27	1 482	4.41	2.97	38	26
1996	8 754	0.28	1 492	4.47	3.00	41	27
1997	9 374	0.30	1 428	4.55	3.18	31	22
1998	9 190	0.29	1 568	4.39	2.80	61	39
1999	8 635	0.27	1 741	4.15	2.38	90	52
2000	8 240	0.26	1 805	4.03	2.23	72	40
2001	8 799	0.28	1 954	4.10	2.10	88	45
2002	8 947	0.28	2 014	4.18	2.08	84	42
2003	8 819	0.28	2 030	3.92	1.93	133	66
2004	8 442	0.27	1 963	5.11	2.60	122	62
2005	8 755	0.28	1 637	5.21	3.18	122	75

3.5.2.3 1 B 2 b Fugitive Emissions from Fuels – Natural Gas

Emissions: CH_4, CO_2

Key Source: *Yes (CH_4)*

CH_4 emissions from 1 B 2 b Natural gas is a key source because of the contribution both to the level of all years of the greenhouse gas inventory and to the trend. In 2005 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 82) 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 82).

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 82: Activity data and emissions for Fugitive Emissions from Fuels – Natural Gas Distribution and Sour Gas Processing 1990-2005

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
1998	25 792	15.86	367 195	81

Year	Natural Gas Distribution		Sour Gas Processing	
	Gas network [km]	CH_4 Emissions [Gg]	Sour Gas Prod. [1000m³]	CO_2 Emissions [Gg]
1999	27 300	16.79	352 318	81
2000	28 800	17.71	358 357	93
2001	29 700	18.27	393 492	95
2002	31 500	19.37	347 513	83
2003	32 000	19.68	408 198	100
2004	33 800	20.79	373 099	88
2005	34 450	21.19	338 349	83

Table 83: Activity data and emissions for Fugitive Emissions from Fuels – Natural Gas Transmission and Storage 1990-2005

Year	Natural Gas Transmission (Pipelines Fugitive & Venting)			Natural Gas Storage	
	Pipelines [km]	CH_4 Emissions [Gg]	CO_2 Emissions [Gg]	Natural Gas Stored [Mm³]	CH_4 Emissions [Gg]
1990	1 032	2.99	0.03	1 500	0.65
1991	1 032	2.99	0.03	1 500	0.65
1992	1 032	2.99	0.03	1 625	0.70
1993	1 032	2.99	0.03	1 980	0.85
1994	1 032	2.99	0.03	1 329	0.57
1995	1 032	2.99	0.03	1 820	0.78
1996	1 238	3.59	0.03	1 820	0.78
1997	1 238	3.59	0.03	1 820	0.78
1998	1 238	3.59	0.03	1 820	0.78
1999	1 358	3.94	0.03	1 820	0.78
2000	1 358	3.94	0.03	1 665	0.72
2001	1 358	3.94	0.03	1 132	0.49
2002	1 358	3.94	0.03	789	0.34
2003	1 430	4.15	0.04	1 651	0.71
2004	1 430	4.15	0.04	1 716	0.74
2005	1 430	4.15	0.04	2 207	0.95

3.5.3 QA/QC

This source category is covered by the general QA/QC of the greenhouse gas inventory in chapter 1.6. Additional checks performed are cross-checks between activities reported by the operators and activities from national statistics, wherever possible.

3.5.4 Uncertainty

For the key source 1 B 2 b Natural Gas – CH_4 an uncertainty estimate was made that was calculated from the combination of estimated uncertainties of the sub-sources.

Transmission: The total pipeline length crossing Austria is assumed to be well known (5% uncertainty). The uncertainty of the EF is estimated according to the range given in the GPG (40%).

Storage: The uncertainty of the AD (20%) results from the fact that the value reported for natural gas stored corresponds to the meter reading at the end of the respective year and not to a mean value of daily meter readings. The uncertainty of the EF is assumed to be high (100%), because of the wide range that is given in the GPG.

Distribution: The total length of distribution mains is assumed to be well known (5% uncertainty) The uncertainty of the EF is estimated according to the range given in the GPG (15%).

This leads to the combined uncertainty (using the Tier 1 approach, with weights for the contribution to total source emissions) of 4% for AD, 14% for EF, resulting in a total uncertainty of emissions of 15%.

3.5.5 Recalculations

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

3.5.6 Planned improvements

It is planned to investigate the data availability for implementing a higher Tier method for the key source 1.B.2.b Fugitive Emissions from Fuels – Natural Gas.

4 INDUSTRIAL PROCESSES (CRF SECTOR 2)

4.1 Sector Overview

This chapter includes information on and descriptions of methodologies used for estimating greenhouse gas emissions as well as references for activity data and emission factors reported under IPCC Category *2 Industrial Processes* for the period from 1990 to 2005.

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 91.

4.1.1 Emission Trends

In the year 2005, 11.0% 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 2005, greenhouse gas emissions from Category *2 Industrial Processes* amount to 10 295 Gg CO_2 equivalent compared to 10 111 Gg in the base year. Figure 14 shows the trend of GHG emissions from this category for 1990-2005.

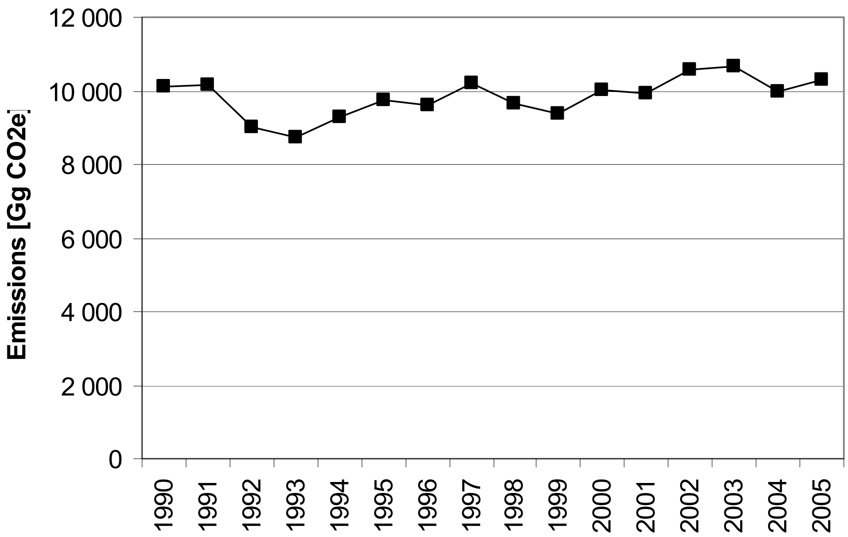

Figure 14: GHG emissions from IPCC Sector 2 Industrial Processes 1990-2005

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 2005.

Table 84: Greenhouse gas emissions from 2 Industrial Processes by gas in the base year and in 2005

GHG	Base year*	2005	Base year*	2005
	CO_2 equivalent [Gg CO_2e]		[%]	
Total	**10 110.82**	**10 294.78**	***100.0%***	***100.0%***
CO_2	7 579.11	8 688.54	*75.0%*	*84.4%*
CH_4	14.83	15.79	*0.1%*	*0.2%*
N_2O	912.02	274.16	*9.0%*	*2.7%*
HFCs	23.03	911.55	*0.2%*	*8.9%*
PFCs	1 079.24	117.97	*10.7%*	*1.1%*
SF_6	502.58	286.77	*5.0%*	*2.8%*

**1990 for all gases*

The most important GHG of the industrial processes sector is carbon dioxide with 84.4% of emissions from this category in 2005, followed by HFCs with 8.9%, SF_6 with 2.8%, N_2O with 2.7%, PFCs with 1.1% and finally CH_4 with 0.2%. Emissions by gas and their trends are presented in Table 85.

Table 85: Emissions from IPCC Category 2 Industrial Processes by gas from 1990-2005 and their trend

Gas	GHG emissions [Gg CO_2e]												
	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Trend BY*-2005
Total	**10 111**	**9 729**	**9 601**	**10 193**	**9 674**	**9 391**	**10 034**	**9 908**	**10 593**	**10 664**	**9 976**	**10 295**	*1.8%*
CO_2	7 579	7 382	7 081	7 671	7 315	7 162	7 766	7 694	8 261	8 205	8 154	8 689	14.6%
CH_4	15	14	15	15	15	15	15	14	15	15	15	16	6.5%
N_2O	912	857	874	863	897	923	952	786	807	883	281	274	-69.9%
HFCs	23	267	347	427	495	542	596	695	782	865	900	912	3858%
PFCs	1 079	69	66	97	45	65	72	82	87	103	115	118	-89.1%
SF_6	503	1 139	1 218	1 120	908	684	633	637	641	594	513	287	-42.9%

** BY: 1990 for all gases*

CO_2 emissions

As can be seen in Figure 15, CO_2 emissions from the industrial processes sector fluctuate during the period from 1990 to 2005, showing no clear trend. In 2005 CO_2 emissions from Industrial Processes amount to 8 689 Gg CO_2 equivalent, which corresponds to an increase of 15% compared to base year emissions (7 579 Gg).

About 58% of CO_2 emissions originate from *Metal Production (mainly Iron and Steel Production)* and about 36% from *Mineral Products*. The rest originates from *Chemical Industry (mainly Ammonia Production)*.

CH_4 emissions

As can be seen in Figure 15, CH_4 emissions from Industrial Processes fluctuate over the period from 1990 to 2005, 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, Ethylene and Ammonia);* a minor source for CH_4 emissions is *Metal Production (Electric Furnace Steel Plants, Rolling Mills)*.

N_2O emissions

N_2O emissions from this sector arise from *Nitric Acid Production (Chemical Industry)*. As can be seen in Figure 15, N_2O emissions from the industrial processes sector fluctuate until 2000. From 2000 to 2001 emissions drop by 17%; this is due to the introduction of a new catalyst in the nitric acid plant. After an increase until 2003, emissions decrease strongly from 2003 to 2004 by 68%. This decrease is due to the installation of a N_2O decomposition facility in the nitric acid plant.

In 2005, N_2O emissions from *Industrial Processes* are 71% below the level of the base year.

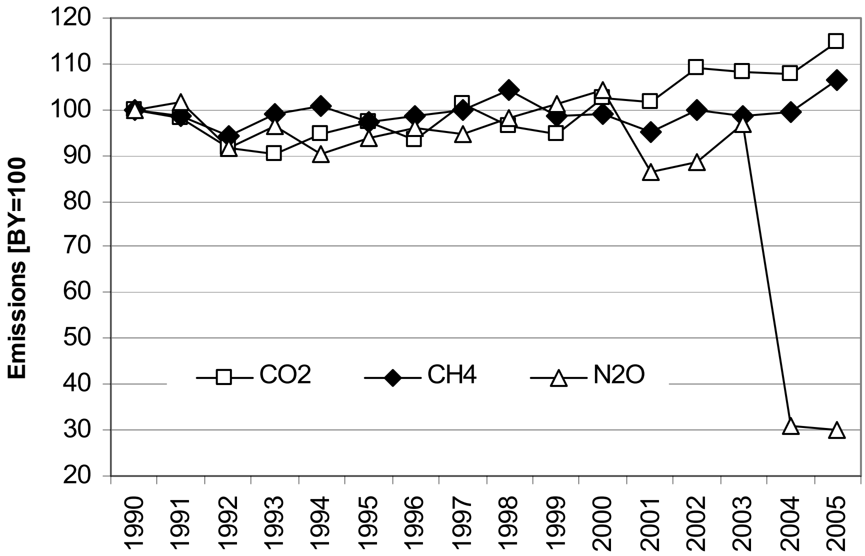

Figure 15: CO_2, CH_4 and N_2O emissions from Industrial Processes 1990-2005 in index form (base year = 100)

HFC emissions

As can be seen in Figure 16, HFC emissions increase remarkably during the period from 1990 to 2005. In 2005 HFC emissions amount to 912 Gg CO_2 equivalents, about 50 times the level of the base year (1990).

HFC emissions mainly arise from *Refrigeration and Air Conditioning Equipment* and *Foam Blowing*.

PFC emissions

As can be seen in Figure 16, PFC emissions decrease remarkably during the period from 1990 to 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 2005 they amounted to 118 Gg CO_2 equivalent, which is 89.1% below the level of the base year (1990).

In 2005 PFC emissions only arise from semiconductor manufacture.

SF_6 emissions

As can be seen in Figure 16, SF_6 emissions increase at the beginning of the period and reach a maximum in 1996, since then SF_6 emissions are decreasing again. The strong decrease between 2004 and 2005 is explained by a lower SF_6 use in Semiconductor Manufacture. In 2005 SF_6 emissions amount to 287 Gg CO_2 equivalent, 43% below the level of the base year (1990).

In 2005 SF_6 emissions arise mainly from semiconductor manufacture, electric equipment and noise insulating windows.

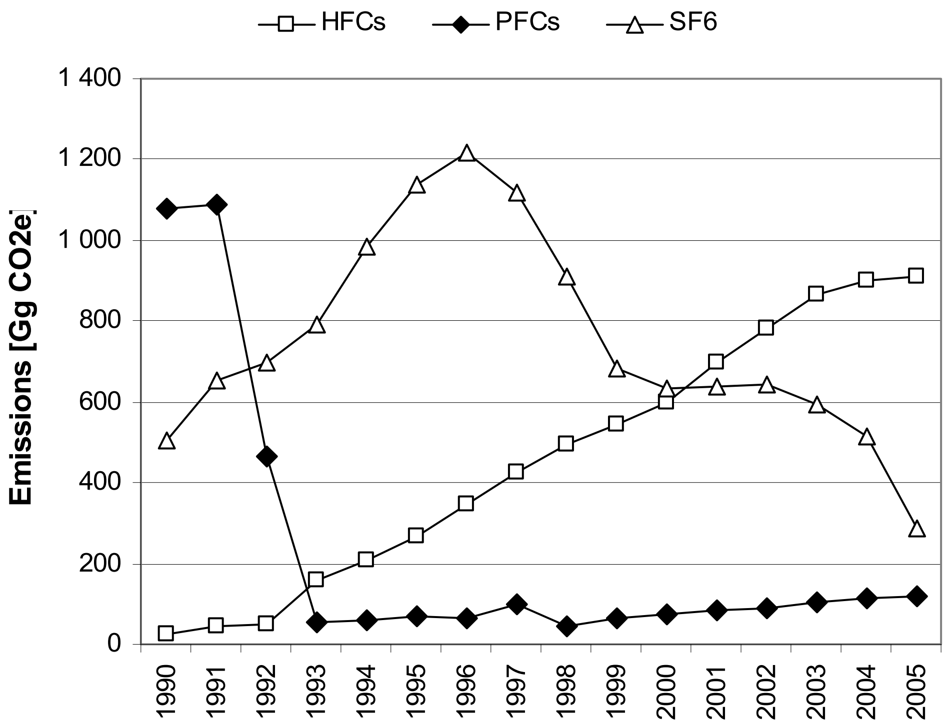

Figure 16: HFC, PFC and SF_6 emissions from Industrial Processes 1990-2005

Emission trends by sources

The main sources of greenhouse gas emissions in the industrial processes sector are *Metal Production* and *Mineral Products*, which cause 49% and 30%, respectively, of the emissions from this sector in 2005 (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 2005.

	Emissions [Gg CO_2e]		Share [%]		Trend
	BY*	2005	BY*	2005	BY - 2005
2 Industrial Processes	**10 110.82**	**10 294.78**	***100.0%***	***100.0%***	***1.8%***
A Mineral Products	3 269.05	3 119.86	32.3%	30.3%	-4.6%
B Chemical Industry	1 511.91	847.25	15.0%	8.2%	-44.0%
C Metal Production	5 028.54	5 011.39	49.7%	48.7%	-0.3%
F Consumption of Halocarbons and SF_6	301.33	1 316.29	3.0%	12.8%	336.8%

**1990 for all gases*

Figure 17 and Table 87 present greenhouse gas emissions from IPCC Category *2 Industrial Processes* by sub category for the years 1990 to 2005.

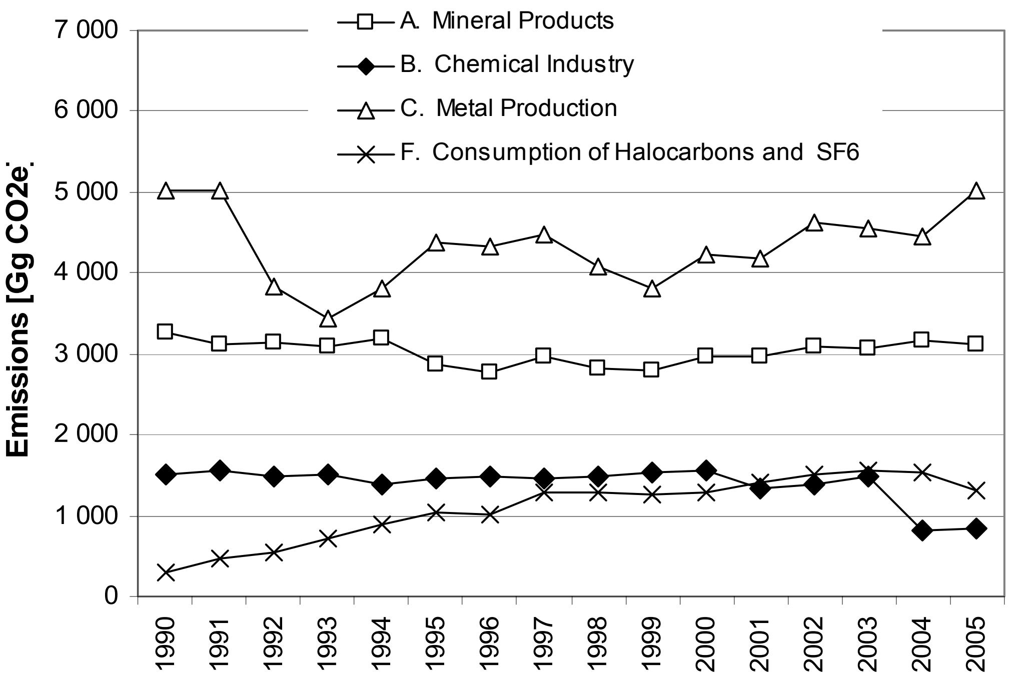

Figure 17: Emissions from IPCC Category 2 Industrial Processes per sub sector 1990-2005

Table 87: Total greenhouse gas emissions from 1990–2005 by subcategories of Category 2 Industrial Processes

	GHG emissions [Gg CO_2 equivalent]											
	BY*	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
2	**10 111**	**9 729**	**9 601**	**10 193**	**9 674**	**9 391**	**10 034**	**9 908**	**10 593**	**10 664**	**9 976**	**10 295**
2 A	3 269	2 857	2 769	2 969	2 815	2 801	2 958	2 977	3 085	3 073	3 163	3 120
2 B	1 512	1 455	1 479	1 460	1 492	1 521	1 553	1 340	1 373	1 490	824	847
2 C	5 029	4 385	4 332	4 468	4 084	3 801	4 228	4 185	4 632	4 540	4 463	5 011
2 F	301	1 032	1 021	1 295	1 283	1 268	1 294	1 406	1 502	1 561	1 527	1 316

**1990 for all gases*

2 A Mineral Products

Greenhouse gas emissions decrease by 4.6% from 1990 to 2005 in this sub-category. This is due to decreasing production in cement and magnesia sinter industry.

Only CO_2 emissions arise from this source category.

2 B Chemical Industry

For the source *Chemical Industry* greenhouse gas emissions remain quite stable over the period from 1990 to 2003. From 2003 to 2004 emissions decrease by 45%, because of implemented mitigation techniques in the nitric acid production. In 2005 emissions are 44% 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 a strong increase in CO_2 emissions from *Iron and Steel Production* (+41%). The overall trend is a decrease by 0.3% related to emissions of the base year (1990).

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

2 F Consumption of Halocarbons and SF_6

In 2005 greenhouse gas emissions are 3 times higher than base year emissions for the subcategory *Consumption of Halocarbons and SF_6.* This increase is mainly due to the higher consumption of HFCs as substitutes for ozone depleting substances (*ODS Substitutes*).

4.1.2 Key Sources

The methodology and results of the key category 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
2 A 3	Limestone and Dolomite Use	CO_2	LA98, 00, 05
2 A 7 b	Magnesia Sinter Plants	CO_2	All
2 B 1	Ammonia Production	CO_2	All LA
2 B 2	Nitric Acid Production	N_2O	LA90-03, TA
2 C 1	Iron and Steel Production	CO_2	All
2 C 3	Aluminium production	PFCs	LA90-92, TA
2 C 3	Aluminium production	CO_2	TA
2 C 4	SF_6 used in Al and Mg Foundries	SF_6	LA90-97, TA
2 F 1/2/3/4/5	ODS Substitutes	HFCs	LA95-05, TA
2 F 7	Semiconductor Manufacture	FCs	LA92-04
2 F 9	Other Sources of SF6	SF_6	LA97, 98, 00

LA90 = Level Assessment 1990

LA04 = Level Assessment 2005

TA = Trend Assessment BY-2005

In the base year (1990), 12.5% of total greenhouse gas emissions in Austria originate from the 13 key sources of the industrial processes sector compared to 10.8% in 2005. These key sources cover 97% of total emissions from IPCC Sector *2 Industrial Processes.* The most important key source is *Iron and Steel Production* which has a share of 5.4% in total emissions in 2005. Emissions from *Cement Production* contribute with 1.9% to total emissions 2005 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 2005 (see Table 89).

Table 89: Level Assessment for the base year and 2005 for the key sources of Category 2 Industrial Processes

IPCC Category	Source Categories	GHG	Level Assessment	
			BY	2005
2 A 1	Cement Production	CO_2	2.6%	1.9%
2 A 2	Lime Production	CO_2	0.5%	0.6%
2 A 3	Limestone and Dolomite Use	CO_2	0.3%*	0.3%
2 A 7 b	Magnesia Sinter Plants	CO_2	0.6%	0.3%
2 B 1	Ammonia Production	CO_2	0.7%	0.5%
2 B 2	Nitric Acid Production	N_2O	1.2%	0.3%*
2 C 1	Iron and Steel Production	CO_2	4.5%	5.4%
2 C 3	Aluminium production	PFCs	1.3%	0.0%*

IPCC Category	Source Categories	GHG	Level Assessment	
			BY	2005
2 C 3	Aluminium production	CO_2	0.2%*	0.0%*
2 C 4	SF_6 used in Al and Mg Foundries	SF_6	0.3%	0.0%*
2 F 1/2/3/4/5	ODS Substitutes	HFCs	0.0%*	1.0%
2 F 7	Semiconductor Manufacture	FCs	0.2%*	0.3%*
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. Methodologies are described for all IPCC source categories.

4.1.3.1 Emission data reported under the European Emission Trading Scheme (ETS)

Verified CO_2 emissions reported under the EU ETS were available for the first time in this submission for the year 2005. These emissions have been incorporated in the inventory as far as possible (see respective sub-chapters for more information). The relevant sources are 2.A.1 Cement Production, 2.A.2 Lime Production, 2.A.3 Limestone and Dolomite Use, 2.A.4 Soda Ash Use, 2.A.7a Bricks production, 2.A.7b Magnesia Sinter Plants and 2.C.1 Iron and Steel. Special attention was turned to time-series consistency. Furthermore the background data for the emission calculations under the ETS were used for further QA/QC checks.

4.1.4 Uncertainty Assessment

In this year's submissions uncertainty estimates for all key sources based on the IPCC GPG, on the uncertainty study cited in Chapter 1.7 and on expert judgement by Umweltbundesamt are provided (see Table 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

IPCC Category	Source Categories	Uncertainty [%]		
		Activity data	Emission factor	Emission estimate
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. The QC procedures defined in the QMS correspond to general QC Tier 1 procedures defined in the IPCC GPG. For further information see Chapter 1.6.

Concerning measurement and documentation of emission data the Commission Decision 2004/156/EC establishes guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council that establishes a scheme for greenhouse gas emission allowance trading within the Community (EU ETS).

This decision provides general guidelines on emission reporting and verification as well as sector specific guidelines on the methodologies to account for process specific CO_2 emissions. These include guidance on calculations and measurements at different level of detail, similar to the different Tier methods in the IPCC guidelines.

The implementation of the European directive in Austria is furthermore supplemented by specific national regulations: the Austrian Emissions Certificate Trading Act[22] and the Ordinance regarding Monitoring and Reporting of Greenhouse Gas Emissions[23].

Furthermore, most of the plants that are reporting emission data – this includes plants that are not obliged to participate in the EU ETS – have quality management systems according to the ISO 9000–series or similar systems.

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[22] "*Emissionszertifikate-Gesetz*", Federal Law Gazette 46/2004

[23] „*Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Überwachung und Berichterstattung betreffend Emissionen von Treibhausgasen*", Federal Law Gazette 458/2004

4.1.6 Recalculations

Compared to last year's inventory only few recalculations were made. A summary of these changes is presented below:

Update of activity data:

2 A 1 Cement Production:

Activity and emission data for CO_2 emissions from *Cement Production* 2004 has been updated using plant-specific data provided by the Association of the Austrian Cement Industry.

2 B 1 Ammonia Production:

During the in-country review of the initial report of Austria (February 2007) the ERT found that there was a double counting concerning CO_2 emissions from ammonia. The double counting was corrected in this submission.

2 C 1 Iron and Steel:

Process-specific CO_2 emissions from pig iron production for several years 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 C 2 Ferroalloys: Activity data for 2004 has been updated.

2 F Consumption of Halocarbons and SF_6:

4 Aerosols and 5 Solvents: Potential emissions have been updated for the years 2002-2004.

8 Electrical equipment: Potential emissions have been updated for 2004.

Improvements of methodologies and emission factors:

2 A 2 Lime: Emissions have been updated for 2003 and 2004 using plant specific emission factors.

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 91 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 91: 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)	✓	NA	NA
2 A 2	Lime Production	040614	Lime (decarbonising)	✓	NA	NA
2 A 3	Limestone and Dolomite Use	040618	Limestone and Dolomite Use	✓	NA	NA
2 A 4	Soda Ash Production and Use	040619	Soda Ash Production and Use	✓	NA	NA
2 A 5	Asphalt Roofing	040610	Roof covering with asphalt materials	IE(1)	NA	NA
2 A 6	Road Paving with Asphalt	040611	Road paving with asphalt	IE(1)	NA	NA
2 A 7	*Other*					
	2 A 7 a Bricks	040613	Bricks (decarbonising)	✓	NA	NA
	2 A 7 b Magnesit Sinter	040617	Other - Magnesia Sinter Plants	✓	NA	NA
2 B	**CHEMICAL INDUSTRY**					
2 B 1	Ammonia Production	040403	Ammonia	✓	✓	NA
2 B 2	Nitric Acid Production	040402	Nitric acid	✓	NA	✓
2 B 3	Adipic Acid Production	040521	Adipic acid	NA	NA	NO(2)
2 B 4	Carbide Production	040412	Calcium carbide production	✓	NA	NA
2 B 5	Other	040407 040408	NPK fertilisers Urea	✓	✓	NA
2 B 5	Other	040501	Ethylene production	NA	✓	NA
2 C	**METAL PRODUCTION**					
2 C 1	Iron and Steel Production	040202 040206 040207 040208	Blast furnace charging Basic oxygen furnace steel plant Electric furnace steel plant Rolling mills	✓	✓	NA
2 C 2	Ferroalloys Production	040302	Ferro alloys	✓	NA	NA
2 C 3	Aluminium Production	040301	Aluminium production (electrolysis) – except SF_6	✓ / NO(3)	✓ / NO(3)	NA
2 C 4	SF_6 Used in Aluminium and Magnesium Foundries	040301 040304	Aluminium Production – SF_6 only Magnesium Production – SF_6 only		SF_6 ✓	
2 C 5	*Other*					
2 D	**OTHER PRODUCTION**					
2 D 1	*Pulp and Paper*					
2 D 1	*Food and Drink*			NA(4)	NA	NA

	IPCC Category		SNAP	HFCs, PFCs, SF_6
2 E	**PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE**	0408	Production of halocarbons and sulphur hexaflouride	NO[(5)]
2 F	**CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE** [(6)]	0605	Use of HFC, PFC and SF_6	
2 F 1	Refrigeration and Air Conditioning Equipment			✓
2 F 2	Foam Blowing			✓
2 F 3	Fire Extinguishers			✓
2 F 4	Aerosols			✓
2 F 5	Solvents			✓
2 F 6	Other applications using ODS substitutes			NO
2 F 7	Semiconductor Manufacture			✓
2 F 8	Electrical Equipment			✓
2 F 9	*Other*			✓

[(1)] *Emissions are included in Sector* 3 Solvent and Other Product Use

[(2)] *There is no adipic acid production in Austria.*

[(3)] *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

The data availability problem in this sector that occurred in previous submissions is solved for all key sources. The ordinance that regulates monitoring and reporting in the context of the EU Emissions Trading scheme in Austria also regulates that data reported from the plant operators can be used for the inventory (see Chapter 1.2).

During the in-country review of the initial report of Austria (February 2007) the ERT encouraged to further investigate whether emissions occur from foam manufacturing/installation (or other ODS substitute applications) to determine whether emissions are currently being underestimated. It is planned to make these investigations.

4.2 Mineral Products (CRF Source Category 2 A)

4.2.1 Cement Production (2 A 1)

4.2.1.1 Source Category Description

Emissions: CO_2

Key Source: Yes (CO_2)

CO_2 emissions from cement production is a key source because of its contribution to the level of the greenhouse gas inventory of all years and was also identified as key in the trend analysis. In 2005 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 92 presents the process-related CO_2 emissions from the production of cement for the period from 1990 to 2005.

Table 92: 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
2003	1 754	3 119 808	562
2004	1 790	3 222 802	555
2005	1 797	3 221 167	558

CO_2 emissions (see Table 92) are quite constant from 1990 to 1994; 1995 they drop by 21.7% compared to the previous year, due to a drop in clinker production of almost 20%. This drop is due to an economic turndown in cement industry and the shutdown of one clinker oven. Since 1995 emissions as well as production of cement remain on this lower level with only minor fluctuations. The overall trend from 1990 to 2005 is minus 12%.

4.2.1.2 Methodological Issues

Emissions were estimated using a country specific method similar to the IPCC Tier 2 methodology.

Activity data (clinker production) as well as emission data were taken from studies on emissions from the Austrian cement production industry (HACKL & MAUSCHITZ 1995, 1997, 2001, 2003 and MAUSCHITZ 2004). The studies cover the years 1988 to 2003.

In these studies process-specific CO_2 emissions and CO_2 emissions due to combustion are presented separately. In the course of these studies all cement production plants in Austria were investigated. The determination of the emission data took place by inspection of every single plant, recording and evaluation of plant specific records and also plant specific measurements and analysis carried out by independent scientific institutes.

Activity data and emissions for 2004 were reported directly by the Association of the Austrian Cement Industry as well as activity data for 2005. For 2005 verified CO_2 emissions, reported under the ETS, were used for the inventory. These data cover the whole cement industry in Austria. The methodology for these emission calculations is the same like in the years before.

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

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

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, considering also the $MgCO_3$ content of the raw meal. Based on this data and plant specific production data total emissions from this source were calculated.

With the used methodology no cement kiln dust (CKD) correction factor has to be considered. However, in the Austrian plants cement kiln dust is returned back into the process.

4.2.1.3 Source specific QA/QC

The analysis of the raw material was carried out by independent scientific institutes. Cement production was checked with statistical data to ensure completeness. The Association of the Austrian Cement Industry reported total CO_2 emissions, which were compared with the ETS data and found to accord.

4.2.1.4 Uncertainty Assessment

As the applied methodology is based on plant specific data, the uncertainty of activity data is assumed to be low (5%). According to the IPCC GPG (p. 3.14) the uncertainty of the CO_2 emission factor for Tier 2 is low (1-2%). In the Austrian method the uncertainty derives basically from the raw meal composition as the uncertainty for the stochiometric emission factor is negligible; thus, the uncertainty of the emission factor is assumed to be 2%. This results in a combined uncertainty of 5.4% (according to the IPCC GPG Table 3.2, the uncertainty for emissions using Tier 2 methodology (based on clinker production data) is 5-10%).

4.2.1.5 Recalculations

Activity data and emission data for 2004 have been updated (previously the estimate of 2003 was used for 2004). The recalculation difference resulting from the update of data is presented in the following table.

Table 93: Recalculation difference for CO_2 emissions from Cement Production with respect to submission 2006

	2004
Recalculation Difference [Gg]	35.53

4.2.2 Lime Production (2 A 2)

4.2.2.1 Source Category Description

Emissions: CO_2

Key Source: *Yes (CO_2)*

CO_2 emissions from lime production is a key source because of its contribution to the total inventory's level in all inventory years and to the trend of emissions of the total greenhouse gas inventory. In the year 2005 emissions from this category contributed 0.6% 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 94 presents activity data for this category (lime produced) as well as CO_2 emissions from lime production for the period from 1990 to 2005.

Table 94: Activity data and CO_2 emissions for Lime production 1990–2005

Year	Lime Produced [t/a]	CO_2 emissions [Gg]	CO_2 IEF [kg/Mg]
1990	512 610	396	773
1991	477 135	361	757
1992	462 392	355	768
1993	479 883	365	761
1994	518 544	390	753
1995	522 934	395	755
1996	505 189	383	758
1997	549 952	412	750
1998	594 695	454	763
1999	595 978	453	760
2000	654 437	498	760
2001	666 633	507	760
2002	719 246	547	760
2003	756 140	577	763
2004	788 790	601	762

Year	Lime Produced [t/a]	CO_2 emissions [Gg]	CO_2 IEF [kg/Mg]
2005	760 464	579	761

The overall trend for CO_2 emissions from this category is increasing emissions, in the year 2005 emissions were 52% higher than 1990 (see Table 94).

4.2.2.2 Methodological Issues

Emissions were estimated using a country specific method based on detailed production data.

Activity data and emission values were reported by the *Association of the Stone & Ceramic Industry.* For 2005 verified CO_2 emissions reported under the ETS were used for the inventory. These data cover the whole lime producing industry in Austria. The methodology for this emission calculation is the same like in the years before.

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

4.2.2.3 Source specific QA/QC

Lime production was checked with statistical data. The IEF are compared with IPCC default values. The Association of the Stone & Ceramic Industry reported total CO_2 emissions, which were compared with the ETS data and found to accord.

4.2.2.4 Uncertainty Assessment

Uncertainties for activity data are considered to be low as it is based on plant specific data of all Austrian plants. However, according to the IPCC GPG (p 3.22) omission of non-marketed lime production may lead to an error of +100% or more. Considering the Austrian circumstances the uncertainty of activity data is assumed to be plus 20% and minus 5%. The uncertainty of the emission factor derives basically from the raw-material composition and is assumed to be 5%. This leads to a combined uncertainty of 20.6% (calculating with the plus 20% of activity data).

4.2.2.5 Recalculations

Emissions have been updated for 2003 and 2004 using plant specific emission factors. In the previous submission the IEF from 2001 was used for these years.

Table 95: Recalculation difference for CO_2 emissions from lime production with respect to submission 2006

	2003	2004
Recalculation Difference [Gg]	2.21	1.61

4.2.3 Limestone and Dolomite Use (2 A 3)

4.2.3.1 Source Category Description

Emissions: CO_2

Key Source: Yes (CO_2)

CO_2 emissions from limestone and dolomite use is a key source because of its contribution to the total inventory's level for the years 1998 and 2000. In the year 2005 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 31% between 1990 and 2005 mainly due to increased limestone use in iron and steel industries.

Table 96: Activity data and CO_2 emissions for Limestone and Dolomite Use 1990–2005

Year	Limestone Used [t/a]	Dolomite Used [t/a]	CO_2 emissions [Gg]
1990	479 376	24 020	222
1991	481 769	27 646	225
1992	439 897	24 463	205
1993	439 433	24 485	205
1994	471 505	26 212	220
1995	542 377	26 225	251
1996	487 657	26 225	227
1997	551 173	24 457	254
1998	573 724	24 457	264
1999	533 213	26 826	247
2000	601 844	22 624	276
2001	587 220	26 573	271
2002	634 620	23 477	290
2003	638 899	30 368	296
2004	655 220	19 208	297
2005	644 921	21 241	291

4.2.3.2 Methodological Issues

Emissions were estimated using the methodology and the default emission factor of the IPCC guidelines for the years 1990-2004.

Activity data for limestone and dolomite used in glass industry were reported by the *Association of Glass Industry* for the years 2002-2004, for the years before activity data was estimated using a constant ratio of limestone and dolomite used per ton of glass produced (glass production was reported by the *Association of Glass Industry* for all years).

Activity data for limestone used in blast furnaces for the years 1998 to 2002 was reported directly by the plant operator of the two integrated iron and steel production sites that operate blast furnaces. For the years before and after activity data was estimated using the average ratio of limestone used per ton of pig iron produced of the years 1998-2002.

For 2005 verified CO_2 emissions and activity data, reported under the ETS, were used for the inventory. These data cover limestone and dolomite use in the glass and iron and steel industry.

Activity data for limestone used for desulphurization were taken from a national report on desulphurization technologies in Austria (WINDSPERGER & HINTERMEIER 2002). The time series was constructed with the help of plant specific SO_2 emission declarations from the annual steam boiler database. For 2005 additional information due to emissions reported under the ETS was included.

For calculation of CO_2 emissions the IPCC default emission factors of 440 kg CO_2/ t limestone and 477 kg CO_2/ t dolomite were used. For 2005 ETS background data provided more detailed information on the actual carbon content of the limestone and dolomite used. Therefore, the IEFs for 2005 are slightly different to the IPCC default values.

4.2.3.3 Source specific QA/QC

Limestone and dolomite use in glass industry is checked with glass production figures.

4.2.3.4 Uncertainty Assessment

According to the IPCC GPG (Table. 3.4) the uncertainty of the CO_2 emission factor is ± 2%. This derives from the uncertainty about the composition and fractional purity of limestone in $CaCO_3$ (or of dolomite in $CaCO_3 \cdot MgCO_3$) per tonne of total raw material.

Uncertainty of activity data derives mainly from omission of limestone and dolomite use in unidentified industries. For limestone it is assumed to be plus 20% and minus 10%, because the use in iron and steel industry covers the major part and this is included. Dolomite use covers only glass industry, therefore the uncertainty is assumed to be high (plus 100%). This results in a combined uncertainty of activity data of 19.6%, using the higher limits and taking into account their respective shares in total emissions from this sector; and leads to a combined uncertainty of emissions of 19.7%.

4.2.3.5 Recalculations

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

4.2.4 Soda Ash Use (2 A 4)

4.2.4.1 Source Category Description

Emissions: CO_2

Key Source: *No*

In this category CO_2 emissions from decarbonising of soda used in glass industry is considered. In 2005 emissions from this category contributed 0.02% to total emissions in Austria. The following table presents CO_2 emissions from this category.

Table 97: Activity data and CO_2 emissions for Soda Use 1990–2005

Year	Soda Used [t/a]	CO_2 emissions [Gg]
1990	46 690	19
1991	53 737	22
1992	47 551	20
1993	47 593	20
1994	50 950	21
1995	50 975	21
1996	50 975	21
1997	47 539	20
1998	47 539	20
1999	52 144	22
2000	43 976	18
2001	51 652	21
2002	45 633	19
2003	45 263	19
2004	28 559	12
2005	36 876	15

4.2.4.2 Methodological Issues

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

Activity data for soda used in glass industry were reported from the *Association of Glass Industry* for the years 2002-2004, for the years before activity data was estimated using a constant ratio of soda used per ton of glass produced, taken from the data reported for 2002 (glass production was reported by the *Association of Glass Industry* for all years).

For 2005 verified CO_2 emissions and activity data, reported under the ETS, were taken for the inventory. These data cover soda ash use in the glass industry.

For calculation of CO_2 emissions from 1990 to 2004 the IPCC default emission factor of 415 kg CO_2/ t soda was used. For 2005 ETS background data provided more detailed information on the actual carbon content of the limestone and dolomite used. Therefore, the IEF for 2005 slightly differs from the IPCC default value.

4.2.4.3 Recalculations

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

4.2.5 Asphalt Roofing (2 A 5) and Road Paving with Asphalt (2 A 6)

Emissions previously reported under these categories resulted from asphalt roofing production and bitumen production as well as pre-painting before the asphalt roofing or road paving. However, these emissions are already accounted for in the solvents sector, that's why emissions are now reported as included elsewhere "IE".

4.2.6 Mineral Products – Other (2 A 7)

4.2.6.1 Source Category Description

In this category bricks (decarbonising) and magnesia sinter production are addressed.

4.2.6.2 Bricks Production

Emissions: CO_2

Key Source: *No*

This category includes CO_2 emissions from the production of bricks where CO_2 is generated through decomposition of the carbonate content of the raw materials.

Table 98 presents CO_2 emissions from bricks production for the period from 1990 to 2005. CO_2 emissions from bricks production had a maximum in 1995/1996, following brick production. In the year 2005 emissions from this category contributed 0.1% to the total amount of greenhouse gas emissions in Austria.

Methodological Issues

No IPCC methodology is available for this source.

Emission values for the years 1998-2001 were reported by the *Association of the Stone & Ceramic Industry*. The reported CO_2 emission data is based on data of the different brick production sites in Austria, considering the carbonate contents of raw materials used for bricks production at the different plants and calculating CO_2 emissions from the stoichiometric ratios (using IPCC default emission factors). For 2005 verified CO_2 emissions, reported under the ETS, were taken for the inventory. These data cover the whole brick industry in Austria.

Activity data for the production of bricks was taken from national statistics (STATISTIK AUSTRIA), for 1996 the value of 1995 was used due to lack of data. From the IEF for 1998 emissions of the years before 1998 were calculated; and the IEF from 2001 was used to calculate emissions after 2001.

Table 98 presents activity data for production of bricks and CO_2 emissions for this category for the period from 1990 to 2005.

Table 98: Activity data and CO_2 emissions for Bricks Production 1990-2005

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

Year	Bricks [t/a]	CO_2 emissions [Gg]	CO_2 IEF
2002	1 904 142	120	63.15
2003	1 833 557	116	63.15
2004	2 116 786	134	63.15
2005	2 083 074	128	61.46

The increasing IEF between 1998 and 2001 is due to a switch in porous material used in brick production. Previously mainly sawdust was used, whereas nowadays residual fibre material from paper industry is used. Furthermore, $CaCO_3$ is added for moisture compensation.

Generally, fluctuations in the IEF occur because of different brick types produced. The higher the density of the particular brick, the more CO_2 is emitted during production. High and low density bricks have different properties. Consequently, fluctuating quantities of brick types are produced from year to year depending on the demand.

Recalculations

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

4.2.6.3 Magnesia Sinter Production

Emissions: CO_2

Key Source: Yes (CO_2)

This category includes CO_2 emissions from the production of magnesia sinter. CO_2 emission from magnesia sinter production is a key source both due to the contribution to total emissions of all inventory years and also with regard to the trend assessment. In 2005 it contributed 0.3% 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 sintered at high temperatures in a kiln to produce MgO. Magnesia sinter is processed in the refractory industry.

Table 99 presents CO_2 emissions from production of magnesia sinter for the period from 1990 to 2005. CO_2 emissions from magnesia sinter plants vary over the period from 1990 to 2004 with an overall decreasing trend. In 2005 emissions are 36% less than in 1990.

Fluctuations in CO_2 emissions from this category are explained by:

- Varying implied emission factors that reflect different qualities of sinter produced and proportions of sinter / caustic sinter production.
- Varying production figures. The decrease in production figures between 1990 and 1992 results from a more efficient sinter production process due to a higher quality of the magnesite raw material.

Methodological Issues

No IPCC methodology is available for this source.

Emission values and activity data were directly reported by the only company in Austria sintering magnesia. For 2005 verified CO_2 emissions, reported under the ETS, were taken for the inventory.

Emissions are calculated stoichiometrically according to Calculation method B: Alkali Oxides (2004/156/EC Guidelines for the monitoring and reporting of GHG emissions, Annex X). Oxides are measured by X-ray fluorescence analysis.

Table 99 presents activity data and CO_2 emissions from this category for the period from 1990 to 2005.

Table 99: CO_2 emissions from Magnesia Sinter Production 1990-2005

Year	Magnesite [t]	CO_2 Emissions [Gg]	CO_2 IEF [kg/Mg]
1990	966 066	481	498
1991	795 932	392	492
1992	675 284	336	498
1993	670 294	325	484
1994	669 260	323	482
1995	753 575	410	544
1996	744 726	355	477
1997	801 273	384	480
1998	716 869	345	482
1999	716 959	350	488
2000	699 707	339	485
2001	691 278	334	483
2002	766 887	374	487
2003	651 332	311	478
2004	655 236	329	501
2005	638 749	310	485

Source specific QA/QC

The calculation is based on a European recognized standard method. Order of magnitude and time-series checks are performed. The operator is contacted in case of inconsistencies. The operator reported total CO_2 emissions, which were compared with the ETS data and found to accord.

Uncertainty Assessment

Emissions were calculated based on stoichiometric ratios and this is a fixed number, therefore the uncertainty of the emission factor is the uncertainty of raw material composition which is estimated to be about 5%. The uncertainty of activity data is assumed to be low (2%) as there is only one plant in Austria and data is obtained from this plant.

Recalculations

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

4.3 Chemical Industry (CRF Source Category 2 B)

4.3.1 Ammonia Production (2 B 1)

4.3.1.1 Source Category Description

Emissions: *CO_2 and CH_4*

Key source: *Yes (CO_2)*

CO_2 emissions from production of ammonia are a key source due to the contribution to the level of total emissions of the Austrian greenhouse gas inventory of all years from 1990 to 2005. In 2005 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) – in Austria natural gas is used. By way of these processes the feedstock is reformed with steam in a heated primary reformer and subsequently with air in a second reformer in order to produce the synthesis gas. CO_2 is produced by stoichiometric conversion and is mainly emitted during the primary reforming step.

One half of the methane introduced in the synthesis is CH_4 that is generated in the so called methanator: small amounts of CO and CO_2, remaining in the synthesis gas, are poisonous for the ammonia synthesis catalyst and have to be removed by conversion to CH_4 in the methanator. The other half is recycled methane that has not been converted in the reforming step. Only a small part of the methane is actually emitted, the main part is used as a fuel in the primary reformer.

Table 100 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 2005.

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 2005 CO_2 emissions are 2.6% lower than in the base year.

4.3.1.2 Methodological Issues

Activity data since 1990 and CH_4 emission data from 1994 onwards were reported directly to the UMWELTBUNDESAMT by the only ammonia producer in Austria and thus represent plant specific data. The composition of the synthesis gas is measured regularly at the only ammonia producer in Austria. CH_4 emissions are calculated from the measured synthesis gas composition and the number and duration of start-ups. The implied emission factor for CH_4 that was calculated from activity and emission data from 1994 was applied to calculate emissions of the years 1990 to 1993 as no emission data was available for these years.

CH_4 emission factors of ammonia plants depend largely on the number of shutdowns and start ups during the year. Especially a start up after a turn around with exchange of catalyst in some of the reactors of the plant (as in 1998) needs a prolonged start up procedure. This causes an increase of emissions without production of ammonia.

CO_2 emissions are calculated from the natural gas input – Tier 2 method of the IPCC guidelines - (non-energy use from the national energy balance) with a standard emission factor (55.4 t/TJ). For the years 1990, 1991 and 1993 natural gas input was calculated from Ammonia Production with the conversion factor 0.451 t/t NH_3, because natural gas input in the Energy Balance exceeded by far ammonia production capacity in these years.

In this methodology it is assumed that all natural gas is transformed to CO_2 and emitted at once. But, according to information from the producer, there are also CH_4 emissions during start-ups of the ammonia production. Therefore this CH_4 has to be subtracted from total CO_2 to avoid double counting. Furthermore, CO_2 and CH_4 emissions from urea production are reported, that both derive directly from ammonia (see chapter 4.3.4.2 for further information). These emissions are reported under urea production – where they occur – and are also subtracted from total CO_2 emissions from ammonia production to avoid double counting of emissions. CO_2 is directly subtracted and CH_4 is converted to CO_2 by multiplying with the stoichiometric ratio (44/12) and subsequently subtracted.

According to the IPCC guidelines no account should be taken for intermediate binding of CO_2 in downstream manufacturing processing and products. Nevertheless in the Austrian ammonia production facility melamine is produced from urea, a product in which carbon can be considered to be stored for a long time. Melamine is primarily used to produce melamine resin, which when combined with formaldehyde produces a very durable thermoset plastic. Melamine is fire resistant and heat tolerant and has a highly stable structure. Thus, account was taken for the carbon bound in the melamine production. Carbon stored was calculated stoichiometrically from urea input for melamine production, and was subtracted from the total CO_2 emissions.

Table 100 shows all the relevant parameters for the calculation of CO_2 emissions from ammonia production. The resulting CO_2 IEF (with respect to ammonia) is decreasing over time, because of the increasing melamine production.

Table 100: Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from ammonia production 1990–2005

Year	Ammonia Produced [t]	Natural gas input [TJ]	Carbon stored [Gg C]	CO_2 Emissions [Gg]	IEF CO_2 [kg/ t Ammonia]	CH_4 Emissions [Mg]
1990	461 000	10 239	13.6	517	1 121	62.2
1991	475 000	10 550	10.4	546	1 149	64.1
1992	432 000	10 735	11.2	553	1 280	58.3
1993	469 000	10 417	10.2	539	1 149	63.3
1994	444 000	10 036	13.1	507	1 142	59.9
1995	473 000	10 518	12.2	537	1 136	61.2
1996	484 772	10 781	15.7	539	1 111	59.1
1997	479 698	10 669	15.8	532	1 109	81.1
1998	484 449	10 554	15.9	525	1 084	102.0
1999	490 493	10 644	15.9	530	1 081	54.8
2000	482 333	10 504	17.2	518	1 074	60.0
2001	448 176	9 945	21.2	472	1 054	51.0
2002	464 028	10 336	23.3	486	1 048	68.8
2003	510 887	11 278	26.6	526	1 030	47.3
2004	510 024	10 253	27.1	468	917	56.4
2005	478 427	10 795	25.7	503	1 051	93.9

4.3.1.3 Source specific QA/QC

Emission factor is consistent with emission factor used in fuel combustion. Natural gas input from energy balance is checked for plausibility with ammonia production figures.

4.3.1.4 Uncertainty assessment

As activity data are obtained from the only ammonia plant in Austria and from the national energy balance, uncertainty is rated as very low (2%). Also the emission factor and other conversion factors are considered to have low uncertainties. Thus, the quality of emission estimates is rated as "high" (5% uncertainty).

4.3.1.5 Recalculations

During the in-country review of the initial report of Austria (February 2007) it was found that there was a double counting concerning CO_2 emissions from ammonia. The double counting was corrected in this submission (see chapter 4.3.1.2 for the methodology) and CO_2 emissions have been recalculated for the whole time-series

Table 101: Recalculation difference for CO_2 emissions from Ammonia production with respect to submission 2006

	Recalculation difference [Gg]
1990	-0.74
1991	-0.77
1992	-0.69
1993	-0.79
1994	-0.90
1995	-0.98
1996	-0.91
1997	-0.99
1998	-0.99
1999	-0.82
2000	-0.80
2001	-0.78
2002	-0.95
2003	-0.75
2004	-0.76

4.3.2 Nitric Acid Production (2 B 2)

4.3.2.1 Source Category Description

Emission: N_2O, CO_2

Key Source: Yes (N_2O)

N_2O emissions from nitric acid production is a key source due to the contribution to the level of total emissions of the Austrian greenhouse gas inventory in the years 1990 to 2003 and to the trend of emissions. In 2005 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 102 presents N_2O and CO_2 emissions from production of nitric acid for the period from 1990 to 2005.

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 1990-2005 following the trend of nitric acid production closely until 1999. Specific emissions decreased since 2000 due to process optimization (also see implied emission factors in Table 102).

4.3.2.2 Methodological Issues

Following the IPCC Guidelines plant specific measurement data was collected.

Activity and emission data of N_2O emissions was obtained directly from the plant operator. Since 1998, emissions are measured continuously. Based on the analysed emission data of 1998 and due to the fact that the production technology has not changed between 1990 and 1998 emission factors per ton of product were calculated for the used technologies (nitric acid is produced at one site in up to five plants with different technologies; some of the plants were closed since 1990, two are still in operation). With these estimates of plant specific emission factors and the production volume of the individual plants the total emission of N_2O per year was calculated.

Activity and emission data of CO_2 emissions from the years 1994 onwards have been reported directly to the *Umweltbundesamt* by the plant operator and thus represent plant specific data. The implied emission factor that was calculated from activity and CO_2 emission data from 1994 was applied to calculate CO_2 emissions of the years 1990 to 1993 as no CO_2 emission data was available for these years.

Table 102: Activity data, emissions and implied emission factors for N_2O and CO_2 emissions from Nitric Acid Production 1990-2005

Year	Nitric Acid Produced [t]	N_2O Emissions [Mg]	CO_2 Emissions [Gg]	IEF N_2O [kg/t]	IEF CO_2 [kg/t]
1990	529 998	2 942	0.41	5.55	0.78
1991	534 910	2 991	0.42	5.59	0.78
1992	484 731	2 702	0.38	5.57	0.78
1993	513 224	2 835	0.40	5.52	0.78
1994	467 391	2 662	0.36	5.70	0.78
1995	484 016	2 765	0.37	5.71	0.76
1996	495 738	2 820	0.38	5.69	0.76
1997	489 376	2 783	0.36	5.69	0.73
1998	504 977	2 893	0.38	5.73	0.75
1999	512 797	2 979	0.40	5.81	0.78
2000	533 715	3 070	0.37	5.75	0.69
2001	510 800	2 537	0.36	4.97	0.71
2002	522 410	2 604	0.37	4.98	0.70
2003	558 226	2 850	0.41	5.10	0.73
2004	572 719	906	0.41	1.58	0.71
2005	557 870	884	0.41	1.59	0.74

4.3.2.3 Source specific QA/QC

Measurements are done by accredited testing body with internationally recognized standard methods. Order of magnitude and time-series checks are performed and operator is contacted in case of inconsistencies.

4.3.2.4 Uncertainty assessment

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).

4.3.2.5 Recalculations

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

4.3.3 Calcium Carbide Production (2 B 4)

4.3.3.1 Source Category Description

Emission: CO_2

Key Source: *No*

Calcium carbide is made by heating calcium carbonate and subsequently reducing CaO with carbon – both steps lead to emissions of CO_2.

This source is only a minor source of CO_2 emissions in Austria: in 2005, 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 103: Activity data and emissions for CO_2 emissions from Calcium Carbide Production 1990-2005

Year	Calcium Carbide [t]	CO_2 Emissions [Gg]
1990	28 951	38
1991	27 159	35
1992	31 896	41
1993	25 374	33
1994	19 406	25
1995	20 236	26
1996	25 324	33
1997	25 313	33
1998	27 043	35
1999	25 047	32
2000	37 130	48
2001	36 026	47
2002	31 488	41
2003	32 010	41
2004	27 613	36
2005	27 677	36

4.3.3.3 Recalculations

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

4.3.4 Chemical Industry – Other: Production of Fertilizers and Urea (2 B 5)

4.3.4.1 Source Category Description

Emission: CH_4, CO_2

Key Source: No

This category includes CH_4 and CO_2 emissions from the production of urea and from the production of fertilizers (NPK as well as calcium ammonium nitrate). There is only one producer of urea in Austria, it is also the main producer of fertilizers in Austria.

This source is only a minor source in Austria: in 2005, 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 the trend of fertilizer production. They first decreased, reaching a minimum in 1997 and since then increased again. In 2005 emissions from this category are 41% lower than in 1990 (see Table 104).

4.3.4.2 Methodological Issues

No IPCC methodology is available for these sources.

Data for urea production were directly reported by the Austrian producer of urea and thus represent plant-specific data. Urea is a downstream manufacturing process of ammonia production. The input gases for urea production are NH_3 and CO_2; the latter is also formed in the ammonia production. In urea production CO_2 is emitted at start-ups of the process and emissions are calculated by the number and duration of start-ups. Ammonia always contains a small amount of non-reacted CH_4 that is released when NH_3 reacts to urea. CH_4 emissions are calculated from the ammonia input and its methane content.

CH_4 emissions from the production of urea were reported for the years 2002-2005. For the years before no data is available; therefore the implied emission factor for the year 2002 was used for all years. CO_2 emissions are reported by the operator since 1995. The IEF from this year was applied to calculate emissions from the previous years.

Data for fertilizer production for 1990 to 1994 were taken from national statistics (STATISTIK AUSTRIA), for 1995 to 2004 production data were reported directly by the main producer of fertilizers in Austria.

Emission data for CO_2 emissions from the production of fertilizers for 1994 to 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 were reported for the years 2002-2005; these data became available due to a measurement programme for CH_4 at the plant starting in 2002. For the years before no data is available; therefore the implied emission factor for the year 2002 was used for all years.

Table 104 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 2005.

Table 104: Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from NPK-fertilizer Production and Urea Production 1990-2005

Year	Urea Production			Fertilizer Production			
	Urea Production [t]	CO_2 [Gg]	CH_4 [Mg]	Fertilizer Production [t]	CO_2 [Gg]	IEF CO_2 [kg/t]	CH_4 [Mg]
1990	282 000	0.27	108.4	1 388 621	30.26	21.79	183.5
1991	295 000	0.29	113.4	1 273 467	27.75	21.79	168.3
1992	259 000	0.25	99.5	1 182 595	37.75	31.92	156.3
1993	305 000	0.30	117.2	1 250 804	33.53	26.81	165.3
1994	360 000	0.35	138.3	1 222 578	22.27	18.22	161.6

Year	Urea Production			Fertilizer Production			
	Urea Production [t]	CO_2 [Gg]	CH_4 [Mg]	Fertilizer Production [t]	CO_2 [Gg]	IEF CO_2 [kg/t]	CH_4 [Mg]
1995	393 000	0.40	151.0	916 265	19.55	21.34	121.1
1996	417 705	0.30	160.5	940 313	18.07	19.22	124.3
1997	392 017	0.35	150.6	924 856	17.22	18.62	122.2
1998	395 288	0.29	151.9	977 212	18.68	19.12	129.2
1999	408 386	0.24	156.9	988 662	19.65	19.88	130.7
2000	390 185	0.22	149.9	1 022 983	20.59	20.13	135.2
2001	367 218	0.26	141.1	959 698	19.75	20.58	126.9
2002	389 574	0.35	149.7	1 013 767	23.61	23.29	134.0
2003	447 450	0.18	163.0	1 073 940	24.07	22.41	134.0
2004	442 252	0.14	165.8	1 090 069	24.03	22.05	126.0
2005	416 407	0.21	155.8	1 043 916	17.84	17.09	148.6

4.3.4.3 Time Series Consistency / Planned improvements

The time series of fertilizer production is not consistent with respect to activity data. Whereas the date obtained from STATISTIK AUSTRIA for the period from 1990 to 1994 cover data for the total production in Austria the data for the period 1995 to 2004 reflect only the production of the largest Austrian producer. It is planned to prepare a consistent time series.

4.3.4.4 Recalculations

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

4.3.5 Chemical Industry – Other: Ethylene Production (2 B 5)

4.3.5.1 Source Category Description

Emission: CH_4

Key Source: No

Ethylene is made by steam cracking of petrochemical feedstocks. This production process leads to fugitive methane emissions.

This source is only a minor source of CH_4 emissions in Austria.

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.

4.3.5.3 Recalculations

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

4.4 Metal Production (CRF Source Category 2 C)

4.4.1 Iron and Steel (2 C 1)

4.4.1.1 Source Category Description

Emissions: CO_2, CH_4

Key Category: *Yes* (CO_2)

In Austria iron and steel production is concentrated mainly at two integrated sites operated by the same company. This company is the only company operating blast furnaces in Austria. Additionally there are some companies operating electric arc furnaces, contributing about 10% to total steel production in Austria.

In this category only process specific CO_2 emissions are reported, emissions due to combustion in iron and steel industry are reported in the energy sector (Category *1 A 2 a*).

Process specific CO_2 emissions result from the use of reducing agent in pig iron production in blast furnaces and steel production in electric arc furnaces (use of electrodes) as well as from steel production (lowering the carbon content of steel compared to pig iron in electric arc furnaces and basic oxygen furnaces respectively).

Also CH_4 emissions from rolling mills and from electric arc furnaces are reported in this category.

CO_2 emissions from iron and steel production is an important key category of the Austrian greenhouse gas inventory because of its contribution to the total inventory level for all years of the inventory (ranking between six to nine) and because of its contribution to the trend.

In the year 2005, CO_2 emissions from production of iron and steel contributed 5.4% 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 2005 was 0.0001%.

Table 105 presents total CO_2 and CH_4 emissions from the production of iron and steel for the period from 1990 to 2005. 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 2005 emissions were 41% above the level of 1990.

Table 105: Total CO_2 and CH_4 emissions from iron and steel 1990–2005

Year	CO_2 [Gg]	CH_4 [Gg CO_2 eq]
1990	3 546	0.047
1991	3 509	0.039
1992	3 075	0.045
1993	3 145	0.051
1994	3 411	0.054
1995	3 921	0.057
1996	3 703	0.050
1997	4 100	0.059
1998	3 900	0.063
1999	3 759	0.061
2000	4 202	0.068
2001	4 159	0.069
2002	4 607	0.068
2003	4 523	0.072
2004	4 446	0.077
2005	4 995	0.079

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[24] 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*).

[24] Process specific emissions considered are CO_2 emissions resulting from the use of reducing agent in pig iron production in blast furnaces and CO_2 emissions from steel production resulting from the lowering of the carbon content of steel compared to pig iron in basic oxygen furnaces as well as CO_2 emissions from limestone use in blast furnaces. The latter is reported under 2.A.3

For 2005 verified CO_2 emissions, reported under the ETS, were taken for the inventory. These data cover CO_2 emissions from pig iron and basic oxygen furnace steel.

CO_2 emissions from blast furnace pig iron production

CO_2 emissions were calculated following closely the IPCC GPG guidelines Tier 2 approach, applying the default emission factor of table 3.6 of the IPCC GPG:

*CO_2 Emissions = Mass of reducing agent * 3.1 t CO_2/ t reducing agent + (Mass of Carbon in the Ore – Mass of Carbon in the Crude Iron) * 44/12*

The mass of reducing agent (coke) was taken from the national energy balance (see Annex 4). According to a national study (HIEBLER et al.) 56.3% of coke used in blast furnaces is actually needed as reducing agent, this part is reported as non-energy use in the national energy balance[25].

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[26] (however, the carbon content of iron oxide is only small). Carbon content of the ore was calculated assuming pure ore, thus the factor used for calculating the mass of carbon in the ore was based on the stochiometric ratio of carbon in $FeCO_3$:

*Mass of Carbon in the Ore = Mass of ore * 12/ 116*

Mass of ore used in pig iron production for the years 1990 to 1995 was taken from national statistics (statistical yearbook of STATISTIK AUSTRIA), the value of 1995 was also used for 1996 and 1997. From 1998 –2002 the mass of ore was directly reported by industry; for 2003 the value of the Steel statistical yearbook 2004 was used (IISI 2004). The value for 2004 was estimated with the pig iron production, multiplied by the mean proportion iron ore/pig iron from the years 2000-2003. The value for 2005 corresponds to the background data (for consistency reasons just carbonatious ore) given in the ETS report.

Mass of carbon in pig iron was calculated by applying the IPCC default value of 4% carbon in crude steel.

Pig iron production data for 1990 and 1995 to 2001 was taken from national statistics (statistical yearbook of STATISTIK AUSTRIA), data for 1991 to 1994 was taken from www.worldsteel.org; for 2002-2005 pig iron production data were directly reported by industry; activity data reported from industry are validated in the time series in comparison with data from National Statistics, with which they are consistent.

For 2005 CO_2 emissions from non-carbonatious ore and other additives were taken into account additionally. This information became available from background data reported under the

[25] 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.

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

ETS. Again it has to be stressed that this additional accounting does not affect total CO_2 emissions, but only improves the accuracy of the split made between process and combustion specific emissions.

Activity data, calculated CO_2 emission data as well as the implied emission factor for CO_2 emissions from pig iron production are presented in Table 106. The trend in IEF values from Pig iron production fluctuates, because CO_2 emissions follow closely the coke input (more than 97% of CO_2 emissions originate from coke input). Coke input (non-energy-use) from the national energy balance shows a different trend to Pig iron production. The reason for this to some extend could be the imperfect separation of total coke input in energy and non-energy use in the national energy balance and the use of other reducing agents that are not directly allocated.

Table 106: Activity data, emissions and implied emission factors for CO_2 emissions from pig iron production 1990–2005

Year	Coke [kt]	Ore [kt]	Pig Iron [kt]	CO_2 [Gg]	IEF CO_2 [t/kt Pig Iron]
1990	872	2 225	3 444	3 043	883
1991	878	2 092	3 442	3 011	875
1992	793	1 629	3 074	2 625	854
1993	815	1 627	3 070	2 693	877
1994	893	1 695	3 320	2 923	880
1995	1 012	2 071	3 888	3 352	862
1996	941	2 071	3 432	3 201	933
1997	1 070	2 071	3 972	3 519	886
1998	1 037	1 810	4 032	3 309	821
1999	1 001	1 734	3 912	3 186	814
2000	1 125	1 879	4 320	3 568	826
2001	1 113	1 875	4 380	3 518	803
2002	1 251	1 925	4 669	3 925	841
2003	1 200	2 119	4 677	3 838	821
2004	1 177	2 100	4 861	3 733	768
2005	1 332	2 038	5 458	4 186	767

CO_2 emissions from basic oxygen furnace steel production

CO_2 emissions from steel production, which corresponds to steel production at the two integrated sites operating basic oxygen furnaces (BOF), were calculated following the IPCC GPG guidelines Tier 2 approach:

*CO_2 Emissions = (Mass of Carbon in the Crude Iron used for Crude Steel – Mass of Carbon in the Crude Steel) * 44/12*

For the years 1990 to 2001 activity data for electric steel production was subtracted from total steel production in Austria taken from national statistics (statistical yearbook of STATISTIK AUSTRIA) to obtain steel production of the two integrated sites operating blast furnaces. For 2002 to 2005 steel production of the two integrated sites operating blast furnaces was directly reported by industry.

The average carbon content of 0.15% for steel was obtained from the operator of the two integrated sites; as mentioned above, the IPCC default value was used for the carbon content of pig iron (4%).

CO_2 and CH_4 emissions from electric arc furnace steel production

Emissions were estimated using a country specific methodology.

CO_2 emissions for the 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 2005 verified CO_2 emissions, reported under the ETS, were taken for the inventory.

For calculating CH_4 emissions an emission factor of 5 g CH_4 /Mg electric steel was applied. An emission factor for VOC emissions from production of steel in Austria was taken from a study published by the Austrian chamber of commerce, section industry (WINDSPERGER & TURI 1997). It was assumed that total VOC emissions are composed of 10% CH_4 and 90% NMVOC (expert judgement *Umweltbundesamt*).

Activity data were obtained from the *Association of Mining and Steel* and thus represent plant specific data.

CH_4 emissions from rolling mills

Emissions were estimated using a country specific methodology.

The emission factor for VOC emissions from rolling mills (1 g VOC/ Mg steel) was reported directly by industry and thus represents plant specific data. It was assumed that VOC emissions are composed of 10% CH_4 and 90% NMVOC (expert judgement *Umweltbundesamt*).

Activity data as used for calculating CO_2 emissions from steel production (see above) was applied.

Table 107 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 107: Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from Steel Production 1990–2005

Year	Steel Production				Electric Steel Production			Total CH_4 [Mg]	Total CO_2 [Gg]
	Steel [kt]	CO_2 [Gg]	IEF CO_2 [t/kt]	CH_4 [Mg]	Electric Steel [kt]	CO_2 [Gg]	CH_4 [Mg]		
1990	3 921	484	123	0.39	370	20	1.85	2.24	503
1991	3 896	483	124	0.39	290	15	1.45	1.84	499
1992	3 592	431	120	0.36	361	19	1.80	2.16	450
1993	3 738	430	115	0.37	411	22	2.05	2.43	451
1994	3 968	465	117	0.40	431	23	2.15	2.55	488
1995	4 538	545	120	0.45	454	24	2.27	2.72	569
1996	4 032	481	119	0.40	396	21	1.98	2.38	502
1997	4 718	557	118	0.47	466	25	2.33	2.80	581
1998	4 801	565	118	0.48	503	27	2.51	2.99	592
1999	4 722	548	116	0.47	486	26	2.43	2.90	573
2000	5 183	605	117	0.52	541	29	2.70	3.22	634

Year	Steel Production				Electric Steel Production			Total CH_4 [Mg]	Total CO_2 [Gg]
	Steel [kt]	CO_2 [Gg]	IEF CO_2 [t/kt]	CH_4 [Mg]	Electric Steel [kt]	CO_2 [Gg]	CH_4 [Mg]		
2001	5 346	613	115	0.53	546	29	2.73	3.26	642
2002	5 647	654	116	0.56	538	28	2.69	3.26	682
2003	5 707	655	115	0.57	568	30	2.84	3.41	685
2004	5 901	680	115	0.59	614	32	3.07	3.66	713
2005	6 408	763	119	0.64	624	45	3.12	3.76	808

4.4.1.3 Source specific QA/QC

Coke input from the energy balance is compared with coke input reported by the operator. Pig iron and steel production figures are compared with international published data (International Iron and Steel Institute) to ensure completeness. For 2005 detailed information on the carbon mass balance applied by the company to calculate total emissions from pig iron and BOF steel were available due to the ETS. Thus it was possible to validate CO_2 emissions with this background data.

4.4.1.4 Uncertainty Assessment

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[27], uncertainty of emission estimates for process emissions from solid raw materials is 5%.

4.4.1.5 Recalculations

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.

Table 108: Recalculation difference of CO_2 emissions from pig iron production 1990–2004

Year	CO_2 emissions [Gg]
1990	0.01
1991	1.09
1992	1.03
1993	0.00

27 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

Year	CO_2 emissions [Gg]
1994	0.00
1995	0.00
1996	0.00
1997	0.00
1998	0.00
1999	0.00
2000	0.00
2001	0.00
2002	0.00
2003	0.00
2004	31.42

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.

According to publications from the *British Geological Survey* (BRITISH GEOLOGICAL SURVEY 2001, 2005, 2006) Austria produce ferro-molybdenum, ferro-vanadium and ferro-nickel. Activity data from 1995 to 2004 were directly taken from these publications. As no data were available for 1990-1994 the value from 1995 was taken for these years. For 2005 the trend 1990-2004 was extrapolated.

The emission factor for ferro-nickel of 1.36 t CO_2 / t product was taken from (SJARDIN 2003) and applied to all ferroalloys as no specific emission factors for ferro-molybdenum and ferro-vanadium were available.

Table 109 presents activity data and CO_2 emissions from ferroalloy production.

Table 109: Activity data and emissions from ferroalloy production 1990–2005

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

Year	Ferroalloy production [kt]	CO_2 emissions [Gg]
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	12.4	16.9
2005	12.0	16.3

4.4.2.3 Recalculations

Activity data for the year 2004 has been updated since the last submission.

4.4.3 Aluminium Production (2 C 3)

4.4.3.1 Source Category Description

Emissions: PFCs and CO_2

Key Source: Yes (PFCs, CO_2)

This category includes emissions of CO_2 and PFCs from aluminium production. Primary aluminium production in Austria was terminated in 1992.

The two PFCs, tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6) are emitted from the process of primary aluminium smelting. They are formed during the phenomenon known as the anode effect (AE).

CO_2 emissions arise from the consumption of the anode in the production process.

This category is a key source for PFC emissions because of the contribution to the total level of greenhouse gas emissions in the years 1990 to 1992; and a key source for both PFC and CO_2 emissions due to its trend.

Table 110 presents PFC and CO_2 emissions from primary aluminium production for the period from 1990 to 1992.

Table 110: PFC emissions from primary aluminium production from 1990 to 1992

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

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

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 Source specific QA/QC

Country specific parameters were compared with international data.

4.4.3.4 Uncertainty Assessment

The uncertainty for the PFC emission factors ("Søderberg" process) 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%.

4.4.3.5 Recalculations

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

4.4.4 SF_6 Used in Aluminium and Magnesium Foundries (2 C 4)

4.4.4.1 Source Category Description

Emissions: SF_6

Key Source: Yes (SF_6)

This category includes emissions of SF_6 from magnesium and aluminium foundries.

This source is a key source because of its contribution to total emissions in the years 1990 to 1997 and to the trend of emissions in the trend assessment.

In the base year (1990), SF_6 emission from aluminium and magnesium foundries contributed 0.3% to the total amount of greenhouse gas emissions in Austria, in the year 2005 no emissions arose from this category (see Table 89).

Table 111 presents SF_6 emissions from magnesium and aluminium foundries for the period from 1990 to 2005.

As can be seen in the table below, SF_6 emissions have been fluctuating during the period, but the overall trend has been decreasing SF_6 emissions; from 1990 to 2000 they decreased by 97%. This decreasing trend is explained by technological advances and the replacement of SF_6 by other substances used for surface protection. For the years 2001 and 2002 the value of 2000 was used due to lack of more up to date data; since 2003 the use of SF_6 in foundries is prohibited in Austria.

Table 111: SF_6 emissions from magnesium and aluminium foundries 1990–2005

Year	SF_6 emissions [Gg]
1990	0.0106
1991	0.0116
1992	0.0106
1993	0.0116
1994	0.0156
1995	0.0185
1996	0.0256
1997	0.0146
1998	0.0069
1999	0.0009
2000	0.0003
2001	0.0003
2002	0.0003
2003	0
2004	0
2005	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.

The amount of Magnesium cast, SF_6 emissions and the implied emission factors are presented in Table 112. For the years 1996-1998 the value from 1995 is reported because the categories in the statistics changed and no activity data for Magnesium cast as reported in the previous years was available.

Table 112: Magnesium cast, SF_6 emissions and IEF 1990–1999

Year	Magnesium cast [t]	SF_6 emissions [t]	IEF SF_6 [kg/t]
1990	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 Source specific QA/QC

The amount of SF_6 used is cross-checked with data from SF_6 suppliers. All IEFs are within the range of the Norsk Hydro survey (0.1 to 11 kg / t Mg) cited in the IPCC GPG (p.3.47).

4.4.4.4 Uncertainty Assessment

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

4.4.4.5 Recalculations

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

4.5 Consumption of Halocarbons and SF_6 (CRF Source Category 2 F)

4.5.1 Source Category Description

This category includes the following emission sources: refrigeration and air conditioning equipment, foam blowing, fire extinguishers, aerosols, solvents semiconductor manufacture, electrical equipment and other sources (noise insulation windows, tyres and research).

There is no production of Halocarbons in Austria.

The year 1990 was chosen as base year for HFC, PFC and SF_6 emissions.

Potential emissions are reported as sums under category *2 F*, for estimates of actual emissions please refer to the respective sub-categories.

Emission Trends

For the source *Consumption of Halocarbons and SF_6* greenhouse gas emissions are more than four times higher in 2005 than in the base year 1990. This was mainly due to strongly increasing emissions from the use of HFCs as substitutes for ozone depleting substance (*ODS Substitutes*).

Potential and actual emissions per substance group is presented in Table 113, emissions by sub sector and gas are presented in Table 114.

Table 113: Potential and actual emissions of IPCC Category 2 F per substance group [Gg CO_2e] 1990-2005

	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	1 932.73	782.41	316.48	86.87	1 030.86	633.19	3 280.08	1 502.47
2003	1 960.33	864.81	380.59	102.54	812.96	593.52	3 153.88	1 560.87
2004	1 917.64	899.62	320.26	114.72	655.98	512.51	2 893.88	1 526.86
2005	1 462.39	911.55	332.79	117.97	473.65	286.77	2 268.83	1 316.29

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 categories see chapter 1.5).

4.5.2 Methodological Issues

A study has been contracted out to determine the consumption data and emissions from 1990-2000 for all uses of FCs (BICHLER et al. 2001). In this study, bottom up data for consumption per sector were compared with top-down data from importers and retailers of FCs as well as with data from the national statistics (import/export statistics).

The study also included projections until 2010, these were used to estimate emissions from 2001-2005 for the subcategories *2 F 1 Refrigeration and Air conditioning equipment*, *2 F 3 Fire Extinguishers* and *2 F 9 Other sources of* SF_6. For the sub-categories *2 F 7 Semiconductor Manufacture* and *2 F 8 Electrical Equipment* data for these years were available due to the Austrian reporting obligation (see below). The sub-category *2 F 2 Foam blowing* was re-evaluated in a new contracted study (OBERNOSTERER et al 2004). Austrian estimates of emissions from the sources *2 F 4 Aerosols* and *2 F 5 Solvents* are based on a European evaluation of emissions from this sector (HARNISCH & SCHWARZ 2003), subsequently disaggregated to provide a top-down Austrian estimate.

Data about consumption of HFC, PFC and SF_6 were determined from the following sources:

- data from national statistics
- data from associations of industry
- direct information from importers and end users

Since 2004 there is also a reporting obligation under the Austrian FC-regulation[28] for users of FCs in the following applications: refrigeration and air-conditioning, foam blowing, semiconductor manufacture, electrical equipment, fire extinguishers and aerosols. Data is either reported electronically with a system set up by the *Umweltbundesamt* or per mail (electronic or letter) to the Ministry for Environment (these reports are then forwarded to the *Umweltbundesamt* to be brought together with data from the electronic system).

The first reporting year is 2003, from this year on the end users of FCs are obliged to report annually about the amounts used and recycled. Theoretically, almost the whole activity data used for inventory preparation is covered by the reporting obligation. However, especially the refrigeration sector is very complex, there are numerous small enterprises, and not all of them are organised in an industry association, they are hard to reach and to inform about the reporting

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

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.

Emissions for all subcategories were estimated using a country specific methodology, emission factors are based on information of experts from the respective industries (except emissions from aerosols and solvents, where IPCC default emission factors are used). For most sources emissions are calculated from annual stocks using emission factors. Additionally emissions can occur during production or disposal of Halocarbons or SF_6 containing products. Annual stocks correspond to the amounts of FCs stored in applications in the year before, minus emissions of the year before, plus consumption of the considered year. Potential emissions correspond to the amounts consumed in the considered year.

The following subchapters present emission factors and data sources used for the respective subcategories.

Table 114: Emissions of IPCC Category 2 F by source 1990-2005

GHG	GWP	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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	5.53
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	53.52
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	206.17
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	0.84
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	44.47
		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**	**590.60**
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	122.46
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	572.83
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	3.80
		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**	**243.20**
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	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	2.07
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	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**	**28.57**
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	50.16	50.38	47.15	43.57
		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**	**50.16**	**50.38**	**47.15**	**43.57**
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	1.42	1.45
		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**	**1.89**
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	0.35
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	5.69
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	7.67
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	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	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	7.07
		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**	**290.60**
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	1.51
		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**	**33.67**	**36.20**
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	3.42
		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**	**81.66**

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 115. Annual stocks refer to total stock in Austria, thus import and export of pre-filled equipment is considered indirectly (but not separately).

Remaining refrigerants in products at decommissioning have been estimated. Until 2005 decommissioning becomes relevant for Commercial Refrigeration, Transport and Mobile Air Conditioning (busses and freight vehicles). The estimates have been made taking into account the life-time of refrigeration and air-conditioning equipment (or vehicles in the case of mobile-air conditioning) and the year in which HFC usage in the respective sub-category began. The assumptions for calculating emissions from disposal were for (1) Commercial refrigeration and Transport: 20% disposal loss factor (IPCC GPG p 3.105) and for (2) Mobile air conditioning: until 2001 75%, from 2002 on 25% disposal loss factor[29]

Generally emissions from disposal can be considered to be low, as cooling devices are recycled in Austria, and the refrigerant is usually recovered[30]. There is production of fridges and freezers in Austria (equipment filled at the production site), however emissions from production have not been estimated and are considered to be minor (as emissions from larger devices that are filled after installation clearly dominate total emissions from this sub-category).

Table 115: 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%

[29] Since 2002 there is a regulation that old vehicles have to be taken back by retailers for recycling/recovering ("Altfahrzeugeverordnung", BGBl. II Nr. 407/2002 idF BGBl. II Nr. 168/2005)

[30] There is a regulation that old cooling devices have to be taken back by retailers for recycling/recovering ("Verordnung über die Rücknahme von Kühlgeräten" BGBl. Nr. 408/1992 idF BGBl. II Nr. 440/2001

Sub-category	Description	Used Refrig-erants	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 are based on a study on HFC used in foam blowing (OBERNOSTERER et al 2004), that was subcontracted by the Umweltbundesamt.

Soft foam

HFC 134a and HFC 152a are used as blowing agents for PU soft foam since 1993 in Austria. The consumption of PU foam cans was estimated using information from the construction industry. An average charge of HFC blowing agent of 85g per can was assumed.

For calculating emissions it is assumed that 50% of the blowing agent is emitted in the first year, and the rest within the following three years. This assumption is based on information from producers.

Hard foam

Emissions were calculated from the total consumption of XPS/PU plates in Austria - about 60% of the XPS/ PU plates are imported. The consumption per capita of XPS/ PU plates in Austria is higher than in all other European countries.

XPS Plates

HFC 134a and HFC 152a are used as blowing agents in XPS hard foam in Austria since 1995 and 2000, respectively. Production data and information about the used blowing agent were obtained from Associations of Industry (construction industry) and from producers.

Based on expert judgement it was assumed that HFC 134a has a market share of 10% (since 2000, before 15%) and HFC 152a of 40% (until 2003 60%). In both cases the blowing agent content in the foam is 6.5%.

For HFC 134a it was assumed that 1.2% per year is emitted through diffusion, for HFC 152a it is assumed that 24.2% per year is emitted through diffusion. These assumptions are based on information from producers.

PU hard foam

HFC 134a, HFC 245fa and HFC 365mfc are used as blowing agents in PU hard foams (Sandwich, foil-clad and tube) in Austria since 2000. Production data and information about the used blowing agent were obtained from producers and literature.

Based on expert judgement it was assumed that HFC 134a has a market share of 25% for Sandwich foam and 10% for foil-clad foam. In both cases the blowing agent content in the foam is 3%. For HFC 245fa and HFC 365mfc a market share of 5% each for tube foam and a blowing agent content of 12% were assumed.

For HFC 134a it was assumed that about 0.4% per year is emitted through diffusion; for HFC 245fa and HFC 365mfc a diffusion factor of 2.3% was assumed.

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, 2003-2005 from producers due to the reporting obligation under the Austrian FC-regulation. Information about HFC use in Novelty Sprays was taken from a European evaluation of emissions from this sector (HARNISCH & SCHWARZ 2003) for the years 1995 and 2001, subsequently disaggregated to provide a top-down Austrian estimate. The other years for HFC use in technical, medical and novelty sprays were estimated using the Austrian GDP as indicator.

Emissions were estimated according to the IPCC Guidelines assuming that 50% are emitted in the first year and the rest in the second year.

4.5.2.5 2 F 5 Solvents

Information about HFC-43-10mee used as Solvent was taken from a European evaluation of emissions from this sector (HARNISCH & SCHWARZ 2003) for the years 2001 and 2002, subsequently disaggregated to provide a top-down Austrian estimate. The other years were estimated using the Austrian GDP as indicator.

Emissions were estimated according to the IPCC Guidelines assuming that 50% are emitted in the first year and the rest in the second year.

4.5.2.6 2 F 7 Semiconductor Manufacture (HFC, PFC, SF_6)

All consumption data and data about actual emissions from semiconductor manufacture are based on direct information from industry. Consumption data is not reported in the CRF as it is treated confidential. The gases and their applications are presented below:

SF_6: Isolation-gas for high-voltage measurement / Process-gas for plasma-etching

CF_4, C_2F_6, C_3F_8, C_4F_{10}: Process-gas for plasma-etching / Cleaning chemical vapor deposition

CHF_3: Process-gas for plasma-etching

Emissions are calculated according to the formula presented below:

Emissions = Consumption(1-emission control technology) * efficiency factor * uptime*

Typical ranges of these parameters are: for emission control technology 0.01 – 0.95, for efficiency factor 0.75-0.95, and for uptime 0.9. The emission control technology applied is high temperature combustion and elution of HF.

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 2003-2005 were obtained from energy suppliers and industrial facilities (as mentioned above, there is a reporting obligation for operators of SF_6 filled equipment since 2004). For the time series information on new equipment per year and the average SF_6 content per equipment type was used; this information was obtained from energy suppliers and experts from industry.

SF_6 emissions were calculated based on the assumption that there are no emissions during first filling on site (furthermore, smaller equipment is already filled during manufacture); based on information from experts from industry, it was thus estimated that emissions during service and leakage are 1% of annual stocks.

4.5.2.8 2 F 9 Other Sources of SF_6

Noise insulating windows

Activity data were estimated based upon information from experts from industry.

The average consumption of SF_6 was calculated by multiplying the area of SF_6 filled insulate glass produced by the average SF_6 consumption per square meter glass (11 litre SF_6/m^2 – 8 litre filling plus 3 litre losses). The calculated volume was multiplied by a density of 6.18 g/litre.

The actual emissions are the sum of emissions during production and leakage, which is estimated to be 1% of the original SF_6 filling. Emissions at disposal are not yet relevant, because the average life time is estimated to be 25 years and the first SF_6 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 Source specific QA/QC

The total consumption of HFC and PFC (potential emissions) since 1990 was checked against import/export statistics to verify the trend. For this comparison only fluorinated (hydro)carbons that are used for production in Austria have been considered as potential emissions. The numbers from the Import/Export statistics are the sum of KN8 29033010 (fluorides) and KN8 29033080A (other fluoride or bromide derivatives of acyclic hydrocarbons). Figure 18 shows that the numbers from the Import/Export statistics agree largely with the total consumption and the trend is definitely verified by this comparison. The deviations that appear as overestimation in potential emissions are explained by the fact that the categories of the statistics are not well defined. Thus it is possible that importers report not always in the above mentioned categories but in other categories that include very generally halogen derivates of acyclic hydrocarbons.

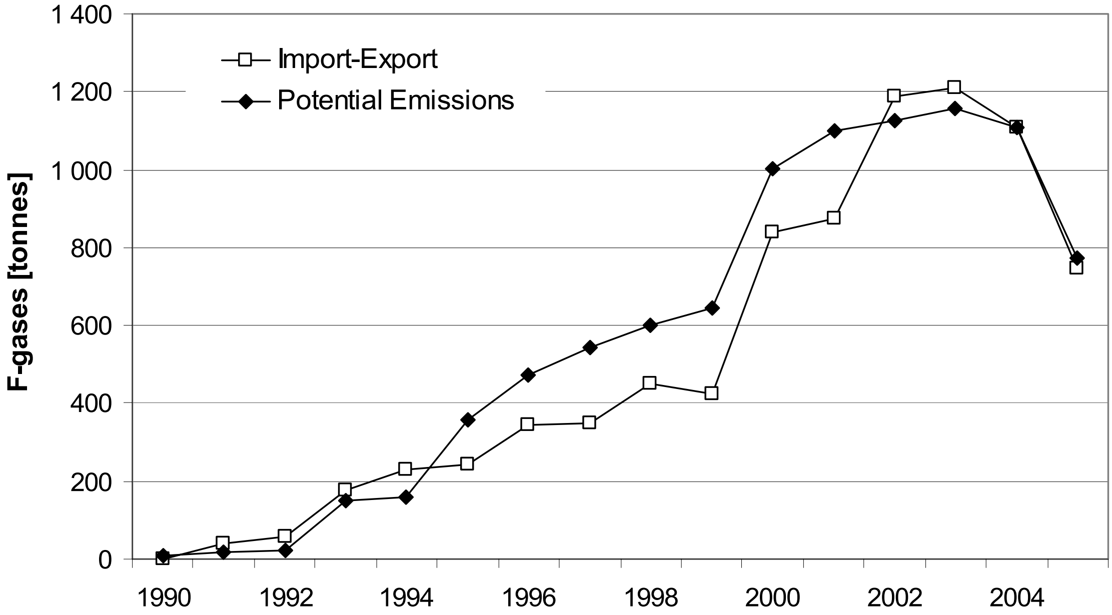

Figure 18: Comparison of potential emissions and Import/Export statistics

4.5.4 Uncertainty estimate

For the key sources an uncertainty estimate was made:

2 F 1/2/3/4/5 ODS Substitute

Activity data uncertainty is estimated to be 20%, as on the one hand total consumption figures are adjusted with import/export statistics but on the other hand the categories of the statistics do not always distinguish between HFCs and HCFCs for example, resulting in a higher uncertainty.

Apart from the uncertainty of the activity data the following uncertainties occur for emissions from this source:

i. the uncertainty of disaggregating total consumption to sub sectors (which has an effect on emissions as the emission factors used for the different sub categories differ significantly). However, the foam blowing sub sector is small, there are only a few producers that have to be considered and information was available from most of them.

ii. the uncertainty of disaggregation from substance groups (eg. from the import/export statistics) into substances (which affects total GHG emissions because the GWPs differ significantly).

iii. the uncertainty of the emission factors.

The uncertainty of the emission factor is considered to be dominating, it is estimated to be 50%; the other uncertainties were considered to be negligible compared to the emission factor uncertainty.

2 F 7 Semiconductor Manufacture

Activity data 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.

4.5.5 Recalculations

HFC emissions from the sub-categories *2 F 4 Aerosols/Metered dose inhalers* and *2 F 5 Solvents* have been recalculated for the years 2002-2004, because of an update of potential emissions.

SF_6 emissions from 2 F 8 Electrical equipment have been recalculated for the year 2004 because of an error correction.

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

Table 116: Recalculation difference of HFC and SF_6 emissions from category 2 F 2002–2004

Year	HFC emissions [Gg CO_2e]	SF6 emissions [Gg CO_2e]
2002	-0.027	0.000
2003	-0.105	0.000
2004	-4.764	0.006

4.5.6 Planned Improvements

As already mentioned above, for the next submission more results from the reporting obligation concerning the use of FCs will be considered as far as possible. Furthermore it is planned to investigate if emissions occur from foam manufacturing/installation (or other ODS substitute applications).

5 SOLVENT AND OTHER PRODUCT USE (CRF SOURCE CATEGORY 3)

5.1 Sector Overview

This chapter describes the methodology used for calculating greenhouse gas emissions from solvent use in Austria. Solvents are chemical compounds, which are used to dissolve substances as paint, glues, ink, rubber, plastic, pesticides or for cleaning purposes (degreasing). After application of these substances or other procedures of solvent use most of the solvents are released into air. Because solvents consist mainly of NMVOC, solvent use is a major source for anthropogenic NMVOC emissions in Austria. Once released into the atmosphere NMVOCs react with reactive molecules (mainly HO-radicals) or high energetic light to finally form CO_2.

Estimations for N_2O emissions from other product use (anaesthesia and aerosol cans) are also addressed in this chapter.

5.1.1 Emission Trends

In the year 2005 this category had a contribution of 0.4% to total greenhouse gas emissions (351 Gg CO_2 equivalents) (not considering CO_2 from LULUCF). There has been a decrease of 32% in greenhouse gas emissions for this source category from 1990 to 2005 (see Figure 19 and Table 117) due to the positive impact of the enforced laws and regulations in Austria:

- Solvent Ordinance: for limitation of emission of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products in order to combat acidification and ground-level ozone

  Federal Law Gazette 398/2005[31]*, amendment of Federal Law Gazette 872/1995*[32]*; amendment of Federal Law Gazette 492/1991*[33] *(implementation of Council Directive 2004/42/CE)*
- Ordinance for paint finishing system (surface technology systems): for limitation of emission of volatile organic compounds due to the use of organic solvents by activities such as surface coating, painting or varnishing of different materials and products along the entire chain in the painting process in order to combat acidification and ground-level ozone

  Federal Law Gazette 873/1995[34]*, amendment of Federal Law Gazette 27/1990*[35]

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[31] Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Begrenzung der Emissionen flüchtiger organischer Verbindungen durch Beschränkung des Inverkehrsetzens und der Verwendung organischer Lösungsmittel in bestimmten Farben und Lacken (Lösungsmittelverordnung 2005 – LMV 2005), BGBl 398/2005; Umsetzung der Richtlinie 2004/42/EG

[32] Verordnung des Bundesministers für Umwelt über Verbote und Beschränkungen von organischen Lösungsmitteln (Lösungsmittelverordnung 1995 – LMVO 1995), BGBl 872/1995

[33] Verordnung des Bundesministers für Umwelt, Jugend und Familie über Verbote und Beschränkungen von organischen Lösungsmitteln (Lösungsmittelverordnung), BGBl 492/1991

[34] Verordnung des Bundesministers für wirtschaftliche Angelegenheiten über die Begrenzung der Emission von luftverunreinigenden Stoffen aus Lackieranlagen in gewerblichen Betriebsanlagen (Lackieranlagen-Verordnung), BGBl 873/1995

[35] Verordnung des Bundesministers für wirtschaftliche Angelegenheiten vom 26. April 1989 über die Begrenzung der Emission von chlorierten organischen Lösemitteln aus CKW-Anlagen in gewerblichen Betriebsanlagen (CKW-

- Federal Ozone Law: establishes by various measures a reduction in emissions of ozone precursors NO_x and NMVOC

  Federal Law Gazette 309/1994; amendment of Federal Law Gazette 210/1992[36]
- Ordinance for industrial facilities and installations applying chlorinated hydrocarbon: for limitation of emission of chlorinated organic solvents from industrial facilities and installations applying chlorinated hydrocarbon

  Federal Law Gazette 865/1994[37]
- Convention on Long-range Transboundary Air Pollution (LRTAP)[38], extended by eight protocols from which the following have relevance
  - The 1988 Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes[39]
  - The 1991 Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes[40]
  - The 1998 Protocol on Persistent Organic Pollutants (POPs)[41]
  - The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone; 21 Parties.[42]
- Ordinance for volatile organic compounds (VOC) due to the use of organic solvents in certain activities and installations;

  Federal Law Gazette 301/2002[43]*, amended by Federal Law Gazette*[44]
- Council Directive 1999/13/EC[45] of March 1999 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations
- Council Directive 2004/42/CE[46] of the European Parliament and of the Council of 21 April

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Anlagen-Verordnung), BGBl 27/1990

[36] Bundesgesetz über Maßnahmen zur Abwehr der Ozonbelastung und die Information der Bevölkerung über hohe Ozonbelastungen, mit dem das Smogalarmgesetz, BGBl. Nr. 38/1989, geändert wird (Ozongesetz)

[37] Verordnung des Bundesministers für wirtschaftliche Angelegenheiten über die Begrenzung der Emission von chlorierten organischen Lösemitteln aus CKW-Anlagen in gewerblichen Betriebsanlagen (CKW-Anlagen-Verordnung 1994), BGBl. 865/1994

[38] Entered into force 14 February 1991; ratified by Austria 16 December 1982;; See for more information UMWELTBUNDESAMT (2006): Informative Inventory report. Vienna.

[39] Entered into force 14 February 1991; ratified by Austria 15 January 1990; BGBl. Nr. 273/1991

[40] Entered into force 29 September 1997; ratified by Austria 23 August 1994; Bekämpfung von Emissionen flüchtiger organischer Verbindungen oder ihres grenzüberschreitenden Flusses samt Anhängen und Erklärung, BGBl 164/1997

[41] Entered into force on 23 October 2003; ratified by Austria 27 August 2002

[42] Entered into force on 17 May 2005; signed by Austria 1 December 2000

[43] Verordnung des Bundesministers für Wirtschaft und Arbeit zur Umsetzung der Richtlinie 1999/13/EG über die Begrenzung der Emissionen bei der Verwendung organischer Lösungsmittel in gewerblichen Betriebsanlagen (VOC-Anlagen-Verordnung – VAV) VOC Anlagen - Verordnung BGBL II 301/2002 - VAV (Umsetzung der der Richtlinie 1999/13/EG

[44] Änderung der VOC-Anlagen-Verordnung – VAV, BGBl 42/2005

[45] Richtlinie 1999/13/EG des Rates vom 11. März 1999 über die Begrenzung von Emissionen flüchtiger organischer Verbindungen, die bei bestimmten Tätigkeiten und in bestimmten Anlagen bei der Verwendung organischer Lösungsmittel entstehen

[46] Richtlinie 2004/42/EG des Europäischen Rates vom 21. April 2004 über die Begrenzung von Emissionen flüchtiger

2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC

- Ordinance on the limitation of emission during the use of solvents containing lightly volatile halogenated hydrocarbons in industrial facilities and installations

  Federal Law Gazette 411/2005[47]

In emission intensive activity areas such as coating, painting, and printing as well as in the pharmaceutical industry several measures were implemented:

- Primary measures
  - complete substitution of certain solvents
  - Reduction of the solvent content by changing the composition of solvent containing products
  - technological change from solvent emitting processes to low or non-solvent emitting processes
  - implementation of resources saving procedures and techniques
  - installation of new equipments and facilities and shutdown of old equipments and facilities
  - avoidance of fugitive emissions
- Secondary measures
  - Waste gas collection and waste gas purification, whereas the solvents in the exhaust air are precipitated and either recycled if applicable or destructed.
  - raising of environmental awareness
  - compliance with emission limit values for exhaust gas
  - compilation of solvent balance
  - compilation of solvent reduction plan

But also the N_2O use has significantly decreased due to shorter duration of anaesthesia during operations and more regional anaesthetics than general anaesthesia.

51% of the emission in Sector *Solvent and Other Product Use* were indirect CO_2 emissions, 49% were accounted for by N_2O emissions.

In Figure 20 and Table 118 the total greenhouse gas emissions are shown by subcategories.

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organischer Verbindungen aufgrund der Verwendung organischer Lösemittel in bestimmten Farben und Lacken und in Produkten der Fahrzeugreparaturlackierung sowie zur Änderung der Richtlinie 1999/13/EG

[47] Verordnung des Bundesministers für Wirtschaft und Arbeit über die Begrenzung der Emissionen bei der Verwendung halogenierter organischer Lösungsmittel in gewerblichen Betriebsanlagen (HKW-Anlagen-Verordnung– HAV) BGBl. 411/2005

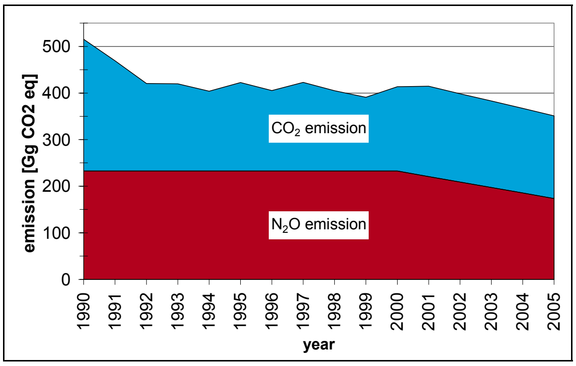

Figure 19: Trend in greenhouse gas emissions of Category 3 Solvent and Other Product Use 1990 – 2005

Table 117: Trend in greenhouse gas emissions of Category 3 Solvent and Other Product Use 1990 – 2005

GHG	CO_2 emission [Gg CO_2 equivalent]	N_2O emission [Gg CO_2 equivalent]	Total [Gg CO_2 equivalent]
1990	232.50	282.67	515.17
1991	232.50	236.77	469.27
1992	232.50	187.74	420.24
1993	232.50	187.35	419.85
1994	232.50	171.54	404.04
1995	232.50	189.88	422.38
1996	232.50	172.81	405.31
1997	232.50	190.09	422.59
1998	232.50	172.24	404.74
1999	232.50	158.37	390.87
2000	232.50	181.02	413.52
2001	220.72	193.60	414.32
2002	208.94	189.63	398.57
2003	197.16	185.66	382.82
2004	185.38	181.69	367.07
2005	173.60	177.40	351.00
Trend 2004 – 2005	*-25%*	*-37%*	*-32%*
Trend 1990 – 2005	*-6%*	*-2%*	*-4%*

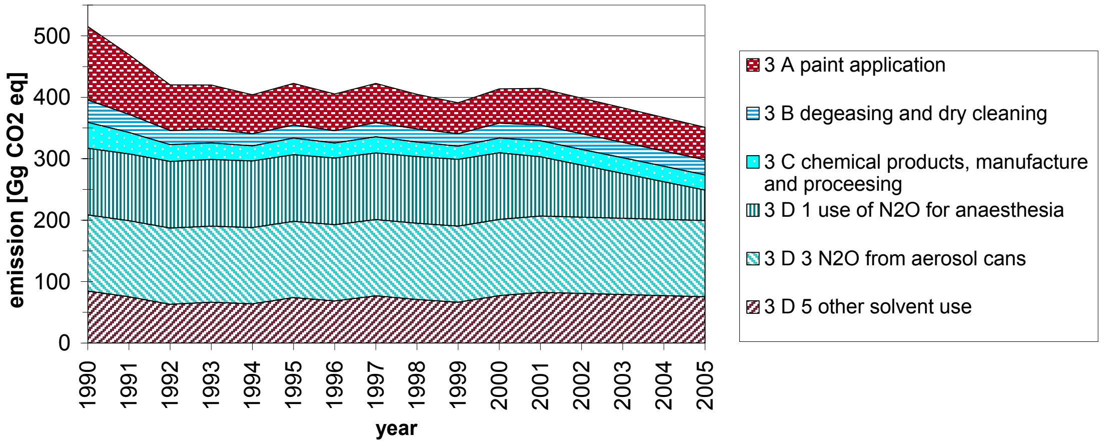

Figure 20: Total greenhouse gas emissions and trend from 1990 – 2005 by subcategories of Category 3 Solvent and Other Product Use

Table 118: Total greenhouse gas emissions and trend from 1990 – 2005 by subcategories of Category 3 Solvent and Other Product Use

GHG	Total	3 A	3 B	3 C	3 D	3 D 1	3 D 3	3 D 5
		Solvent	*Solvent*	*Solvent*		*Use of N_2O*		*Solvent*
	[Gg CO_2 equivalent]							
1990	515.17	119.69	36.11	42.25	317.13	108.50	124.00	84.63
1991	469.27	97.02	29.53	35.02	307.69	108.50	124.00	75.19
1992	420.24	74.37	22.85	27.48	295.54	108.50	124.00	63.04
1993	419.85	71.67	22.23	27.13	298.82	108.50	124.00	66.32
1994	404.04	63.28	19.84	24.58	296.35	108.50	124.00	63.85
1995	422.38	67.46	21.38	26.91	306.62	108.50	124.00	74.12
1996	405.31	59.76	20.15	24.21	301.20	108.50	124.00	68.70
1997	422.59	63.93	22.91	26.31	309.43	108.50	124.00	76.93
1998	404.74	56.29	21.45	23.56	303.45	108.50	124.00	70.95
1999	390.87	50.26	20.34	21.40	298.87	108.50	124.00	66.37
2000	413.52	55.73	23.97	24.16	309.66	108.50	124.00	77.16
2001	414.32	59.60	25.64	25.84	303.24	96.72	124.00	82.52
2002	398.57	57.91	25.38	25.62	289.66	84.94	124.00	80.72
2003	382.82	56.21	25.12	25.41	276.08	73.16	124.00	78.92
2004	367.07	54.52	24.86	25.19	262.50	61.38	124.00	77.12
2005	351.00	52.82	24.60	24.66	248.92	49.60	124.00	75.32
Trend 2004 – 2005	*-4%*	*-3%*	*-1%*	*-2%*	*-5%*	*-19%*	*0%*	*-2%*
Trend 1990 – 2005	*-32%*	*-56%*	*-32%*	*-42%*	*-22%*	*-54%*	*0%*	*-11%*

5.1.2 Key Sources

The key category analysis is presented in Chapter 1.5. This chapter includes information about the key sources in the IPCC Sector *3 Solvents*. CO_2 emissions of this source have been identified as key category.

Table 119: 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

LA05 = Level Assessment 2005

TA = Trend Assessment

5.1.3 Completeness

Table 120 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 120: Overview of subcategories of IPCC Category 3 Solvents and Other Product Use: transformation into SNAP Codes and status of estimation

IPCC Category		SNAP		CO_2	N_2O
3 A	Paint application	0601	Paint application	✓	NA
3 B	Degreasing and Dry Cleaning	0602	Degreasing, dry cleaning and electronics	✓	NA
3 C	Chemical Products, Manufacture and Processing	0603	Chemical products manufacturing and processing	✓	NA
3 D	Other	0604	Other use of solvents and related activities	✓	NA
		0605	Use of HFC, N2O, NH3, PFC and SF6	NA	✓

5.2 CO_2 Emissions from Solvent and Other Product Use (IPCC Sector 3 A, 3 B, 3 C and 3 D 5)

5.2.1 Methodology Overview

CO_2 emissions from solvent use were calculated from NMVOC emissions of this sector. As a first step the quantity of solvents used and the solvent emissions were calculated.

To determine the quantity of solvents used in Austria in the various applications, a bottom up and a top down approach were combined. Figure 21 and Figure 22 present an overview of the methodology.

The top down approach provided total quantities of solvents used in Austria. The share of the solvents used for the different applications and the solvent emission factors have been calculated on the basis of the bottom up approach. By linking the results of bottom up and top down approach, quantities of solvents annually used and solvent emissions for the different applications were obtained.

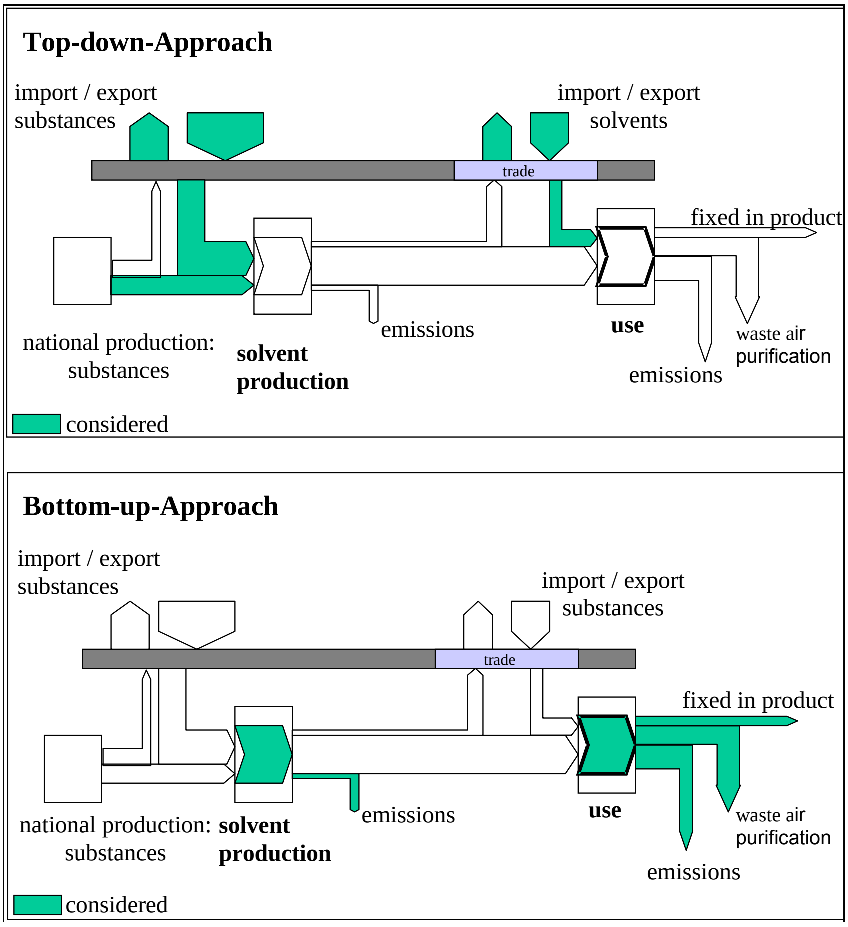

Figure 21: Top-down-Approach compared to Bottom-up-Approach

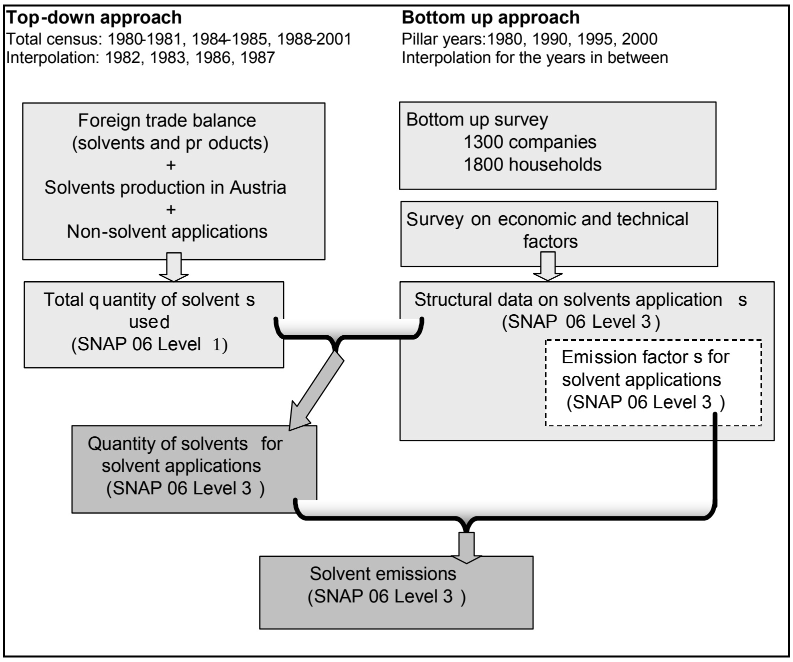

Figure 22: Overview of the methodology for solvent emissions

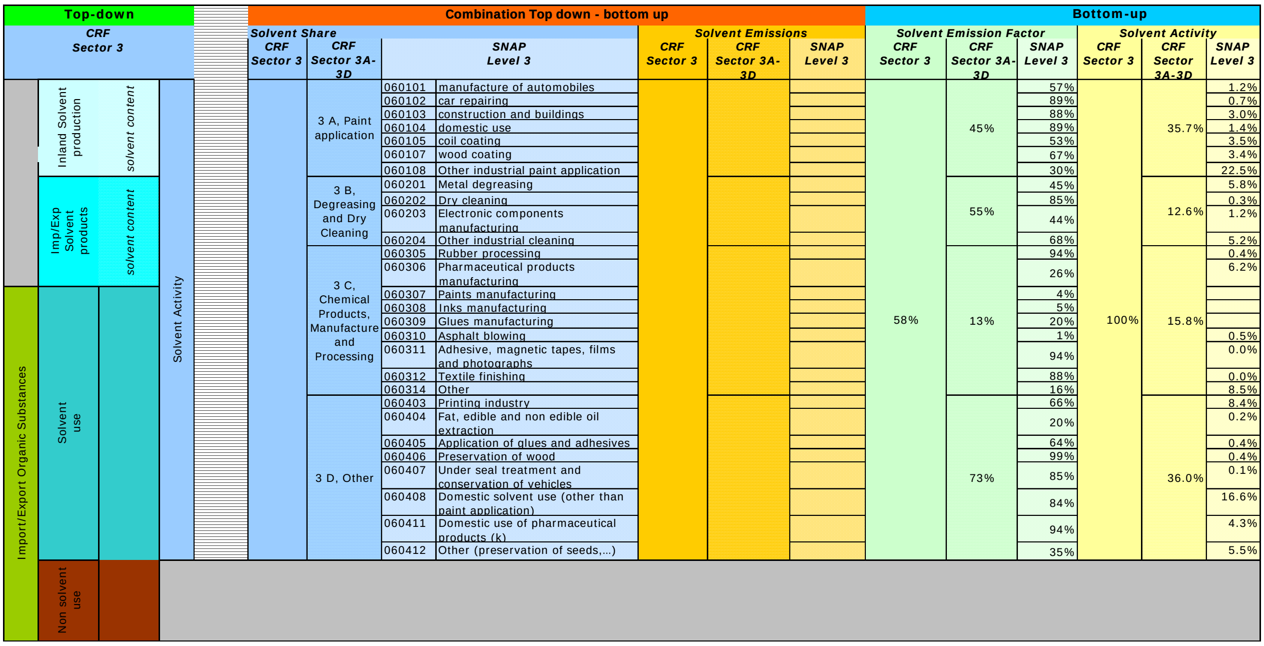

Figure 23: Combination of Top-down-Approach compared to Bottom-up-Approach for 2005

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 121).

Table 121: Emission factors for NMVOC emissions from Solvent Use

Category	Factor
final application	1.00
cleaner	0.85
product preparation	0.05
open application	1.00
waste gas collection	0.50
waste gas treatment	0.20

In a second step a survey in 1 800 households was made (WINDSPERGER et al. 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 122: 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 123: 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%
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%

SNAP category	description	year	Distribution of used paints		Part of waste gas treatment	
			Solvent based paints	*Water based paints*	*application*	*purification*
		1980	100%	0%	0%	0%
060412	Other (pres-ervation of seeds,…)	*2000*	100%	0%	90%	0%
		1995	100%	0%	80%	0%
		1990	100%	0%	10%	0%
		1980	100%	0%	0%	0%

Table 124: 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%
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%

SNAP97		Changes in the number of employees compared to the year 2000			
		1980	1990	1995	2000
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 125). The differences between the quantities of solvents from the top down approach and bottom up approach respectively are lower than 10%. Table 125 shows the range of the differences in the considered pillar years broken down to the 15 substance categories.

Table 125: 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 differDif-ferences [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 126 and Table 127 as well as in Figure 24.

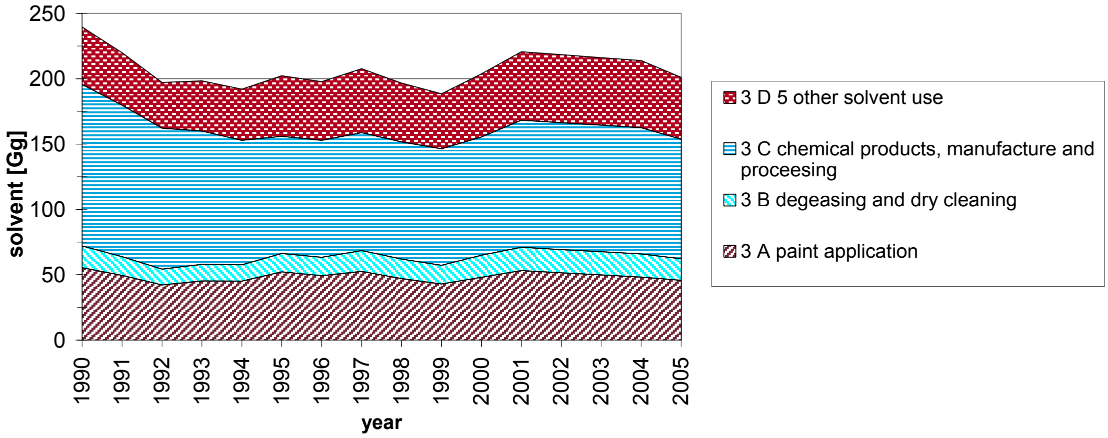

Figure 24: Activity data of Category 3 Solvent and other product use [Gg]

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 2006 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 2005 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 126: Activity data of Category 3 Solvent and other product use [Mg]

IPCC	3 A	3 A	3 A	3 A	3 A	3 A	3 A	3 A	3 B	3 B	3 B	3 B	3 B
SNAP		060101	060102	060103	060104	060105	060107	060108		060201	060202	060203	060204
Unit	Mg Solvent												
1990	**55 450**	1 811	1 009	3 882	4 600	5 706	7 103	31 339	**16 472**	9 391	466	2 540	4 075
1991	**49 437**	1 535	900	3 585	3 607	5 124	6 217	28 469	**14 406**	7 969	413	2 153	3 871
1992	**42 141**	1 240	768	3 162	2 654	4 398	5 200	24 719	**12 041**	6 448	350	1 740	3 503
1993	**45 302**	1 260	827	3 514	2 399	4 761	5 484	27 057	**12 685**	6 560	375	1 767	3 983
1994	**45 124**	1 182	824	3 614	1 938	4 775	5 356	27 435	**12 378**	6 164	371	1 657	4 186
1995	**52 220**	1 283	955	4 315	1 718	5 564	6 075	32 310	**14 027**	6 704	427	1 799	5 097
1996	**49 331**	1 304	905	4 080	1 668	5 186	5 548	30 640	**14 008**	6 635	418	1 697	5 258
1997	**52 586**	1 493	968	4 353	1 829	5 450	5 701	32 792	**15 775**	7 408	461	1 807	6 099
1998	**47 044**	1 432	869	3 897	1 683	4 803	4 902	29 458	**14 902**	6 941	427	1 615	5 919
1999	**42 851**	1 396	794	3 554	1 578	4 305	4 275	26 949	**14 326**	6 622	403	1 469	5 832
2000	**47 985**	1 671	893	3 983	1 820	4 739	4 565	30 314	**16 924**	7 766	468	1 643	7 047
2001	**53 155**	1 732	985	4 408	1 958	5 340	5 303	33 429	**17 770**	8 214	500	1 822	7 234
2002	**51 490**	1 736	978	4 355	1 950	5 346	5 243	31 882	**17 765**	8 148	498	1 823	7 295
2003	**49 825**	1 739	971	4 303	1 942	5 352	5 183	30 334	**17 759**	8 082	495	1 825	7 357
2004	**48 160**	1 743	964	4 250	1 934	5 358	5 123	28 787	**17 754**	8 016	493	1 826	7 418
2005	**45 731**	1 576	903	3 982	1 716	4 469	4 501	28 585	**16 439**	7 323	441	1 549	7 125

IPCC	3 C	3 C	3 C	3 C	3 C	3 C	3 C	3 C	3 C	3 C
SNAP		060305	060306	060307	060308	060309	060310	060311	060312	060314
Unit					Mg Solvent					
1990	**123 768**	991	8 391	59 952	7 173	4 203	1 348	3	159	41 548
1991	**115 918**	864	6 978	54 971	6 930	4 168	1 173	3	133	40 698
1992	**107 979**	720	5 519	49 990	6 687	4 133	975	3	105	39 847
1993	**101 904**	755	5 470	45 010	6 444	4 098	1 022	3	105	38 997
1994	**95 251**	734	4 987	40 029	6 201	4 063	991	3	96	38 147
1995	**89 617**	828	5 237	35 048	5 958	4 028	1 116	4	102	37 296
1996	**89 460**	750	5 619	34 486	5 795	4 126	989	4	89	37 602
1997	**90 263**	764	6 739	33 924	5 632	4 225	980	4	87	37 908
1998	**89 630**	650	6 729	33 362	5 469	4 323	808	4	71	38 214
1999	**89 135**	560	6 797	32 799	5 306	4 421	671	4	57	38 520
2000	**90 444**	589	8 394	32 237	5 143	4 520	674	5	56	38 826
2001	**97 371**	694	8 431	34 878	5 564	4 890	832	5	71	42 006
2002	**97 119**	666	8 432	34 761	5 592	4 864	821	5	70	41 910
2003	**96 866**	638	8 433	34 643	5 619	4 837	809	5	68	41 814
2004	**96 614**	610	8 433	34 526	5 647	4 811	798	5	67	41 718
2005	**91 501**	555	7 915	29 565	6 496	4 531	636	5	53	41 746

IPCC	3 D 5	3 D 5	3 D 5	3 D 5	3 D 5	3 D 5	3 D 5	3 D 5	3 D 5
SNAP		060403	060404	060405	060406	060407	060408	060411	060412
Unit					Mg Solvent				
1990	**43 887**	14 941	541	824	687	221	14 041	5 055	7 577
1991	**40 081**	13 214	464	709	609	199	13 460	4 633	6 793
1992	**34 983**	11 174	380	582	516	172	12 279	4 058	5 822
1993	**38 483**	11 914	392	602	552	187	14 065	4 478	6 293
1994	**39 207**	11 770	374	576	546	188	14 874	4 576	6 303
1995	**46 388**	13 509	413	639	629	221	18 214	5 430	7 333
1996	**44 909**	12 564	369	602	595	203	18 262	5 273	7 041
1997	**49 082**	13 172	370	640	636	211	20 642	5 780	7 631
1998	**45 042**	11 578	309	570	571	183	19 567	5 320	6 944
1999	**42 108**	10 350	261	518	522	162	18 871	4 987	6 437
2000	**48 417**	11 359	267	578	586	175	22 361	5 752	7 339
2001	**52 231**	12 838	323	642	647	201	23 408	6 187	7 985
2002	**51 949**	12 687	322	609	629	194	23 356	6 162	7 990
2003	**51 666**	12 537	321	575	611	187	23 305	6 137	7 995
2004	**51 384**	12 386	319	542	592	180	23 253	6 112	7 999
2005	**47 410**	10 711	252	581	553	177	22 056	5 449	7 631

Table 127: Implied NMVOC emission factors for Solvent Use 1990 – 2005 [kg]

IPCC	**3 A**	**3 A**	**3 A**	**3 A**	**3 A**	**3 A**	**3 A**	**3 B**	**3 B**	**3 B**	**3 B**
SNAP	060101	060102	060103	060104	060105	060107	060108	060201	060202	060203	060204
Unit						kg					
1990	940.36	976.21	920.40	884.57	841.40	937.21	782.41	934.83	950.64	680.31	722.70
1991	880.78	973.33	904.60	885.50	789.62	892.55	700.76	859.83	937.05	642.82	717.64
1992	821.77	970.05	888.68	885.83	738.06	848.08	619.16	784.89	922.86	605.75	712.53
1993	762.70	967.35	872.51	886.62	686.20	803.43	537.53	710.06	906.67	568.19	707.51
1994	703.89	964.81	856.67	887.00	634.55	758.78	455.91	634.98	894.88	531.08	702.34
1995	644.58	961.26	840.56	887.66	582.85	714.07	374.28	560.11	880.56	493.61	697.27
1996	630.37	948.07	848.28	887.89	572.31	705.66	360.18	537.30	873.21	483.21	693.80
1997	616.21	934.92	855.96	887.37	561.47	697.25	346.09	514.71	867.68	472.05	690.28
1998	601.96	921.75	863.74	887.70	550.91	688.70	332.00	492.00	861.83	460.68	686.60
1999	588.11	908.06	871.13	887.83	540.07	680.23	317.90	469.34	856.08	449.97	682.96
2000	573.31	894.74	878.99	887.36	529.44	671.63	303.82	446.69	850.43	438.83	679.44
2001	559.47	882.23	886.57	887.64	518.91	663.21	290.35	425.01	844.00	427.55	675.84
2002	548.82	872.81	873.87	863.68	499.37	647.24	296.43	421.71	824.42	413.62	668.50
2003	538.21	863.26	860.85	839.53	479.88	630.90	303.13	418.35	804.66	399.71	661.29
2004	527.65	853.57	847.52	815.18	460.42	614.18	310.56	414.94	784.71	385.82	654.19
2005	573.31	894.74	878.99	887.36	529.44	671.63	303.82	446.69	850.43	438.83	679.44

IPCC	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**
SNAP	060305	060306	060307	060308	060309	060310	060311	060312	060314
Unit					kg				
1990	985.87	462.52	53.64	50.75	200.10	10.39	1 000.00	886.79	224.37
1991	981.48	420.46	52.63	50.79	200.10	10.23	1 000.00	879.70	219.10
1992	976.39	378.51	51.61	50.70	200.10	10.26	666.67	885.71	213.84
1993	973.51	336.75	50.59	50.74	200.10	9.78	1 000.00	885.71	208.55
1994	968.66	294.77	49.56	50.80	200.10	10.09	1 000.00	885.42	203.29
1995	963.77	252.82	48.56	50.69	200.10	9.86	750.00	882.35	198.01
1996	958.67	253.96	45.93	50.73	199.95	10.11	750.00	887.64	190.57
1997	952.88	254.93	43.30	50.78	200.00	10.20	1 000.00	885.06	183.13
1998	946.15	255.91	40.70	50.65	200.09	9.90	1 000.00	873.24	175.67
1999	941.07	256.88	38.08	50.70	199.95	10.43	1 000.00	894.74	168.20
2000	935.48	257.92	35.46	50.55	200.00	10.39	800.00	892.86	160.74
2001	930.84	258.93	33.03	50.68	200.00	9.62	1 000.00	887.32	153.62
2002	922.74	258.87	32.39	52.51	197.40	9.32	938.59	847.22	153.73
2003	913.93	258.80	31.76	54.31	194.76	9.02	877.19	805.56	153.85
2004	904.31	258.74	31.11	56.10	192.10	8.71	815.78	762.27	153.96
2005	935.48	257.92	35.46	50.55	200.00	10.39	800.00	892.86	153.62

IPCC	3 D 5	3 D 5	3 D 5	3 D 5	3 D 5	3 D 5	3 D 5	3 D 5
SNAP	060403	060404	060405	060406	060407	060408	060411	060412
Unit				kg				
1990	859.05	192.24	860.44	989.81	846.15	838.54	940.85	916.72
1991	824.81	193.97	826.52	990.15	849.25	838.93	940.86	818.93
1992	790.50	194.74	792.10	990.31	848.84	839.32	940.86	721.40
1993	756.17	196.43	759.14	990.94	850.27	839.67	940.82	623.71
1994	721.92	197.86	723.96	990.84	851.06	840.06	941.00	525.94
1995	687.54	200.97	690.14	990.46	850.68	840.40	940.88	428.34
1996	681.47	200.54	679.40	991.60	852.22	840.65	940.83	411.59
1997	675.37	200.00	668.75	992.14	848.34	840.96	940.83	395.10
1998	669.29	200.65	659.65	991.24	852.46	841.16	940.79	378.46
1999	663.19	199.23	648.65	990.42	845.68	841.40	941.05	361.81
2000	657.10	202.25	638.41	991.47	851.43	841.69	940.72	345.28
2001	651.11	201.24	629.28	992.27	845.77	841.93	940.84	329.37
2002	632.82	191.05	650.27	983.56	851.25	831.55	916.49	329.32
2003	614.09	180.79	673.69	974.34	857.13	821.13	891.93	329.28
2004	594.91	170.45	700.00	964.54	863.47	810.65	867.17	329.24
2005	657.10	202.25	638.41	991.47	851.43	841.69	940.72	345.28

5.2.5 Calculation of CO_2 emissions from Solvent Emissions

The basis for the calculation of the carbon dioxide emissions were the quantities of solvent emissions differentiated by the 15 groups of substances (acetone, methanol, propanol, solvent naphtha, paraffins, alcohols, glycols, ester, aromates, ketones, aldehydes, amines, organic acids, cyclic hydrocarbons, and others). Substance specific carbon dioxide factors for these 15 substance groups have been created (see Table 128) on the basis of the carbon content and the stoichiometrically formed CO_2.

Table 128: Substance specific carbon dioxide emission factors

Substances	CO_2 factor [kg CO_2/kg substance]	Substances	CO_2 factor [kg CO_2/kg substance]
Acetone	2.28	Glycols	1.82
Aldehydes	2.44	Ketones	2.45
Alcohols	1.91	Methanol	1.38
Alcohols / Propanols	2.20	Paraffins	3.14
Aromates	3.33	Residuals	0.92
Cydic Hydrocarbons	3.14	Solvent naphta	3.14
Ester	2.16	Glycols	1.82

The amount of carbon dioxide emissions was disaggregated to SNAP level 3 according to the share of solvents used and solvent emissions respectively, that were calculated in the context of the bottom up approach. In Figure 25 and Table 129 the carbon dioxide emissions of Category 3 Solvent and Other Product Use for the years 1990 to 2005 are shown.

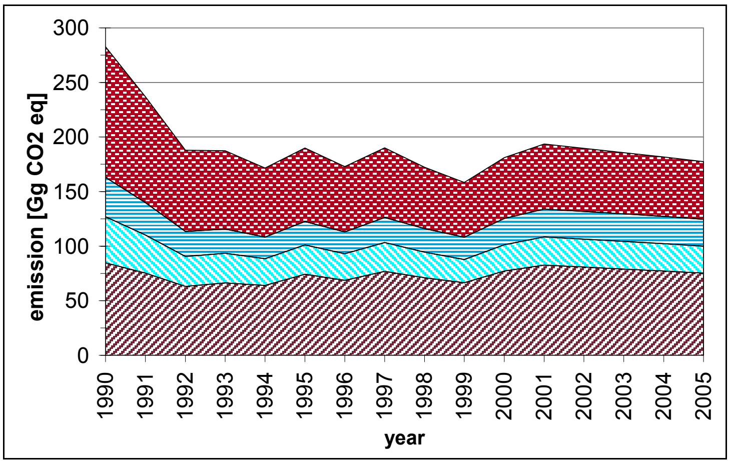

Figure 25: Carbon dioxide emission of Category 3 Solvent and Other Product Use 1990 – 2005

Table 129: Carbon dioxide emission of Category 3 Solvent and Other Product Use 1990 – 2005 [Gg]

IPCC	3 A	3 A	3 A	3 A	3 A	3 A	3 A	3 A	3 B	3 B	3 B	3 B	3 B
SNAP		060101	060102	060103	060104	060105	060107	060108		060201	060202	060203	060204
Unit	Gg $CO_{2\ equivalent}$												
1990	**119.69**	4.75	2.60	13.65	17.79	59.89	36.11	23.28	0.51	4.33	7.99	119.69	4.75
1991	**97.02**	3.72	2.33	11.35	14.71	47.34	29.53	17.99	0.49	3.38	7.67	97.02	3.72
1992	**74.37**	2.75	1.97	8.93	11.51	35.31	22.85	13.07	0.44	2.49	6.85	74.37	2.75
1993	**71.67**	2.55	2.08	8.85	11.34	33.00	22.23	11.85	0.48	2.30	7.60	71.67	2.55
1994	**63.28**	2.15	2.02	8.04	10.24	28.18	19.84	9.76	0.49	1.93	7.67	63.28	2.15
1995	**67.46**	2.18	2.36	8.83	11.18	28.93	21.38	9.59	0.59	1.94	9.26	67.46	2.18
1996	**59.76**	2.08	2.11	7.76	9.67	25.27	20.15	8.71	0.56	1.71	9.17	59.76	2.08
1997	**63.93**	2.38	2.29	8.22	10.07	26.64	22.91	9.56	0.64	1.81	10.90	63.93	2.38
1998	**56.29**	2.25	2.05	7.17	8.62	23.09	21.45	8.64	0.61	1.59	10.61	56.29	2.25
1999	**50.26**	2.15	1.85	6.33	7.46	20.27	20.34	7.93	0.58	1.41	10.43	50.26	2.15
2000	**55.73**	2.55	2.09	6.95	7.99	22.06	23.97	9.04	0.69	1.55	12.70	55.73	2.55
2001	**59.60**	2.73	2.23	7.43	8.55	23.59	25.64	9.67	0.74	1.65	13.58	59.60	2.73
2002	**57.91**	2.68	2.19	7.16	8.25	22.97	25.38	9.51	0.72	1.60	13.55	57.91	2.68
2003	**56.21**	2.64	2.15	6.89	7.95	22.35	25.12	9.36	0.70	1.55	13.51	56.21	2.64
2004	**54.52**	2.59	2.11	6.61	7.65	21.73	24.86	9.21	0.68	1.49	13.48	54.52	2.59
2005	**52.82**	2.54	2.07	6.34	7.35	21.11	24.60	9.06	0.66	1.44	13.45	52.82	2.54

IPCC	3 C	3 C	3 C	3 C	3 C	3 C	3 C	3 C	3 C	3 C
SNAP		060305	060306	060307	060308	060309	060310	060311	060312	060314
Unit	Gg $CO_{2\ equivalent}$									
1990	**42.25**	2.87	8.35	8.94	0.65	2.26	0.05	0.01	0.34	18.79
1991	**35.02**	2.50	6.30	7.15	0.57	2.05	0.04	0.01	0.28	16.15
1992	**27.48**	2.06	4.44	5.39	0.47	1.75	0.03	0.01	0.22	13.13
1993	**27.13**	2.13	3.88	5.11	0.49	1.86	0.03	0.01	0.22	13.42
1994	**24.58**	2.02	3.04	4.42	0.46	1.82	0.03	0.01	0.20	12.58
1995	**26.91**	2.31	2.81	4.62	0.53	2.14	0.04	0.01	0.22	14.25
1996	**24.21**	1.99	2.92	3.95	0.48	2.02	0.03	0.01	0.18	12.63

IPCC	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**	**3 C**
SNAP		060305	060306	060307	060308	060309	060310	060311	060312	060314
Unit	Gg $CO_{2\ equivalent}$									
1997	**26.31**	2.07	3.61	4.07	0.51	2.30	0.03	0.01	0.18	13.52
1998	**23.56**	1.77	3.64	3.43	0.46	2.16	0.03	0.01	0.15	11.92
1999	**21.40**	1.53	3.68	2.92	0.41	2.05	0.02	0.01	0.12	10.65
2000	**24.16**	1.63	4.59	3.08	0.46	2.43	0.02	0.01	0.12	11.82
2001	**25.84**	1.74	4.91	3.29	0.50	2.59	0.02	0.01	0.13	12.64
2002	**25.62**	1.66	4.90	3.22	0.52	2.55	0.02	0.01	0.12	12.62
2003	**25.41**	1.57	4.90	3.14	0.54	2.50	0.02	0.01	0.11	12.60
2004	**96 614**	610	8 433	34 526	5 647	4 811	798	5	67	41 718
2005	**91 501**	555	7 915	29 565	6 496	4 531	636	5	53	41 746

IPCC	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**
SNAP		060403	060404	060405	060406	060407	060408	060411	060412
Unit	Gg $CO_{2\ equivalent}$								
1990	**84.63**	29.68	0.34	2.17	1.86	0.42	26.36	10.89	12.91
1991	**75.19**	24.91	0.30	1.76	1.66	0.39	25.92	10.17	10.08
1992	**63.04**	19.80	0.24	1.36	1.39	0.34	23.59	8.90	7.42
1993	**66.32**	19.80	0.25	1.32	1.47	0.37	26.57	9.72	6.82
1994	**63.85**	18.17	0.24	1.17	1.41	0.36	27.11	9.66	5.72
1995	**74.12**	20.16	0.27	1.26	1.64	0.43	33.08	11.53	5.75
1996	**68.70**	17.72	0.23	1.12	1.49	0.38	31.84	10.76	5.16
1997	**76.93**	18.80	0.24	1.20	1.64	0.41	36.92	12.12	5.60
1998	**70.95**	16.41	0.20	1.06	1.48	0.36	35.18	11.25	5.00
1999	**66.37**	14.52	0.17	0.95	1.36	0.32	33.93	10.58	4.54
2000	**77.16**	15.94	0.18	1.06	1.55	0.36	40.60	12.37	5.11
2001	**82.52**	17.04	0.19	1.14	1.66	0.38	43.42	13.23	5.46
2002	**80.72**	16.37	0.18	1.11	1.60	0.37	42.79	12.83	5.47
2003	**78.92**	15.70	0.17	1.09	1.54	0.36	42.16	12.44	5.47
2004	**77.12**	15.02	0.16	1.07	1.48	0.35	41.53	12.04	5.47
2005	**75.32**	14.35	0.15	1.04	1.42	0.34	40.90	11.65	5.47

Table 130: CO_2 Emission factor for Category 3 Solvent and Other Product Use 1990 – 2005 [kg]

IPCC	3 A	3 A	3 A	3 A	3 A	3 A	3 A	3 B	3 B	3 B	3 B
SNAP	060101	060102	060103	060104	060105	060107	060108	060201	060202	060203	060204
Unit						kg					
1990	2 620.10	2 576.81	2 613.60	2 361.52	2 392.74	2 504.72	1 910.97	2 478.65	1 100.86	1 702.76	1 961.47
1991	2 425.41	2 587.78	2 588.28	2 297.48	2 215.26	2 365.93	1 663.00	2 257.50	1 186.44	1 570.83	1 980.37
1992	2 220.16	2 561.20	2 522.45	2 233.23	2 031.15	2 213.65	1 428.29	2 026.99	1 248.57	1 431.61	1 955.18
1993	2 023.02	2 519.95	2 440.81	2 197.58	1 858.43	2 066.92	1 219.76	1 806.40	1 290.67	1 298.81	1 908.86
1994	1 820.64	2 449.03	2 329.55	2 186.79	1 683.77	1 911.69	1 027.01	1 583.06	1 312.67	1 162.95	1 831.10
1995	1 699.92	2 465.97	2 304.75	2 351.57	1 587.35	1 840.16	895.33	1 430.94	1 374.71	1 078.38	1 817.34
1996	1 591.26	2 334.81	2 230.88	2 260.79	1 495.56	1 742.07	824.87	1 312.74	1 337.32	1 005.89	1 743.82
1997	1 595.45	2 365.70	2 312.66	2 324.77	1 508.62	1 766.53	812.45	1 290.36	1 394.79	1 003.87	1 786.85
1998	1 569.83	2 353.28	2 353.86	2 345.22	1 492.82	1 758.26	783.86	1 244.92	1 421.55	982.04	1 792.70
1999	1 540.11	2 332.49	2 386.04	2 354.25	1 471.31	1 744.56	752.01	1 196.92	1 441.69	956.43	1 788.75
2000	1 527.23	2 334.83	2 446.90	2 387.36	1 465.71	1 750.71	727.75	1 163.92	1 474.36	940.35	1 801.90
2001	1 575.64	2 263.96	2 364.79	2 373.34	1 391.01	1 611.73	705.79	1 176.89	1 476.00	906.70	1 877.25
2002	1 545.64	2 239.79	2 330.91	2 309.29	1 338.63	1 572.92	720.58	1 167.76	1 441.76	877.15	1 856.87
2003	1 515.77	2 215.27	2 296.20	2 244.71	1 286.37	1 533.21	736.88	1 158.47	1 407.20	847.65	1 836.83
2004	1 486.02	2 190.41	2 260.62	2 179.59	1 234.22	1 492.57	754.93	1 149.03	1 372.32	818.20	1 817.13
2005	1 614.61	2 296.05	2 344.56	2 372.60	1 419.22	1 632.20	738.55	1 236.94	1 487.24	930.62	1 887.25

IPCC	3 C	3 C	3 C	3 C	3 C	3 C	3 C	3 C	3 C
SNAP	060305	060306	060307	060308	060309	060310	060311	060312	060314
Unit					kg				
1990	2 891.02	994.99	149.19	90.62	537.47	33.38	2 333.33	2 125.79	452.34
1991	2 888.89	902.12	129.98	81.96	490.88	34.10	2 000.00	2 105.26	396.75
1992	2 854.17	804.13	107.82	70.14	422.21	33.85	2 000.00	2 095.24	329.38
1993	2 815.89	708.59	113.42	75.57	454.61	33.27	2 000.00	2 076.19	344.08
1994	2 746.59	610.19	110.49	74.67	447.21	32.29	2 000.00	2 062.50	329.75
1995	2 787.44	536.38	131.76	89.12	530.04	33.15	2 000.00	2 127.45	382.05
1996	2 656.00	519.84	114.54	81.97	489.09	31.34	2 000.00	2 033.71	335.91
1997	2 710.73	536.13	119.89	91.09	544.62	32.65	2 250.00	2 091.95	356.76
1998	2 721.54	540.50	102.90	83.56	499.65	32.18	2 250.00	2 098.59	311.90
1999	2 725.00	541.12	89.15	77.65	464.60	32.79	2 250.00	2 140.35	276.51
2000	2 769.10	546.34	95.48	90.03	536.73	34.12	2 000.00	2 196.43	304.49
2001	2 512.97	581.78	94.39	88.96	530.47	28.85	2 200.00	1 845.07	300.98
2002	2 491.12	581.65	92.57	92.17	523.56	27.96	2 064.90	1 761.67	301.20
2003	2 467.33	581.51	90.75	95.34	516.58	27.06	1 929.81	1 675.06	301.43
2004	2 441.35	581.37	88.91	98.47	509.52	26.13	1 794.71	1 585.04	301.65
2005	2 525.52	579.53	101.32	88.74	530.47	31.16	1 760.00	1 856.58	300.98

IPCC	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**	**3 D 5**
SNAP	060403	060404	060405	060406	060407	060408	060411	060412
Unit				kg				
1990	1 986.35	635.86	2 627.43	2 710.33	1 891.40	1 877.57	2 153.91	1 703.84
1991	1 885.35	642.24	2 488.01	2 722.50	1 949.75	1 925.33	2 195.77	1 484.32
1992	1 771.79	642.11	2 336.77	2 697.67	1 965.12	1 921.08	2 193.45	1 273.96
1993	1 661.99	642.86	2 189.37	2 657.61	1 962.57	1 889.37	2 169.50	1 084.38
1994	1 543.84	636.36	2 034.72	2 589.74	1 930.85	1 822.58	2 110.58	907.50
1995	1 492.12	656.17	1 968.70	2 613.67	1 954.75	1 816.30	2 124.13	783.58
1996	1 410.30	626.02	1 857.14	2 509.24	1 886.70	1 743.35	2 040.39	732.71
1997	1 427.42	640.54	1 876.56	2 578.62	1 938.39	1 788.78	2 097.40	733.59
1998	1 417.52	647.25	1 863.16	2 598.95	1 961.75	1 798.03	2 113.91	720.33
1999	1 402.51	647.51	1 839.77	2 609.20	1 975.31	1 798.16	2 121.52	704.52
2000	1 403.03	662.92	1 837.37	2 651.88	2 028.57	1 815.62	2 150.21	696.14
2001	1 327.62	588.24	1 767.91	2 568.78	1 885.57	1 854.92	2 138.03	684.28
2002	1 290.33	558.46	1 826.86	2 546.24	1 897.78	1 832.05	2 082.68	684.19
2003	1 252.13	528.47	1 892.66	2 522.35	1 910.90	1 809.08	2 026.88	684.10
2004	1 213.01	498.25	1 966.58	2 497.00	1 925.03	1 786.00	1 970.62	684.01
2005	1 339.83	591.18	1 793.55	2 566.70	1 898.18	1 854.38	2 137.74	717.34

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 131 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 131: 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 132 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 132: 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 133.

Table 133: 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 (IPCC Sector 3 D 1, 3 D 2 and 3 D 3)

	3 D 1 **Use of N_2O for anaesthesia**	3 D 3 **Use of N_2O in aerosol cans**	3 D 2 **Use of N_2O in fire extinguishers**
GHG key category	no	no	not ocurring
gas	N_2O emission from the use of anaesthesia	N_2O emission from the use of aerosol cans	-
activity	N_2O-consumption of anaesthesia	N_2O -consumption in aerosol cans	N_2O is not flammable, but has oxidising properties. There is no evidence of this gas being used in fire extinguishers in Austria.
	Due to new industry inquiries (ÖIGV 2006) the amount of N_2O used for anaesthesia was updated for the years 2001–2004.	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.	
method	A specific methodology for these activities has not been prepared yet.[48]		-
	100 % of N_2O used for anaesthesia is released into atmosphere	100 % of N_2O used for aerosol cans is released into atmosphere	
emission factor	activity data = emission 1.00 Mg N_2O / Mg product use		-

Table 134: N_2O-consumption of anaesthesia and N_2O-consumption in aerosol cans

	3 D 1	3 D 3
	use of N2O for anaesthesia	**use of N_2O in aerosol cans**
Unit	Mg	
1990	350	400
1991	350	400
1992	350	400
1993	350	400
1994	350	400
1995	350	400
1996	350	400
1997	350	400
1998	350	400
1999	350	400
2000	350	400
2001	312	400

[48] CORINAIR Guidebook 3rd edition

	3 D 1	3 D 3
	use of N2O for anaesthesia	**use of N_2O in aerosol cans**
Unit	Mg	
2002	274	400
2003	236	400
2004	198	400
2005	160	400

5.4 Recalculation for Emissions from Solvent and Other Product Use

The reasons for recalculation are updates of activity data:

3 A, 3 B, 3 C and 3 D 5:

Indirect CO_2 emissions from solvent use have been interpolated between 2001 and 2005; this results in a decrease of indirect CO_2 emissions from solvent use for the years 2002–2004 compared to the previous submission, where emission data were extrapolated from 2002 onwards.

3 D 1: Use of N2O for Anaesthesia:

Due to new industry inquiries the amount of N_2O used for anaesthesia was updated for the years 2001–2004.

The tables below show the recalculation difference of emissions from Sector 3 Solvent and Other Product Use and its subcategories with respect to the previous submission.

Table 135: Recalculation difference with respect to submission 2005

CO_2 Emission		**Absolute difference [Gg]**			**Relative difference [∆%]**	
		2002	**2003**	**2004**	**1990**	**2004**
3	Solvent and Other Product Use	-2.72	-5.44	-8.16	=	-4%
3 A	Paint application	-1.44	-2.88	-4.32	=	-7%
3 B	Degreasing and dry cleaning	0.10	0.19	0.29	=	1%
3 C	Chemical products, manufacture and processing	0.00	0.01	0.01	=	0%
3 D 5	Other solvent use	-1.38	-2.76	-4.13	=	-5%

N_2O Emission		**Absolute difference [Gg]**				**Relative difference [∆%]**	
		2001	**2002**	**2003**	**2004**	**1990**	**2004**
3	Solvent and Other Product Use	-0.04	-0.08	-0.11	-0.15	=	-20%
3 D 1	Use of N2O for anaesthesia	-0.04	-0.08	-0.11	-0.15	=	-43%
3 D 2	N2O from fire extinguishers	NO	NO	NO	NO		
3 D 3	N2O from aerosol cans	=	=	=	=	=	=
3 D 4	Other Use of N2O	NO	NO	NO	NO		

6 AGRICULTURE (CRF SOURCE CATEGORY 4)

6.1 Sector Overview

This chapter gives information about the estimation of greenhouse gas emissions from sector *Agriculture* in correspondence to the data reported under the IPCC Category 4 in the Common Reporting Format.

The following sources exist in Austria: domestic livestock activities with enteric fermentation and manure management, agricultural soils and agricultural residue burning.

Applied methods are in line with the 1996 Revised IPCC Guidelines and are based on following studies commissioned by the Umweltbundesamt: (GEBETSROITHER ET AL. 2002), (AMON ET AL. 2002) and (STREBL ET AL. 2002).

These studies are not published. A detailed description of the applied methods is given in this report.

To give an overview of Austria's agricultural sector some information is provided below (according to the 2003 Farm Structure Survey – full survey) (BMLFUW 2006a):

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 2005 the sector *Agriculture* contributed 8.4% to the total of Austria's greenhouse gas emissions (without LULUCF). The trend of GHG emissions from 1990 to 2005 shows a decrease of 14.3% for this sector (see Figure 26 and Table 137) due to a decrease in activity data.

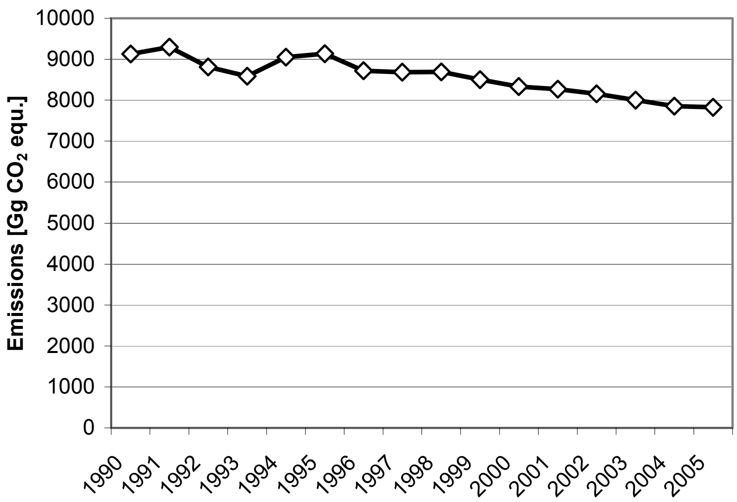

Figure 26: Trend of total GHG emissions from Agriculture

The fluctuations in the time series shown in Figure 26 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 14.6% 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 136.

Table 136: Emissions of greenhouse gases and their trend from 1990-2005 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	12.87
1994	219.12	14.35
1995	220.14	14.55
1996	216.81	13.44
1997	213.78	13.54
1998	212.92	13.61

Year	GHG emissions [Gg]	
	CH_4	N_2O
1999	208.82	13.29
2000	206.62	12.88
2001	204.44	12.82
2002	200.09	12.75
2003	199.20	12.32
2004	198.28	11.91
2005	196.34	11.94
Trend 90-05	*-14.6%*	*-13.8%*

Emission trends per sector

Table 137 presents total GHG emissions and trend 1990-2005 from *Agriculture* by subcategories as well as the contribution to the overall inventory emissions. Important sub- sectors are *4 A Enteric Fermentation* (3.5%) and *4 D Agricultural Soils* (3.0%) followed by *4 B Manure Management* (1.9%).

Table 137: Total GHG emissions and trend 1990-2005 by subcategories of Agriculture

Year	GHG emissions [Gg CO_2 equivalent] by sub categories				
	4	4 A	4 B	4 D	4 F
1990	9 123.86	3 761.65	2 065.40	3 295.07	1.74
1991	9 297.98	3 709.11	2 038.44	3 548.72	1.72
1992	8 813.92	3 547.66	1 985.45	3 279.16	1.65
1993	8 583.93	3 546.56	1 995.68	3 040.06	1.63
1994	9 049.11	3 565.63	1 983.77	3 498.02	1.69
1995	9 134.98	3 594.32	1 996.91	3 542.05	1.71
1996	8 718.22	3 543.71	1 960.11	3 212.71	1.68
1997	8 687.06	3 481.65	1 947.38	3 256.26	1.77
1998	8 690.53	3 453.79	1 955.31	3 279.71	1.72
1999	8 503.84	3 419.53	1 891.11	3 191.43	1.76
2000	8 332.69	3 399.28	1 852.83	3 078.94	1.65
2001	8 268.92	3 349.15	1 849.44	3 068.58	1.74
2002	8 155.34	3 288.46	1 800.89	3 064.25	1.74
2003	8 002.32	3 266.59	1 796.18	2 937.96	1.58
2004	7 855.33	3 274.66	1 765.65	2 812.65	2.38
2005	7 823.37	3 233.02	1 757.45	2 831.31	1.59
Share in Austrian Total 2005	8.4%	3.5%	1.9%	3.0%	0.0%
Trend 1990-2005	-14.3%	-14.1%	-14.9%	14.1%	-8.6%

As can be seen in Figure 27 and Table 137 the trend concerning emissions from all categories is decreasing. The reason for the nearly linear decrease of emissions from categories *4 A En-*

teric 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).

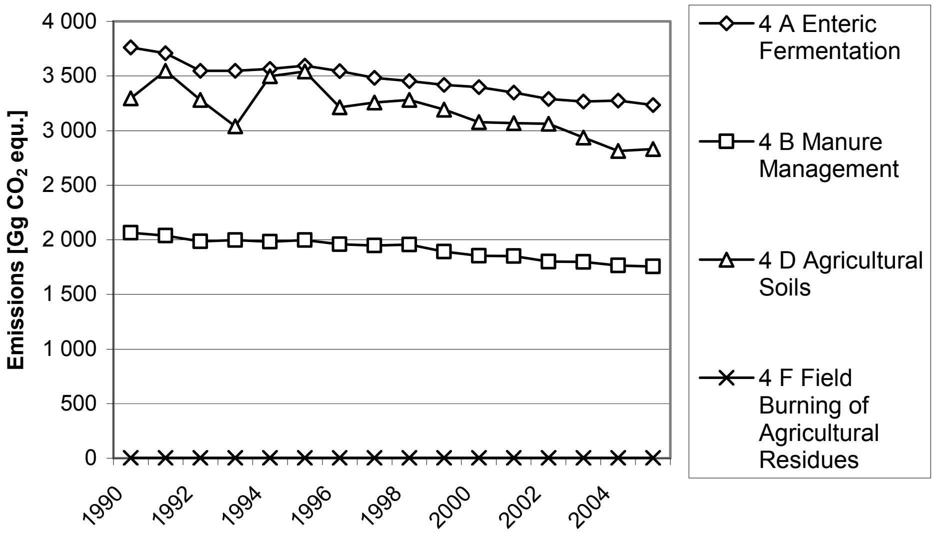

Figure 27: Emission trends of sub- sectors of Agriculture

As can be seen in Table 138, in 2005 about 41% 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 (0.02% in 2005).

Table 138: Total greenhouse gas emissions and share of subcategories of Agriculture, 1990 and 2005

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%
2005	100.0%	41.3%	22.5%	36.2%	0.0%

6.1.2 Key Sources

The key category analysis is presented in Chapter 1.5. This chapter includes information about the key sources in the IPCC Sector *4 Agriculture*. Key sources within this category are presented in Table 139.

Table 139: Key sources of Category 4 Agriculture

IPCC Category	Source Categories	Key Sources	
		GHG	KS-Assessment*
4 A 1	Cattle	CH_4	LA90-LA05, TA
4 B 1	Cattle	N_2O	LA90-LA05, TA
4 B 1	Cattle	CH_4	LA90-LA05, TA
4 B 8	Swine	CH_4	LA90-LA05
4 D 1	Direct Soil Emissions	N_2O	LA90-LA05, TA
4 D 3	Indirect Emissions	N_2O	LA90-LA05, TA

6.1.3 Methodology

For the sub sectors *4 A Enteric Fermentation, 4 B Manure Management* and *4 D Agricultural Soils* IPCC Tier 1 methods and IPCC default emission factors were used, except for key sources of these sub sectors (sub categories *Cattle* of *4 A* as well as *Cattle* and *Swine* of *4 B*) where the more detailed Tier 2 method and country specific emission factors were used.

For the calculation of emissions from category *4 A 9 Poultry* the IPCC Tier 2 method with Swiss emission factors (Gross Energy Intake, Methane Conversion Rate) was used. It is assumed that Swiss conditions are very similar to Austrian conditions.

As recommended in the Centralized Review 2003 for the estimation of emissions from category *4 F Field Burning of Agricultural Wastes* the IPCC methodology using default values was applied.

6.1.4 Quality Assurance and Quality Control (QA/QC)

Data were checked for transcription errors between input data and calculation sheets. Calculations were examined focusing on units/scale and formulas. Quality Control following the GPG is described in the chapters of the sub sectors. A description of the QMS (Quality Management System) is presented in chapter 1.6.

6.1.5 Uncertainty Assessment

Table 140 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 140: 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 179)
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

4 D 1 and 4 D 3 – urea consumption data:

Revised urea application data from 2002 to 2004 have been used. In accordance with the other N mineral fertilizer application data, figures now relate to the economic year of the farmers and not to the calendar year.

4 D 1 and 4 D 3 – sewage sludge application:

2004 data has been updated, which resulted in lower emissions. Emissions from sewage sludge application on agricultural soils have been shifted from source category 4 D 4 Other to 4 D 1 Direct Soil Emissions – 6. Other.

6.1.7 Completeness

Table 141 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 141: 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** **1009**	**MANURE MANAGEMENT REGARDING ORGANIC COMPOUNDS** **MANURE MANAGEMENT REGARDING NITROGEN COMPOUNDS**	✓ **NO**	**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 /08/09	Laying hens, broilers, Other poultry (ducks, gooses,…)	✓	✓
4 B 10	Other Livestock	100515	Deer	✓	✓
4 B 11	Anaerobic		Anaerobic	NO	NO
4 B 12	Liquid Systems		Liquid Systems	IE(3)	✓
4 B 13	Solid Storage		Solid Storage and Dry Lot	IE(3)	✓
4 B 14	Other		Other management / manure without bedding	IE(3)	✓
4 C	**RICE CULTIVATION**	**100103** **100103**	**Rice Field (with fertilizers)** **Rice Field (without fertilizers)**	**NO**	**NO**
4 D	**AGRICULTURAL SOILS**	**1001**	**CULTURES WITH FERTILIZERS** **CULTURES WITHOUT**	**NO**	✓

IPCC Category		SNAP		CH_4	N_2O
		1002	**FERTILIZERS**		
4 D 1	Direct Soil Emissions	1001 / 1002	Cultures with and without fertilizers	NO	✓
4 D 2	Pasture, Range and Paddock Manure	1002	Cultures without fertilizers	NO	✓
4 D 3	Indirect Emissions	1001 / 1002	Cultures with and without fertilizers	NO	✓
4 E	**PRESCRIBED BURNING OF SAVANNAS**	**--**	**--**	**NO**	**NO**
4 F	**FIELD BURNING OF AGRICULTURAL RESIDUES**	**1003**	**ON- FIELD BURNING OF STUBBLE, STRAW, …**	✓	✓
4 F 1	Cereals	100301	Cereals	✓	✓
4 F 2	Pulses	100302	Pulse	NO	NO
4 F 3	Tubers and Roots	100303	Tuber and Root	NO	NO
4 F 4	Sugar Cane	100304	Sugar Cane	NO	NO
4 F 5	Other: Vine	100305 [0907]	Other: Open burning of agricultural wastes (except 1003)	✓	✓

(1) included in 4 A 6 Horses*, SNAP 100406*

(2) included in 4 B 6 Horses*, SNAP 100506*

(3) CH_4 emissions included in 4 B 1 to 4 B 10

6.1.8 Planned Improvements

Planned Improvements are presented in the respective subcategories of this chapter.

6.2 Enteric Fermentation (CRF Source Category 4 A)

This chapter describes the estimation of CH_4 emissions from *Enteric Fermentation*. In 2005 78.4% of agricultural CH_4 emissions arose from this source category.

6.2.1 Source Category Description

CH_4 emissions amounted to 179.1 Gg in the "Kyoto" base year and have decreased by 14.1% to 154.0 Gg in 2005. Almost all emissions of category 4 A (93.7% in 2005) are caused by cattle farming. The contribution of *Dairy Cattle* (4 A 1 a) decreased from 49.3% in 1990 to 39.9% in 2005.

Table 142: Greenhouse gas emissions from Enteric Fermentation by sub categories 1990-2005

Year	CH_4 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	162.83	73.79	78.82	2.82	0.29	1.47	5.15	0.19	0.31
2000	161.87	66.64	85.28	2.71	0.28	1.47	5.02	0.15	0.31
2001	159.48	65.12	84.41	2.56	0.30	1.47	5.16	0.16	0.31
2002	156.59	65.06	81.91	2.43	0.29	1.47	4.96	0.16	0.31
2003	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
2005	153.95	61.48	82.78	2.61	0.28	1.57	4.75	0.17	0.33
Share 2005	100%	39.9%	53.8%	1.7%	0.2%	1.0%	3.1%	0.1%	0.2%
Trend 1990-2005	-14.1%	-30.4%	1.9%	5.1%	47.6%	77.0%	-14.1%	-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 2005) provides national data of annual livestock numbers on a very detailed level. These data are based on livestock counts held in December each year[49]. The inherent uncertainty is estimated to be about 5% (FREIBAUER & KALTSCHMITT 2001).

In Table 143 and Table 144 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 *suckling cows* results in a shift from dairy to suckling cows (numbers of suckling 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.

49 For cattle livestock counts are also held in June, but seasonal changes are very small (between 0% and 2%). Livestock counts of sheep are only held in December (sheep is only a minor source for Austria and seasonal changes of the population are not considered relevant).

1993: For the first time other animals e.g. *deer (but not wild living animals)* were counted. Following the recommendations of the Centralized Review 2004, to ensure consistency and completeness animal number of 1993 was used for the years 1990 to 1992.

1995: The financial support of suckling cow husbandry increased significantly in 1995 when Austria became a Member State of the European Union. The husbandry of suckling cows is used for the production of beef; the milk yield of the cow is only provided for the suckling calves. Especially in mountainous regions with unfavourable farming conditions, suckling cow husbandry allows an extensive and economic reasonable utilisation of the pastures. Suckling cow husbandry contributes to the conservation of the traditional Austrian alpine landscape.

1996-1998: The increase of *dairy cattle* numbers is connected with a decrease of *suckling cows* in this period: Statistik Austria derives the *suckling 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 suckling 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 143: Domestic livestock population and its trend 1990-2005 (I)

Year	Population size [heads] *							
	Livestock Category							
	Dairy	Non Dairy	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
2005	534 417	1 476 263	270 465	628 426	436 303	141 069	325 728	55 100

Year	Population size [heads] * Livestock Category							
	Dairy	Non Dairy	Suckling Cows >2yr	Young Cattle <1yr	Young Cattle 1-2yr	Cattle > 2yr	Sheep	Goats
Trend 90-05	-40.9%	-12.1%	475.2%	-32.1%	-22.2%	-3.6%	5.1%	47.6%

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 144: Domestic livestock population and its trend 1990-2005 (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	2 014 296	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
2005	87 072	3 169 541	1 224 053	315 731	1 629 757	13 027 145	12 354 358	672 787	41 190
Trend	77.0%	-14.1%	-6.5%	-17.4%	-18.4%	-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[50] database (KIRNER & SCHNEEBERGER 1999), which was established to account for the financial support for sustainable agriculture including organic farming. INVEKOS data were used to calculate the share of animals that are subject to organic farming practices. However, INVEKOS data were available only for the years 1997 to 2000, and these data referred only to aggregated livestock categories. Furthermore, the INVEKOS data are not fully compatible with the Statistik Austria data because they rely on different data reporting periods.

The data gaps in the INVEKOS data sets (insufficiently detailed animal categories, lack of data for 1990-1996) were filled through expert judgments and trend extrapolations using surrogate data (e.g. the development of organic farming).

For all major animal categories the average share of organic farming in the 1997-2000 period was calculated from the INVEKOS data. This average share was then allocated to all animal sub-categories, assuming a default ratio between all sub-categories (e.g. assuming that the cattle in organic and conventional farming have the same ratios of dairy cattle, suckling cows, calves etc.).

Table 145 shows the results of the shares of organic farming in the relevant livestock categories for 1997-2000.

Table 145: Share of cattle population under organic farming systems (average 1997-2000, calculations by ARCS, based on INVEKOS data)

IPCC Category	% organic
CATTLE	15%
MATURE DAIRY CATTLE	
Dairy Cattle > 2 yr	15%
MATURE NON DAIRY	
CATTLE	
Suckling Cows > 2 yr	25%
Cattle > 2 yr	20%
YOUNG CATTLE	
Young Cattle < 1 yr	13%
Young Cattle 1-2 yr	12%

For the years 1990-1996, a trend extrapolation using surrogate data was made, namely the number of farms that apply organic farming practices (BMLFUW 2001). These data for expansion development of organic farming in Austria were applied to derive a trend of the animal population numbers in organic farming for the years 1990-1996 where no other relevant data were available. For the years 2001 to 2003 the data for 2000 was used. From 2004 onwards INVEKOS data of organic cattle population as reported in the so called 'Green Reports' of the ministery of agriculture (BMLFUW 2005, 2006a) was used.

50 INVEKOS (Integriertes Verwaltungs- und Kontrollsystem, Integrated Administration and Control System) contains data about the regional distribution, land use, and the number of animals per farm. The INVEKOS is managed by the Federal Ministry of Agriculture, Forestry, Environment and Water Management.

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 2005, emissions from *Enteric Fermentation - Cattle* contributed 3.2% 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 143 and Table 144.

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).

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

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 146: 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 5 783 kg/cow (2005). The time series of average milk yields per dairy cow was taken from national statistics and are presented in Table 147. For dairy cattle there was a 17.8% increase of GE intake between 1990 and 2005 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 147: Annual milk yield, Gross Energy Intake and Emission Factors of Dairy Cattle 1990-2005

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
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
2005	5 783	292	115.0

[1)] *From 1995 onwards data have been revised by Statistik Austria.*

Up to the early 1990ies Austrian dairy husbandry was determined by traditional Austrian green feeding and traditional Austrian races. From the mid 1990ies onwards milk production has been intensified: diets with higher energy concentration were fed and the share of high yield breeds (e.g. Holstein Friesian) in dairy farming was increased.

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

The husbandry of suckling cows is used for the production of beef; the milk yield of the cow is only provided for the suckling calves. As a rule of thumb under the national circumstances in Austria 10 kg milk are needed for 1 kg gain in weight for a calve. A new born calve has around 40 kg and suckles until it weighs about 350 kg.

The study "Mutterkuh und Ochsenhaltung 2003" in which 56 holdings in Styria, Lower Austria, Carinthia and Salzburg were investigated, reports daily rates of weight increases of 1 020g (2002) and 1 060 g (2003). Calves were suckled about 300 days (GRABNER ET AL. 2004). An experiment based on measurements made from 1978 to 1987 (STEINWENDER & GOLD 1989) shows similar results: The daily increase of weight of young bulls was 1 225 g and of young cows 1 044 g.

In an study (STEINWIDDER ET AL. 2006) with Austrian suckling cows (Simmental) the influence of duration of suckling period (6 months and 9 months) on milk yield and body weight of cows and weight gain of calves was determined. Cows were fed with forage of low quality. Anyhow, the milk yield of the 1st lactating suckling cows was on a high level: For the period of 6 month suckling a milk yield of 2 040 kg, for the period of 9 month suckling a milk yield of 3 329 kg per cow has been measured. The daily gains of the beef cattle (Simental x Limousin steers and heifers) were 1.22 and 1.26 kg for the 180 or 270 days of suckling period, respectively. The experiment (2004 to 2008) is still is ongoing.

According to an article in the Swiss agricultural journal UFA-Revue 2005 (HEIM, P. 2005), measurements show that in mother cow husbandry a milk yield of 3 000kg is needed to achieve a daily gain in weight of one kg.

Thus, in the Austrian Greenhouse Gas Emission Inventory for the period from 1990 to 2005 a constant average milk yield of 3 000 kg was applied. This results in a Gross Energy Intake of 235.3 MJ per suckling cow and day (see Table 146).

Other non dairy cattle categories:

Gross Energy Intake for all other cattle categories were calculated from typical Austrian diets. Animal nutrition expert Andreas Steinwidder worked out animal diets as shown in Table 148 and Table 149 (AMON ET AL. 2002).

These livestock categories show distinct differences in organic and conventional diets. Thus, in this section a differentiation between both production systems was worked out. Gross Energy Intake was calculated using the methodology as described in (GRUBER & STEINWIDDER 1996).

Table 148: Typical Austrian diets and gross energy intake of Non-Dairy Cattle, conventional 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

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

		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 1990-2005, 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 1990-2005

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 142, CH_4 emissions from *Sheep, Goats, Horses, Swine, Poultry* and *Other (deer)* are only minor emission sources of category *4 A Enteric Fermentation*. Together they contributed 6.3% to total emissions from this category in 2005. The most important sub source is *Swine*, with a contribution of 3.1%, followed by *Sheep* (1.7%), *Horses* (1.0%), *Other Livestock/ Deer* and *Goats* with each 0.2% and finally *Poultry* with 0.1%. (figures are also presented in Table 142).

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 (MINONZIO 1998), a compilation of scientific literature and research of agricultural CH_4 emissions.

Activity data were obtained from national statistics and are presented in Table 143 and Table 144.

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
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

IPCC Category	Farming Type	Standard deviation (σ) in%
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	NE
SOLIPEDS	Total	5
Horses	Conventional	5
Other Solipeds	Conventional	NE
OTHER ANIMAL	Conventional	NE
Total		**4**

6.2.4 Recalculations

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

6.2.5 Planned Improvements

A comprehensive investigation on Austria's agricultural practice is carried out currently 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 2005 21.4% of the agricultural CH_4 emissions and 23.7% of the agricultural N_2O emissions were caused by this source category.

6.3.1 Source Category Description

From 1990 to 2005 CH_4 emissions from *Manure Management* decreased by 16.9% to 42.0 Gg. This is mainly due a decrease of the livestock categories cattle and swine.

Table 153: CH_4 Emissions from Manure Management 1990-2005

	CH_4 emissions from Manure Management [Gg]								
	Livestock Categories								
	4 B Total	4 B 1 a Dairy	4 B 1 b Non Dairy	4 B 3 Sheep	4 B 4 Goats	4 B 6 Horses	4 B 8 Swine	4 B 9 Poultry	4 B 10 Other/ Deer
1990	50.49	17.60	10.36	0.06	0.00	0.07	21.32	1.08	0.01
1991	49.78	17.07	10.40	0.06	0.00	0.08	21.03	1.12	0.01
1992	49.02	16.42	9.86	0.06	0.00	0.09	21.50	1.07	0.01
1993	49.39	16.19	9.83	0.06	0.01	0.09	22.08	1.13	0.01
1994	48.86	15.89	9.93	0.07	0.01	0.09	21.77	1.11	0.01
1995	48.48	13.91	11.47	0.07	0.01	0.10	21.83	1.09	0.01
1996	47.55	13.76	11.28	0.07	0.01	0.10	21.31	1.01	0.01
1997	47.48	14.23	10.55	0.07	0.01	0.10	21.35	1.15	0.01
1998	47.94	14.43	10.19	0.07	0.01	0.10	22.02	1.12	0.01
1999	45.47	13.85	10.46	0.07	0.01	0.11	19.84	1.13	0.01
2000	44.23	12.38	11.49	0.06	0.01	0.11	19.25	0.92	0.01
2001	44.46	11.98	11.19	0.06	0.01	0.11	20.12	0.98	0.01
2002	43.05	11.86	10.82	0.06	0.01	0.11	19.20	0.98	0.01
2003	43.18	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
2005	41.96	10.88	10.97	0.06	0.01	0.12	18.90	1.02	0.01
Share 2005	100%	25.9%	26.1%	0.1%	0.0%	0.3%	45.0%	2.4%	0.0%
Trend 1990-2005	-16.9%	-38.2%	5.9%	5.1%	47.6%	77.0%	-11.4%	-5.7%	11.0%

From 1990 to 2005 the N_2O emissions from *Manure Management* decreased by 12.8% to 2.8 Gg. Emissions of cattle dominate the trend. The reduction of diary cows is partly counter-balanced by an increase in emissions per animal (because of the increasing gross energy in-take, milk production and N excretion of diary cattle since 1990).

Table 154: N_2O Emissions from Manure Management 1990-2005

	N_2O emissions from Manure Management [Gg] Livestock Categories								
	4 B	4 B 1 a	4 B 1 b	4 B 3	4 B 4	4 B 6	4 B 8	4 B 9	4 B 10
	Total	Dairy	Non Dairy	Sheep	Goats	Horses	Swine	Poultry	Other/ Deer
1990	3.24	1.55	1.38	0.01	0.00	0.00	0.25	0.05	0.00
1991	3.20	1.52	1.37	0.01	0.00	0.00	0.25	0.06	0.00
1992	3.08	1.47	1.30	0.01	0.00	0.00	0.25	0.05	0.00
1993	3.09	1.46	1.31	0.01	0.00	0.00	0.26	0.06	0.00
1994	3.09	1.44	1.33	0.01	0.00	0.00	0.26	0.06	0.00
1995	3.16	1.33	1.50	0.01	0.00	0.00	0.26	0.05	0.00
1996	3.10	1.32	1.47	0.01	0.00	0.00	0.25	0.05	0.00
1997	3.07	1.38	1.36	0.01	0.00	0.00	0.25	0.06	0.00
1998	3.06	1.42	1.32	0.01	0.00	0.00	0.26	0.06	0.00
1999	3.02	1.38	1.34	0.01	0.00	0.00	0.23	0.06	0.00
2000	2.98	1.24	1.45	0.01	0.00	0.00	0.23	0.05	0.00
2001	2.95	1.22	1.44	0.01	0.00	0.00	0.24	0.05	0.00
2002	2.89	1.21	1.40	0.01	0.00	0.00	0.23	0.05	0.00
2003	2.87	1.17	1.41	0.01	0.00	0.00	0.23	0.05	0.00
2004	2.86	1.14	1.44	0.01	0.00	0.00	0.22	0.05	0.00
2005	2.83	1.13	1.41	0.01	0.00	0.00	0.22	0.05	0.00
Share 2005	100%	40.1%	50.0%	0.2%	0.0%	0.0%	7.9%	1.8%	0.0%
Trend 1990-2005	-12.8	-27.1	2.7%	5.1%	47.6%	77.0%	-11.6%	-5.5	11.0%

6.3.2 Methodological Issues

The IPPC-Tier 2 methodology is applied to estimate CH_4 emissions from manure management of cattle and swine as these are key sources. This method requires detailed information on animal characteristics and the manner in which manure is managed. Sheep, goats, horses and other soliped, chicken, other poultry and other animals are of minor importance in Austria, therefore the CH_4 emissions of these livestock categories are estimated with the Tier 1 approach.

For the estimation of N_2O emissions a Tier 1 methodology is used. N_2O emissions are calculated on the basis of N excretion per animal and waste management system.

Data on the distribution of Austria's manure management system were taken from (KONRAD 1995). In this study data on existing Austrian conditions were derived from a research survey carried out on 720 randomly-chosen agricultural enterprises in the years 1989-1992.

Activity data

(STATISTIK AUSTRIA 2005) provides national data of annual livestock numbers on a very detailed level (see Table 143 and Table 144).These data are basis for the estimation.

The animal numbers of *Young Swine* were not taken into account because the emission factors for *Breeding Sows* already includes nursery and growing pigs (SCHECHTNER 1991).

6.3.2.1 Estimation of CH_4 Emissions

CH_4 emissions of cattle and swine are estimated with the Tier 2 approach. This method requires detailed information on animal characteristics and the manner in which manure is managed. The following formula has been used (GPG, Equation 4.17):

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

EF_i = annual emission factor (kg) for animal type i (e.g. dairy cows)
VS_i = Average daily volatile solids excreted (kg) for animal type i
B_{0i} = maximum methane producing capacity (m³ per kg of VS) for manure produced by animal type I
MCF_{jK} = methane conversion factors for each manure management system j by climate region K
$MS\%_{ijK}$ = fraction of animal type i`s manure handled using manure systems j in climate region K

Cattle (4 B 1)

Key Source: Yes (CH_4, N_2O)

B_{0i} Values

IPCC default values were used (Appendix B, IPCC Guidelines, Reference Manual)

MCF Values

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 applied.

According the guidelines, cool climates have an average temperature below 15°C. The average temperature in Austria varies from 8.4°C in Klagenfurt to 10.5°C in Vienna (ZAMG, Jahrbuch 2004).

Manure Management Systems

In Austria national statistics on manure management systems are not available. Up to now, only one comprehensive survey has been carried out (KONRAD, 1995) (Table 155). This manure management system distribution was used for the whole period from 1990-2005.

Table 155: 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]

Livestock category	Liquid/Slurry [%]	Solid Storage [%]	Pasture/range/paddock [%]
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 155). During the summer months, a part of the manure from these livestock categories is managed in "pasture/range/paddock". The value for "pasture/range/paddock" is estimated as follows: During summer, 14.1% of Austrian dairy cows and suckling cows are on alpine pastures 24 hours a day. 43.6% are on pasture for 4 hours a day and 42.3% stay in the housing for the whole year (KONRAD 1995). "Alpine pasture" and "pasture" are counted together as MMS "pasture/range/paddock". As "pasture" only lasts for about 4 hours a day, only 1/6 of the dairy cow pasture-% (43.6%) is added to the total number. This results in 21.3% "pasture/range/paddock" during summer. In winter, "pasture/range/paddock" does not occur in Austria. Summer and winter both last for six months (AMON ET AL 2002).

VS Values

Austrian specific values for dairy cows were calculated in dependency of annual milk yields and corresponding feed intake data (gross energy intake, feed digestibility, ash content, see Table 146 and Table 156). 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 *suckling cows* were recalculated (PÖTSCH 2005 following GRUBER & STEINWIDDER 1996).

Table 156: VS excretion of Austrian dairy cattle (PÖTSCH 2005 following GRUBER & STEINWIDDER 1996)

Milk yield	[kg/yr]	3 000	3 500	4 000	4 500	5 000	5 500	6 000
GE intake	[MJ/day]	235.32	242.55	249.77	259.23	268.68	280.72	292.32
feed digestibility	[%]	65.7	66.0	66.3	67.3	68.2	69.1	70.0
ash content	[%]	11	11	11	11	11	11	11
VS excretion [kg $cow^{-1}day^{-1}$]		3.90	3.98	4.06	4.09	4.12	4.18	4.23

A time series of VS excretion of dairy cattle was calculated by interpolation of these data (see Table 157).

For the calculation of VS excretion of suckling cows for the years 1990-2005 an average milk yield of 3 000 kg was applied (see Table 156). As already mentioned in Chapter 6.2 data is based on several Austrian and Swiss studies (STEINWENDER & GOLD 1989), (GRABNER ET AL. 2004), (STEINWIDDER ET AL. 2006) and (HEIM, P. 2005).

Table 157: VS excretion of Austrian diary cows for the period 1990-2005

Year	Milk Yield [kg/cow*yr]	VS [kg/cow*day]
1990	3 791	4.04
1991	3 862	4.05
1992	3 934	4.05
1993	4 005	4.06
1994	4 076	4.07
1995	4 619[1)]	4.09
1996	4 670	4.10
1997	4 787	4.11
1998	4 924	4.11
1999	5 062	4.12
2000	5 210	4.14
2001	5 394	4.16
2002	5 487	4.18
2003	5 638	4.21
2004	5 802	4.23
2005	5 783	4.23

[1)]From 1995 onwards data have been revised by Statistik Austria.

Austrian specific values on VS excretion for all other cattle categories were calculated from typical Austrian diets under organic and conventional management (according to Andreas Steinwidder, see Table 148).

As no major changes in diets of *Non-Dairy Cattle* occurred in the period from 1990-2005, 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 158 presents data for the calculation of VS excretion of the livestock categories *Non-Dairy Cattle*.

Table 158: 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 159: Manure management distribution in Austria: Swine

Livestock category	Liquid/Slurry [%]	Solid Storage [%]	Pasture/ range/paddock [%]
breeding sows	70[2]	30[2]	---
fattening pigs	71.9[1]	28.1[1]	---

[1]. "Die Rinder-, Schweine- und Legehennenhaltung in Österreich aus ethologischer Sicht" (KONRAD 1995)

[2]..Expert estimation of Dipl.-Ing. Alfred Pöllinger (Federal Research Institute, Gumpenstein)

VS excretion

VS excretion of *Swine* was estimated from country-specific data on VS content in the manure (SCHECHTNER 1991). Changes in animal performance of *Swine* are not reported for Austria. Thus, VS excretion rates of *Swine* were kept constant for the whole time series.

Table 160: VS excretion from Austrian swine, calculated with (SCHECHTNER 1991)

Livestock category	Manure Production given in Schechtner (1991)	Calculated manure production [t head^{-1} yr^{-1}]	VS content in manure [kg (t manure)$^{-1}$]	VS excretion [kg head^{-1} day^{-1}]
breeding sows	4 t sow^{-1}yr^{-1}	4.00	75	0.82
fattening pigs	0.63 t pig^{-1} 120 days^{-1}	1.92	55	0.29

Animal numbers of *Young Swine* were not taken into account because the emission factors for *Breeding Sows* already include nursery and growing pigs (SCHECHTNER 1991).

Sheep (4 B 3), Goats (4 B 4), Horses (4 B 6), Poultry (4 B 9) and Other Livestock/ Deer (4 B 10)

Key Source: No

CH_4 emissions from *Manure Management* for *Sheep, Goats, Horses, Poultry* and *Other Livestock/ Deer* are estimated with the Tier 1 approach.

Default emission factors were taken from the IPCC guidelines (Table 4-5 of the Reference Manual). CH_4 emissions were estimated multiplying these emission factors by national animal numbers.

Table 161: CH_4 emissions from manure management systems for Sheep, Goats, Horses and Other Soliped, Chicken, Other Poultry and Other Livestock/ Deer in Austria

Livestock category	Emission Factor [kg CH_4 per head per yr]	Livestock category	Emission Factor [kg CH_4 per head per yr]
Sheep	0.19	Chicken	0.078
Goats	0.12	Other Poultry[1]	0.078
Horses & other soliped	1.39	Other Livestock/ Deer	0.19

[1]*the IPCC guidelines do not differentiate between laying hens and other poultry. The same emission factor was applied to both livestock categories.*

The Austrian inventory does not distinguish between *Horses* and *Mules and Asses*. As *Mules and Asses* are only of very little importance in Austria, CH_4 emissions from manure of horses and other soliped were estimated with the default emission factors for *Horses*.

In Austria the animal category *Other Animal* corresponds to deer (held in pastures). As sheep is the most similar animal category to deer, emissions from deer were estimated applying the default emission factor of sheep.

6.3.2.2 Estimation of N_2O Emissions

Key Source: 4 B 1

Following the guidelines, all emissions of N_2O taking place before the manure is applied to soils are reported under *Manure Management*.

For the estimation of N_2O emissions from manure management systems only a Tier 1 approach is available. The IPCC Guidelines method for estimating N_2O emissions from manure management entails multiplying the total amount of N excretion (from all animal species/categories) in each type of manure management system by an emission factor for that type of manure management system. Emissions are then summed over all manure management systems (see formulas below).

N excretion per animal waste management system:

$$Nex_{(AWMS)} = \sum_{(T)}[N_{(T)} \times Nex_{(T)} \times AWMS_{(T)}]$$

$Nex_{(AWMS)}$	=	N excretion per animal waste management system [kg yr^{-1}]
$N_{(T)}$	=	number of animals of type T in the country
$Nex_{(T)}$	=	N excretion of animals of type T in the country [kg N $animal^{-1}$ yr^{-1}]
$AWMS_{(T)}$	=	fraction of $Nex_{(T)}$ that is managed in one of the different distinguished animal waste management systems for animals of type T in the country
T	=	type of animal category

N_2O emission per animal waste management system:

$$N_2O_{(AWMS)} = \sum[Nex_{(AWMS)} \times EF_{3(AWMS)}]$$

$N_2O_{(AWMS)}$	=	N_2O emissions from all animal waste management systems in the country [kg N yr^{-1}]
$Nex_{(AWMS)}$	=	N excretion per animal waste management system [kg yr^{-1}]
$EF_{3(AWMS)}$	=	N_2O emissions factor for an AWMS [kg N_2O-N per kg of Nex in AWMS]

AWMS

The animal waste management system distribution data applied to estimate N_2O emissions from *Manure Management* is the same as used for the estimation of CH_4 emissions from *Manure Management* (see Table 155 and Table 159).

N excretion

As recommended in the Centralized Review 2004, Austrian N excretion values were reviewed and recalculated. The revised values consider the typical agricultural practice in Austria. Especially N excretion rates of dairy and suckling cows are higher now (see Table 162):

Table 162: Austria specific N excretion values of dairy cows for the period 1990-2005 and for 1980

Year	Milk yield *[kg yr^{-1}]*	*Nitrogen excretion [kg/animal*yr]*	*Year*	Milk yield *[kg yr^{-1}]*	*Nitrogen excretion [kg/animal*yr]*
1980	3 518	74.16	1998	4 924	86.82
1990	3 791	76.62	1999	5 062	88.06
1991	3 862	77.26	2000	5 210	89.39
1992	3 934	77.90	2001	5 394	91.05
1993	4 005	78.54	2002	5 487	91.88
1994	4 076	79.18	2003	5 638	93.24
1995	4 619[1)]	84.07	2004	5 802	94.72
1996	4 670	84.53	2005	5 783	94.55
1997	4 787	85.58			

1) From 1995 onwards data have been revised by Statistik Austria, which led to significant higher milk yield data of Austrian dairy cows.

N excretion values as shown in Table 162 and Table 163 are based on the following literature: (GRUBER & POETSCH 2005), (PÖTSCH et al. 2005), (STEINWIDDER & GUGGENBERGER 2003), (UNTERARBEITSGRUPPE N-ADHOC 2004) and (ZAR 2004)

According to the requirements of the European nitrate directive, the Austrian N excretion data were recalculated following the guidelines of the European Commission. The revised nitrogen excretion coefficients were calculated based on following input parameters:

Cattle:

Feed rations represent data of practical farms consulting representatives of the working groups "Dairy production". These groups are managed by well-trained advisors. Their members, i.e. farmers, regularly exchange their knowledge and experience. Forage quality is based on field studies, carried out in representative grassland and dairy farm areas. The calculations depend on feeding ration, gain of weight, nitrogen and energy uptake, efficiency, duration of livestock keeping etc.

Sheep and goats: life weight, daily gain of weight, degree of pregnancy or lactating, feeding rations.

Pigs: breeding pigs, piglets, boars, fattening pigs: number and weight of piglets, daily gain of weight, energy content of feeding, energy and nitrogen uptake, N-reduced feeding.

Poultry: feeding ration, duration of keeping, nitrogen uptake, nitrogen efficiency.

Horses: feeding ration per horse category, weight of horses.

Table 163: Austria specific N excretion values of other livestock categories

Livestock category	*Nitrogen excretion* [kg/animal*yr]
suckling cows[1]	69.5
cattle 1 – 2 years	53.6
cattle < 1 year	25.7
cattle > 2 years	68.4
breeding sows	29.1
fattening pigs	10.3
sheep	13.1
goats	12.3
horses	47.9
chicken[2]	0.52
other poultry[3]	1.1
other livestock/ deer[4]	13.1

(1) annual milk yield: 3 000 kg

(2) weighted average of hens and broilers

(3) weighted average of turkeys and other (ducks, gooses)

(4) N-ex value of sheep applied

Livestock numbers per category can be found in Table 143 and Table 144, manure management system distribution for *cattle* and *swine* can be found in Table 155 and Table 159. For the other livestock categories it is presented in the following table (Table 164).

Table 164: 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 165: 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 140.

6.3.4 Recalculations

No recalculations have been done.

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 2005 76.3% of total N_2O emissions from *Agriculture* (54.0% 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 3.0% (2 831.3 Gg CO_2 equivalents) to Austria's total greenhouse gas emissions in the year 2005. This is 36.2% of total GHG emissions of the sector *Agriculture*.

The trend of N_2O emissions from this category is decreasing: in 2005 emissions were 14.1% below 1990 levels.

Table 166 presents N_2O emissions of *Agricultural Soils* by sub-category as well as their trends and their share in total N_2O emissions.

Table 166: N_2O emissions from Category 4 D, 1990-2005

	N_2O emissions [Gg]										
	IPCC Categories										
Year	**4 D** total	**4 D 1** Direct Soil Emissions	Synthetic Fertilisers	Organic Fertiliser	Crop Residue	N-fixing Crops	Sewage Sludge	**4 D 2** Pasture	**4 D 3** Indir. Soil Emissions	Nitrogen Leaching	Athm. Deposition
1990	10.61	5.68	2.62	2.28	0.43	0.33	0.02	0.70	4.22	3.56	0.67
1991	11.43	6.21	3.07	2.27	0.48	0.36	0.02	0.72	4.50	3.84	0.66
1992	10.56	5.74	2.60	2.20	0.46	0.46	0.02	0.70	4.12	3.48	0.63
1993	9.77	5.23	2.05	2.23	0.47	0.45	0.03	0.74	3.81	3.19	0.62
1994	11.26	6.19	2.88	2.22	0.61	0.45	0.03	0.74	4.32	3.69	0.63
1995	11.40	6.22	2.92	2.26	0.69	0.32	0.03	0.77	4.40	3.76	0.64
1996	10.33	5.53	2.42	2.23	0.51	0.34	0.03	0.77	4.04	3.43	0.61
1997	10.47	5.65	2.45	2.23	0.53	0.40	0.03	0.77	4.05	3.45	0.60
1998	10.55	5.74	2.47	2.22	0.58	0.43	0.03	0.75	4.06	3.45	0.61
1999	10.26	5.57	2.35	2.18	0.61	0.39	0.03	0.75	3.94	3.35	0.60
2000	9.90	5.31	2.30	2.12	0.48	0.37	0.03	0.73	3.86	3.26	0.59
2001	9.87	5.32	2.28	2.11	0.54	0.36	0.03	0.72	3.83	3.24	0.59
2002	9.86	5.34	2.34	2.06	0.54	0.38	0.03	0.70	3.81	3.23	0.58
2003	9.45	5.07	2.12	2.07	0.46	0.39	0.03	0.71	3.67	3.11	0.57
2004	9.05	4.85	1.86	2.05	0.51	0.40	0.03	0.71	3.49	2.93	0.56
2005	9.11	4.90	1.90	2.04	0.51	0.42	0.03	0.71	3.50	2.95	0.56
Share 2005	100%	53.8%	20.9%	22.3%	5.6%	4.6%	0.3%	7.8%	38.5%	32.4%	6.1%
Trend 90-05	-14.1%	-13.7%	-27.3%	-10.6%	18.2%	28.1%	12.9%	0.4%	-17.1%	-17.1%	-16.9%

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 0.37 Gg CH_4 2005). This is about 0.2% of total CH_4 from sector *Agriculture*.

Table 167: CH_4 emissions from Category 4 D, 1990-2005

	CH_4 emissions [Gg]	
	IPCC Category	
Year	4 D total	Other direct emissions (sewage sludge)
1990	0.33	0.33
1991	0.33	0.33
1992	0.31	0.31
1993	0.47	0.47
1994	0.40	0.40
1995	0.44	0.44
1996	0.45	0.45
1997	0.45	0.45
1998	0.45	0.45
1999	0.45	0.45
2000	0.45	0.45
2001	0.43	0.43
2002	0.38	0.38
2003	0.41	0.41
2004	0.37	0.37
2005	0.37	0.37
Share 2005	100.0%	100.0%
Trend 90-05	12.9%	12.9%

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 168: N_2O emissions factors for Agricultural Soils

Category	Emission Factor [t N_2O-N / t N]	Source
4 D 1 Direct Soil Emissions		
Synthetic Fertilizers (mineral fert.)	0.0125	IPCC GPG (Table 4.17)
Animal Waste applied to soils		
N- fixing Crops		
Crop Residue		
Sewage Sludge Spreading		

Category	Emission Factor [t N_2O-N / t N]	Source
4 D 2 Pasture, Range and Paddock Manure		
Grazing Animals	0.02/ t N_{exGRAZ}	IPCC Guidelines (Table 4.22)
4 D 3 Indirect Soil Emissions		
Athmospheric Deposition	0.01/ t of volatized nitrogen	IPCC GPG (Table 4.18)
Nitrogen Leaching (and Run- off)	0.0025/ t N- loss by leaching	IPCC GPG (Table 4.18)

For agricultural sewage sludge application on fields also CH_4 emissions were estimated (country specific method).

Activity Data

Data for necessary input parameters (activity data) were taken from the following sources:

Table 169: Data sources for nitrogen input to Agricultural Soils

Category	Data Sources
4 D 1 Direct Soil Emissions	
Synthetic Fertilizers (mineral fert.)	Mineral fertilizer consumption: Grüne Berichte (BMLFUW 2006a) [(1)] ; urea application in Austria: Sales data RWA, 2006 [(2)]
Animal Waste applied to soils	The amount of manure left for spreading was calculated within source category 4 B following (AMON et al. 2002)
N- fixing Crops	Cropped area legume production: (BMLFUW 2006a) [(1)]
Crop Residue	Harvested amount of agricultural crops: (BMLFUW 2006a) [(1)]
Sewage Sludge Spreading	Water Quality Report 2000 (PHILIPPITSCH et al. 2001), Report on sewage sludge (SCHARF et al. 1997), Austrian report on water pollution control (GEWÄSSERSCHUTZBERICHT 2002), National Austrian Waste Water Database 2006
4 D 2 Pasture, Range and Paddock Manure	
Grazing Animals	Calculations within source category 4 B are based on (AMON et al. 2002)
4 D 3 Indirect Soil Emissions	
Athmospheric Deposition	The amount of manure left for spreading was calculated within source category 4 B following (AMON et al. 2002). Mineral fertilizer data: (BMLFUW 2006a)
Nitrogen Leaching (and Run- off)	see above (synthetic fertilizers, animal waste, sewage sludge)

[1] *http://www.gruenerbericht.at and http://www.awi.bmlf.gv.at*

[2] *RWA: Raiffeisen Ware Austria*

Mineral Fertilizer Application

Detailed data about the use of different kind of fertilizers are available until 1994, because until then, a fertilizer tax („Düngemittelabgabe") had been collected. Data about the total mineral fertilizer consumption are available for amounts (but not for fertilizer types) from the statistical office (Statistik Austria) and from an agricultural marketing association (Agrarmarkt Austria, AMA). Annual sales figures about urea are available for the years 1994 onwards from a leading fertilizer trading firm (RWA). These sources were used to get a time series of annual fertilizer application distinguishing urea fertilizers and other N-fertilizers ("mineral fertilizers").

The S&A report 2004 noticed high inter-annual variations in N_2O emissions of sector 4 D mineral fertilizer use. These variations are caused by the effect of storage: Fertilizers have a high elasticity to prices. Sales data are changing very rapidly due to changing market prices. Not the whole amount purchased is applied in the year of purchase. The fertilizer tax intensivied this effect at the beginning of the 1990ies.

Considering this effect, the arithmetic average of each two years is used as fertilizer application data. The time series for fertilizer consumption is presented in Table 170.

Table 170: Mineral fertilizer N consumption in Austria 1990-2005 and arithmetic average of each two years

Year	Annual Nutrient Sales Data [t N/yr]	of which Urea	Data Source	Weighted Nutrient Consumption [t N/yr]	Weighted Urea Consumption [t N/yr]
1989	133 304	1 700	FAO		
1990	140 379	3 965	estimated, GB[1]	136 842	2 833
1991	180 388	3 965	GB[1]	160 384	3 965
1992	91 154	3 886	GB[1]	135 771	3 926
1993	123 634	3 478	GB[3], RWA[2]	107 394	3 682
1994	177 266	4 917	GB[3], RWA[2]	150 450	4 198
1995	128 000	5 198	GB[4], RWA[2]	152 633	5 058
1996	125 300	4 600	GB[5], RWA[2]	126 650	4 899
1997	131 800	6 440	GB[5], RWA[2]	128 550	5 520
1998	127 500	6 440	GB[5], RWA[2]	129 650	6 440
1999	119 500	6 808	GB[5], RWA[2]	123 500	6 624
2000	121 600	3 848	GB[5], RWA[2]	120 550	5 328
2001	117 100	3 329	GB[5], RWA[2]	119 350	3 589
2002	127 600	4 470	GB[5], RWA[2]	122 350	3 900
2003	94 400	6 506	GB[5], RWA[2]	111 000	5 488
2004	100 800	7 293	GB[5], RWA[2]	97 600	6 900
2005	99 700	7 673	GB[5], RWA[2]	100 250	7 483

1 (BMLFUW 2000)

2 Raiffeisen Ware Austria, sales company

3 (BMLFUW 2003)

4 (BMLFUW, 2005)

5 (BMLFUW, 2006a)

Values of Table 170 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 occurring during fertilizer application are subtracted.

Legume Cropping Areas

The yearly numbers of the legume cropping areas were taken from official statistics (BMLFUW 2006a).

Table 171: Cropped area legume production, 1990-2005

	Areas [ha]			
Year	peas	soja beans	horse/field beans	clover hey, lucerne,..
1990	40 619	9 271	13 131	57 875
1991	37 880	14 733	14 377	65 467
1992	43 706	52 795	14 014	64 379
1993	44 028	54 064	1 064	68 124
1994	38 839	46 632	10 081	72 388
1995	19 133	13 669	6 886	71 024
1996	30 782	13 315	4 574	72 052
1997	50 913	15 217	2 783	75 976
1998	58 637	20 031	2 043	76 245
1999	46 007	18 541	2 333	75 028
2000	41 114	15 537	2 952	74 266
2001	38 567	16 336	2 789	72 196
2002	41 605	13 995	3 415	75 429
2003	42 097	15 463	3 465	78 813
2004	39 320	17 864	2 835	83 349
2005	36 037	21 429	3 549	88 973

Harvest Data

Harvest data were taken from (BMLFUW 2006a) and the datapool of (BUNDESANSTALT FÜR AGRARWIRTSCHAFT 2006) and are presented in Table 172.

Table 172: Harvest Data I, 1990-2005

	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

	Harvest [1000 t]								
	corn	wheat	rye	barley	oats	maize (corn)	potato	sugar beet	fodder beet
1996	4 493	1 240	156	1 083	153	1 736	769	3 131	62
1997	5 009	1 352	207	1 258	197	1 842	677	3 012	59
1998	4 771	1 342	236	1 212	164	1 646	647	3 314	72
1999	4 806	1 416	218	1 153	152	1 700	712	3 217	70
2000	4 490	1 313	183	855	118	1 852	695	2 634	47
2001	4 827	1 508	214	1 012	128	1 771	695	2 773	43
2002	4 745	1 434	171	861	117	1 956	684	3 043	40
2003	4 246	1 191	133	882	129	1 708	560	2 485	33
2004	5 295	1 719	213	1 007	139	1 945	693	2 902	33
2005	4 880	1 453	164	880	128	2 021	763	3 084	17

Table 173: Harvest Data II, 1990-2005

	Harvest [1000 t]								
Year	silo-green maize	clover-hey	rape	sun-flower	soja bean	horse-/fodder bean	peas	vege-tables	oil pumkin
1990	4 289	717	102	57	18	41	145	273	3
1991	4 252	797	128	72	37	37	133	277	4
1992	3 523	587	126	79	81	31	137	227	4
1993	4 220	628	125	104	103	29	107	230	3
1994	4 152	743	217	92	105	27	134	246	3
1995	3 996	823	268	61	31	17	60	302	5
1996	3 918	858	121	44	27	10	93	297	8
1997	3 940	962	129	44	34	6	162	349	8
1998	3 865	1 014	128	57	51	5	178	313	11
1999	3 729	1 025	193	64	50	6	140	399	6
2000	3 531	1 440	125	55	33	7	97	361	6
2001	3 035	1 349	147	51	34	7	112	391	7
2002	3 285	1 395	129	58	35	9	96	406	9
2003	3 026	1 425	78	71	39	9	93	376	10
2004	3 374	1 474	121	78	45	8	122	414	5
2005	3 600	1 515	104	81	61	10	90	384	8

Sewage Sludge Application on Fields

Agriculturally applied sewage sludge data were taken from Water Quality Report 2000 (PHILIPPITSCH et al. 2001), Report on sewage sludge (SCHARF et al. 1997) and (GEWÄSSERSCHUTZBERICHT 2002). For 2001 to 2005 data from the National Austrian Waste Water Database operated by the Umweltbundesamt was used (data query 2006).

The federal provinces (Bundesländer) Niederösterreich, Oberösterreich, Steiermark and Tirol didn't report data for 2005. For these Bundesländer the values of 2004 have been used.

Table 174: Amount of sewage sludge (dry matter) produced in Austria, 1990-2005

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
1997	390 500	42 955	11.0
1998	392 909	43 220	11.0
1999	392 909	43 220	11.0
2000	392 909	43 220	11.0
2001	398 800	41 600	10.4
2002	322 096	36 065	11.2
2003	315 130	39 186	12.4
2004	294 942	35 357	12.0
2005	299 166	35 656	11.9

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.* 53.8% (4.9 Gg in 2005) of N_2O emissions from *Agricultural Soils* arise from this sub-category (see Table 166).

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
- Application of sewage sludge on agricultural soils

In this method, the nitrogen input is corrected for gaseous losses through volatilization of NH_3 and NO_X.

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 synthetic (mineral) N fertilizers

The method applied for calculation of the emissions is IPCC Tier 1a (GPG, Equation 4.22):

$$F_{SN} = N_{FERT} * (1 - Frac_{GASF})$$

F_{SN}	=	Annual amount of synthetic fertilizer nitrogen applied on soils, corrected for volatile N-losses [t N]
N_{FERT}	=	Annual amount of nitrogen in synthetic fertilizers (mineral and urea) applied on soils [t N] – (see Table 170)
$Frac_{GASF}$	=	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 2006 – Submission under the UNECE Convention on Long-range Transboundary Air Pollution". Austria's Informative Report 2007 will be published in October 2007.

Table 175 presents the calculated amounts of nitrogen left for spreading from 1990 to 2005

Table 175: Animal manure left for spreading on agricultural soils per livestock category 1990-2005

year	Nitrogen left for spreading [Mg N per year] IPCC Livestock Categories													
	total	dairy cattle	suckling cows	cattle 1-2 a	cattle < 1 a	cattle > 2 a	sows	fattening pigs	chicken	other poultry	sheep	goats	horses / sol-ipeds	oth. animals
1990	141271	55395	2398	18215	19501	8193	8525	10334	8100	1057	5909	712	2225	708
1991	141025	54091	2924	18041	18846	8468	8409	10194	8309	1424	6217	781	2614	708
1992	136509	52406	3084	16925	17529	8167	8598	10423	7935	1259	5948	752	2776	708
1993	138091	51985	3535	18609	14872	8845	8829	10704	8377	1426	6365	902	2935	708
1994	137708	51217	4589	18617	14893	8332	8806	10450	8178	1416	6523	949	3018	720
1995	140276	47351	10733	18330	14575	8570	8952	10364	8111	1244	6964	1034	3278	769
1996	137956	46926	10847	17454	14131	8619	8888	9970	7530	1186	7261	1039	3311	792
1997	138344	48985	8697	16711	13297	9054	8868	10021	8600	1257	7314	1113	3354	1073
1998	137656	50182	7867	16116	13387	8815	8613	10860	8347	1189	6879	1035	3407	961
1999	135142	48665	9010	15860	13292	8924	7666	9878	8506	1086	6716	1106	3688	746
2000	131602	43884	12891	15152	13814	8949	7453	9572	6829	1100	6468	1070	3688	734
2001	130925	42967	13143	14802	13889	8293	7808	9985	7339	1033	6110	1134	3688	734
2002	127928	42636	12491	14614	13491	8009	7604	9382	7339	1033	5803	1103	3688	734
2003	128376	40913	12397	14490	13525	9144	7454	9823	7616	1043	6206	1042	3937	786
2004	127360	40008	13337	14337	13636	9137	7069	9157	7616	1043	6237	1059	3937	786
2005	126065	39606	13792	14171	13246	7900	7040	9667	7616	1043	6210	1051	3937	786

Values of Table 175 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 2006 – 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 1990-2005 can be found in Table 171.

Values for biological nitrogen fixation (120 kg N/ ha for peas, soja beans and horse/field beans and 160 kg N/ ha for clover- hey, respectively) were taken from a study made by the Umweltbundesamt (GÖTZ 1998); these values are constant over the time series.

(GÖTZ 1998) represents average data for Austria, which were used for calculating the Austrian Nitrogen Surface balance according to the OECD method. In the study available Austrian data and coefficients were put together, including literature and expert opinions from the Austrian "Fachbeirat für Bodenfruchtbarkeit und Bodenschutz" (advisory board for soil fertility and soil protection of the Federal Ministry for Agriculture and Forestry, Environment and Water Management). This advisory board is a platform of agricultural experts, which publishes regularly the "Richtlinien für die sachgerechte Düngung" (Austrian fertilizer recommendations).

Nitrogen input from 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 172)
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 2006a) and the datapool of (BUNDESANSTALT FÜR AGRARWIRTSCHAFT 2006) and are presented in Table 172. The other parameters used are presented in the following table:

Table 176: Input parameters used to estimate emissions from crop residues

	Dm [t/t]	ExF [t/t]	$Frac_{NCR}$ [t N/t d.m.]	$Frac_{CRR}$ [t/t]	$Frac_{CRB}$ [t/t]
Wheat	0.86	1.0	0.005	0.7	0.0042
Rye	0.86	1.4	0.005	0.7	0.0042
Barley	0.86	1.1	0.005	0.7	0.0042
Oats	0.86	1.5	0.005	0.7	0.0042
Maize (corn)	0.50	1.4	0.005	0.0	0.0000
Potato	0.30	0.3	0.005	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	1.5	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

Values were taken from (GÖTZ 1998) and had been worked out by Austrian Experts (Ministery of Agriculture, Fachbeirat für Bodenschutz und Bodenfruchtbarkeit - advisory board for soil fertility and soil protection of the Federal Ministry for Agriculture and Forestry, Environment and Water Management).

In additional table 4 D for the fraction of nitrogen in N-fixing crops ($Frac_{NCRBF}$) an average value of 0.015 is reported. For the fraction of nitrogen in non-N-fixing crops ($Frac_{NCRO}$) in additional table 4 D the value of cereal straw (0.005 kg N/ kg dm) is reported.

Nitrogen input through use of sewage sludge

N_2O emissions

The method applied for the calculation of the emissions is IPCC Tier 1b with a default emission factor of 1.25% N_2O-N per Mg N input to agricultural soils.

In Austria fertilisation by sewage sludge is very small. In 2005 N_2O emissions from sewage sludge contributed only 0.3% of N_2O emissions from category 4 D Agricultural Soils.

N content data of sewage sludge was obtained from (SCHARF et al. 1997). The study contains sewage sludge analyses carried out by the Umweltbundesamt. Digested sludge samples from 17 municipal sewage sludge treatment plants taken in winter 1994/1995 were investigated with regard to more than one hundred inorganic, organic and biological parameters in order to get an idea of the quality of municipal sewage sludge. Following this study a mean value of 3.9% N in dry matter was taken.

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 174)

Annual nitrogen input from sewage sludge applied on agricultural soils is presented in Table 174.

CH_4 emissions

According to the Institute for Applied Ecology (DETZEL ET AL. 2003) and (SCHÄFER 2002) the average carbon content of sewage sludge amounts about 300 kg carbon per ton sewage sludge. While 48% of the carbon remains in the soil, 52% are emitted to air. 5% of this emitted carbon is emitted as CH_4. Consequential about 10.4 kg methane is emitted per ton sewage sludge.

6.4.2.2 Pasture, Range and Paddock Manure (4 D 2)

Key Source: 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 177
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 177: Nitrogen excreted during grazing (N_{exGRAZ}) 1990-2005

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	2005	22 504

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 170)
$Frac_{GASF}$	=	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 162, Table 163)
$Frac_{GASM}$	=	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 178: N-losses and $Frac_{Gasm}$ 1990 to 2005

Year	Total N-losses [t N/yr]	$Frac_{Gasm}$ (N_{losses}/Nex_{total})
1990	39 022	0.22
1991	37 866	0.22
1992	36 696	0.22
1993	36 269	0.21
1994	35 905	0.21
1995	36 492	0.21
1996	35 505	0.21
1997	34 589	0.20
1998	35 166	0.21
1999	34 216	0.20
2000	34 272	0.21
2001	34 414	0.21

Year	Total N-losses [t N/yr]	$Frac_{Gasm}$ (N_{losses}/Nex_{total})
2002	33 692	0.21
2003	32 808	0.21
2004	32 417	0.20
2005	32 049	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 following the CORINAIR detailed methodology (EMEP/CORINAIR 1999), for the other livestock categories the CORINAIR simple methodology was used.

Following (EMEP/CORINAIR 1999), the NO_X emissions were estimated according to the assumption from (FREIBAUER & KALTSCHMITT 2001) that 1% of the manure nitrogen left for spreading N_{LFS} (see Table 175) 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 2006 – Submission under the UNECE Convention on Long-range Transboundary Air Pollution'. Austria's Informative Report 2007 will be published in October 2007.

N_2O emissions through nitrogen leaching losses

The method applied for emission calculation is IPCC Tier 1b.

Following IPCC recommended values, leaching losses from nitrogen fertilizers are estimated to be about 30% of the nitrogen inputs from synthetic fertilizer use, livestock excretion, and sewage sludge application. N_2O emissions are then estimated as 2.5% of the leaching losses, as suggested by the IPCC.

The calculation follows the following formular:

$$E\text{-}N_2O_{LL} = (F_{FERT} + N_{exLFS} + N_{exGRAZ} + F_{SSlu}) * Frac_{LEACH} * EF\text{-}N_2O_{LL}$$

$E\text{-}N_2O_{LL}$	=	N_2O emissions from leaching losses, expressed as N_2O-N [t N]
F_{FERT}	=	Annual amount of nitrogen in synthetic fertilizers (mineral and urea) applied on soils [t N] (see Table 170)
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 175)
N_{exGRAZ}	=	Annual amount of animal manure nitrogen produced by grazing animals and directly dropped on agricultural soils during grazing [t N] (see Table 177)
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)

6.4.3 Uncertainties

The uncertainties for N_2O emissions are presented in Table 179 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 179: 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%
Sewage sludge application	+/- 25%
4 D 2 Pasture, Range and Paddock Manure	
Grazing Animals	+/- 58%
4 D 3 Indirect emissions	
Leaching	+/- 25%
Atmospheric deposition	+/- 57%
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

4 D 1 and 4 D 3 – urea consumption data:

Revised urea application data from 2002 to 2004 have been used. In accordance with the other N mineral fertilizer application data, figures now relate to the economic year of the farmers and not to the calendar year.

4 D 1 and 4 D 3 – sewage sludge application:

Emissions from sewage sludge application on agricultural soils have been shifted from source category 4 D 4 Other to 4 D 1 Direct Soil Emissions – 6. Other. 2004 data has been updated.

Table 180: Difference to submission 2005 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 3 Indirect Emissions
1990	0.00	0.03	0.00
1991	0.00	0.03	0.00
1992	0.00	0.03	0.00
1993	0.00	0.04	0.00
1994	0.00	0.03	0.00
1995	0.00	0.03	0.00

Year	N_2O emissions [Gg]		
	4 D Total	4 D 1 Direct Soil Emissions	4 D 3 Indirect Emissions
1996	0.00	0.03	0.00
1997	0.00	0.03	0.00
1998	0.00	0.03	0.00
1999	0.00	0.03	0.00
2000	0.00	0.03	0.00
2001	0.00	0.03	0.00
2002	-0.01	0.02	0.00
2003	-0.01	0.03	-0.01
2004	-0.02	0.02	-0.01

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 2005 total emissions from this category amounted to 1.6 Gg CO_2 equivalent, this is a share of 0.02% in total GHG emissions from *Sector Agriculture*. CH_4 and N_2O emissions for the years from 1990 to 2005 are presented in Table 181.

Table 181: Emissions from Category 4 F Field Burning 1990-2005

	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
2005	0.06	0.001
Trend 1990-2005	-8.9%	-7.2%
Share in Agriculture	0.0%	0.0%

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 the *Presidential Conference of the Austrian Chambers of Agriculture* (personal communication to Dr. Reindl 2004 & 2006), 2004 about 3 400 ha and 2005 about 2 160 ha of straw fields were burnt. This corresponds to about 0.3% of total area under cereals 2005. 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) and (BMLFUW 2006a). 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 182: Activity data for 4 F Field Burning of Agricultural Waste 1990–2005

Year	Viniculture Area [ha]	Burnt Residual Wood [t]
1990	58 364	4 377
1991	58 364	4 377
1992	58 364	4 377
1993	57 216	4 291
1994	57 216	4 291
1995	55 628	4 172
1996	55 628	4 172
1997	52 494	3 937
1998	52 494	3 937
1999	51 214	3 841
2000	51 214	3 841
2001	51 214	3 841
2002	51 214	3 841
2003	47 572	3 568
2004	47 572	3 568
2005	47 572	3 568

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 183: 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 Grass-land	D Wetlands(2)	E Settle-ments(2)	F Other land (2)
1990	-11 913	-12 359	-525	445	212	172	140
1991	-17 660	-18 285	-529	447	212	355	140
1992	-12 643	-13 106	-518	446	212	182	140
1993	-16 460	-16 937	-454	416	210	180	125
1994	-15 161	-15 836	-462	416	210	385	125
1995	-14 721	-15 368	-282	415	210	179	125
1996	-9 730	-10 622	-260	385	227	428	111
1997	-18 810	-19 724	-246	385	227	437	111
1998	-17 155	-17 874	-214	385	208	229	111
1999	-21 687	-22 367	-196	385	208	172	111
2000	-16 355	-17 028	-187	385	208	157	111
2001	-19 122	-19 804	-192	422	208	133	111
2002	-15 474	-16 086	-199	360	208	132	111
2003	-16 945	-17 640	-136	382	208	130	111
2004	-16 974	-17 640	-132	341	208	138	111
2005	-17 037	-17 640	-186	377	78	223	111
Trend BY - 2005	43.0	42.7	-64.6	-15.3	-63.3	29.2	-20.6

(1) Other GHG are also considered, therefore the totals are different compared to the totals in the CRF tables.

(2) Only land use conversions from wetland are reported

As the table shows, the Sector *Land Use, Land Use Change and Forestry* is a net sink in Austria.

An important sub category is *5 A Forest Land*, in particular its sub source *5 A 1 Forest Land remaining Forest Land*. This category 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 4-11% 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 18% of total GHG in Austria (without LUCF), compared to 15% in the base year. The removals increased by 43.0% from the base year to 2005, mainly due to an increase of the carbon stock in forest land.

Due to additional estimations of C-stock changes for land use changes in the categories "Wetlands" and "Settlements" the figures of previous NIRs and submissions differ from the actual figures.

7.1.2 Methodology

The methodologies for estimating emissions from LUC from and to these land use categories are described in the sub chapters 7.2, 7.3, 7.4, 7.5, 7.6 and 7.7. Following the methodology of the actual emission/removal calculations, all land use changes from forest land (which are sub categories of 5 B – 5 F) are included in the methodological description of *5 A 2 Land converted to Forest Land*. The 2001 is the media year of the last national forest inventory period, which was carried out between 2000 and 2002.

The derivation of a complete time series from 1990 to 2005 on areas remaining in a land use category and areas affected by LUC required the compilation of activity data obtained from different statistical surveys.

The keypoints of the applied compilation technique are as follows:

- Consistency with respect to the Austrian area (use of sub-category „Other land")
- Consistency within and across years in sub-sectors
- Hierarchical treatment of data sources:

  1st hierarchy: Systematically measured statistics are considered to have highest reliability (e.g. NFI forest area)

  2nd hierarchy: Land use statistics based on land register and land use surveys for EU-funding are given higher hierarchy than estimates for land use (agricultural areas)

  3rd hierarchy: Estimates for land use based on specific information are given higher priority than mere estimates on likelihood basis (e.g. bogs in 5.D)

  4th hierarchy: Estimates on likelihood basis are given higher priority than data gaps (e.g. no LUC from wetland to cropland)

  5th hierarchy: Data gaps (5.F „Other land")

Table 184 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 184: 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**
productive forest	3 332 667	3 371 000	38 333
non-productive forest	561 333	589 000	27 667
1. Forest land remaining forest land			
productive forest	3 326 107	3 365 060	38 953
non-productive forest	553 303	583 558	30 255
2. Land converted to forest land	14 590	11 382	-3 208

Area in ha	1990	2001	Diff 1990-2001
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	1 473 634	1 420 986	-52 648
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 crop-land	33 467	38 675	5 209
2.3 Wetland Land converted to cropland	NO	NO	
2.4 Settlement converted to cropland	NO	NO	
2.5 Other Land converted to Cropland	NO	NO	
5.C. Grassland - total area	**1 992 765**	**1 929 902**	**-62 863**
1. Grassland remaining grassland	1 962 944	1 897 805	-65 139
2. Land converted to grassland	29 821	32 097	2 276
2.1 Forest land converted to grassland	3 540	2 810	-730
2.2 Arable land converted to grassland	26 124	29 051	2 927
2.3 Wetland land converted to grassland	NO	NO	
2.4 Settlement converted to grassland	NO	NO	
2.5 Other land converted to grassland	NO	NO	
5 D Wetlands - total area	**132 015**	**139 874**	**7 859**
1. Wetlands remaining wetlands	131 301	139 160	7 859
2. Land converted to wetlands	714	714	0
2.1 Forest land converted to wetlands	200	160	-40
2.2 Arable land converted to wetlands	NO	NO	
2.3 Grassland converted to wetlands	514	554	40
2.4 Settlement converted to wetlands	NO	NO	
2.5 Other land converted to wetlands	NO	NO	
5 E Settlements - total area	**323 994**	**449 678**	**125 684**
1. Settlements remaining settlements	312 568	438 252	125 684
2. Land converted to settlements	11 426	1 426	0
2.1 Forest land converted to settlements	1 000	800	-200
2.2 Arable land converted to settlements	5 594	754	-4 840
2.3 Grassland converted to settlements	4 832	9 872	5 039
2.4 Wetlands converted to settlements	NO	NO	
2.5 Other land converted to settlements	NO	NO	
5 F Other land - total area	**529 749**	**440 535**	**-89 214**
Total area	**8 380 056**	**8 380 056**	

7.1.3 Completeness

Table 185 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 185: IPCC categories according to the IPCC-Good Practice Guidance for Land-Use, Land-Use Change and Forestry.

IPCC categories[51]/ Sub division for calculation	Description	Status for CO_2	Other GHG
5 A	Forest land	✓	
5.A.1	Forest land remaining forest land	✓	
Coniferous	Increase, decrease, net change of carbon stock	✓	
Deciduous	Increase, decrease, net change of carbon stock	✓	
	Net carbon stock change in dead organic matter	✓	
	Net carbon stock change in soils	✓	
5.A.2	Land converted to forest land	✓	
5.A.2.1	Cropland converted to forest land	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.A.2.2	Grassland converted to forest land	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.A.2.3	Wetlands converted to forest land	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.A.2.4	Settlements converted to forest land	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5.A.2.5	Other land converted to forest land	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5 B	Cropland	✓	
5 B 1	Cropland remaining cropland	✓	
Annual remaining annual	Carbon stock change in living biomass	✓	
Annual remaining annual	Carbon stock change in soils	✓	
Annual converted to perennial	Carbon stock change in living biomass	✓	

51 IPCC categories – applied according to the "Good Practice Guidance for LULUCF (2003)"

IPCC categories[51]/ Sub division for calculation	Description	Status for CO_2	Other GHG
Annual converted to perennial	Carbon stock change in soils	✓	
Perennial converted to annual	Carbon stock change in living biomass	✓	
Perennial converted to annual	Carbon stock change in soils	✓	
5 B 2	Land converted to cropland	✓	
5 B 2 1	Forest land converted to cropland	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5 B 2 2	Grassland converted to cropland	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soils	✓	✓ N_2O
5 B 2 3	Wetland converted to cropland	NO	
5 B 2 4	Settlements converted to cropland	NO	
5 B 2 5	Other land converted to cropland	NO	
5 C	Grassland	✓	
5 C 1	Grassland remaining grassland	✓	
	Carbon stock change in soils	✓	
5 C 2	Land converted to grassland	✓	
5 C 2 1	Forest land converted to grassland	✓	
	Carbon stock change in biomass	✓	
	Carbon stock change in soils	✓	
5 C 2 2	Cropland converted to grassland	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5 C 2 3	Wetland converted to grassland	NO	
5 C 2 4	Settlements converted to grassland	NO	
5 C 2 5	Other land converted to grassland	NO	
5 D	Wetlands	✓	
5 D 2 1	Forest land converted to wetlands	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5 D 2 2	Cropland converted to wetlands	NO	
5 D 2 3	Grassland converted to wetlands	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5 D 2 4	Settlements converted to wetlands	NO	
5 D 2 5	Other land converted to wetlands	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5 E	Settlements		

IPCC categories[51]/ Sub division for calculation	Description	Status for CO_2	Other GHG
5 E 2 1	Forest land converted to settlements	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5 E 2 2	Cropland converted to settlements	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5 E 2 3	Grassland converted to settlements	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5 E 2 4	Wetlands converted to settlements	NO	
5 E 2 5	Other land converted to settlements	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5 F	Other Land		
5 F 2 1	Forest land converted to other land	✓	
	Carbon stock change in living biomass	✓	
	Carbon stock change in soil	✓	
5 F 2 2	Cropland converted to other land	NO	
5 F 2 3	Grassland converted to other land	NO	
5 F 2 4	Wetlands converted to other land	NO	
5 F 2 5	Settlements converted to other land	NO	
5(IV) 5 B Limestone 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)	✓ N_20 ✓ CH_4

(1) CO2 emissions caused by wildfires (CRF Table 5(V)) are included in the category 5.A.1.. Data on the area affected by wildfires are available for the years 1990 to 2002.

7.2 Forest Land (5 A)

3.96 Mio ha (47.2%) of Austria are forest land (BFW 2004a). The sustaining of the Austrian forests in the past helped to restore an important carbon stock in the Austrian landscape and to avoid net CO_2 emissions to the atmosphere from the Sector LULUCF: In 1990 the Austrian forests represented a carbon stock of 320 ± 42 Mt carbon from biomass and 463 ± 185 Mt carbon from soil, i.e. humus layer plus mineral soil to 50 cm depth. This total carbon stock represents approximately 40 times the Austrian CO_2 equivalent emissions of the greenhouse gases CO_2, CH_4 and N_2O in the year 1990 (WEISS et al. 2000).

Emission/Removal trends of Forest Land

With regard to forest land the annual net CO_2 removals under sector 5 of the reported period 1990 – 2005[52] range from 10,622 Gg CO_2 to 22,367 Gg CO_2 (mean: 16,770 Gg CO_2). The most relevant parts derive from the sub-category 5.A.1 (Forest Land remaining Forest Land), whereas land use changes to forests (5.A.2) and from forests (5.B.2 to 5.F.2) have only minor influence on the net CO_2 balance.

For the years since 2003 the means for the last period (2000 to 2002) of the National Forest Inventory (NFI) have been reported.

The reported CO_2 emissions from forest soils have to be considered with a very high uncertainty (-0.4-0.5 Mt C / year) whereas removals of dead wood in general have a minor influence on the totals of sector 5 (about 600 Gg CO_2).

As already reported in previous submissions, changes in the Austrian forest biomass also resulted in a net carbon sink in the years before 1990. In the period 1961 to 1989 the mean annual net carbon sink amounted to 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 2006 minor difference in the figures result from the recalculation of the dead wood part.

Details on the methodology, uncertainty assessment, quality assurance, quality control and verification are given in each sub chapter.

For the reported period 1990 to 2005 the total annual net CO_2 removals (biomass and soil) from land use changes to forest range from about 104 Gg CO_2 to 133 Gg CO_2. The total annual emissions (biomass and soil) from land use changes from forests vary between 487 Gg CO_2 and 611 Gg CO_2. These figures are in the order of approximately ± 1 to 5% of the annual net CO_2 removals under sector 5.

52 For the years 2003 to 2005 the means for the last period (2000 to 2002) of the National Forest Inventory (NFI) have been reported

Table 186: CO_2 removals/emissions from IPCC Category 5 for Forest Land from 1990-2005

	GHG removals/emissions [Gg CO_2]										*Trend BY-2005*
	1990	1997	1998	1999	2000	2001	2002	2003	2004	2005	%
5	-11 913	-18 810	-17 155	-21 687	-16 355	-19 122	-15 474	-16 945	-16 974	-17 037	43.0
5.A	-12 359	-19 724	-17 874	-22 367	-17 028	-19 804	-16 086	-17 640	-17 640	-17 640	42.7
5.A.1	-12 226	-19 620	-17 770	-22 264	-16 925	-19 701	-15 982	-17 536	-17 536	-17 536	43.4
5.A.2	-133	-104	-104	-104	-104	-104	-104	-104	-104	-104	-21.8
5 Forestland Conv	611	487	487	487	487	487	487	487	487	487	-20.3
5A1_BiomassBurn_wild_CO_2	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	
5A1_BiomassBurn_wild_CH4	0.012	0.0012	0.0058	0.0005	0.0026	0.0015	0.0120	0.0042	0.0042	0.0042	NA
5A1_BiomassBurn_wild_N_2O	0.0002	0.00002	0.00009	0.00001	0.00004	0.00002	0.00019	0.00002	0.00009	0.00001	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 regrowth 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 - 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[53] to obtain annual data of increment and harvest (instead of using the means or interpolated values for single years). For harvest these relative indices are derived from further national statistics on harvest which are the annually reported records of wood felled (BMLF 1964-2003) and the wood balance (BITTERMANN 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 187). 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 187: Conversion factors for the stemwood o.b. of the Austrian forests, mean of several NFIs (WEISS et al. 2000)

Conversion factors	Coniferous	Deciduous
m^3 o.b. to t dm (stemwood)	0.39	0.53
t dm to t C (stemwood)	0.50	0.48

53 Values for the relative variation in the individual years of the time series

Biomass functions (BF)

The increment and harvest of the other tree compartments (branches, needles, roots) are estimated with the help of biomassfunctions (BF,Table 188) 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 188: Used biomass functions

Tree species	Tree parts	Input parameter	Literature
Norway spruce (Douglas fir and other coniferous species than listed below)	Branches, needles	Dbh, height, crown ratio	(ECKMÜLLNER 2006)
Fir	Branches, needles	Dbh, crown ratio	(LEDERMANN & NEUMANN 2006)
Pine	Branches, needles	Dbh, height, crown ratio	(ECKMÜLLNER 2006)
Larch	Branches	Dbh, height, crown ratio	(RUBATSCHER et al. 2006)
Beech	Branches	Dbh, crown ratio	(LEDERMANN& NEUMANN 2006)
Oak	Branches	Dbh, crown ratio	(LEDERMANN& NEUMANN 2006
Oak (coppice)	Branches	Dbh, crown ratio	(HOCHBICHLER et al. 2006)
Hornbeam	Branches	Dbh, crown ratio	(LEDERMANN& NEUMANN 2006)
Ash	Branches	Dbh, crown ratio	(GSCHWANTNER & SCHADAUER 2006)
Other hardwood deciduous species	Branches	Dbh, crown ratio	(GSCHWANTNER & SCHADAUER 2006)
Poplar	Branches	Dbh, crown ratio	(GSCHWANTNER & SCHADAUER 2006)
Other weed tree species	Branches	Dbh, crown ratio	(GSCHWANTNER & SCHADAUER 2006)
All	Roots	Dbh	(WIRTH et al. 2004), (OFFENTHALER & HOCHBICHLER 2006)

The use of these biomass functions leads to the following changes in the biomass expansion ratios total tree biomass/stemwood biomass in comparison to estimates before NIR2006:

Table 189: Average expansion ratios total tree biomass/stemwood biomass for the Austrian forests for the period 1990 – 2002; old figures from (WEISS et al. 2000), new figures from (BFW 2006, pers. comm.)

Expansion ratio t dm stemwood → t dm whole tree (incl. also below ground biomass)	Coniferous		Deciduous	
	Old	new	old	new
increment	1.45	1.75	1.46	1.77
harvest	1.54	1.62	1.50	1.63

The resulting mean annual biomass increments and harvests of the other tree biomass compartments (needles, branches, roots) for the individual NFI periods are converted to figures for single years in the same way as described for stemwood (see above).

The time series of measured values for individual years ends with the year 2002. For the following years the mean values for the last inventory period (2000/02) are reported. This procedure is carried out for the following reasons:

The extrapolation of trends for increment and harvest from the inventory period 1986/90 to the 90ies led to figures, which had to be strongly revised downwards after the inventory period 1992/96. One of the main reasons was that increment did not increase as in the years before. The use of mean values for increment and for harvest, which are based on the last NFI results, for years after the last NFI provides more probable figures than an extrapolation of trends that is rather uncertain. This is particularly true for an increment that strongly depends on weather conditions, but also for harvest, when e.g. storm fellings are taken into account.

Dead wood

The estimates on C-stock changes in dead wood include only standing dead wood, because any inclusion of lying dead wood would cause a double accounting (the estimates for "harvest" include all losses of tree biomass in forests, also for instance the falling of standing dead trees). Since national data on the stock of dead wood are available from the NFI a Tier 3 method was applied.

On average of all tree species the stock of dead wood is 4.5 m^3/ha for the inventory period 1992/96 and 6.1 m^3/ha for the inventory period 2000/02. Between the two periods 1986/90 to 1992/96 an increase of 10% of dead wood is estimated.

For the calculation of the C-stock changes the conversion factors for stemwood as shown in Table 187 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 600 Gg CO_2, which is only a minor part of the total C-balance of sector 5.

Soil

As already mentioned in the introduction, (WEISS et al. 2000) estimated carbon-stocks of the Austrian forest soils are based on data of the Austrian forest soil survey (humus layers and mineral soil layers 0-50 cm were sampled at the grid points of an 8.7 x 8.7 km grid across all Austria in the period 1987 to 1989; BFW 1992). The changes in the carbon content of the soils are very small and slow and so far no reassessments of the Austrian soil inventories have taken place that would allow estimates for the carbon stock changes of the soils which are based on measured data. Therefore, modelling approaches were used to estimate the carbon stock change of the Austrian forest soils in the period 1961 to 1996 (WEISS et al. 2000). According to these estimates it is assumed that the Austrian forest soils were a carbon sink of about 10% of the net carbon sink of the forest biomass in the period 1961–1996. For the time period 1990 to 2006 these estimates resulted in a C stock increase of 0.5 Mt C per year (0.7 Mt C if temperature change is not considered). Main reasons for this estimated increase of the forest soil C pool in Austria were the increase in forest area (former land use changes to forests and the related higher C input to the soils), an increase in 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 190). 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 190. A new uncertainty assessment is planned for the future.

This previous calculation of the uncertainty of the reported data for category 5 A 1 (biomass) took into account:

- The statistical uncertainty of the forest inventory,
- The uncertainty related to the calculation of annual data,
- The uncertainty related to the missing consistency of different statistics[54]
- and the uncertainty of each conversion and expansion factor.

The estimates of the uncertainty included a consistency approach with other national statistics. This approach went far beyond the usual approach of uncertainty estimates which are only based on single statistics or single input data (Table 190), details are described in (WEISS et al. 2000)). Error propagation was used to calculate the overall uncertainty, which was on average ±30% for the annual net change of biomass C stocks between 1961 and 1996.

Table 190: Relative uncertainties of the previous biomass estimates of sector 5.A.1 (WEISS et al. 2000)

	Relative uncertainties [%]				
	Forest inventory	Uncertainty related to the calculation of annual data and to the necessary consistency of different statistics	Conversion factor „m³ o.b. → t dm“	Conversion factor „t dm stemwood → t dm whole tree“	Conversion factor „t dm → t C“
Increment	2.0	3.2	11.1	6.5	2.0
Harvest	3.5	12.2			

7.2.1.3 Recalculations

The "dead wood" time series has been corrected according to findings of internal quality control checks.

54 e.g.: There are three different Austrian statistics for annual harvest: measured harvest according to NFI, national annual records of wood felled, and the national wood balance.

7.2.2 Land Use Changes to Forest Land (5 A 2)

7.2.2.1 Methodological Issues

Since data on Land use changes from and to Forest Land derive from the same data sets the methodology and activity data are described for both land use change activities from and to forests in this chapter.

Activity data

Areas were land use changes to and from forests take place are generally very small in Austria. By means of the NFI, which follows a regular grid of 4 x 4 km (see also chapter 7.2.1.1) land use changes can only be observed by chance and therefore the number of grid points with observed land use change is small. Therefore the estimates for land use changes from and to forest uses have a significantly higher uncertainty compared to the uncertainty for the total forest land (see below).

In case a land use change has been observed at an inventory point of the last NFI (2000/02) the type of the neighbouring non-forest land was recorded. The evaluation of 2/3 of such forest boundary points led to the land use statistic shown in the Table 191 and Table 192. 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 191: 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 192: 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 191 and Table 192 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 193 the conversion factors for the total above ground biomass (with no further division into coniferous and deciduous) is shown.

Table 193: 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 forest soil C stocks represent 0-50 cm soil depth. Estimates for the soil C stock changes of and between the other land use categories are based on a soil depth of 0-30 cm (see chapter 7.3.3.3).

Therfore, the following soil C stocks (0-50 cm) have been used to calculate emissions/removals of LUC from and to forests:

- Forests: 121 t C/ha (Weiss et al. 2001)
- Cropland: 60 t C/ha, (Gerzabek et al. 2005)
- Vineyards: 58 t C/ha, (Gerzabek et al. 2005)
- Orchards/garden: land 78 t C/ha, (Gerzabek et al. 2005)
- Grassland (intensive use): 81 t C/ha, (Gerzabek et al. 2005)
- Grassland (extensive use) 119 t C/ha (Gerzabek et al. 2005).
- Bogs: 150 t C/ha (expert judgement)
- Surface waters and reed beds: 0 t C/ha (expert judgement)
- Settlements and traffic area (on average): 50 t C/ha (expert judgement)
- Alpine shrub lands: 119 t C/ha (KÖRNER et al. 1993)

- Rocks and stone slopes: 0 t C/ha (expert judgement)
- Other land uses: 30 t C/ha (expert judgement)

The values for forests, cropland and grassland represent averages which are based on Austrian soil inventories for forests (BFW 1992) and agricultural land (AMT DER STEIERMÄRKISCHEN LANDESREGIERUNG 1988-1996, AMT DER TIROLER LANDESREGIERUNG 1988, AMT DER OBERÖSTERREICHISCHEN LANDESREGIERUNG 1993, AMT DER SALZBURGER LANDESREGIERUNG 1993, AMT DER NIEDERÖSTERREICHISCHEN LANDEREGIERUNG 1994, AMT DER BURGENLÄNDISCHEN LANDESREGIERUNG 1996, AMT DER KÄRNTNER LANDESREGIERUNG 1999, Compiled in the Austrian Soil Information System BORIS).

Based on these soil C stock data and the measured land use change areas by the NFI an area weighted mean value of soil C stock was calculated for each land use category of the IPCC GPG.

7.2.2.2 Uncertainty Assessment

The results of the NFI provide very accurate and reliable data on the increment, harvest, distribution of tree species and other characteristics of the Austrian forest as a whole. The regular grid of 4 x 4 km is an appropriate way to meet this information. It is obvious, that only a limited number of the observed grid points of the NFI by chance describe a forest boundary, where land use changes can be detected. In addition, the stock changes in soils due to LUC are based on accounting and discounting of representative mean values. Therefore a high uncertainty for the results of the sub categories on land use changes from and to forests must be considered (expert judgement: between 50 and 100%, depending on the other categories from or to which forest land changes).

7.3 Cropland (5 B)

In this category emissions/removals from cropland management are considered.

1.5 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. The sink is mainly caused by the changes in soil C stock, while the variance is mainly caused by the changes of living biomass of perennial crops (orchards, vineyards..). The methodological issue is described in chapter 7.3.1.1 .

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 2005.

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 194.

Table 194: 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 195: Activity data for cropland (1990-2005) in ha

	5.B Total Cropland	1 Cropland remaining Cropland	Perennial Cropland converted to Cropland	Cropland converted to perennial Cropland	2 Land converted to Cropland	2.1 Forest Land converted to Cropland	2.2 Grassland converted to Cropland	2 Grassland converted to perennial Cropland	2.3 Wetlands converted to Cropland	2.5 Other Land converted to Cropland	2.4 Settlements converted to Cropland
1990	1 507 533	1 472 471	487	676	33 899	330	33 467	102	NO	NO	NO
1991	1 526 723	1 491 702	490	681	34 146	330	33 712	103	NO	NO	NO
1992	1 518 074	1 483 168	489	678	34 034	330	33 602	103	NO	NO	NO
1993	1 500 454	1 465 849	485	673	33 714	300	33 312	102	NO	NO	NO
1994	1 501 408	1 466 790	485	673	33 727	300	33 325	102	NO	NO	NO
1995	1 492 280	1 458 021	480	666	33 380	300	32 979	101	NO	NO	NO
1996	1 491 907	1 457 676	479	665	33 323	270	32 952	101	NO	NO	NO
1997	1 500 207	1 465 990	479	665	33 310	270	32 939	101	NO	NO	NO
1998	1 507 728	1 473 659	477	662	33 166	270	32 796	100	NO	NO	NO
1999	1 470 396	1 436 332	477	662	33 162	270	32 791	100	NO	NO	NO
2000	1 462 108	1 428 265	474	658	32 949	270	32 579	100	NO	NO	NO
2001	1 460 067	1 419 789	524	673	39 081	270	38 675	136	NO	NO	NO
2002	1 459 095	1 426 286	337	729	31 742	270	31 377	95	NO	NO	NO
2003	1 459 991	1 430 955	559	568	27 909	270	27 571	68	NO	NO	NO
2004	1 454 572	1 419 014	392	485	34 681	270	34 360	51	NO	NO	NO
2005	1 455 984	1 424 417	435	456	30 676	270	30 339	68	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 196: Emissions from cropland management (1990-2005) 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	-513.39	-484.69	104.17	6.32	90.30	-119.00	27.98	-158.91	0.60	11.33	NO	NO	NO
1991	-517.76	-488.73	104.93	6.36	91.06	-120.08	27.98	-160.08	0.60	11.41	NO	NO	NO
1992	-506.57	-477.69	104.59	6.34	90.72	-119.59	27.98	-159.55	0.60	11.37	NO	NO	NO
1993	-443.20	-413.03	103.68	6.29	90.69	-120.87	25.44	-158.18	0.59	11.27	NO	NO	NO
1994	-450.35	-420.16	103.72	6.29	90.73	-120.92	25.44	-158.24	0.59	11.28	NO	NO	NO
1995	-270.35	-242.91	102.65	6.23	91.97	-119.41	25.44	-156.60	0.59	11.16	NO	NO	NO
1996	-248.35	-218.47	102.57	6.22	91.95	-121.83	22.90	-156.47	0.59	11.15	NO	NO	NO
1997	-235.05	-205.36	102.52	6.22	92.08	-121.77	22.90	-156.40	0.59	11.15	NO	NO	NO
1998	-203.20	-173.70	102.08	6.19	91.64	-121.14	22.90	-155.73	0.59	11.10	NO	NO	NO
1999	-185.15	-155.65	102.06	6.19	91.63	-121.12	22.90	-155.70	0.59	11.10	NO	NO	NO
2000	-176.43	-146.59	101.40	6.15	90.35	-120.19	22.90	-154.70	0.58	11.03	NO	NO	NO
2001	-179.24	-122.65	112.06	6.30	90.27	-146.86	22.90	-183.64	0.79	13.10	NO	NO	NO
2002	-188.33	-163.64	72.16	6.82	90.23	-114.92	22.90	-148.99	0.55	10.62	NO	NO	NO
2003	-126.82	-118.79	119.65	5.31	90.27	-98.30	22.90	-130.92	0.40	9.33	NO	NO	NO
2004	-120.24	-82.11	83.84	4.54	90.22	-128.35	22.90	-163.16	0.30	11.61	NO	NO	NO
2005	-175.64	-155.41	93.12	4.26	90.28	-110.51	22.90	-144.06	0.39	10.26	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 1990-2005. 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).

The reason for the change of the biomass in this sub-category from a sink to a source is that the perennial cropland area from 1990-2004 decreases below the area of the period 1961-75. Taking into account the 30-years rotation period for perennial cropland according to IPCC-GPG this leads to significant losses in perennial biomass from 1995-2004. While the continuous increase of perennial cropland area from 1961-1975 causes a net sink in the first years of the 90ies.

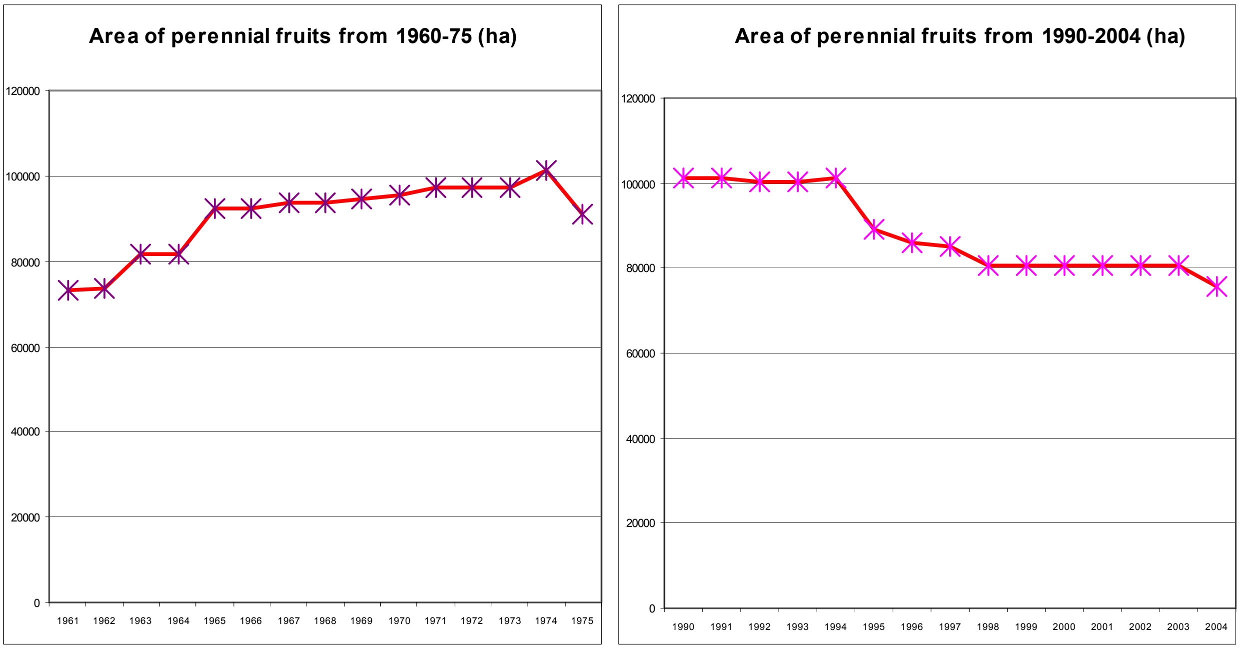

Figure 28: Change of the perennial cropland area from 1961-2004

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 in 2005 was 435 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 * (*$L_{conversion} + \Delta C_{growth}$*)*

$L\ conversion = C_{after} - C_{before}$

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 in 2005 was 456 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 * (*$L_{conversion} + \Delta C_{growth}$*)*

$L_{conversion} = C_{after} - C_{before}$

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 197: Weighted mean values of management factors

factor	F_{LU} modified	F_{MG} modified	F_{I} modified
1985	0.820	1.035	0.966
1990	0.822	1.035	0.976
1995	0.829	1.039	0.977
2003	0.828	1.042	0.990

It was assumed that the Austrian specific reference value for arable land of 50 t C ha^{-1} represents the soil carbon stock of 1990. This assumption is supported by the fact that 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 7.3.1.5

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.

According to expert judgement the area for the calculation of liming comprises cropland (without perennial cropland), two and more cut meadows and cultivated pastures.

Table 198: Area with lime application

Landuse (ha)	1990	2005
Cropland	1 406 394	1 380 481
Grassland	884 124	909 754
Total	2 290 518	2 289 888

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 2005 are based on the uncertainty values for IPCC default values taken from the GPG (for most sources these default values were used), and on expert judgement and literature (GERZABEK ET. AL. 2003).

→ cropland area→ +/-10% (based on expert judgement)

→ converted area: annual cropland to perennial +/- 50%

→ perennial cropland to annual cropland +/- 20%

→ country specific data for carbon stock in cropland soils is +/- 5% and perennial cropland +/- 15%

→ emission factors for biomass carbon stock default values according IPCC

The uncertainties of the converted area for the years 2001-2003 are the following:

Table 199: Uncertainties for areas of land use change (%)

	2001	2002	2003
Annual cropland to perennial	21	26	28
Perennial cropland to annual cropland	38	30	52
Grassland converted to cropland	7	7	9

The estimated total uncertainty for this category ranges between +40 and -130% (expert judgement).

The estimated total uncertainties for liming range between +/- 50% (expert judgement).

7.3.2 Forest Land converted to Cropland (5 B 2 1)

The methodology and activity data are described in chapter 7.2.2. 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.

For the calculation of the annual change of carbon stocks in forest soils converted to cropland soils the IPCC Tier 1 approach is used. Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of forest land (121 t C/ha) and arable land (62 t C/ha, area weighted mean value of input data described in chapter 7.2.2).

7.3.3 Grassland converted to Cropland (5 B 2 2)

In 2005 the converted area was 30 676 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 195.

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* $_{conversion}$ + ΔC_{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 (1990-2005).

*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.

The data in the CRF table represent the sum of grassland to annual cropland and grassland to perennial cropland. This will be reported more detailed in the next submission.

7.3.3.3 Changes of carbon stock in mineral soils of grassland converted to 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 7.3.1.5).

$$\Delta SOC = ((SOC_O - SOC_{O-T}) * 0.66)/ 20 = - 0.665 \text{ t C ha}^{-1} \text{ a}^{-1}$$

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 for the turn-over times of soil C (TRUMBORE et al. 1996), (HARRISON et al. 1993A), (HARRISON et al. 1993B), (HARRISON et al. 1995), (HARRISON 1996) it is assumed that due to LUC 2/3 of the difference of the mean carbon stock between the different land uses is reduced (or built up) within the first 20 years whereas the turn-over (or build up) 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 7.3.1.5).

$\Delta SOC = (SOC_O - SOC_{O-T}) / 20 = - 0.65\ t\ C\ ha^{-1}\ a^{-1}$

annual change in carbon stock of mineral soils converted from grassland to perennial cropland =

*Δ SOC * conversion area*

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}

The data in the CRF table represent the sum of grassland to annual cropland and grassland to perennial cropland - see comment above for biomass. This will be reported more detailed in the next submission.

7.3.3.5 N_2O emissions in soils of grassland converted to cropland

This chapter deals with the increase in N_2O emissions due to the conversion of grassland to cropland. The area of land converted (grassland to cropland and grassland to perennial cropland respectively) was taken from Table 195. 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 for 2005 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: +/- 16%

→ country specific data for carbon stock in cropland soils +/- 5% and in perennial cropland soils +/- 15%

→ emission factors for biomass carbon stock default values according IPCC GPG guidance (2003):

Uncertainties from the converted area for the years 2001-2003 are listed in Table 199.

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 200: 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 201: Activity data of grassland 1990-2005 in ha

	C. Total Grassland	1. Grassland remaining Grassland	2. Land converted to Grassland	2.1 Forest Land converted to Grassland	2.2 Cropland converted to Grassland	perennial Cropland converted to Grassland	2.3 Wetlands converted to Grassland	2.4 Settlements converted to Grassland	2.5 Other Land converted to Grassland
1990	1 992 765	1 962 944	29 821	3 540	26 124	156	NO	NO	NO
1991	1 989 050	1 962 576	26 474	3 540	26 316	158	NO	NO	NO
1992	1 985 335	1 955 233	26 387	3 540	26 230	157	NO	NO	NO
1993	1 981 620	1 955 461	26 159	3 175	26 004	156	NO	NO	NO
1994	1 979 096	1 952 926	26 169	3 175	26 014	156	NO	NO	NO
1995	1 976 571	1 950 673	25 898	3 175	25 744	154	NO	NO	NO
1996	1 978 490	1 952 613	25 877	2 810	25 723	154	NO	NO	NO
1997	1 980 408	1 954 542	25 866	2 810	25 712	154	NO	NO	NO
1998	1 972 662	1 946 908	25 754	2 810	25 601	153	NO	NO	NO
1999	1 964 915	1 939 165	25 750	2 810	25 597	153	NO	NO	NO
2000	1 957 169	1 931 585	25 584	2 810	25 431	152	NO	NO	NO
2001	1 929 902	1 897 805	32 097	2 810	29 051	236	NO	NO	NO
2002	1 902 636	1 876 931	25 705	2 810	22 815	79	NO	NO	NO
2003	1 875 369	1 848 078	27 291	2 810	24 339	141	NO	NO	NO
2004	1 848 102	1 828 135	19 967	2 810	17 055	103	NO	NO	NO
2005	1 848 102	1 818 543	29 559	2 810	26 689	60	NO	NO	NO

Table 202: Emissions from grassland management in Gg CO_2

	5C. 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	445.37	6.13	439.24	282.14	123.09	34.01	NO	NO	NO
1991	446.55	6.15	440.40	282.14	123.99	34.26	NO	NO	NO
1992	446.45	6.58	439.88	282.14	123.59	34.15	NO	NO	NO
1993	415.99	6.57	409.42	253.05	122.52	33.85	NO	NO	NO
1994	416.20	6.71	409.48	253.05	122.57	33.87	NO	NO	NO
1995	414.70	6.84	407.86	253.05	121.30	33.52	NO	NO	NO
1996	385.38	6.73	378.65	223.96	121.20	33.49	NO	NO	NO
1997	385.20	6.62	378.58	223.96	121.15	33.47	NO	NO	NO
1998	384.97	7.06	377.91	223.96	120.62	33.33	NO	NO	NO
1999	385.40	7.51	377.89	223.96	120.61	33.32	NO	NO	NO
2000	384.84	7.94	376.89	223.96	119.82	33.11	NO	NO	NO
2001	421.94	9.89	412.05	223.96	136.88	51.21	NO	NO	NO
2002	359.84	11.10	348.74	223.96	107.50	17.28	NO	NO	NO
2003	382.13	12.77	369.37	223.96	114.68	30.73	NO	NO	NO
2004	340.54	13.92	326.62	223.96	80.36	22.30	NO	NO	NO
2005	377.29	14.47	362.81	223.96	125.75	13.11	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 in 2005 was 1.81 Mio ha.

The annual emissions from 1990-2005 range between 6 Gg CO_2 and 15 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 203: Weighted mean values of management factors for grassland

factor	F_{LU} modified	F_{MG} modified	F_I modified
1985	1.000	1.062	1.048
1990	1.000	1.062	1.049
1995	1.000	1.064	1.052
2003	1.000	1.064	1.052

It was assumed that the Austrian specific average value of 70 t C ha^{-1} 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 1990-2005 was calculated by using the management factors above. For the default inventory time of 20 years an increase from 70 t C ha^{-1} to 70.315 t C ha^{-1} was estimated.

The formula used for calculating the change in carbon stocks of grassland soils was the same as for cropland (see chapter 7.3.1.4).

Annual change in carbon stock of mineral soils in grassland remaining grassland = 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 7.3.1.7. Therefore the CO_2 emissions resulting from liming of grassland are included in category 5 B 1.

7.4.1.3 Changes in carbon stocks of organic soils of grassland remaining grassland

The area of organic grassland soils was estimated with data of the 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 2005. 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.

For the calculation of the annual change of carbon stocks in forest soils converted to grassland soils the IPCC Tier 1 approach is used. Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of forest land (121 t C/ha) and grassland soils (104 t C/ha, area weighted mean value of input data described in chapter 7.2.2).

7.4.3 Cropland converted to Grassland (5 C 2 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 in 2005 was 26 689 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 1990-2005 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 $ha^{-1}yr^{-1}$

The data in the CRF table show the sum of biomass carbon stock changes of cropland converted to grassland and perennial cropland converted to grassland. This will be reported more detailed in the next submission.

7.4.3.3 Changes of carbon stock in mineral soil of cropland converted to grassland

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 =

*Δ SOC * 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}

The data in the CRF table show the sum of soil carbon stock changes of cropland converted to grassland and perennial cropland converted to grassland respectively. This will be reported more detailed in the next submission.

7.4.4 Uncertainty assessment

The following uncertainties were estimated: They are based on uncertainty values for IPCC default values taken from the IPCC GPG (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 +/- 15%

→ perennial cropland to grassland +/- 23%

→ country specific data for carbon stock in grassland soils is +/- 9%

country specific data for carbon stock in perennial cropland soils +/- 15%

→ emission factors for biomass carbon stock default values according IPCC (GPG 2003).

The uncertainties of the converted area for the years 2001-2003 are the following:

Table 204: 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 Wetlands 5 D

In this category only emissions/removals from the sub-categories "Land converted to wetland" are considered.

The average wetland area from 1990-2005 is 137.343 ha.

Table 205: Activity data of wetland 1990-2005 in ha

	5 D Total Wetland	1. Wetland remaining Wetland	2. Land converted to Wetland	2.1 Forest Land converted to Wetlands	2.2 Cropland converted to Wetlands	2.3 Grassland converted to Wetlands	2.4 Settlements converted to Wetlands	2.5 Other Land converted to Wetlands
1990	132 015	131 301	714	200	NO	514	NO	-
1991	132 730	132 015	714	200	NO	514	NO	-
1992	133 444	132 730	714	200	NO	514	NO	-
1993	134 159	133 444	714	180	NO	534	NO	-
1994	134 873	134 159	714	180	NO	534	NO	-
1995	135 587	134 873	714	180	NO	534	NO	-
1996	136 302	135 587	714	160	NO	-	NO	554
1997	137 016	136 302	714	160	NO	-	NO	554
1998	137 731	137 016	714	160	NO	554	NO	-
1999	138 445	137 731	714	160	NO	554	NO	-
2000	139 160	138 445	714	160	NO	554	NO	-
2001	139 874	139 160	714	160	NO	554	NO	-
2002	140 589	139 873	716	160	NO	554	NO	-
2003	141 303	140 589	714	160	NO	554	NO	-
2004	142 018	141 303	714	160	NO	554	NO	-
2005	142 245	142 085	160	160	NO	-	NO	-

Table 206: Emissions of wetland 1990-2005 in Gg CO_2

	5 D Total Wetland	1. Wetland remaining Wetland	2. Land converted to Wetland	2.1 Forest Land converted to Wetlands	2.2 Cropland converted to Wetlands	2.3 Grassland converted to Wetlands	2.4 Settlements converted to Wetlands	2.5 Other Land converted to Wetlands
1990	212.46	NE	212.46	74.68	NO	137.78	NO	0.00
1991	212.46	NE	212.46	74.68	NO	137.78	NO	0.00
1992	212.46	NE	212.46	74.68	NO	137.78	NO	0.00
1993	210.35	NE	210.35	67.21	NO	143.14	NO	0.00
1994	210.35	NE	210.35	67.21	NO	143.14	NO	0.00
1995	210.35	NE	210.35	67.21	NO	143.14	NO	0.00
1996	226.72	NE	226.72	59.74	NO	0.00	NO	166.98
1997	226.72	NE	226.72	59.74	NO	0.00	NO	166.98
1998	208.24	NE	208.24	59.74	NO	148.49	NO	0.00

	5 D Total Wetland	1. Wetland remaining Wetland	2. Land converted to Wetland	2.1 Forest Land converted to Wetlands	2.2 Cropland converted to Wetlands	2.3 Grassland converted to Wetlands	2.4 Settlements converted to Wetlands	2.5 Other Land converted to Wetlands
1999	208.24	NE	208.24	59.74	NO	148.49	NO	0.00
2000	208.24	NE	208.24	59.74	NO	148.49	NO	0.00
2001	208.24	NE	208.24	59.74	NO	148.49	NO	0.00
2002	208.24	NE	208.24	59.74	NO	148.49	NO	0.00
2003	208.24	NE	208.24	59.74	NO	148.49	NO	0.00
2004	208.24	NE	208.24	59.74	NO	148.49	NO	0.00
2005	77.95	NE	77.95	59.74	NO	18.21	NO	0.00

Methodological Issues

Activity data

The total wetland area was taken from the regional information derived from the Real Estate Database available since 1995 (BEV 2006). The change in the annual water body area was calculated from mean average increase (714 ha) of water bodies from the period 1990-2004. According to methodological changes in the inventory of the regional information derived from the Real Estate Database the real annual reported wetland area was taken since 2005. Due to the fact that the peat areas are protected in most Austrian provinces, it is assumed that there is no further draining of peat land. According to the peat land database of (STEINER & REITER 1992) a constant bog area of 22.239 ha was taken into account for the total reporting period.

7.5.1 Forest Land converted to Wetland (5 D 2 1)

The methodology and activity data are described in chapter 7.2.2. The annual area converted from Forest Land to Wetland ranges from 160 ha to 200 ha between the year 1990 and 2005 causing annual emission rates due to the loss of biomass and C changes in soils from 47 Gg CO_2 to 59 Gg CO_2.

For the calculation of the annual change of carbon stocks in forest soils converted to wetland soils the IPCC Tier 1 approach is used. Emissions/removals were calculated by country specific values for carbon stocks in soils of forest land (121 t C/ha). Water bodies were estimated with 0 t/ha C-stock, bogs with 150 t C/ha (0- 50 cm).

7.5.2 Cropland converted to Wetland (5 D 2 2)

It is assumed by expert judgment that in Austria no conversion occurs from cropland to wetland. The conversion areas are mainly from grassland or other land.

7.5.3 Grassland converted to Wetland (5 D 2 3)

The conversion area from 1990-2005 from grassland to wetland ranges between 415 and 454 ha.

7.5.3.1 Changes in carbon stocks in biomass of grassland converted to wetland

For the calculation of the annual change in carbon stocks of living biomass in grassland converted to wetland the following formula was applied – IPCC TIER 1 (equation 3.5.6 GPG)

Annual change in carbon stocks of living biomass in land converted to wetland (tones $C.y^{-1}$):

$\Delta C_{LW\ flood}= (Sum\ A_i*(B_{after}-B_{before})$

Ai = area of land converted annually to flooded land from original land use, ha

B_{before} = living biomass in land immediately before conversion to wetland = for grassland 3,04 t C $ha.y^{-1}$

B_{after} = living biomass in land immediately after conversion to wetland (default = 0 t C $ha.y^{-1}$)

7.5.3.2 Changes in carbon stocks in soil of grassland converted to wetland

Calculation:

$\Delta C_{LW\ flood}= (Sum\ A_i*(B_{after}-B_{before})$

Ai = area of land converted annually to flooded land from original land use, ha

B_{before} = carbon stock in land immediately before conversion to wetland = for grassland 70 t C $ha.y^{-1}$

B_{after} = carbon stock in land immediately after conversion to wetland (default = 0 t C $ha.y^{-1}$)

7.5.4 Settlement converted to Wetland (5 D 2 4)

By expert judgment it is assumed that in Austria no conversion from settlement to wetland occurs.

7.5.5 Other Land converted to Wetland (5 D 2 5)

The average annual amount of area converted to wetland is 554 ha.

7.5.5.1 Changes in carbon stocks in biomass of other converted to wetland

For the calculation of the annual change in carbon stocks of living biomass in grassland converted to wetland the following formula was applied – IPCC Tier 1 (equation 3.5.6 GPG)

Annual change in carbon stocks of living biomass in land converted to wetland (tones $C.y^{-1}$):

$\Delta C_{LW\ flood}= (Sum\ A_i*(B_{after}-B_{before})$

Ai = area of land converted annually to flooded land from original land use, ha

B_{before} = living biomass in land immediately before conversion to wetland = for other land 10,89 t C $ha.y^{-1}$ see chapter 7.7

B_{after} = living biomass in land immediately after conversion to wetland (default = 0 t C $ha.y^{-1}$)

7.5.5.2 Changes in carbon stocks in soil of other land converted to wetland

Calculation:

$\Delta C_{LW\ flood} = (Sum\ A_i * (B_{after} - B_{before})$

Ai = area of land converted annually to flooded land from original land use, ha

B_{before} = carbon stock in land immediately before conversion to wetland = for other land 71,24 t C.ha.y^{-1} see chapter 7.7

B_{after} = carbon stock in land immediately after conversion to wetland (default=0)

7.5.6 Uncertainty assessment

According to a first rough expert judgement, the uncertainty of this subcategory is -90 to +50 % (expert judgement). This high uncertainty is mainly due to the unknown processes for the soil C stock after conversion. The used approach assumes more or less that the whole soil C stock of the previous land use is emitted in the year of conversion to flooded land.

7.6 Settlements (5 E)

In this category only emissions/removals from the sub-categories "Land converted to settlement" are considered.

About 0.49 Mio ha of Austria's surface can be allocated to the IPCC land use category "Settlement" (BEV, 2006). From the years 1990 to 2005 the settlement area shows an annual mean increase of 11,426 ha. The annual emissions due to land use changes to settlement range between 130 Gg CO_2 and 437 Gg CO_2.

Methodological Issues

Activity data

The basis for the area that can be allocated to this land use category is the regional information derived from the real estate database (BEV, 2006). The total settlement area comprises the following sub-categories: building land – sealed, partly sealed and unsealed area; parks and gardens; road, railway, track and excavation area and other, not further differentiated settlement area.

The real estate database is updated in case of occasion; therefore a mean annual increase of the settlement area of 11,426 ha a^{-1} was calculated for the years 1990 to 2004. For the following years, so for 2005, the yearly reported data from the regional information are taken into consideration.

Obviously the annual increase of settlement area results in a decrease of other land use categories. Therefore the following criteria were set up to allocate to the categories of land use changes:

- Land use changes from forests are based on the statistical results of the NFI.
- Further increases of the settlement area were considered to come to the same relative parts from agricultural land and grassland.
- In cases were the changes from forest land and the decreases of cropland and grassland did not cover the increases of the settlement area, the remaining parts were taken from "Other land".

In compliance with this method the following land use changes to settlement area were derived for the period 1990 to 2005.

Table 207: Derived land use changes to settlements for the period 1990 to 2005 in ha

	.2.1 Forest land converted to settlement	2.2 Cropland converted to settlement	2.3 Grassland converted to settlement	2.4 Wetlands converted to settlements	2.5 Other land converted to settlements
1990	1000	5594	4832	NO	NO
1991	1000	NO	3201	NO	7225
1992	1000	7610	2816	NO	NO
1993	900	8916	1609	NO	NO
1994	900	NO	1990	NO	8536

	2.1 Forest land converted to settlement	2.2 Cropland converted to settlement	2.3 Grassland converted to settlement	2.4 Wetlands converted to settlements	2.5 Other land converted to settlements
1995	900	8642	1884	NO	NO
1996	800	373	NO	NO	10253
1997	800	NO	NO	NO	10626
1998	800	NO	7192	NO	3434
1999	800	8909	1716	NO	NO
2000	800	5689	4937	NO	NO
2001	800	754	9872	NO	NO
2002	800	373	10253	NO	NO
2003	800	NO	10626	NO	NO
2004	800	1792	8834	NO	NO
2005	800	NO	NO	NO	4435

Table 208: Emissions from land use changes to settlement in Gg CO_2

	2 Land converted to settlement	2.1 Forest land converted to settlement	2.2 Cropland converted to settlement	2.3 Grassland converted to settlement	2.4 Wetlands converted to settlements	2.5 Other land converted to settlements
1990	172.43	86.15	58.59	27.69	NO	NO
1991	355.03	86.15	NO	18.34	NO	250.53
1992	181.99	86.15	79.70	16.14	NO	NO
1993	180.14	77.53	93.38	9.22	NO	NO
1994	384.91	77.53	NO	11.40	NO	295.98
1995	178.84	77.53	90.51	10.80	NO	NO
1996	428.34	68.92	3.91	NO	NO	355.51
1997	437.37	68.92	NO	NO	NO	368.45
1998	229.21	68.92	NO	41.22	NO	119.07
1999	172.07	68.92	93.31	9.84	NO	NO
2000	156.79	68.92	59.58	28.29	NO	NO
2001	133.39	68.92	7.90	56.57	NO	NO
2002	131.58	68.92	3.91	58.76	NO	NO
2003	129.81	68.92	NO	60.90	NO	NO
2004	138.31	68.92	18.77	50.63	NO	NO
2005	222.71	68.92	NO	NO	NO	153.79

Calculation of the emissions

Biomass

Estimations about living biomass in settlement areas were based on the results of a scientific study carried out in Vienna (DÖRFLINGER et al. 1995). In this study the total living biomass was calculated for different ecological sub-systems in Vienna. For the reporting to this sector biomass data from the sub systems gardens, urban industrial areas and brown fields were taken into consideration. Based on the biomass data of trees, shrubs and ground vegetation an average biomass per ha settlement area was calculated. An average rotation period of 60 years for trees and 10 years for shrubs was defined by expert judgement to derive an average annual biomass increment. The biomass of ground vegetation is calculated as yearly C-pool.

The following stocks (t C ha^{-1}) and average annual increments (t C $ha^{-1}a^{-1}$) of biomass were calculated:

t C ha^{-1}				t C ha^{-1} a^{-1}			
trees	shrubs	ground veg.	total	trees	shrubs	ground veg.	total
31.4	1.2	1.5	34.1	0.52	0.12	1.5	2.14

Soil

For the calculation of the annual changes of carbon stocks in soils converted to settlement the IPCC Tier 1 approach is used.

The calculations of emissions from soils due to land use changes from forests to settlements are based on country specific values for carbon stocks in soils of forest land (121 t C ha^{-1}) and carbon stocks in mineral soils of settlement land (32 t C ha^{-1}, area weighted mean value of input data described in chapter 7.2.2). These C stocks refer to a soil depth of 0-50 cm.

For the calculation of emissions from soil C stocks changes due to land use changes from the other IPCC land use categories the following values were used.

Cropland: 50 t ha^{-1}

Grassland: 70 t ha^{-1}

Wetlands: 0 t ha^{-1}

Other land: 71 t ha^{-1}

Uncertainty assessment

According to a first rough expert judgement, the uncertainty of this category is +-70 %.

7.7 Other Land 5 F

The soil carbon content and the biomass carbon content of other land were estimated by using data compiled in (KÖRNER et al. 1993) who estimated the C stock of the Austrian landscape.

Methodological Issues

Biomass

Estimations of living biomass in other land areas were based on the results of a study carried by (KÖRNER et al. 1993)

This study gives an overview of the constitution (mixture) of "other land" area. The study provides also information about the carbon stock of living biomass as well as about the soil carbon stock of the different plant societies and land use.

Table 209: carbon content of living biomass and soil of other land

	ha	biomass t C ha^{-1}	soil t C ha^{-1}
glacier, bolder	**109,200**	0	0
unproductive area	**168,900**		
alpine Urweiden	56,300	8.2	99.6
Schutt-Felsvegetation	56,300	0.4	13.3
Schneetälchengesellschaften	18,800	0.9	14.3
Spalierstrauch	18,800	7.6	83.6
Kahlflächen	18,700	0	0
abandoned alpine meadows	**243,200**	20.7	119

According to the share of the different land use areas (glaciers, unproductive area, abandoned alpine meadows) in the category other land a weighted mean for living biomass was calculated. The estimated amount for biomass is 10.89 t C per ha.

Soil

Estimates for the soil carbon stock in other land areas were also based on the results of a study carried out by (KÖRNER et al. 1993).

According to the share of the different areas (glaciers, unproductive area, abandoned alpine meadows) in the category other land a weighted mean for the soil carbon stock was calculated. The amount for soil is 71.24 t C per ha.

7.7.1 Forest Land converted to Other Land (5 F 2 1)

The methodology and activity data are described in chapter 7.2.2. The annual area converted from Forest Land to Other land ranges from 1270 ha to 1600 ha between the year 1990 and 2005 causing annual emission rates due to the loss of biomass and C changes in soils from 111 Gg CO_2 to 140 Gg CO_2.

For the calculation of the annual change of carbon stocks in forest soils converted to soils of other land the IPCC Tier 1 approach is used. Emissions/removals were calculated by country specific values for carbon stocks in mineral soils of forest land (121 t C ha^{-1}). Other land were estimated of 71,24 t ha^{-1} C-stock.

7.8 QA/QC, Verification

The calculations of the data for category 5 are embedded in the overall QA/QC-system of the Austrian GHG inventory (see Chapter 1.6).

Important elements of QA/QC:

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

7.9 Planned improvements

There is a steady re-evaluation and substitution of the used input parameters and the applied methods.

Based on the comments of the ICR taken place in February 2007 the following issues will be considered in the next submission:

- LUC areas will be considered for a period of 20 years in the sub category of LUC
- According to IPCC GPG the C-stock changes in soils due to LUC will be calculated as the difference in stocks divided by the inventory time period (default = 20 years).

Furthermore 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 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 2005 amounted to 2 282 Gg CO_2 equivalent. These are about 2.4% of total greenhouse gas emissions in Austria in 2005 and 4.6% in the base year. In 2005, greenhouse gas emissions from the waste sector were 37.4% below the level of the base year. Figure 29 presents the trend of GHG emissions from IPCC sector 6 Waste for the time period 1990 to 2005.

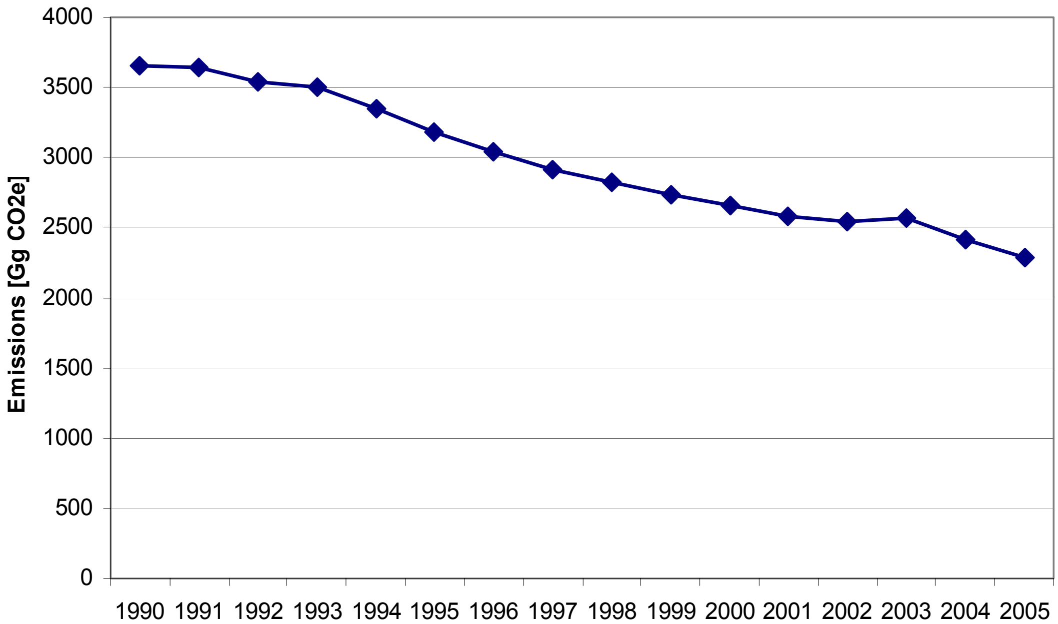

Figure 29: GHG emissions from IPPC Sector 6 Waste 1990-2005

Table 210 presents the emission trend by GHG. The major greenhouse gas emissions from this sector are CH_4 emissions, which represent 85.6% of all emissions from this sector in 2005 followed by N_2O (13.9%) and CO_2 (0.5%).

CH_4 emissions

CH_4 emissions originate from all subcategories within the sector but the largest source is *Solid Waste Disposal on Land*, it contributes 97% of total CH4 emissions from this sector.

The decrease of CH_4 emissions is a result of waste management policies. The amount of land filled waste and the organic carbon content in deposited waste has decreased significantly and the implemented methane recovery systems have increased during the period, all influencing the amount of methane emitted.

N_2O emissions

N_2O emissions from the waste sector have remarkably increased over the considered period (see Table 210). In 2005, N_2O emissions from the Waste sector amounted to 317 Gg CO_2 equivalent. This was 140 % above the level of the base year.

N_2O emissions mainly arise by about 80% from the category *Waste Water Handling* and by about 20% from *Other Waste (Compost production)*. In both categories emissions are increasing, while *Waste Incineration* (*Municipal Solid Waste* and *Waste Oil*) is a minor source of N_2O emissions.

CO_2 emissions

CO_2 emissions of the sector Waste decreased (see Table 210). In 2005, CO_2 emissions from this sector amounted to 12.3 Gg CO_2 equivalent, this was 54.4% below the level of the base year.

CO_2 emissions originate from *Waste Incineration* (*Municipal Solid Waste, Waste Oil and Hospital Waste*). The only plant incinerating municipal waste without energy recovery was shut down in 1991, which resulted in a drop of CO_2 emissions from 1991-1992.

Table 210: Emissions of greenhouse gases and their trend from 1990-2005 from category 6 Waste

	CO_2 [Gg CO_2 e]	CH_4 [Gg CO_2 e]	N_2O [Gg CO_2 e]	Total [Gg CO_2 e]
1990	26.89	3 489.41	132.41	3 648.70
1991	23.40	3 483.04	132.94	3 639.37
1992	10.86	3 394.14	135.76	3 540.76
1993	10.60	3 348.72	142.20	3 501.52
1994	10.65	3 173.78	164.02	3 348.45
1995	10.97	3 003.80	169.73	3 184.50
1996	11.30	2 841.71	189.94	3 042.94
1997	11.62	2 704.32	200.75	2 916.68
1998	11.94	2 602.22	211.47	2 825.63
1999	12.26	2 493.03	230.82	2 736.10
2000	12.26	2 385.18	258.61	2 656.06
2001	12.26	2 285.04	284.93	2 582.23
2002	12.26	2 240.82	286.97	2 540.06
2003	12.26	2 264.71	292.84	2 569.82
2004	12.26	2 098.66	305.53	2 416.45
2005	12.26	1 953.03	317.20	2 282.49
Trend 1990-2005	-54.4%	-44.0%	139.6%	-37.4%

Emission trends by sources

Table 211 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 2005, *Solid Waste Disposal on Land* contributed 82.3% to total greenhouse gas emissions of sector *Waste*.

Table 211: Total greenhouse gas emissions and trend from 1990–200 by subcategories of Category 6 Waste

CO_2 equivalent [Gg]	6 A	6 B	6 C	6 D	Total
1990	3 376.63	210.20	27.09	34.78	3 648.70
1991	3 369.98	209.37	23.58	36.43	3 639.37
1992	3 281.66	204.81	10.91	43.39	3 540.76
1993	3 235.80	200.91	10.64	54.17	3 501.52
1994	3 061.09	212.30	10.69	64.37	3 348.45
1995	2 893.60	211.67	11.01	68.22	3 184.50
1996	2 737.51	222.71	11.33	71.38	3 042.94
1997	2 607.54	227.15	11.66	70.34	2 916.68
1998	2 511.76	229.11	11.98	72.78	2 825.63
1999	2 406.74	239.71	12.30	77.35	2 736.10
2000	2 303.32	259.43	12.30	81.00	2 656.06
2001	2 207.86	279.52	12.30	82.54	2 582.23
2002	2 168.14	275.58	12.30	84.03	2 540.06
2003	2 194.67	270.50	12.30	92.34	2 569.82
2004	2 029.54	287.00	12.30	87.61	2 416.45
2005	1 879.59	289.06	12.30	101.55	2 282.49
Trend 1990 -2005	-44.3%	37.5%	-54.6%	191.9%	-37.4%

8.1.2 Key Sources

Key category analysis is presented in Chapter 1.5. This chapter includes information about the key sources in the IPCC Sector *6 Waste*. Table 212 presents the source categories in the level of aggregation as used for the key source analysis.

The key source of *IPCC Category 6* is CH_4 emissions from *6 A Managed Waste Disposal on Land*.

In the base year, 4.3% of total greenhouse gas emissions originate from this key source and in 2005 2.0%.

Table 212: 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-LA05 TA

LA00= Level Assessment 2000

TA= Trend Assessment BY-2005

8.1.3 Methodology

Detailed information on the methodology can be found in the corresponding subchapters.

8.1.4 Uncertainty Assessment

In this submission uncertainty estimates based on expert judgement by Umweltbundesamt 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 222) 6 B *Wastewater Handling* see

Table 225 and *6D Other Waste* (compost). For further information please refer to the respective subchapters.

8.1.6 Completeness

Table 213 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.

Table 213: Overview of subcategories of Category Waste: transformation into SNAP Codes and status of estimation

IPCC Category	SNAP	CO_2	CH_4	N_2O
6 A SOLID WASTE DISPOSAL ON LAND				
6 A 1 Managed Waste Disposal	090401 Solid Waste Disposal on Land	NA	✓	NA
6 A 2 Unmanaged Waste Disposal	090402 Unmanaged Waste Disposal	NO	NO	NO
6 B WASTEWATER HANDLING				
6 B 1 Industrial Wastewater	091001 Wastewater treatment in industry	NA	NA	✓
6 B 2 Domestic and Commercial Wastewater	091002 Wastewater treatment in residential/commercial sect.	NA	✓	✓
6 C WASTE INCINERATION				
	090201 Incineration of domestic or municipal waste	✓	✓	✓
	090207 Incineration of hospital wastes	✓	✓	✓
	090208 Incineration of waste oil	✓	NA	✓
6 D OTHER WASTE				
	091003 Sludge spreading	IE	IE	IE
	091005 Compost production	NA	✓	✓

In Austria all waste disposal sites are managed sites (also see Chapter 8.2.1.1).

Sludge spreading is included in category 4 D 1.

8.2 Waste Disposal on Land (CRF Source Category 6 A)

8.2.1 Managed Waste Disposal on Land (CRF Source Category 6 A 1)

8.2.1.1 Source Category Description

Key Source: Yes

Emissions: CH4

In Austria all waste disposal sites are managed sites (landfills).

In the year 2005 about 491 landfill sites received waste (see Table 214), 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.

Table 214: Number and type of landfill sites

landfills for	2002	2003	2004	2005
mass waste	61	62	58	50
residual waste/treated waste	18	23	30	27
construction-waste	64	63	124	74
excavated-soil	108	211	454	340

The amount of deposited waste is taken into account from 1950 on. From 1950 to 1990 a steady increase occurred with a peak at 1989, which is due to the introduction of disposal fees. This fee originates from an Austrian Law for cleaning up contaminated sites with the objective to finance cleaning up and securing activities for contaminated site. As long as disposal fees were low high amounts were deposited, which was the case in 1989. From 1990 to 1994 amounts of deposited waste decreased, as waste management was regulated by an own law - the Austrian Waste Management Law[55] (1990). Due to this, waste separation and reuse and recycling activities respectively, increased. The potential of waste prevention and waste recycling was exhausted after 1994, so amounts of deposited waste did not decrease any further. The strong increase in 2003 can mainly be explained by clean up operations of some old landfills which did not meet the standards and the resulting waste was landfilled again. This led to an overestimation or even double counting of emissions in this year, which will be corrected in the next submission as agreed with the ERT during the in-country review of the initial report of Austria (February 2007).

The decrease between 2003 and 2004 is due to the Austrian Landfill Ordinance, which only allows the disposal of treated waste and therefore leads to reduced waste volumes and masses, as well as decreased carbon content in deposited waste.

Table 215 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 - 2005.

[55] Abfallwirtschaftsgesetz 2002, BGBl. I Nr. 102/2002

Table 215: Activity data for "*Residual Waste" and "Non Residual Waste"*, greenhouse gas emissions and implied emission factors *1990–2005*

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	160 792	60.4
1991	677 827	1 799 718	2 477 545	160 475	64.8
1992	691 383	1 614 157	2 305 541	156 269	67.8
1993	705 211	1 644 718	2 349 929	154 086	65.6
1994	719 315	1 142 067	1 861 382	145 766	78.3
1995	733 702	1 049 709	1 783 410	137 790	77.3
1996	748 376	1 124 169	1 872 545	130 358	69.6
1997	763 343	1 082 634	1 845 977	124 168	67.3
1998	778 578	1 081 114	1 859 692	119 608	64.3
1999	841 123	1 084 625	1 925 748	114 607	59.5
2000	843 780	1 052 061	1 895 841	109 682	57.9
2001	795 262	1 065 592	1 860 854	105 136	56.5
2002	808 279	1 374 543	2 182 822	103 245	47.3
2003	899 548	1 815 944	2 715 492	104 508	38.5
2004	367 301	282 656	649 957	96 645	148.7
2005 *)	367 301	282 656	649 957	89 504	137.7

*) Activity data for 2005 are the same as 2004, as the data from the Austrian landfill database were not available in time, but emissions were calculated and are therefore not the same as in 2004.

8.2.1.2 Methodological Issues

IPCC Tier 2 method is applied.

Until submission 2006, country specific methodologies were used (BAUMELER et al 1998). In 2005 a national study (SCHACHERMAYER 2005) which showed that the IPCC tier 2 method is more appropriate and accurate. The change to IPCC tier 2 was also approved by the ERT during the in-country review of the initial report of Austria (February 2007).

Activity data - Residual waste

"Residual waste" corresponds to waste from households and similar establishments after separate collection directly deposited at landfills without any treatment. It originates from private households, administrative facilities of commerce, industry and public administration, kindergartens, schools, hospitals, small enterprises, agriculture, market places and other generation points covered by the municipal waste collecting system.

Only 7.7% of residual waste was deposited in 2004. The remaining part was recycled, incinerated or treated biologically. According to the recent federal waste management plans 2001 and 2006 recycling and treatment of waste from households and similar establishments was performed according to the following routes in 1989 and 2004 respectively:

Table 216: recycling and treatment of waste from households and similar establishments (BUNDESABFALLWIRTSCHAFTPLAN 2006)

Treatment	1989	2004
mechanical-biological treatment	16.7%	11.2%
thermal treatment (incineration)	5.9%	28.3%
treatment in plants for hazardous waste	0.4%	1.2%
recycling	12.9%	35.6%
recycling (biogenous waste)	1.0%	16.0%
direct deposition at landfills ("residual waste")	63.1%	7.7%

The quantities of "residual waste"

- from 1998 to 2004 were taken from the database for solid waste disposals "Deponiedatenbank" ("Austrian landfill database"). According to the Landfill Ordinance[56], which came into force in 1997, the operators of landfill sites have to report how much and what kind of waste they receive at their landfill site annually to the *Umweltbundesamt,* where the data are stored in the database for solid waste disposals.
- from 1989 to 1997 were taken from the respective Federal Waste Management Plan (BUNDESABFALLWIRTSCHAFTPLAN 1995, 2001and 2006).
- 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 residual waste from administrative facilities of businesses and industries is not considered (data from 1950 to 1999) whereas it is reported by the operators of landfill sites from 1998 on and included in the "Deponiedatenbank". Thus to achieve a consistent time series the two overlapping years (1998 and 1999) were examined and the difference which represents the residual waste from administrative facilities of industries and businesses calculated. This difference was then applied to the years 1950 to 1997 according to the relative known change in data from residual waste from households.

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

[56] Deponieverordnung, Federal Gazette BGBl. Nr 164/1996

- 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 217 presents a summary of all considered waste types and the corresponding identification numbers. For calculating the emissions of residual waste the waste types were aggregated to the categories wood, paper, sludge, other waste, bio waste, textiles, construction waste and fats.

There are no data available for the years before 1998. Thus extrapolation was done using the Austrian GDP (gross domestic product) per inhabitant (KAUSEL 1998) as indicator using a 20 year average value in order to get a more robust estimate.

Table 217: Considered types of waste

Waste Identification No	Type of Waste	Waste Identification No	Type of Waste
200301	mixed municipal waste ("residual waste")	170204	Glass, plastic and wood containing or contaminated with dangerous substances
303	wastes from pulp. paper and cardboard production and processing	170903	other construction and demolition wastes (including mixed wastes) containing dangerous substances
1905	wastes from aerobic treatment of solid waste	170904	mixed construction and demolition waste
1908	wastes from wastewater treatment plants not otherwise specified	190805	sludge from treatment of urban wastewater
1909	wastes from the preparation of water intended for human consumption or water for industrial use	190809	grease and oil mixture from oil/water separation containing only edible oil and fats
1912	wastes from the mechanical treatment of waste (for example sorting. crushing. compacting. pelletising) not otherwise specified	200101/ 200102	paper and cardboard
20303	waste from solvent extraction	200108	biodegradable kitchen and canteen waste
30105	sawdust. shavings. cuttings. wood. particle board and veneer	200111	textiles
30304	de-inking sludge from paper recycling	200201	Bio-degradable wastes
30307	mechanically separated rejects from pulping of waste paper and cardboard	200302	waste from markets

Waste Identification No	Type of Waste	Waste Identification No	Type of Waste
30310	fibre rejects. fibre-. filler-. and coating sludge from mechanical separation	200307	bulky waste
40106	sludge. in particular from on-site effluent treatment containing chromium	190811 - 14	sludge from treatment of industrial wastewater
40109	waste from dressing and finishing	20 01 25	edible oil and fat
40221	wastes from unprocessed textile fibres	170201	wood
150103	wooden packaging	303	wastes from pulp. paper and cardboard production and processing

Methodology

Where available, country specific factors are used. If these were not available IPCC default values are taken. Table 218 summarises the parameters used plus the corresponding references.

Table 218: 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 DOC_F	0.6	0.5	0.55	0.77	0.55	0.77	0.55	0.55	0.77
	The DOC_F for residual waste reflects the recent increase of biogenic components (see Table 219). IPCC default taking into account national waste expertises.								
DOC	See Table 220	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	10	15	20	4
	National waste experts	(GILBERG et al. 2005)	(GILBERG et al. 2005)	Assumption: same as residual waste	IPCC default slow decay	Assumption: same as paper	Assumption: same as paper	IPCC default slow decay	(GILBERG et al. 2005)
Number of considered years	56								
	IPCC default including data for 3 to 5 half lives								
Fraction of CH4 in	0.55								
	Mean value cited in the literature, also within the IPCC range.								

Parameters	residual waste	wood	paper	sludges	bulky waste and other waste	Bio-waste	textiles	Construct. waste	fats
Landfill Gas									
Methane Oxidation in the upper layer	10%								
	IPCC default								
Landfill gas recovery	See Figure 30								
	(ROLLAND & OLIVA 2004)								

Biodegradable organic carbon (DOC) of residual waste

The decrease in DOC is due to the introduction of separate collection of bioorganic waste and paper waste. The amount of bio-waste that is collected separately increased over the time, while the organic share in residual waste decreased. This resulted in a change of waste composition with the effect of a decreasing DOC content.

A study (ROLLAND & SCHEIBENGRAF 2003) was undertaken in 2003 to estimate the carbon content in residual waste. The carbon content of different fractions was estimated by viewing literature on direct waste analyses. According to the changing waste composition the carbon content of residual waste (mixture of different waste fractions) over the time was calculated until 2003. For 2004 and 2005, the same DOC values as for 2003 is used.

As can be seen Table 219 presents the composition of residual waste for several years between 1990 and 2004. On the basis of this information a time series for DOC was estimated (see Table 220). For the years before 1990, quantities according to a national study (HACKL & MAUSCHITZ 1999) were used.

Table 219: Composition of residual waste (ROLLAND & SCHEIBENGRAF 2003), (BUNDESABFALLWIRTSCHAFTSPLAN 2006)

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

Residual waste	1990 [% of moist mass]	1993 [% of moist mass]	1996 [% of moist mass]	1999 [% of moist mass]	2004 [% of moist mass]
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 220: 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* investigated the amount of annual collected landfill gas by questionnaires sent to landfill operators (ROLLAND & OLIVA 2004). The amount of collected and burnt landfill gas increased constantly over the time period (Figure 30). While for example the amount of the collected landfill gas was about 2% in 1990, this amount reached 13% in the year 2002.

As this study only covers the amount of collected landfill gas from 1990 to 2002, the 2002 data were also used for 2003 to 2005. A study to update the amounts of collected landfill gas will be undertaken in 2007.

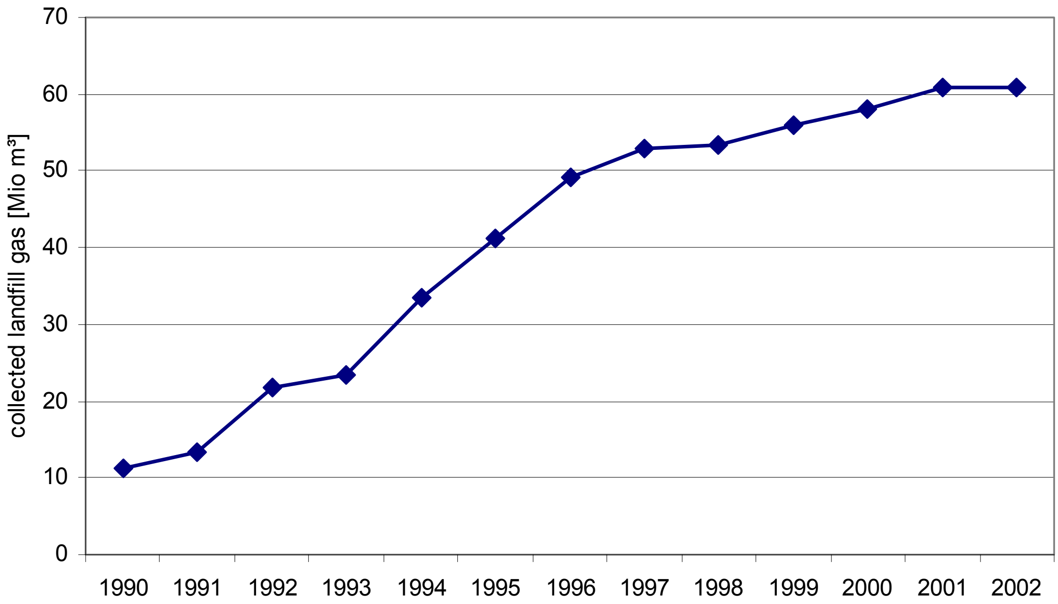

Figure 30: Amount of collected landfill gas 1990 to 2002 (ROLLAND & OLIVA 2004)

Uncertainty Assessment

The uncertainty is based on a national study (WINIWARTER & RYPDAL 2000) and was improved and revised by expert judgement for the submission 2005. The uncertainty decreased due

- to use of IPCC Tier 2 method is used
- to activity data which are now taken from the Austrian landfill database reported from landfill operators,
- to data on the amount of annual collected landfill gas were collected and the DOC was updated according to a study of the *Umweltbundesamt*
- to emission factors which were determined taking into account IPCC default values and national experts on waste and landfills

For this submission uncertainty remained unchanged.

Table 221: Uncertainty assessment for managed waste disposal on land

	WINIWARTER & RYPDAL 2000	Expert judgement 2005 Submission 2007
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:

- During QA/QC procedures it was detected that for bio waste, textiles and construction waste wrong DOCf values were used. The change due to this correction is minor.
- The activity data of "residual waste" and "non residual waste" were updated. According to the Landfill Ordinance[56] the operators of landfill sites have to report their data annually. Due to reports after the due-date there are major changes for 2004 values of activity data in this submission compared to the previous submission.

Table 222: Recalculations with respect to previous submission from Category Managed Waste Disposal on Land 1990-2004

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
CH_4 [Gg Difference]	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.06	0.04	0.01	0.01	-9.01

8.3 Wastewater Handling (CRF Source Category 6 B)

8.3.1 Source Category Description

Key Source: No

Emissions: CH_4, N_2O

In the year 2005, greenhouse gas emissions from Wastewater Handling contributed 0.3% to total greenhouse gas emissions in Austria.

The trend of greenhouse gas emissions during the period is increasing. From 1990 to 2005 greenhouse gas emissions increased by 37.5% due to increasing amounts of wastewater that is treated in treatment plants and increasing amount of denitrification. Table 223 presents CH_4 and N_2O emissions from category Wastewater Handling for the period from 1990 to 2005.

This source category is separated into the subcategories *6 B 1 Industrial Wastewater Handling* and *6 B 2 Urban Wastewater Handling*.

Table 223: Greenhouse gas emissions from Subcategories Industrial Wastewater Handling 6B1 and Urban Wastewater Handling 6B2 for the period 1990-2005

	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	0.34	210.20
1991	0.01	4.84	0.33	209.37
1992	0.01	4.70	0.33	204.81
1993	0.01	4.56	0.33	200.91
1994	0.03	4.39	0.36	212.30
1995	0.05	4.21	0.35	211.67
1996	0.06	3.87	0.40	222.71
1997	0.07	3.53	0.42	227.15
1998	0.09	3.19	0.44	229.11
1999	0.10	2.93	0.48	239.71
2000	0.12	2.68	0.54	259.43
2001	0.14	2.42	0.59	279.52
2002	0.14	2.18	0.60	275.58
2003	0.15	1.93	0.59	270.50
2004	0.16	1.95	0.63	287.00
2005	0.16	1.96	0.64	289.06
Trend 1990-2005	1171.1%	-59.6%	89.4%	37.5%

8.3.2 Methodological Issues

8.3.2.1 CH_4 Emissions

Municipal wastewater treatment

Municipal wastewater treatment in Austria uses mainly aerobic procedures. As a result no or negligible methane emissions are produced since such emissions only occur under anaerobic conditions.

Mainly due to the structure of area of settlement in Austria there is still a small amount of inhabitants not connected to sewage systems and wastewater treatment plants. This wastewater is discharged in septic tanks and cesspools. Due to the tanks anaerobic processes occurring there methane emissions are produced.

CH4 emissions from cesspools and septic tanks are calculated pursuant to the IPCC method. The following parameters were used:

Average organic load:	60 g BOD_5 per inhabitant and day [IPCC default]
Methane producing capacity B_o:	0.6 kg CH_4/ kg BoB_5 [IPCC default]
Methane conversion factor MCF:	0.27 (STEINLECHNER et al. 1994)

The MCF defines the portion of methane producing capacity (B_o) that degrades anaerobically and may vary between 0.0 (completely aerobic) to 1.0 (completely anaerobic). When the system is anaerobic only the temperature is the deciding influence. In Austria there are two ranges of temperature: 20°C for 2/3 of the year with a MCF of 35% and 10°C for 1/3 of the year with a MCF of 10% (STEINLECHNER et al. 1994).

Activity data

The amount of inhabitants not connected to sewage systems and wastewater treatment plants was taken from the respective Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHT 1993, 1996, 1999, 2002) and the situation report on the disposal of urban wastewater and sludge (BMLFUW 2006b). Data for the years 1971, 1981, 1991, 1995, 1998, 2001 and 2003 were available. The missing data were interpolated.

For the years 1971 to 1998 statistical data were available for the categories "municipal wastewater treatment", "domestic sewage treatment plant", "septic tank" and "other treatment". But statistical investigations were changed and thus from 2001 to 2005 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 2005 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 is emitted as well.

Industrial Wastewater Treatment

Industrial Wastewater treatment and sewage sludge treatment is carried out under aerobic as well as anaerobic conditions. Due to lack of data the overall amount of industrial wastewater cannot be estimated. But according to national experts the amount of CH_4 emissions from industrial wastewater treatment and sewage sludge treatment is negligible because CH_4 gas is usually used for energy recovery or is flared. In the Energy Sector sewage gas as an energy source is considered.

8.3.2.2 N_2O Emissions

N_2O emissions from Urban Wastewater Handling are calculated by differentiating between wastewater arising from households connected and from households not connected to the public sewage system. This approach was chosen because of a recommendation by the ERT during the in-country review of the initial report of Austria (February 2007).

N_2O emissions resulting from households not connected to the public sewage system were calculated according to the IPCC default method, as described in the Revised 1996 IPCC Guidelines. The data for the daily protein intake per person are taken from FAO statistics. The number of inhabitants is provided by *Austria Statistics.* Emission factor (0.01) and fraction of nitrogen in protein (0.16) are IPCC default values.

N_2O emissions arising in waste water treatment plants are calculated by using a country-specific method based on IPCC. According to a national study (ORTHOFER et al. 1995) the amount of wastewater that is treated in sewage plants and the amount of nitrogen that is denitrificated should be considered additionally. This approach better reflects that in Austria we have advanced centralized wastewater treatment plants with denitrification steps. Denitrification is a treatment requirement in Austria for Urban Waste Water Treatment Plants based on the Waste water emission ordinance for urban waste water for an organic design capacity larger than 5000 population equivalents[57] in order to fulfill the minimum reduction rate of 70% of total nitrogen. The objective of denitrification is to reduce the risk of eutrophication of surface waters. In 1990, waste water treatment was at its beginning and only 10% of the nitrogen was denitrificated. In 2005 this value increased to 68%.

According to (ORTHOFER et al. 1995) only 1% of the total nitrogen in the denitrification process is emitted as N_2O. The formula for estimating the N_2O emissions from wastewater treatment is:

$$N_2O\ Emissions = WW_{tr} * DF * 0.01 * P * Frac_{NPR} * Inhabitants * F$$

Where:

WWtr	amount of wastewater that is treated in sewage plants
DF	percentage of nitrogen that is denitrificated
P	annual protein intake per capita [kg protein/ person/ a]
$Frac_{NPR}$	Fraction of nitrogen in protein (IPCC default value – 0.16 kg N/kg protein)
Inhabitants	number of inhabitants in Austria
F	Factor [1.57 kg N_2O/ kg N]

Finally the N_2O emissions arising from waste water treatment plants and other treatment are summed up.

[57] 1. Abwasseremissionsverordnung für kommunales Abwasser (BGBl 1996/210)

It is assumed that industrial wastewater handling additionally contributes 30% of N_2O emissions from urban wastewater treatment plants (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 appropriate 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 224. Data were taken from the Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHTE 1993, 1996, 1999, 2002); data in between were interpolated or used further for the last years.

Table 224: Parameters used for the calculation of N2O emissions for 1990 -2005

	Connection rate to public sewage systems [%]	Denitrification rate [%]	Protein intake (g/day/capita)	Total Inhabitants
1990	59.0	0.10	102	7 678 000
1991	60.0	0.10	102	7 754 891
1992	61.4*)	0.10	102	7 840 709
1993	62.7	0.10	103	7 905 632
1994	64.1	0.18	104	7 936 118
1995	73.5*)	0.27	105	7 948 278
1996	74.2	0.35 *)	105	7 959 016
1997	75.0	0.40	105	7 968 041
1998	80.9*)	0.46	107	7 976 789
1999	81.4	0.51 *)	108	7 992 323
2000	81.9	0.60	110	8 011 566
2001	86.0*)	0.68 *)	111	8 043 046
2002	86.0	0.68	111	8 083 797
2003	88.9**)	0.68	111	8 117 754
2004	88.9	0.68	118	8 174 733
2005	88.9	0.68	118	8 233 306

**) Source: Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHTE 1993, 1996, 1999, 2002);*

***) Source: Situation Report on the disposal of urban wastewater and sludge (BMLFUW 2006b)*

8.3.3 Recalculation

The following improvements have been made compared to last year's submission:

- The methodology for calculating N_2O emissions was changed according to recommendation by ERT during the in-country review of the initial report of Austria (February 2007). Now also N_2O emissions are considered which do not arise in waste water treatment plants.
- Update of data for daily protein intake according to FAO statistics.

Table 225: Recalculations with respect to previous submission from Category Wastewater Handling 1990-2004

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
CH_4 [Gg Difference]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
N_2O [Gg]	0.29	0.29	0.28	0.28	0.27	0.20	0.19	0.20	0.14	0.14	0.14	0.11	0.12	0.10	0.15

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 0.7% for the year 1990 and 0.5% for the year 2005.

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 226: Greenhouse gas emissions from Category 6 C.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	27	0.003	0.0004	27
1991	23	0.003	0.0004	24
1992	11	0.001	0.0001	11
1993	11	0.000	0.0001	11
1994	11	0.000	0.0001	11
1995	11	0.000	0.0001	11
1996	11	0.000	0.0001	11
1997	12	0.000	0.0001	12
1998	12	0.000	0.0001	12
1999	12	0.000	0.0001	12
2000	12	0.000	0.0001	12
2001	12	0.000	0.0001	12
2002	12	0.000	0.0001	12
2003	12	0.000	0.0001	12
2004	12	0.000	0.0001	12
2005	12	0.000	0.0001	12
Trend 1990-2005	-54.4%	-90.1%	-74.4%	-54.6%

8.4.2 Methodological Issues

CORINAIR methodology is applied: the quantity of waste is multiplied by an emission factor for CO_2, CH_4 and N_2O.

Emission factors

National emission factors for CH_4 are derived from residual fuel oil VOC emission factors (BMWA-EB 1990, BMWA-EB 1996, UMWELTBUNDESAMT 2001). N_2O emission factors are taken from a national study (ORTHOFER et al. 1995).

For waste oil, the same CO_2 emission factor as for *1 A 1 a* heavy oil (CO_2: 80 [t/TJ]) is used and a heating value of 40.3 GJ/Mg Waste Oil (source: Energy balance-residual fuel oil) is used to convert the emission factors from [kg/TJ] to [kg/Mg].

For municipal solid waste and clinical waste the CO_2 emission factor is calculated by means of default assumptions from (IPCC-GPG 2000) as presented in Table 227.

Table 227: Emission factors and parameters of IPCC Category 6 C Waste Incineration.

Waste Type	Carbon content	Share in fossil carbon	Combus-tion effi-ciency%	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
2005	0	3 100	3 000

Recalculations

No recalculations have been carried out.

8.5 Other Waste (CRF Source Category 6 D)

In this category compost production is addressed.

8.5.1 Compost Production

Key Source: No

Emission: CH_4, N_2O

This category includes CH_4 and N_2O emissions from compost production, which are presented in Table 229 for the period from 1990 to 2005.

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 1990-2005

	CH_4 emissions [Gg]	N_2O emissions [Gg]	Total [CO_2 eq. Gg]
1990	0.52	0.08	34.78
1991	0.54	0.08	36.43
1992	0.65	0.10	43.39
1993	0.82	0.12	54.17
1994	0.98	0.14	64.37
1995	1.04	0.15	68.22
1996	1.09	0.16	71.38
1997	1.08	0.15	70.34
1998	1.12	0.16	72.78
1999	1.18	0.17	77.35
2000	1.22	0.18	81.00
2001	1.25	0.18	82.54
2002	1.28	0.18	84.03
2003	1.40	0.20	92.34
2004	1.34	0.19	87.61
2005	1.54	0.22	101.55
Trend 1990-2005	197%	190%	191.9%

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 the quantity of waste by the corresponding emission factor.

Activity data

The activity data were taken from several national studies. For years where no data were available inter- or extrapolation was done.

Table 230: Sources for Activity data for IPCC Category 6 D Other Waste (Compost Production)

<table>
<tr><th></th><th>mechanical biological treated residual waste</th><th>Bio waste collected in bio waste containers</th><th>Other bio waste, loppings</th><th>sewage sludge</th></tr>
<tr><td>1990</td><td>(Baumeler et al. 1998)</td><td rowspan="16">1990-2005:
Sum of data reported by the Austrian federal provinces, partly interpolated</td><td rowspan="10">1990-1999:
Sum of data reported by the Austrian federal provinces and
(Amlinger 2003)</td><td>Same 1991</td></tr>
<tr><td>1991</td><td>(Baumeler et al. 1998)</td><td>(BAWP 1995)</td></tr>
<tr><td>1992</td><td>(Baumeler et al. 1998)</td><td>Interpolated</td></tr>
<tr><td>1993</td><td>(Baumeler et al. 1998)</td><td>Interpolated</td></tr>
<tr><td>1994</td><td>(Baumeler et al. 1998)</td><td>Interpolated</td></tr>
<tr><td>1995</td><td>(Angerer 1997)</td><td>(Scharf, et al 1998)</td></tr>
<tr><td>1996</td><td>(Rolland) expert judgement</td><td>Interpolated</td></tr>
<tr><td>1997</td><td>(Lahl 1998)</td><td>Interpolated</td></tr>
<tr><td>1998</td><td>(Lahl 2000)</td><td>(BAWP 2001)</td></tr>
<tr><td>1999</td><td>(Grech & Rolland 2001)</td><td>(Amlinger 2003)</td></tr>
<tr><td>2000</td><td>Same as 1999</td><td>Interpolated</td><td>Interpolated</td></tr>
<tr><td>2001</td><td>Same as 1999</td><td>Interpolated</td><td>Interpolated</td></tr>
<tr><td>2002</td><td>Same as 1999</td><td>Interpolated</td><td>Interpolated</td></tr>
<tr><td>2003</td><td>Expert judgement (Domenig 2004)</td><td>Interpolated</td><td>Interpolated</td></tr>
<tr><td>2004</td><td>(Neubauer, et al. 2006)</td><td>(BAWP 2006)</td><td>(BAWP 2006)</td></tr>
<tr><td>2005</td><td>(BAWP 2006)</td><td>Same as 2004</td><td>Same as 2004</td></tr>
</table>

Table 231: Activity data for IPCC Category 6 D Other Waste (Compost Production)

	bio-waste. loppings. home composting in t	mechanical biological treated residual waste in t	sewage sludge in t	Total [Gg]
1990	413 160	345 000	6 800	764 960
1991	448 337	345 000	6 800	800 137
1992	591 317	345 000	11 146	947 463
1993	816 245	345 000	15 492	1 176 737
1994	1 028 500	345 000	19 839	1 393 339
1995	1 151 647	295 000	24 185	1 470 832
1996	1 233 498	280 000	24 000	1 537 498

1997	1 244 076	245 000	23 900	1 512 976
1998	1 300 894	240 000	23 800	1 564 694
1999	1 355 656	265 000	38 528	1 659 184
2000	1 413 993	265 000	53 256	1 732 248
2001	1 453 408	265 000	48 442	1 766 850
2002	1 491 679	265 000	43 628	1 800 307
2003	1 518 208	433 985	38 814	1 991 007
2004	1 553 302	294 783	34 000	1 882 085
2005	1 555 186	612 500	34 000	2 201 686

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 232: 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

The following improvement has been made compared to last year's submission:

– Update of data activity data for the years 1999 to 2005 taking into account information from the Federal Provinces of Austria.

Table 233 Recalculations with respect to previous submission from Category Other Waste (Compost) 1999-2004

	1999	2000	2001	2002	2003	2004
CH_4 [Mg Difference]	0.20	57.8	85.8	106.8	210.0	152.6
N2O [Mg Difference]	1.0	9.5	10.5	12.4	28.0	16.6

9 RECALCULATIONS AND IMPROVEMENTS

This chapter quantifies the changes in emissions for all six greenhouse gases compared to the previous submission – UNFCCC 2006. Recalculations are quantified for total GHG gas emissions for all years and gas specific emissions for 1990 and 2004. The Implication of recalculation for emission levels by category for CO_2, CH_4, N_2O and FCs are presented in Annex 5.

Recalculations of previously submitted inventory data are performed following the IPCC Good Practice Guidance, Chapter 7 "Methodological Choice and Recalculation" with the unique purpose to improve the GHG inventory.

9.1 Explanations and Justifications for Recalculations

Compiling an emission inventory includes data collecting, data transfer and data processing. Data has to be collected from different sources, for instance national statistics, plant operators, studies, personal information or other publications. The provided data must be transferred from different data formats and units into a unique electronic format to be processed further. The calculation of emissions by applying methodologies on the collected data and the final computing of time series into a predefined format (CRF) are further steps in the preparation of the final submission. Finally the submission must be delivered in due time. Even though a QA/QC system gives assistance so that potential error sources are minimized it is sometimes necessary to make some revisions (called recalculations) under the following circumstances:

- An emission source was not considered in the previous inventory.
- A source/data supplier has delivered new data. The causes might be: Previous data were preliminary data only (by estimation, extrapolation), improvements in methodology.
- Occurrence of errors in data transfer or processing: wrong data, unit-conversion, software errors, etc.
- Methodological changes: a new methodology must be applied to fulfil the reporting obligations because one of the following reasons:
  - to decrease uncertainties.
  - an emission source becomes a key source.
  - consistent input data needed for applying the methodology is no longer accessible.
  - input data for more detailed methodology is now available.
  - the methodology is no longer appropriate.

For detailed information on recalculations and their justifications see the corresponding subchapters of Chapters *3 Energy – 8 Waste*.

Below an overview of recalculations made in response to the UNFCCC review process is given.

Table 234: Improvements made in response to the in-country review of the initial report of Austria (February 2007)

Industrial Processes
2 B 1 Ammonia Production: During the in-country review of the initial report of Austria the ERT found that there was a double counting concerning CO_2 emissions from ammonia. The double counting was corrected in this submission.
Waste
6 B Wastewater handling: The methodology for calculating N_2O emissions was changed according to the recommendation by the ERT during the in-country review of the initial report of Austria. Now also N_2O emissions are considered which do not arise in waste water treatment plants.

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 (October 2006).

Energy (IPCC Category 1)

Update of activity data:

Update of activity data is due to updates of the energy balance compiled by the federal statistics authority STATISTIK AUSTRIA.

General improvements

The following improvements affect the years 1999 to 2004 only. It has to be noted that the following recalculations relate to official data published by STATISTIK AUSTRIA ("Österreich-Bilanzen") in November 2005.

Integration of 2003/2004 census data for improvement of the residential sector (*CRF 1A4b*); Definition of improved and more detailed fuel classifications for industrial waste and biomass; Integration of 2004 and 2002 sampling data for recalculation of industrial sub categories from 1999 on. Improvement of companies' allocation to NACE sectors; Integration of 2004 material input survey; Model error correction 1999 to 2000 for residual fuel oil; Consideration of coke oven tar and benzene as refinery input from 2004 on; 1999–2004 correction of coal foreign trade statistics and stock changes which affects coal gross consumption; Integration of 2005 CO_2 emission trading system (ETS) data for improvement and validation of industry sectoral data, especially for non traded fuels and in-plant waste; Update of brown coal NCV by means of ETS data; Because most improvements affect inter-sectoral data without changing gross consumption category *Commerce and Public Services* is chosen as the "residual category" in most cases. This leads to significant changes of CRF category *1A4a* without enhancement of accuracy.

Data harmonisation and consistency

In November 2005, STATISTIK AUSTRIA provided a dataset to emission inventory compilers which was consistent with data submitted to EUROSTAT/IEA but not fully consistent with official data published by STATISTIK AUSTRIA ("Österreich-Bilanzen"). Thus the following inventory recalculations prior to 1999 have been performed additionally to obtain consistency with the official dataset.

1990 to 1998: a share of residual fuel oil final consumption is shifted from *1A4c Agriculture* to *1A2 Manufacturing Industries* subcategories and *1A2a Commercial* (1990: 40 kt). A share of the residual fuel previously considered low sulphur fuel oil is now considered high sulphur residual fuel oil (1990: 11 kt).

1990 to 1997: A share of o*ther solid biomass* is shifted from *1A1* to *1A4* (1990: 0.2 PJ).

1 A 3 b Transport – Road:

Energy data, particularly the biodiesel consumption 2004 have been revised according to the updated national energy balance.

1 A 3 e Pipeline compressors:

Revised 2004 natural gas consumption according to the updated national energy balance.

1 A 4 Mobile Sources:

Revised energy data for railways (coal, diesel, electricity) up to 2000 according to the updated national energy balance.

Improvements of methodologies and emission factors:

Cross sectoral:

2005 ETS activity data (356 PJ) and CO_2 emissions (25 283 Gg CO_2) has been applied for *NFR 1A1 and 1A2* stationary sources (total 490 PJ and 35 538 Gg CO_2).

1 A 1 a Public Electricity and Heat Production:

Fuel consumption previously reported as *fuel wood* is now considered as *other solid biomass.*

1 A 1 b Petroleum Refining:

Error correction of double counting leads to slightly lower CO_2 emissions 1990: -4 kt CO_2 ; 2001: -3 kt CO_2. Update of 2002 to 2004 CO_2 emissions with reported plant emissions (2004: +272 kt CO_2).

Industrial Processes (IPCC Category 2)

Update of activity data:

2 A 1 Cement Production:

Activity and emission data for CO_2 emissions from *Cement Production* 2004 has been updated using plant-specific data provided by the Association of the Austrian Cement Industry.

2 B 1 Ammonia Production:

During the in-country review of the initial report of Austria (February 2007) the ERT found that there was a double counting concerning CO_2 emissions from ammonia. The double counting was corrected in this submission.

2 C 1 Iron and Steel:

Process-specific CO_2 emissions from pig iron production for several years 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 C 2 Ferroalloys: Activity data for 2004 has been updated.

2 F Consumption of Halocarbons and SF_6:

4 Aerosols and 5 Solvents: Potential emissions have been updated for the years 2002–2004.

8 Electrical equipment: Potential emissions have been updated for 2004.

Improvements of methodologies and emission factors:

2 A 2 Lime: Emissions have been updated for 2003 and 2004 using plant specific emission factors.

Solvent and other Product Use (IPCC Category 3)

Update of activity data:

3 A, 3 B, 3 C and 3 D 5:

NMVOC emissions from solvent use have been interpolated between 2001 and 2005. This results in a decrease of indirect CO_2 emissions from solvent use for the years 2002–2004 compared to the previous submission, where emission data were extrapolated from 2002 onwards.

3 D 1: Use of N2O for Anaesthesia

Due to new industry inquiries the amount of N_2O used for anaesthesia was updated for the years 2001–2004.

Agriculture (IPCC Category 4)

Update of activity data:

4 D 1 Direct Soil Emissions – urea consumption data:

Revised urea application data from 2002 to 2004 have been used. In accordance with the other N mineral fertilizer application data, figures now relate to the economic year of the farmers and not to the calendar year.

4 D 1 Direct Soil Emissions – sewage sludge application:

Emissions from sewage sludge application on agricultural soils have been shifted from source category 4 D 4 Other to 4 D 1 Direct Soil Emissions – 6. Other.
2004 data has been updated, which resulted in lower emissions.

LULUCF (IPCC Category 5)

Addition of source or sink categories:

5 D 2 Land converted to Wetlands:

CO_2 emissions and removals from Land use changes (additionally to forestland) to wetland (categories 5 D 2) have been calculated for each year from 1990 onwards.

5 E 2 Land converted to Settlements:

CO_2 emissions and removals from Land use changes (additionally to forestland) to settlements (categories *5 E 2*) have been calculated for each year from 1990 onwards.

Update of activity data:

The whole time series on activity data (consistent area table for land use and land use changes) has been revised, particularly due to the inclusion of further data and statistics or data corrections for settlements and wetlands.

The activity data on grassland from 1990 on have been revised.

5 A Forest Land:

The "dead wood" time series has been corrected according to findings during internal Quality Control checks.

Waste (IPCC Category 6)

Update of activity data

6 A 1 Managed waste disposal on land:

Activity data (1998 to 2004) has been updated. According to the Austrian Landfill Ordinance, the operators of landfill sites have to report their activity data annually. Based on reports received after the due date, there are major changes for 2004 values of activity data in this submission compared to the previous submission.

During quality control checks a calculation error in non-residual waste categories was detected and corrected, the effects on emission are minor.

6 B Waste Water Handling:

The methodology for calculating N_2O emissions was changed according to the recommendation by the ERT during the in-country review of the initial report of Austria (February 2007). Now also N_2O emissions are considered which do not arise in waste water treatment plants.

The protein intake per person has been updated according to data published by the FAO. This results in revised N_2O emission for industrial and domestic waste water treatment.

Population data for 2004 have been updated, which is the reason why CH_4 emissions in 2004 vary slightly from last year's submission.

6 D Other:

Activity data 2000–2004 has been revised by applying a bottom-up approach with information from the waste Management Concepts and Plans of the Federal Provinces (Bundesländer).

9.2 Implication for Emission Levels

As a result of the continuous improvement of Austria's GHG inventory, emissions of some sources have been recalculated on the basis of updated data or revised methodologies, thus emission data for 1990 to 2004 which are submitted this year differ from data reported previously.

The following table presents the recalculation difference with respect to last year's submission for each gas (positive values indicate that this year's estimate is higher).

Table 235: Recalculation difference of Austria's greenhouse gas emissions compared to the previous submission

	1990 (Base year)	2004
	Recalculation Difference [%]	
TOTAL	+0.12%	-0.17%
CO_2	-0.00%	+0.05%
CH_4	+0.02%	-2.59%
N_2O	+1.52%	+0.10%
HFC, PFC, SF6	0.00%	-0.31%

Emissions without LULUCF

The main reason for the increase of reported CO_2 emissions in 2004 is the update of activity data in the sectors *2 A 1 Cement Production* and *2 C 1 Iron and Steel Production*.

The main reason for the decrease of reported methane emissions in 2004 is the update of activity data in the sector *6 A 1 Managed Waste Disposal on Land*.

The main reason for the increase of reported N_2O emissions in 1990 and 2004 is the change in methodology in the sector *6 B Waste Water Handling* that was triggered by the ERT during the in-country review of the initial report of Austria (February 2007).

The main reason for the decrease of reported emissions of fluorinated compounds in 2004 is the update of potential emissions in the 2 F subcategories Aerosols, Solvents and Electrical equipment.

Table 236 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 236: Recalculation Difference of National Total GHG Emissions

Year	National Total GHG emissions without LUCF		
	Submission 2006 [Gg CO_2e]	Submission 2007 [Gg CO_2e]	Recalculation Difference [%]
1990*	78 959.40	79 052.98	0.12%
1991	82 997.57	83 100.95	0.12%
1992	76 300.77	76 394.16	0.12%
1993	76 270.69	76 357.33	0.11%
1994	77 113.09	77 194.64	0.11%
1995	80 234.57	80 294.47	0.07%
1996	83 567.37	83 624.02	0.07%
1997	83 146.28	83 201.23	0.07%
1998	82 605.15	82 626.96	0.03%
1999	80 800.09	80 748.89	-0.06%
2000	81 278.83	81 115.72	-0.20%
2001	85 145.37	85 056.29	-0.10%
2002	86 858.79	86 679.76	-0.21%
2003	92 526.59	92 953.45	0.46%
2004	91 332.60	91 177.27	-0.17%

*Base year is 1990 for all gases

9.3 Implications for Emission Trends

As can be seen in Table 236 and Figure 31, Austria's greenhouse gas emissions as reported in the UNFCCC submission 2007 are slightly different than the values reported last year due to recalculations: for the base year they are 0.12% higher and for the year 2004 0.17% lower. This results in a less strong increasing trend: last year the trend from the base year to 2004 was plus 15.7% whereas now it is plus 15.3% (for explanations please refer to Chapters 9.1 and 9.2).

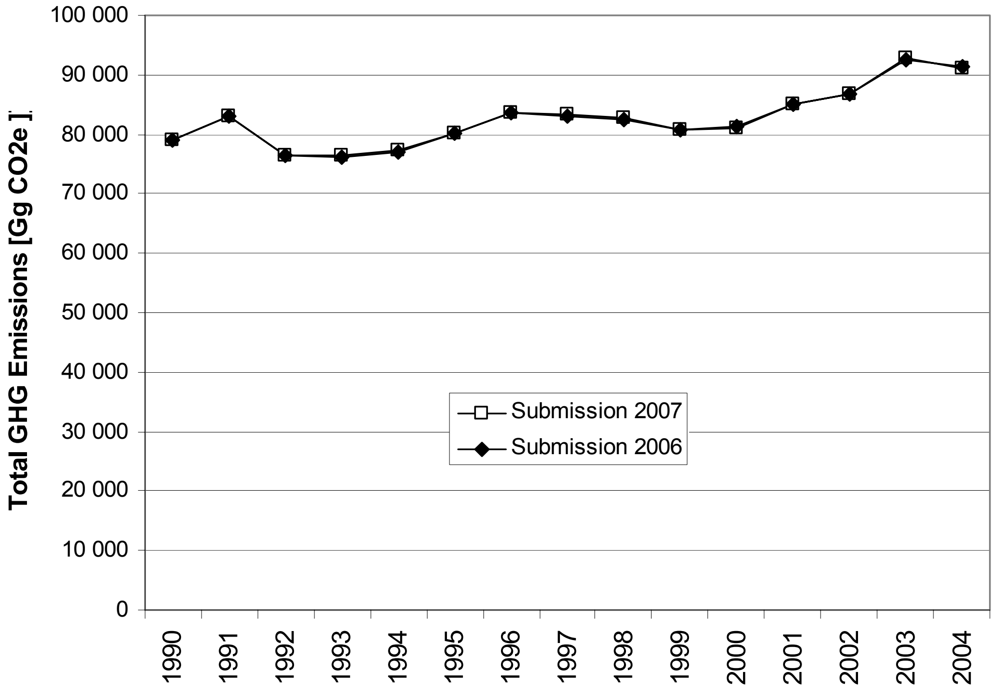

Figure 31: Emission estimates of the submission 2006 and recalculated values of the submission 2007

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
LULUCF	Land Use, Land-Use Change and Forestry – IPCC-CRF Category 5

NACE	Nomenclature des activites economiques de la Communaute Europeenne
NAPFUE	Nomenclature for Air Pollution Fuels
NFI	National Forest Inventory
NFR	Nomenclature for Reporting (Format of Reporting under the UNECE/CLRTAP Convention)
NISA	National Inventory System Austria
OECD	Organisation for Economic Co-operation and Development
OLI	Österreichische Luftschadstoff Inventur Austrian Air Emission Inventory
OMV	Österreichische Mineralölverwaltung Austrian Mineraloil Company
PHARE	Phare is the acronym of the Programme's original name: '**P**oland and **H**ungary: **A**ction for the **R**estructuring of the **E**conomy'. It covers now 14 partner countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, the Former Yugoslav Republic of Macedonia (FYROM), Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. (However, Croatia was suspended from the Phare Programme in July 1995.)
QA/QC	Quality Assurance/ Quality Control
QMS	Quality Management System
RWA	Raiffeisen Ware Austria (see www.rwa.at)
SNAP	Selected Nomenclature on Air Pollutants
UNECE / CLRTAP	United Nations Economic Commission for Europe, Convention on Long-range Transboundary Air Pollution
UNFCCC	United Nations Framework Convention on Climate Change

Notation Keys

according to UNFCCC guidelines on reporting and review [FCCC/CP/2002/8]

"NO" (not occurring)	for activities or processes in a particular source or sink category that do not occur within a country;
"NE" (not estimated)	for existing emissions by sources and removals by sinks of greenhouse gases which have not been estimated. Where "NE" is used in an inventory for emissions or removals of CO_2 , CH_4 , N_2O, HFCs, PFCs, or SF_6 , the Party should indicate in both the NIR and the CRF completeness table why emissions or removals have not been estimated
"NA" (not applicable)	for activities in a given source/sink category that do not result in emissions or removals of a specific gas. If categories in the CRF for which "NA" is applicable are shaded, they do not need to be filled in;
"IE" (included else-where)	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 CATEGORY ANALYSIS

The following tables present results from the key source analysis, the methodology of the analysis is presented in Chapter 1.5 of the NIR 2007.

Table A1.1 presents results from the Level Assessment of the key category analysis excluding LULUCF.

Table A1.2 presents results from the Trend Assessment of the key category analysis excluding LULUCF.

Table A1.3 presents results from the Level Assessment of the key category analysis including LULUCF.

Table A1.4 presents results from the Trend Assessment of the key category analysis including LULUCF.

Table A1.5 presents emission sources and removal sinks in the level of aggregation as used for the key category analysis. Emissions/removals from 1990 to 2005 for these categories are also included.

Table A1.6 summarizes the key categories identified including their ranking in the level and trend assessments.

Rank	IPCC Source Categories		GHG	Unit	BY	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	14.13%	14.13%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	10.01%	24.14%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 319.3	9.26%	33.39%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	7.90%	41.30%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.4	6.34%	47.64%
6	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	5.08%	52.72%
7	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	4.50%	57.22%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4.49%	61.71%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 376.6	4.27%	65.98%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 883.5	3.65%	69.62%
11	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	3.36%	72.98%
12	2 A 1	Cement Production	CO2	Gg	2 033.4	2.57%	75.55%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 956.5	2.47%	78.03%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 760.0	2.23%	80.26%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 314.8	1.66%	81.92%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.7	1.66%	83.58%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1.55%	85.13%
18	2C3	Aluminium production	PFCs	GgCO2e	1 050.2	1.33%	86.46%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 018.4	1.29%	87.75%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	1.15%	88.90%
21	4 B 1	Cattle	N2O	Gg CO2e	908.1	1.15%	90.05%
22	4 B 1	Cattle	CH4	Gg CO2e	587.1	0.74%	90.79%
23	2 B 1	Ammonia Production	CO2	Gg	516.6	0.65%	91.44%
24	2 A 7 b	Sinter Production	CO2	Gg	481.2	0.61%	92.05%
25	4 B 8	Swine	CH4	Gg CO2e	447.7	0.57%	92.62%
26	2 A 2	Lime Production	CO2	Gg	396.2	0.50%	93.12%
27	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	0.47%	93.59%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	314.7	0.40%	93.99%
29	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	0.36%	94.35%
30	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	0.34%	94.70%
31	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	0.32%	95.02%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1991	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 771.2	14.16%	14.16%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 678.7	10.44%	24.61%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 694.7	9.26%	33.87%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 817.0	8.20%	42.07%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 829.9	5.81%	47.88%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 759.8	5.73%	53.61%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 509.5	4.22%	57.83%
8	4 A 1	Cattle	CH4	Gg CO2e	3 503.5	4.22%	62.05%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 370.0	4.06%	66.11%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 270.2	3.94%	70.04%
11	1 A 4 solid	Other Sectors	CO2	Gg	2 934.3	3.53%	73.57%
12	2 A 1	Cement Production	CO2	Gg	2 005.0	2.41%	75.98%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 924.6	2.32%	78.30%
14	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 907.4	2.30%	80.60%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 498.0	1.80%	82.40%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 394.3	1.68%	84.08%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 178.2	1.42%	85.49%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 059.3	1.27%	86.77%
19	2C3	Aluminium production	PFCs	GgCO2e	1 050.2	1.26%	88.03%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	927.3	1.12%	89.15%
21	4 B 1	Cattle	N2O	Gg CO2e	896.1	1.08%	90.23%
22	4 B 1	Cattle	CH4	Gg CO2e	576.9	0.69%	90.92%
23	2 B 1	Ammonia Production	CO2	Gg	545.7	0.66%	91.58%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	468.0	0.56%	92.14%
25	4 B 8	Swine	CH4	Gg CO2e	441.7	0.53%	92.67%
26	2 A 7 b	Sinter Production	CO2	Gg	391.6	0.47%	93.14%
27	2 A 2	Lime Production	CO2	Gg	361.3	0.43%	93.58%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	341.8	0.41%	93.99%
29	1 B 2 b	Natural gas	CH4	Gg CO2e	288.1	0.35%	94.34%
30	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	281.9	0.34%	94.68%
31	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	277.2	0.33%	95.01%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1992	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 834.3	15.49%	15.49%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 297.1	10.86%	26.35%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 183.7	9.40%	35.76%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 156.8	6.75%	42.51%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 138.9	5.42%	47.92%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 009.5	5.25%	53.17%
7	4 A 1	Cattle	CH4	Gg CO2e	3 340.8	4.37%	57.55%
8	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 281.7	4.30%	61.84%
9	2 C 1	Iron and Steel Production	CO2	Gg	3 074.9	4.03%	65.87%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 525.7	3.31%	69.17%
11	1 A 4 solid	Other Sectors	CO2	Gg	2 510.7	3.29%	72.46%
12	2 A 1	Cement Production	CO2	Gg	2 105.0	2.76%	75.21%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 915.7	2.51%	77.72%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 780.0	2.33%	80.05%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 481.6	1.94%	81.99%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 276.6	1.67%	83.66%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 220.1	1.60%	85.26%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 070.6	1.40%	86.66%
19	4 B 1	Cattle	N2O	Gg CO2e	858.5	1.12%	87.78%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	837.5	1.10%	88.88%
21	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	571.0	0.75%	89.63%
22	2 B 1	Ammonia Production	CO2	Gg	552.8	0.72%	90.35%
23	4 B 1	Cattle	CH4	Gg CO2e	552.0	0.72%	91.07%
24	4 B 8	Swine	CH4	Gg CO2e	451.6	0.59%	91.67%
25	2C3	Aluminium production	PFCs	GgCO2e	417.6	0.55%	92.21%
26	2 A 2	Lime Production	CO2	Gg	355.1	0.46%	92.68%
27	2 A 7 b	Sinter Production	CO2	Gg	336.1	0.44%	93.12%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	316.5	0.41%	93.53%
29	1 B 2 b	Natural gas	CH4	Gg CO2e	307.1	0.40%	93.93%
30	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	295.4	0.39%	94.32%
31	2F7	Semiconductor Manufacture	FCs	GgCO2e	287.8	0.38%	94.70%
32	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	0.33%	95.03%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1993	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	12 339.5	16.16%	16.16%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 958.7	10.42%	26.58%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 118.9	9.32%	35.91%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 677.5	7.44%	43.34%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 318.3	5.66%	49.00%
6	4 A 1	Cattle	CH4	Gg CO2e	3 330.5	4.36%	53.36%
7	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 235.8	4.24%	57.60%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 144.7	4.12%	61.72%
9	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 088.9	4.05%	65.76%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 996.2	3.92%	69.68%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 184.3	2.86%	72.54%
12	1 A 4 solid	Other Sectors	CO2	Gg	2 080.0	2.72%	75.27%
13	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 052.0	2.69%	77.96%
14	2 A 1	Cement Production	CO2	Gg	2 031.9	2.66%	80.62%
15	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 622.0	2.12%	82.74%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 230.9	1.61%	84.35%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 180.0	1.55%	85.90%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 036.2	1.36%	87.26%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	878.7	1.15%	88.41%
20	4 B 1	Cattle	N2O	Gg CO2e	857.4	1.12%	89.53%
21	4 B 1	Cattle	CH4	Gg CO2e	546.3	0.72%	90.25%
22	2 B 1	Ammonia Production	CO2	Gg	538.8	0.71%	90.95%
23	4 B 8	Swine	CH4	Gg CO2e	463.7	0.61%	91.56%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	367.2	0.48%	92.04%
25	2 A 2	Lime Production	CO2	Gg	365.2	0.48%	92.52%
26	2F7	Semiconductor Manufacture	FCs	GgCO2e	360.4	0.47%	92.99%
27	1 B 2 b	Natural gas	CH4	Gg CO2e	326.7	0.43%	93.42%
28	2 A 7 b	Sinter Production	CO2	Gg	324.6	0.43%	93.84%
29	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	316.2	0.41%	94.26%
30	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	307.1	0.40%	94.66%
31	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	277.2	0.36%	95.02%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1994	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	12 961.8	16.79%	16.79%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 673.0	9.94%	26.73%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 528.8	8.46%	35.19%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 914.7	7.66%	42.85%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 236.8	5.49%	48.34%
6	2 C 1	Iron and Steel Production	CO2	Gg	3 411.1	4.42%	52.76%
7	4 A 1	Cattle	CH4	Gg CO2e	3 350.1	4.34%	57.10%
8	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 279.1	4.25%	61.35%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 061.1	3.97%	65.31%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 886.7	3.74%	69.05%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 325.5	3.01%	72.06%
12	2 A 1	Cement Production	CO2	Gg	2 102.3	2.72%	74.79%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 919.4	2.49%	77.27%
14	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 901.8	2.46%	79.74%
15	1 A 4 solid	Other Sectors	CO2	Gg	1 855.6	2.40%	82.14%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 339.3	1.73%	83.87%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 311.6	1.70%	85.57%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 063.4	1.38%	86.95%
19	4 B 1	Cattle	N2O	Gg CO2e	858.1	1.11%	88.06%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	825.2	1.07%	89.13%
21	4 B 1	Cattle	CH4	Gg CO2e	542.2	0.70%	89.83%
22	2 B 1	Ammonia Production	CO2	Gg	507.0	0.66%	90.49%
23	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	486.3	0.63%	91.12%
24	4 B 8	Swine	CH4	Gg CO2e	457.1	0.59%	91.71%
25	2F7	Semiconductor Manufacture	FCs	GgCO2e	430.9	0.56%	92.27%
26	2 A 2	Lime Production	CO2	Gg	390.5	0.51%	92.78%
27	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	372.8	0.48%	93.26%
28	1 B 2 b	Natural gas	CH4	Gg CO2e	342.7	0.44%	93.70%
29	2 A 7 b	Sinter Production	CO2	Gg	322.9	0.42%	94.12%
30	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	305.1	0.40%	94.52%
31	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	286.6	0.37%	94.89%
32	3	SOLVENT AND OTHER PRODUCT USE	N2O	Gg CO2e	232.5	0.30%	95.19%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1995	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 058.9	17.51%	17.51%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 411.3	9.23%	26.74%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 191.2	8.96%	35.70%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	6 553.4	8.16%	43.86%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 529.8	5.64%	49.50%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 457.6	5.55%	55.05%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 921.0	4.88%	59.93%
8	4 A 1	Cattle	CH4	Gg CO2e	3 372.6	4.20%	64.13%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 893.6	3.60%	67.74%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 686.4	3.35%	71.08%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 169.5	2.70%	73.79%
12	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 929.4	2.40%	76.19%
13	1 A 4 solid	Other Sectors	CO2	Gg	1 746.4	2.18%	78.36%
14	2 A 1	Cement Production	CO2	Gg	1 631.3	2.03%	80.39%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 556.3	1.94%	82.33%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 364.0	1.70%	84.03%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 220.0	1.52%	85.55%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 038.5	1.29%	86.84%
19	4 B 1	Cattle	N2O	Gg CO2e	879.2	1.10%	87.94%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	857.2	1.07%	89.01%
21	2 B 1	Ammonia Production	CO2	Gg	537.1	0.67%	89.68%
22	4 B 1	Cattle	CH4	Gg CO2e	532.8	0.66%	90.34%
23	2F7	Semiconductor Manufacture	FCs	GgCO2e	505.7	0.63%	90.97%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	500.0	0.62%	91.59%
25	4 B 8	Swine	CH4	Gg CO2e	458.5	0.57%	92.16%
26	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	443.1	0.55%	92.71%
27	2 A 7 b	Sinter Production	CO2	Gg	409.9	0.51%	93.23%
28	2 A 2	Lime Production	CO2	Gg	394.6	0.49%	93.72%
29	1 B 2 b	Natural gas	CH4	Gg CO2e	368.0	0.46%	94.18%
30	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	302.5	0.38%	94.55%
31	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	289.6	0.36%	94.91%
32	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	259.2	0.32%	95.24%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1996	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 219.0	18.20%	18.20%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	8 688.1	10.39%	28.59%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 325.4	9.96%	38.54%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 855.7	8.20%	46.74%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 695.9	5.62%	52.36%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 400.0	5.26%	57.62%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 702.9	4.43%	62.05%
8	4 A 1	Cattle	CH4	Gg CO2e	3 320.4	3.97%	66.02%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 737.5	3.27%	69.29%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 505.6	3.00%	72.29%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 182.2	2.61%	74.90%
12	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 713.6	2.05%	76.95%
13	1 A 4 solid	Other Sectors	CO2	Gg	1 657.7	1.98%	78.93%
14	2 A 1	Cement Production	CO2	Gg	1 634.2	1.95%	80.88%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 549.9	1.85%	82.74%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 338.7	1.60%	84.34%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 252.2	1.50%	85.84%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 010.1	1.21%	87.04%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	874.2	1.05%	88.09%
20	4 B 1	Cattle	N2O	Gg CO2e	865.0	1.03%	89.12%
21	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	610.6	0.73%	89.85%
22	2 B 1	Ammonia Production	CO2	Gg	538.7	0.64%	90.50%
23	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	538.3	0.64%	91.14%
24	4 B 1	Cattle	CH4	Gg CO2e	525.7	0.63%	91.77%
25	4 B 8	Swine	CH4	Gg CO2e	447.6	0.54%	92.31%
26	2F7	Semiconductor Manufacture	FCs	GgCO2e	403.9	0.48%	92.79%
27	1 B 2 b	Natural gas	CH4	Gg CO2e	393.9	0.47%	93.26%
28	2 A 2	Lime Production	CO2	Gg	382.7	0.46%	93.72%
29	2 A 7 b	Sinter Production	CO2	Gg	355.4	0.42%	94.14%
30	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	337.5	0.40%	94.55%
31	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	324.5	0.39%	94.93%
32	1 A 4 other	Other Sectors	CO2	Gg	302.0	0.36%	95.29%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1997	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 678.9	17.64%	17.64%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	7 968.6	9.58%	27.22%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 406.9	8.90%	36.12%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 497.0	7.81%	43.93%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 018.7	6.03%	49.96%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 002.2	6.01%	55.98%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 099.9	4.93%	60.90%
8	4 A 1	Cattle	CH4	Gg CO2e	3 253.7	3.91%	64.81%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 230.5	3.88%	68.70%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 607.5	3.13%	71.83%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 155.8	2.59%	74.42%
12	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 925.2	2.31%	76.74%
13	2 A 1	Cement Production	CO2	Gg	1 760.9	2.12%	78.85%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 752.9	2.11%	80.96%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 431.8	1.72%	82.68%
16	1 A 4 solid	Other Sectors	CO2	Gg	1 294.5	1.56%	84.24%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 256.6	1.51%	85.75%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 026.1	1.23%	86.98%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	862.6	1.04%	88.02%
20	4 B 1	Cattle	N2O	Gg CO2e	851.4	1.02%	89.04%
21	2F7	Semiconductor Manufacture	FCs	GgCO2e	593.8	0.71%	89.75%
22	2 B 1	Ammonia Production	CO2	Gg	532.1	0.64%	90.39%
23	4 B 1	Cattle	CH4	Gg CO2e	520.5	0.63%	91.02%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	506.9	0.61%	91.63%
25	4 B 8	Swine	CH4	Gg CO2e	448.3	0.54%	92.17%
26	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	418.3	0.50%	92.67%
27	2 A 2	Lime Production	CO2	Gg	412.5	0.50%	93.16%
28	1 B 2 b	Natural gas	CH4	Gg CO2e	410.3	0.49%	93.66%
29	2 A 7 b	Sinter Production	CO2	Gg	384.3	0.46%	94.12%
30	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	349.2	0.42%	94.54%
31	1 A 4 other	Other Sectors	CO2	Gg	270.7	0.33%	94.86%
32	2F9	Other Sources of SF6	SF6	GgCO2e	256.1	0.31%	95.17%

Table A1.1: Level assessment excluding LULUCF

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%	29.93%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 456.3	9.02%	38.96%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 798.5	8.23%	47.19%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 466.6	5.41%	52.59%
6	2 C 1	Iron and Steel Production	CO2	Gg	3 900.4	4.72%	57.31%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 498.0	4.23%	61.55%
8	4 A 1	Cattle	CH4	Gg CO2e	3 226.6	3.91%	65.45%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 959.4	3.58%	69.03%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 511.8	3.04%	72.07%
11	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 211.2	2.68%	74.75%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 172.2	2.63%	77.38%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 778.5	2.15%	79.53%
14	2 A 1	Cement Production	CO2	Gg	1 598.7	1.93%	81.46%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 378.2	1.67%	83.13%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 259.7	1.52%	84.66%
17	1 A 4 solid	Other Sectors	CO2	Gg	1 127.3	1.36%	86.02%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 041.2	1.26%	87.28%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	896.7	1.09%	88.37%
20	4 B 1	Cattle	N2O	Gg CO2e	848.1	1.03%	89.39%
21	2 B 1	Ammonia Production	CO2	Gg	525.3	0.64%	90.03%
22	4 B 1	Cattle	CH4	Gg CO2e	517.0	0.63%	90.65%
23	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	492.3	0.60%	91.25%
24	2F7	Semiconductor Manufacture	FCs	GgCO2e	477.8	0.58%	91.83%
25	4 B 8	Swine	CH4	Gg CO2e	462.4	0.56%	92.39%
26	2 A 2	Lime Production	CO2	Gg	453.8	0.55%	92.94%
27	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	427.3	0.52%	93.45%
28	1 B 2 b	Natural gas	CH4	Gg CO2e	424.9	0.51%	93.97%
29	2 A 7 b	Sinter Production	CO2	Gg	345.4	0.42%	94.39%
30	2F9	Other Sources of SF6	SF6	GgCO2e	286.1	0.35%	94.73%
31	2 A 3	Limestone and Dolomite Use	CO2	Gg	264.1	0.32%	95.05%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	1999	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 147.2	18.76%	18.76%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 525.1	11.80%	30.55%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 566.8	9.37%	39.93%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 317.7	7.82%	47.75%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 351.1	5.39%	53.14%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 779.4	4.68%	57.82%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 759.3	4.66%	62.47%
8	4 A 1	Cattle	CH4	Gg CO2e	3 204.8	3.97%	66.44%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 406.7	2.98%	69.42%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 088.2	2.59%	72.01%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 056.5	2.55%	74.56%
12	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 969.0	2.44%	76.99%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 727.7	2.14%	79.13%
14	2 A 1	Cement Production	CO2	Gg	1 607.4	1.99%	81.12%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 401.4	1.74%	82.86%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 222.7	1.51%	84.37%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 047.9	1.30%	85.67%
18	1 A 4 solid	Other Sectors	CO2	Gg	1 041.0	1.29%	86.96%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	923.5	1.14%	88.10%
20	4 B 1	Cattle	N2O	Gg CO2e	843.6	1.04%	89.15%
21	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	539.3	0.67%	89.82%
22	2 B 1	Ammonia Production	CO2	Gg	530.4	0.66%	90.47%
23	4 B 1	Cattle	CH4	Gg CO2e	510.4	0.63%	91.11%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	493.7	0.61%	91.72%
25	2F7	Semiconductor Manufacture	FCs	GgCO2e	453.9	0.56%	92.28%
26	2 A 2	Lime Production	CO2	Gg	453.1	0.56%	92.84%
27	1 B 2 b	Natural gas	CH4	Gg CO2e	451.7	0.56%	93.40%
28	4 B 8	Swine	CH4	Gg CO2e	416.6	0.52%	93.92%
29	2 A 7 b	Sinter Production	CO2	Gg	350.0	0.43%	94.35%
30	1 A 4 other	Other Sectors	CO2	Gg	264.0	0.33%	94.68%
31	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	249.0	0.31%	94.99%
32	2 A 3	Limestone and Dolomite Use	CO2	Gg	247.4	0.31%	95.29%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	2000	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 565.8	17.96%	17.96%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	10 771.7	13.28%	31.24%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 792.8	8.37%	39.61%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 105.3	7.53%	47.14%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 004.2	6.17%	53.31%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 767.9	5.88%	59.18%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 201.8	5.18%	64.36%
8	4 A 1	Cattle	CH4	Gg CO2e	3 190.5	3.93%	68.30%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 303.3	2.84%	71.14%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 066.6	2.55%	73.68%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 991.6	2.46%	76.14%
12	2 A 1	Cement Production	CO2	Gg	1 711.6	2.11%	78.25%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 647.6	2.03%	80.28%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 315.7	1.62%	81.90%
15	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 196.0	1.47%	83.38%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 170.4	1.44%	84.82%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 061.5	1.31%	86.13%
18	2 B 2	Nitric Acid Production	N2O	Gg CO2e	951.6	1.17%	87.30%
19	1 A 4 solid	Other Sectors	CO2	Gg	907.8	1.12%	88.42%
20	4 B 1	Cattle	N2O	Gg CO2e	836.6	1.03%	89.45%
21	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	592.8	0.73%	90.18%
22	2 B 1	Ammonia Production	CO2	Gg	518.0	0.64%	90.82%
23	4 B 1	Cattle	CH4	Gg CO2e	501.3	0.62%	91.44%
24	2 A 2	Lime Production	CO2	Gg	497.5	0.61%	92.05%
25	1 B 2 b	Natural gas	CH4	Gg CO2e	469.7	0.58%	92.63%
26	2F7	Semiconductor Manufacture	FCs	GgCO2e	407.1	0.50%	93.13%
27	4 B 8	Swine	CH4	Gg CO2e	404.3	0.50%	93.63%
28	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	384.0	0.47%	94.11%
29	2 A 7 b	Sinter Production	CO2	Gg	339.2	0.42%	94.52%
30	2 A 3	Limestone and Dolomite Use	CO2	Gg	275.6	0.34%	94.86%
31	2F9	Other Sources of SF6	SF6	GgCO2e	265.2	0.33%	95.19%

Rank	IPCC Source Categories		GHG	Unit	2001	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 482.8	18.20%	18.20%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	11 962.0	14.06%	32.27%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 438.1	8.74%	41.01%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 149.5	7.23%	48.24%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 956.6	7.00%	55.24%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 419.3	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	2 261.5	2.66%	71.68%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 207.9	2.60%	74.28%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 011.6	2.37%	76.64%
12	2 A 1	Cement Production	CO2	Gg	1 719.9	2.02%	78.66%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 650.5	1.94%	80.60%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 383.9	1.63%	82.23%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 366.8	1.61%	83.84%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 186.9	1.40%	85.23%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 076.5	1.27%	86.50%
18	1 A 4 solid	Other Sectors	CO2	Gg	883.4	1.04%	87.54%
19	4 B 1	Cattle	N2O	Gg CO2e	824.5	0.97%	88.51%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	786.5	0.92%	89.43%
21	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	691.7	0.81%	90.25%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	613.4	0.72%	90.97%
23	2 A 2	Lime Production	CO2	Gg	506.6	0.60%	91.56%
24	4 B 1	Cattle	CH4	Gg CO2e	486.6	0.57%	92.13%
25	1 B 2 b	Natural gas	CH4	Gg CO2e	476.5	0.56%	92.69%
26	2 B 1	Ammonia Production	CO2	Gg	472.5	0.56%	93.25%
27	4 B 8	Swine	CH4	Gg CO2e	422.5	0.50%	93.75%
28	2F7	Semiconductor Manufacture	FCs	GgCO2e	416.9	0.49%	94.24%
29	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	336.8	0.40%	94.63%
30	2 A 7 b	Sinter Production	CO2	Gg	334.0	0.39%	95.03%

Rank	IPCC Source Categories		GHG	Unit	2002	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 451.4	17.83%	17.83%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	13 526.0	15.60%	33.43%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 370.6	8.50%	41.93%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 621.6	7.64%	49.57%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 510.1	6.36%	55.93%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 857.8	5.60%	61.53%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 606.8	5.31%	66.85%
8	4 A 1	Cattle	CH4	Gg CO2e	3 086.5	3.56%	70.41%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 168.1	2.50%	72.91%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 156.7	2.49%	75.40%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 778.5	2.05%	77.45%
12	2 A 1	Cement Production	CO2	Gg	1 735.7	2.00%	79.45%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 656.6	1.91%	81.36%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 422.2	1.64%	83.01%
15	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 181.6	1.36%	84.37%
16	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 081.8	1.25%	85.62%
17	4 B 1	Cattle	N2O	Gg CO2e	809.0	0.93%	86.55%
18	2 B 2	Nitric Acid Production	N2O	Gg CO2e	807.2	0.93%	87.48%
19	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	800.2	0.92%	88.40%
20	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	778.6	0.90%	89.30%
21	1 A 4 solid	Other Sectors	CO2	Gg	763.3	0.88%	90.18%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	684.5	0.79%	90.97%
23	2 A 2	Lime Production	CO2	Gg	546.6	0.63%	91.60%
24	1 B 2 b	Natural gas	CH4	Gg CO2e	496.6	0.57%	92.18%
25	2 B 1	Ammonia Production	CO2	Gg	486.1	0.56%	92.74%
26	4 B 1	Cattle	CH4	Gg CO2e	476.4	0.55%	93.29%
27	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	432.3	0.50%	93.79%
28	2F7	Semiconductor Manufacture	FCs	GgCO2e	425.8	0.49%	94.28%
29	4 B 8	Swine	CH4	Gg CO2e	403.3	0.47%	94.74%
30	2 A 7 b	Sinter Production	CO2	Gg	373.5	0.43%	95.17%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	2003	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	16 899.2	18.18%	18.18%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 108.7	16.25%	34.43%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 165.7	8.78%	43.22%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 916.2	7.44%	50.66%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 772.0	7.29%	57.94%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 047.1	5.43%	63.37%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 523.1	4.87%	68.24%
8	4 A 1	Cattle	CH4	Gg CO2e	3 060.6	3.29%	71.53%
9	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 208.3	2.38%	73.91%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 194.7	2.36%	76.27%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 856.3	2.00%	78.27%
12	2 A 1	Cement Production	CO2	Gg	1 754.5	1.89%	80.15%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 570.9	1.69%	81.84%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 416.6	1.52%	83.37%
15	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 138.4	1.22%	84.59%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 134.8	1.22%	85.81%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 086.9	1.17%	86.98%
18	2 B 2	Nitric Acid Production	N2O	Gg CO2e	883.4	0.95%	87.93%
19	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	861.3	0.93%	88.86%
20	4 B 1	Cattle	N2O	Gg CO2e	799.8	0.86%	89.72%
21	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	763.2	0.82%	90.54%
22	1 A 4 solid	Other Sectors	CO2	Gg	694.6	0.75%	91.29%
23	2 A 2	Lime Production	CO2	Gg	576.9	0.62%	91.91%
24	2 B 1	Ammonia Production	CO2	Gg	526.4	0.57%	92.48%
25	1 B 2 b	Natural gas	CH4	Gg CO2e	515.3	0.55%	93.03%
26	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	488.6	0.53%	93.56%
27	2F7	Semiconductor Manufacture	FCs	GgCO2e	483.0	0.52%	94.08%
28	4 B 1	Cattle	CH4	Gg CO2e	470.9	0.51%	94.58%
29	4 B 8	Swine	CH4	Gg CO2e	410.3	0.44%	95.02%

Table A1.1: Level assessment excluding LULUCF

Rank	IPCC Source Categories		GHG	Unit	2004	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	16 473.4	18.07%	18.07%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 803.4	17.33%	35.40%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 797.5	7.46%	42.86%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 674.2	7.32%	50.18%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 586.8	7.22%	57.40%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 121.8	5.62%	63.02%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 446.2	4.88%	67.89%
8	4 A 1	Cattle	CH4	Gg CO2e	3 072.1	3.37%	71.26%
9	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 507.6	2.75%	74.01%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	2 029.5	2.23%	76.24%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 996.8	2.19%	78.43%
12	2 A 1	Cement Production	CO2	Gg	1 790.0	1.96%	80.39%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 502.3	1.65%	82.04%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 460.8	1.60%	83.64%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 174.3	1.29%	84.93%
16	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 144.4	1.26%	86.19%
17	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 082.6	1.19%	87.37%
18	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	895.7	0.98%	88.35%
19	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	895.7	0.98%	89.34%
20	4 B 1	Cattle	N2O	Gg CO2e	800.7	0.88%	90.22%
21	2 A 2	Lime Production	CO2	Gg	601.1	0.66%	90.87%
22	1 A 4 solid	Other Sectors	CO2	Gg	560.8	0.62%	91.49%
23	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	548.4	0.60%	92.09%
24	1 B 2 b	Natural gas	CH4	Gg CO2e	539.1	0.59%	92.68%
25	2F7	Semiconductor Manufacture	FCs	GgCO2e	497.3	0.55%	93.23%
26	4 B 1	Cattle	CH4	Gg CO2e	468.8	0.51%	93.74%
27	2 B 1	Ammonia Production	CO2	Gg	467.7	0.51%	94.26%
28	4 B 8	Swine	CH4	Gg CO2e	385.3	0.42%	94.68%
29	2 A 7 b	Sinter Production	CO2	Gg	328.5	0.36%	95.04%

Rank	IPCC Source Categories		GHG	Unit	2005	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	18 509.6	19.84%	19.84%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	16 644.6	17.84%	37.69%
3	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 125.3	7.64%	45.33%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 392.7	6.85%	52.18%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 844.0	6.27%	58.44%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 601.5	6.01%	64.45%
7	2 C 1	Iron and Steel Production	CO2	Gg	4 995.0	5.35%	69.80%
8	4 A 1	Cattle	CH4	Gg CO2e	3 029.3	3.25%	73.05%
9	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 151.0	2.31%	75.36%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 920.4	2.06%	77.42%
11	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	1 879.6	2.02%	79.43%
12	2 A 1	Cement Production	CO2	Gg	1 797.5	1.93%	81.36%
13	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 518.0	1.63%	82.99%
14	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 410.2	1.51%	84.50%
15	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 161.4	1.25%	85.74%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 086.3	1.16%	86.91%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1082.8998	1.16%	88.07%
18	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	907.8	0.97%	89.04%
19	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	848.8	0.91%	89.95%
20	4 B 1	Cattle	N2O	Gg CO2e	789.1	0.85%	90.80%
21	2 A 2	Lime Production	CO2	Gg	578.7	0.62%	91.42%
22	1 A 4 solid	Other Sectors	CO2	Gg	562.2	0.60%	92.02%
23	1 B 2 b	Natural gas	CH4	Gg CO2e	551.9	0.59%	92.61%
24	2 B 1	Ammonia Production	CO2	Gg	503.1	0.54%	93.15%
25	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	490.0	0.53%	93.68%
26	4 B 1	Cattle	CH4	Gg CO2e	458.8	0.49%	94.17%
27	4 B 8	Swine	CH4	Gg CO2e	396.9	0.43%	94.59%
28	2 A 7 b	Sinter Production	CO2	Gg	309.5	0.33%	94.93%
29	2 A 3	Limestone and Dolomite Use	CO2	Gg	290.8	0.31%	95.24%

Rank	IPCC Source Categories		GHG	Unit	BY	2005	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	16 644.6	17.84%	0.108	28.48%	28.48%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	18 509.6	19.84%	0.048	12.75%	41.23%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 392.7	6.85%	0.027	7.04%	48.27%
4	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	562.2	0.60%	0.023	6.15%	54.41%
5	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO2e	3 376.6	1 879.6	2.02%	0.019	5.03%	59.45%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	5 844.0	6.27%	0.014	3.65%	63.10%
7	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 319.3	7 125.3	7.64%	0.014	3.61%	66.71%
8	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 883.5	1 920.4	2.06%	0.013	3.54%	70.26%
9	2C3	Aluminium production	PFCs	GgCO2e	1 050.2	0.0	0.00%	0.011	2.96%	73.22%
10	4 A 1	Cattle	CH4	Gg CO2e	3 560.9	3 029.3	3.25%	0.011	2.80%	76.02%
11	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO2e	21.1	907.8	0.97%	0.008	2.11%	78.14%
12	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4 995.0	5.35%	0.007	1.94%	80.08%
13	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	274.2	0.29%	0.007	1.92%	81.99%
14	2 A 1	Cement Production	CO2	Gg	2 033.4	1 797.5	1.93%	0.005	1.44%	83.43%
15	4 D 1	Direct Soil Emissions	N2O	Gg CO2e	1 760.0	1 518.0	1.63%	0.005	1.34%	84.77%
16	4 D 3	Indirect Emissions	N2O	Gg CO2e	1 309.7	1 086.3	1.16%	0.004	1.10%	85.87%
17	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	848.8	0.91%	0.004	0.97%	86.84%
18	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1082.9	1.16%	0.003	0.88%	87.72%
19	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	490.0	0.53%	0.003	0.84%	88.56%
20	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.4	5 601.5	6.01%	0.003	0.75%	89.31%
21	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO2e	253.3	0.0	0.00%	0.003	0.71%	90.03%
22	4 B 1	Cattle	N2O	Gg CO2e	908.1	789.1	0.85%	0.003	0.68%	90.70%
23	2 A 7 b	Sinter Production	CO2	Gg	481.2	309.5	0.33%	0.002	0.62%	91.32%
24	4 B 1	Cattle	CH4	Gg CO2e	587.1	458.8	0.49%	0.002	0.56%	91.88%
25	1 B 2 b	Natural gas	CH4	Gg CO2e	272.7	551.9	0.59%	0.002	0.55%	92.43%
26	1 A 4 other	Other Sectors	CO2	Gg	239.1	71.6	0.08%	0.002	0.50%	92.93%
27	2 C 3	Aluminium production	CO2	Gg	158.4	0.0	0.00%	0.002	0.45%	93.38%
28	1 A 3 a jet kerosene	Civil Aviation	CO2	Gg	24.2	208.6	0.22%	0.002	0.43%	93.81%
29	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 956.5	2 151.0	2.31%	0.001	0.38%	94.19%
30	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	177.4	0.19%	0.001	0.37%	94.56%
31	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 314.8	1 410.2	1.51%	0.001	0.34%	94.90%
32	2F7	Semiconductor Manufacture	FCs	GgCO2e	133.1	290.6	0.31%	0.001	0.32%	95.22%

Rank		IPCC Source Categories	GHG	Unit	BY	BY ABS	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-12 226.0	12 226.0	13.13%	13.13%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	11 168.6	12.00%	25.13%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	7 911.2	8.50%	33.63%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 319.3	7 319.3	7.86%	41.49%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	6 247.0	6.71%	48.20%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 014.4	5 014.4	5.39%	53.58%
7	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	4 012.9	4.31%	57.89%
8	4 A 1	Cattle	CH4	Gg CC	3 560.9	3 560.9	3.82%	61.72%
9	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	3 545.7	3.81%	65.53%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	3 376.6	3 376.6	3.63%	69.16%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 883.5	2 883.5	3.10%	72.25%
12	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	2 654.1	2.85%	75.10%
13	2 A 1	Cement Production	CO2	Gg	2 033.4	2 033.4	2.18%	77.29%
14	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 956.5	1 956.5	2.10%	79.39%
15	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 760.0	1 760.0	1.89%	81.28%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 314.8	1 314.8	1.41%	82.69%
17	4 D 3	Indirect Emissions	N2O	Gg CC	1 309.7	1 309.7	1.41%	84.10%
18	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 228.7	1.32%	85.42%
19	2C3	Aluminium production	PFCs	GgCO	1 050.2	1 050.2	1.13%	86.55%
20	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 018.4	1 018.4	1.09%	87.64%
21	2 B 2	Nitric Acid Production	N2O	Gg CC	912.0	912.0	0.98%	88.62%
22	4 B 1	Cattle	N2O	Gg CC	908.1	908.1	0.98%	89.60%
23	4 B 1	Cattle	CH4	Gg CC	587.1	587.1	0.63%	90.23%
24	2 B 1	Ammonia Production	CO2	Gg	516.6	516.6	0.55%	90.78%
25	5 B 1	Cropland remaining cropland	CO2	Gg	-484.7	484.7	0.52%	91.30%
26	2 A 7 b	Sinter Production	CO2	Gg	481.2	481.2	0.52%	91.82%
27	4 B 8	Swine	CH4	Gg CC	447.7	447.7	0.48%	92.30%
28	5 C 2	Land converted to grassland	CO2	Gg	439.2	439.2	0.47%	92.77%
29	2 A 2	Lime Production	CO2	Gg	396.2	396.2	0.43%	93.20%
30	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	374.7	374.7	0.40%	93.60%
31	1 A 4 biomass	Other Sectors	CH4	Gg CC	314.7	314.7	0.34%	93.94%
32	3	SOLVENT AND OTHER PRODUCT USE	CO2	Gg	282.7	282.7	0.30%	94.24%
33	1 B 2 b	Natural gas	CH4	Gg CC	272.7	272.7	0.29%	94.53%
34	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	253.3	253.3	0.27%	94.81%
35	1 A 4 other	Other Sectors	CO2	Gg	239.1	239.1	0.26%	95.06%

Rank		IPCC Source Categories	GHG	Unit	1991	ABS 1991	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-18 152.2	18 152.2	17.58%	17.58%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 771.2	11 771.2	11.40%	28.98%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 678.7	8 678.7	8.40%	37.38%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 694.7	7 694.7	7.45%	44.83%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 817.0	6 817.0	6.60%	51.44%
6	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 829.9	4 829.9	4.68%	56.11%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 759.8	4 759.8	4.61%	60.72%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 509.5	3 509.5	3.40%	64.12%
9	4 A 1	Cattle	CH4	Gg CC	3 503.5	3 503.5	3.39%	67.51%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	3 370.0	3 370.0	3.26%	70.78%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 270.2	3 270.2	3.17%	73.94%
12	1 A 4 solid	Other Sectors	CO2	Gg	2 934.3	2 934.3	2.84%	76.79%
13	2 A 1	Cement Production	CO2	Gg	2 005.0	2 005.0	1.94%	78.73%
14	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 924.6	1 924.6	1.86%	80.59%
15	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 907.4	1 907.4	1.85%	82.44%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 498.0	1 498.0	1.45%	83.89%
17	4 D 3	Indirect Emissions	N2O	Gg CC	1 394.3	1 394.3	1.35%	85.24%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 178.2	1 178.2	1.14%	86.38%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 059.3	1 059.3	1.03%	87.41%
20	2C3	Aluminium production	PFCs	GgCO	1 050.2	1 050.2	1.02%	88.42%
21	2 B 2	Nitric Acid Production	N2O	Gg CC	927.3	927.3	0.90%	89.32%
22	4 B 1	Cattle	N2O	Gg CC	896.1	896.1	0.87%	90.19%
23	4 B 1	Cattle	CH4	Gg CC	576.9	576.9	0.56%	90.75%
24	2 B 1	Ammonia Production	CO2	Gg	545.7	545.7	0.53%	91.28%
25	5 B 1	Cropland remaining cropland	CO2	Gg	-488.7	488.7	0.47%	91.75%
26	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	468.0	468.0	0.45%	92.20%
27	4 B 8	Swine	CH4	Gg CC	441.7	441.7	0.43%	92.63%
28	5 C 2	Land converted to grassland	CO2	Gg	440.4	440.4	0.43%	93.06%
29	2 A 7 b	Sinter Production	CO2	Gg	391.6	391.6	0.38%	93.44%
30	2 A 2	Lime Production	CO2	Gg	361.3	361.3	0.35%	93.79%
31	5 E 2	Land converted to Settlements	CO2	Gg	355.0	355.0	0.34%	94.13%
32	1 A 4 biomass	Other Sectors	CH4	Gg CC	341.8	341.8	0.33%	94.46%
33	1 B 2 b	Natural gas	CH4	Gg CC	288.1	288.1	0.28%	94.74%
34	1 A 3 b gasoline	Road Transportation	N2O	Gg CC	281.9	281.9	0.27%	95.01%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	1992	ABS 1992	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-12 972.8	12 972.8	14.23%	14.23%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 834.3	11 834.3	12.98%	27.20%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 297.1	8 297.1	9.10%	36.30%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 183.7	7 183.7	7.88%	44.18%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 156.8	5 156.8	5.65%	49.83%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 138.9	4 138.9	4.54%	54.37%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 009.5	4 009.5	4.40%	58.77%
8	4 A 1	Cattle	CH4	Gg CC	3 340.8	3 340.8	3.66%	62.43%
9	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	3 281.7	3 281.7	3.60%	66.03%
10	2 C 1	Iron and Steel Production	CO2	Gg	3 074.9	3 074.9	3.37%	69.40%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 525.7	2 525.7	2.77%	72.17%
12	1 A 4 solid	Other Sectors	CO2	Gg	2 510.7	2 510.7	2.75%	74.93%
13	2 A 1	Cement Production	CO2	Gg	2 105.0	2 105.0	2.31%	77.24%
14	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 915.7	1 915.7	2.10%	79.34%
15	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 780.0	1 780.0	1.95%	81.29%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 481.6	1 481.6	1.62%	82.91%
17	4 D 3	Indirect Emissions	N2O	Gg CC	1 276.6	1 276.6	1.40%	84.31%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 220.1	1 220.1	1.34%	85.65%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 070.6	1 070.6	1.17%	86.82%
20	4 B 1	Cattle	N2O	Gg CC	858.5	858.5	0.94%	87.77%
21	2 B 2	Nitric Acid Production	N2O	Gg CC	837.5	837.5	0.92%	88.68%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	571.0	571.0	0.63%	89.31%
23	2 B 1	Ammonia Production	CO2	Gg	552.8	552.8	0.61%	89.92%
24	4 B 1	Cattle	CH4	Gg CC	552.0	552.0	0.61%	90.52%
25	5 B 1	Cropland remaining cropland	CO2	Gg	-477.7	477.7	0.52%	91.05%
26	4 B 8	Swine	CH4	Gg CC	451.6	451.6	0.50%	91.54%
27	5 C 2	Land converted to grassland	CO2	Gg	439.9	439.9	0.48%	92.02%
28	2C3	Aluminium production	PFCs	GgCO	417.6	417.6	0.46%	92.48%
29	2 A 2	Lime Production	CO2	Gg	355.1	355.1	0.39%	92.87%
30	2 A 7 b	Sinter Production	CO2	Gg	336.1	336.1	0.37%	93.24%
31	1 A 4 biomass	Other Sectors	CH4	Gg CC	316.5	316.5	0.35%	93.59%
32	1 B 2 b	Natural gas	CH4	Gg CC	307.1	307.1	0.34%	93.92%
33	1 A 3 b gasoline	Road Transportation	N2O	Gg CC	295.4	295.4	0.32%	94.25%
34	2F7	Semiconductor Manufacture	FCs	GgCO	287.8	287.8	0.32%	94.56%
35	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	253.3	253.3	0.28%	94.84%
36	3	SOLVENT AND OTHER PRODUCT USE	N2O	Gg CC	232.5	232.5	0.25%	95.10%

Rank		IPCC Source Categories	GHG	Unit	1993	ABS 1993	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-16 818.9	16 818.9	17.73%	17.73%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	12 339.5	12 339.5	13.01%	30.74%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 958.7	7 958.7	8.39%	39.13%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 118.9	7 118.9	7.50%	46.63%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 677.5	5 677.5	5.98%	52.62%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 318.3	4 318.3	4.55%	57.17%
7	4 A 1	Cattle	CH4	Gg CC	3 330.5	3 330.5	3.51%	60.68%
8	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	3 235.8	3 235.8	3.41%	64.09%
9	2 C 1	Iron and Steel Production	CO2	Gg	3 144.7	3 144.7	3.31%	67.41%
10	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 088.9	3 088.9	3.26%	70.66%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 996.2	2 996.2	3.16%	73.82%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 184.3	2 184.3	2.30%	76.12%
13	1 A 4 solid	Other Sectors	CO2	Gg	2 080.0	2 080.0	2.19%	78.32%
14	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 052.0	2 052.0	2.16%	80.48%
15	2 A 1	Cement Production	CO2	Gg	2 031.9	2 031.9	2.14%	82.62%
16	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 622.0	1 622.0	1.71%	84.33%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 230.9	1 230.9	1.30%	85.63%
18	4 D 3	Indirect Emissions	N2O	Gg CC	1 180.0	1 180.0	1.24%	86.87%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 036.2	1 036.2	1.09%	87.96%
20	2 B 2	Nitric Acid Production	N2O	Gg CC	878.7	878.7	0.93%	88.89%
21	4 B 1	Cattle	N2O	Gg CC	857.4	857.4	0.90%	89.79%
22	4 B 1	Cattle	CH4	Gg CC	546.3	546.3	0.58%	90.37%
23	2 B 1	Ammonia Production	CO2	Gg	538.8	538.8	0.57%	90.94%
24	4 B 8	Swine	CH4	Gg CC	463.7	463.7	0.49%	91.43%
25	5 B 1	Cropland remaining cropland	CO2	Gg	-413.0	413.0	0.44%	91.86%
26	5 C 2	Land converted to grassland	CO2	Gg	409.4	409.4	0.43%	92.29%
27	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	367.2	367.2	0.39%	92.68%
28	2 A 2	Lime Production	CO2	Gg	365.2	365.2	0.38%	93.07%
29	2F7	Semiconductor Manufacture	FCs	GgCO	360.4	360.4	0.38%	93.45%
30	1 B 2 b	Natural gas	CH4	Gg CC	326.7	326.7	0.34%	93.79%
31	2 A 7 b	Sinter Production	CO2	Gg	324.6	324.6	0.34%	94.13%
32	1 A 4 biomass	Other Sectors	CH4	Gg CC	316.2	316.2	0.33%	94.47%
33	1 A 3 b gasoline	Road Transportation	N2O	Gg CC	307.1	307.1	0.32%	94.79%
34	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	277.2	277.2	0.29%	95.08%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	1994	ABS 1994	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-15 717.5	15 717.5	16.58%	16.58%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	12 961.8	12 961.8	13.67%	30.25%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 673.0	7 673.0	8.09%	38.34%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 528.8	6 528.8	6.89%	45.23%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 914.7	5 914.7	6.24%	51.47%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 236.8	4 236.8	4.47%	55.94%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 411.1	3 411.1	3.60%	59.53%
8	4 A 1	Cattle	CH4	Gg CO	3 350.1	3 350.1	3.53%	63.07%
9	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 279.1	3 279.1	3.46%	66.53%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO	3 061.1	3 061.1	3.23%	69.75%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 886.7	2 886.7	3.04%	72.80%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 325.5	2 325.5	2.45%	75.25%
13	2 A 1	Cement Production	CO2	Gg	2 102.3	2 102.3	2.22%	77.47%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 919.4	1 919.4	2.02%	79.49%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 901.8	1 901.8	2.01%	81.50%
16	1 A 4 solid	Other Sectors	CO2	Gg	1 855.6	1 855.6	1.96%	83.46%
17	4 D 3	Indirect Emissions	N2O	Gg CO	1 339.3	1 339.3	1.41%	84.87%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 311.6	1 311.6	1.38%	86.25%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 063.4	1 063.4	1.12%	87.37%
20	4 B 1	Cattle	N2O	Gg CO	858.1	858.1	0.91%	88.28%
21	2 B 2	Nitric Acid Production	N2O	Gg CO	825.2	825.2	0.87%	89.15%
22	4 B 1	Cattle	CH4	Gg CO	542.2	542.2	0.57%	89.72%
23	2 B 1	Ammonia Production	CO2	Gg	507.0	507.0	0.53%	90.26%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	486.3	486.3	0.51%	90.77%
25	4 B 8	Swine	CH4	Gg CO	457.1	457.1	0.48%	91.25%
26	2F7	Semiconductor Manufacture	FCs	GgCO	430.9	430.9	0.45%	91.71%
27	5 B 1	Cropland remaining cropland	CO2	Gg	-420.2	420.2	0.44%	92.15%
28	5 C 2	Land converted to grassland	CO2	Gg	409.5	409.5	0.43%	92.58%
29	2 A 2	Lime Production	CO2	Gg	390.5	390.5	0.41%	92.99%
30	5 E 2	Land converted to Settlements	CO2	Gg	384.9	384.9	0.41%	93.40%
31	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	372.8	372.8	0.39%	93.79%
32	1 B 2 b	Natural gas	CH4	Gg CO	342.7	342.7	0.36%	94.15%
33	2 A 7 b	Sinter Production	CO2	Gg	322.9	322.9	0.34%	94.49%
34	1 A 3 b gasoline	Road Transportation	N2O	Gg CO	305.1	305.1	0.32%	94.82%
35	1 A 4 biomass	Other Sectors	CH4	Gg CO	286.6	286.6	0.30%	95.12%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	1995	ABS 1995	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-15 250.2	15 250.2	15.71%	15.71%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 058.9	14 058.9	14.49%	30.20%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 411.3	7 411.3	7.64%	37.83%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 191.2	7 191.2	7.41%	45.24%
5	1 A 3 b diesel oil	Road Transportation	CO2	Gg	6 553.4	6 553.4	6.75%	51.99%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 529.8	4 529.8	4.67%	56.66%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 457.6	4 457.6	4.59%	61.25%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 921.0	3 921.0	4.04%	65.29%
9	4 A 1	Cattle	CH4	Gg CC	3 372.6	3 372.6	3.47%	68.77%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	2 893.6	2 893.6	2.98%	71.75%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 686.4	2 686.4	2.77%	74.52%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 169.5	2 169.5	2.24%	76.75%
13	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 929.4	1 929.4	1.99%	78.74%
14	1 A 4 solid	Other Sectors	CO2	Gg	1 746.4	1 746.4	1.80%	80.54%
15	2 A 1	Cement Production	CO2	Gg	1 631.3	1 631.3	1.68%	82.22%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 556.3	1 556.3	1.60%	83.83%
17	4 D 3	Indirect Emissions	N2O	Gg CC	1 364.0	1 364.0	1.41%	85.23%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 220.0	1 220.0	1.26%	86.49%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 038.5	1 038.5	1.07%	87.56%
20	4 B 1	Cattle	N2O	Gg CC	879.2	879.2	0.91%	88.46%
21	2 B 2	Nitric Acid Production	N2O	Gg CC	857.2	857.2	0.88%	89.35%
22	2 B 1	Ammonia Production	CO2	Gg	537.1	537.1	0.55%	89.90%
23	4 B 1	Cattle	CH4	Gg CC	532.8	532.8	0.55%	90.45%
24	2F7	Semiconductor Manufacture	FCs	GgCO	505.7	505.7	0.52%	90.97%
25	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	500.0	500.0	0.52%	91.49%
26	4 B 8	Swine	CH4	Gg CC	458.5	458.5	0.47%	91.96%
27	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	443.1	443.1	0.46%	92.41%
28	2 A 7 b	Sinter Production	CO2	Gg	409.9	409.9	0.42%	92.84%
29	5 C 2	Land converted to grassland	CO2	Gg	407.9	407.9	0.42%	93.26%
30	2 A 2	Lime Production	CO2	Gg	394.6	394.6	0.41%	93.66%
31	1 B 2 b	Natural gas	CH4	Gg CC	368.0	368.0	0.38%	94.04%
32	1 A 4 biomass	Other Sectors	CH4	Gg CC	302.5	302.5	0.31%	94.35%
33	1 A 3 b gasoline	Road Transportation	N2O	Gg CC	289.6	289.6	0.30%	94.65%
34	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	259.2	259.2	0.27%	94.92%
35	2 A 3	Limestone and Dolomite Use	CO2	Gg	251.2	251.2	0.26%	95.18%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	1996	ABS 1996	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 219.0	15 219.0	15.97%	15.97%
2	5 A 1	Forest land remaining forest land	CO2	Gg	-10 518.5	10 518.5	11.04%	27.01%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	8 688.1	8 688.1	9.12%	36.12%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 325.4	8 325.4	8.74%	44.86%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 855.7	6 855.7	7.19%	52.05%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 695.9	4 695.9	4.93%	56.98%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 400.0	4 400.0	4.62%	61.60%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 702.9	3 702.9	3.89%	65.48%
9	4 A 1	Cattle	CH4	Gg CC	3 320.4	3 320.4	3.48%	68.97%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	2 737.5	2 737.5	2.87%	71.84%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 505.6	2 505.6	2.63%	74.47%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 182.2	2 182.2	2.29%	76.76%
13	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 713.6	1 713.6	1.80%	78.56%
14	1 A 4 solid	Other Sectors	CO2	Gg	1 657.7	1 657.7	1.74%	80.29%
15	2 A 1	Cement Production	CO2	Gg	1 634.2	1 634.2	1.71%	82.01%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 549.9	1 549.9	1.63%	83.64%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 338.7	1 338.7	1.40%	85.04%
18	4 D 3	Indirect Emissions	N2O	Gg CC	1 252.2	1 252.2	1.31%	86.35%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 010.1	1 010.1	1.06%	87.41%
20	2 B 2	Nitric Acid Production	N2O	Gg CC	874.2	874.2	0.92%	88.33%
21	4 B 1	Cattle	N2O	Gg CC	865.0	865.0	0.91%	89.24%
22	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	610.6	610.6	0.64%	89.88%
23	2 B 1	Ammonia Production	CO2	Gg	538.7	538.7	0.57%	90.45%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	538.3	538.3	0.56%	91.01%
25	4 B 1	Cattle	CH4	Gg CC	525.7	525.7	0.55%	91.56%
26	4 B 8	Swine	CH4	Gg CC	447.6	447.6	0.47%	92.03%
27	2F7	Semiconductor Manufacture	FCs	GgCO	403.9	403.9	0.42%	92.46%
28	1 B 2 b	Natural gas	CH4	Gg CC	393.9	393.9	0.41%	92.87%
29	2 A 2	Lime Production	CO2	Gg	382.7	382.7	0.40%	93.27%
30	5 C 2	Land converted to grassland	CO2	Gg	378.6	378.6	0.40%	93.67%
31	2 A 7 b	Sinter Production	CO2	Gg	355.4	355.4	0.37%	94.04%
32	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	337.5	337.5	0.35%	94.39%
33	1 A 4 biomass	Other Sectors	CH4	Gg CC	324.5	324.5	0.34%	94.74%
34	1 A 4 other	Other Sectors	CO2	Gg	302.0	302.0	0.32%	95.05%

Rank		IPCC Source Categories	GHG	Unit	1997	ABS 1997	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-19 620.5	19 620.5	18.87%	18.87%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 678.9	14 678.9	14.12%	32.99%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	7 968.6	7 968.6	7.66%	40.65%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 406.9	7 406.9	7.12%	47.78%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 497.0	6 497.0	6.25%	54.03%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 018.7	5 018.7	4.83%	58.86%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 002.2	5 002.2	4.81%	63.67%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 099.9	4 099.9	3.94%	67.61%
9	4 A 1	Cattle	CH4	Gg CC	3 253.7	3 253.7	3.13%	70.74%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	3 230.5	3 230.5	3.11%	73.85%
11	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	2 607.5	2 607.5	2.51%	76.35%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 155.8	2 155.8	2.07%	78.43%
13	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 925.2	1 925.2	1.85%	80.28%
14	2 A 1	Cement Production	CO2	Gg	1 760.9	1 760.9	1.69%	81.97%
15	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 752.9	1 752.9	1.69%	83.66%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 431.8	1 431.8	1.38%	85.04%
17	1 A 4 solid	Other Sectors	CO2	Gg	1 294.5	1 294.5	1.25%	86.28%
18	4 D 3	Indirect Emissions	N2O	Gg CC	1 256.6	1 256.6	1.21%	87.49%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 026.1	1 026.1	0.99%	88.48%
20	2 B 2	Nitric Acid Production	N2O	Gg CC	862.6	862.6	0.83%	89.31%
21	4 B 1	Cattle	N2O	Gg CC	851.4	851.4	0.82%	90.13%
22	2F7	Semiconductor Manufacture	FCs	GgCO	593.8	593.8	0.57%	90.70%
23	2 B 1	Ammonia Production	CO2	Gg	532.1	532.1	0.51%	91.21%
24	4 B 1	Cattle	CH4	Gg CC	520.5	520.5	0.50%	91.71%
25	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	506.9	506.9	0.49%	92.20%
26	4 B 8	Swine	CH4	Gg CC	448.3	448.3	0.43%	92.63%
27	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	418.3	418.3	0.40%	93.03%
28	2 A 2	Lime Production	CO2	Gg	412.5	412.5	0.40%	93.43%
29	1 B 2 b	Natural gas	CH4	Gg CC	410.3	410.3	0.39%	93.82%
30	2 A 7 b	Sinter Production	CO2	Gg	384.3	384.3	0.37%	94.19%
31	5 C 2	Land converted to grassland	CO2	Gg	378.6	378.6	0.36%	94.56%
32	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	349.2	349.2	0.34%	94.89%
33	1 A 4 other	Other Sectors	CO2	Gg	270.7	270.7	0.26%	95.15%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	1998	ABS 1998	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-17 769.9	17 769.9	17.51%	17.51%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 994.8	14 994.8	14.77%	32.28%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 738.1	9 738.1	9.59%	41.88%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 456.3	7 456.3	7.35%	49.22%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 798.5	6 798.5	6.70%	55.92%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 466.6	4 466.6	4.40%	60.32%
7	2 C 1	Iron and Steel Production	CO2	Gg	3 900.4	3 900.4	3.84%	64.17%
8	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 498.0	3 498.0	3.45%	67.61%
9	4 A 1	Cattle	CH4	Gg CC	3 226.6	3 226.6	3.18%	70.79%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 959.4	2 959.4	2.92%	73.71%
11	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	2 511.8	2 511.8	2.47%	76.18%
12	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 211.2	2 211.2	2.18%	78.36%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 172.2	2 172.2	2.14%	80.50%
14	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 778.5	1 778.5	1.75%	82.26%
15	2 A 1	Cement Production	CO2	Gg	1 598.7	1 598.7	1.58%	83.83%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 378.2	1 378.2	1.36%	85.19%
17	4 D 3	Indirect Emissions	N2O	Gg CC	1 259.7	1 259.7	1.24%	86.43%
18	1 A 4 solid	Other Sectors	CO2	Gg	1 127.3	1 127.3	1.11%	87.54%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 041.2	1 041.2	1.03%	88.57%
20	2 B 2	Nitric Acid Production	N2O	Gg CC	896.7	896.7	0.88%	89.45%
21	4 B 1	Cattle	N2O	Gg CC	848.1	848.1	0.84%	90.29%
22	2 B 1	Ammonia Production	CO2	Gg	525.3	525.3	0.52%	90.80%
23	4 B 1	Cattle	CH4	Gg CC	517.0	517.0	0.51%	91.31%
24	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	492.3	492.3	0.49%	91.80%
25	2F7	Semiconductor Manufacture	FCs	GgCO	477.8	477.8	0.47%	92.27%
26	4 B 8	Swine	CH4	Gg CC	462.4	462.4	0.46%	92.72%
27	2 A 2	Lime Production	CO2	Gg	453.8	453.8	0.45%	93.17%
28	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	427.3	427.3	0.42%	93.59%
29	1 B 2 b	Natural gas	CH4	Gg CC	424.9	424.9	0.42%	94.01%
30	5 C 2	Land converted to grassland	CO2	Gg	377.9	377.9	0.37%	94.38%
31	2 A 7 b	Sinter Production	CO2	Gg	345.4	345.4	0.34%	94.72%
32	2F9	Other Sources of SF6	SF6	GgCO	286.1	286.1	0.28%	95.01%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	1999	ABS 1999	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-22 263.5	22 263.5	21.39%	21.39%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 147.2	15 147.2	14.55%	35.94%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 525.1	9 525.1	9.15%	45.09%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 566.8	7 566.8	7.27%	52.36%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 317.7	6 317.7	6.07%	58.43%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 351.1	4 351.1	4.18%	62.61%
7	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 779.4	3 779.4	3.63%	66.24%
8	2 C 1	Iron and Steel Production	CO2	Gg	3 759.3	3 759.3	3.61%	69.85%
9	4 A 1	Cattle	CH4	Gg CO	3 204.8	3 204.8	3.08%	72.93%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CO	2 406.7	2 406.7	2.31%	75.24%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 088.2	2 088.2	2.01%	77.25%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 056.5	2 056.5	1.98%	79.23%
13	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 969.0	1 969.0	1.89%	81.12%
14	4 D 1	Direct Soil Emissions	N2O	Gg CO	1 727.7	1 727.7	1.66%	82.78%
15	2 A 1	Cement Production	CO2	Gg	1 607.4	1 607.4	1.54%	84.32%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 401.4	1 401.4	1.35%	85.67%
17	4 D 3	Indirect Emissions	N2O	Gg CO	1 222.7	1 222.7	1.17%	86.84%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 047.9	1 047.9	1.01%	87.85%
19	1 A 4 solid	Other Sectors	CO2	Gg	1 041.0	1 041.0	1.00%	88.85%
20	2 B 2	Nitric Acid Production	N2O	Gg CO	923.5	923.5	0.89%	89.74%
21	4 B 1	Cattle	N2O	Gg CO	843.6	843.6	0.81%	90.55%
22	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	539.3	539.3	0.52%	91.07%
23	2 B 1	Ammonia Production	CO2	Gg	530.4	530.4	0.51%	91.58%
24	4 B 1	Cattle	CH4	Gg CO	510.4	510.4	0.49%	92.07%
25	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	493.7	493.7	0.47%	92.54%
26	2F7	Semiconductor Manufacture	FCs	GgCO	453.9	453.9	0.44%	92.98%
27	2 A 2	Lime Production	CO2	Gg	453.1	453.1	0.44%	93.41%
28	1 B 2 b	Natural gas	CH4	Gg CO	451.7	451.7	0.43%	93.85%
29	4 B 8	Swine	CH4	Gg CO	416.6	416.6	0.40%	94.25%
30	5 C 2	Land converted to grassland	CO2	Gg	377.9	377.9	0.36%	94.61%
31	2 A 7 b	Sinter Production	CO2	Gg	350.0	350.0	0.34%	94.95%
32	1 A 4 other	Other Sectors	CO2	Gg	264.0	264.0	0.25%	95.20%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	2000	ABS 2000	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-16 924.7	16 924.7	17.08%	17.08%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	14 565.8	14 565.8	14.70%	31.77%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	10 771.7	10 771.7	10.87%	42.64%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 792.8	6 792.8	6.85%	49.50%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 105.3	6 105.3	6.16%	55.66%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 004.2	5 004.2	5.05%	60.71%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 767.9	4 767.9	4.81%	65.52%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 201.8	4 201.8	4.24%	69.76%
9	4 A 1	Cattle	CH4	Gg CC	3 190.5	3 190.5	3.22%	72.98%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	2 303.3	2 303.3	2.32%	75.30%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 066.6	2 066.6	2.09%	77.39%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 991.6	1 991.6	2.01%	79.40%
13	2 A 1	Cement Production	CO2	Gg	1 711.6	1 711.6	1.73%	81.12%
14	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 647.6	1 647.6	1.66%	82.79%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 315.7	1 315.7	1.33%	84.11%
16	4 D 3	Indirect Emissions	N2O	Gg CC	1 196.0	1 196.0	1.21%	85.32%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 170.4	1 170.4	1.18%	86.50%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 061.5	1 061.5	1.07%	87.57%
19	2 B 2	Nitric Acid Production	N2O	Gg CC	951.6	951.6	0.96%	88.53%
20	1 A 4 solid	Other Sectors	CO2	Gg	907.8	907.8	0.92%	89.45%
21	4 B 1	Cattle	N2O	Gg CC	836.6	836.6	0.84%	90.29%
22	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	592.8	592.8	0.60%	90.89%
23	2 B 1	Ammonia Production	CO2	Gg	518.0	518.0	0.52%	91.41%
24	4 B 1	Cattle	CH4	Gg CC	501.3	501.3	0.51%	91.92%
25	2 A 2	Lime Production	CO2	Gg	497.5	497.5	0.50%	92.42%
26	1 B 2 b	Natural gas	CH4	Gg CC	469.7	469.7	0.47%	92.90%
27	2F7	Semiconductor Manufacture	FCs	GgCO	407.1	407.1	0.41%	93.31%
28	4 B 8	Swine	CH4	Gg CC	404.3	404.3	0.41%	93.71%
29	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	384.0	384.0	0.39%	94.10%
30	5 C 2	Land converted to grassland	CO2	Gg	376.9	376.9	0.38%	94.48%
31	2 A 7 b	Sinter Production	CO2	Gg	339.2	339.2	0.34%	94.82%
32	2 A 3	Limestone and Dolomite Use	CO2	Gg	275.6	275.6	0.28%	95.10%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	2001	ABS 2001	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-19 700.7	19 700.7	18.61%	18.61%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 482.8	15 482.8	14.63%	33.23%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	11 962.0	11 962.0	11.30%	44.53%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 438.1	7 438.1	7.03%	51.56%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 149.5	6 149.5	5.81%	57.37%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 956.6	5 956.6	5.63%	63.00%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 419.3	4 419.3	4.17%	67.17%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 159.4	4 159.4	3.93%	71.10%
9	4 A 1	Cattle	CH4	Gg CC	3 140.0	3 140.0	2.97%	74.07%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 261.5	2 261.5	2.14%	76.20%
11	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	2 207.9	2 207.9	2.09%	78.29%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 011.6	2 011.6	1.90%	80.19%
13	2 A 1	Cement Production	CO2	Gg	1 719.9	1 719.9	1.62%	81.81%
14	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 650.5	1 650.5	1.56%	83.37%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 383.9	1 383.9	1.31%	84.68%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 366.8	1 366.8	1.29%	85.97%
17	4 D 3	Indirect Emissions	N2O	Gg CC	1 186.9	1 186.9	1.12%	87.09%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 076.5	1 076.5	1.02%	88.11%
19	1 A 4 solid	Other Sectors	CO2	Gg	883.4	883.4	0.83%	88.94%
20	4 B 1	Cattle	N2O	Gg CC	824.5	824.5	0.78%	89.72%
21	2 B 2	Nitric Acid Production	N2O	Gg CC	786.5	786.5	0.74%	90.46%
22	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	691.7	691.7	0.65%	91.12%
23	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	613.4	613.4	0.58%	91.70%
24	2 A 2	Lime Production	CO2	Gg	506.6	506.6	0.48%	92.17%
25	4 B 1	Cattle	CH4	Gg CC	486.6	486.6	0.46%	92.63%
26	1 B 2 b	Natural gas	CH4	Gg CC	476.5	476.5	0.45%	93.08%
27	2 B 1	Ammonia Production	CO2	Gg	472.5	472.5	0.45%	93.53%
28	4 B 8	Swine	CH4	Gg CC	422.5	422.5	0.40%	93.93%
29	2F7	Semiconductor Manufacture	FCs	GgCO	416.9	416.9	0.39%	94.32%
30	5 C 2	Land converted to grassland	CO2	Gg	412.0	412.0	0.39%	94.71%
31	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	336.8	336.8	0.32%	95.03%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	2002	ABS 2002	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-15 982.4	15 982.4	15.41%	15.41%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	15 451.4	15 451.4	14.90%	30.31%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	13 526.0	13 526.0	13.04%	43.35%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 370.6	7 370.6	7.11%	50.46%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 621.6	6 621.6	6.38%	56.84%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 510.1	5 510.1	5.31%	62.15%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 857.8	4 857.8	4.68%	66.84%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 606.8	4 606.8	4.44%	71.28%
9	4 A 1	Cattle	CH4	Gg CC	3 086.5	3 086.5	2.98%	74.26%
10	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	2 168.1	2 168.1	2.09%	76.35%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 156.7	2 156.7	2.08%	78.43%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 778.5	1 778.5	1.71%	80.14%
13	2 A 1	Cement Production	CO2	Gg	1 735.7	1 735.7	1.67%	81.81%
14	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 656.6	1 656.6	1.60%	83.41%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 422.2	1 422.2	1.37%	84.78%
16	4 D 3	Indirect Emissions	N2O	Gg CC	1 181.6	1 181.6	1.14%	85.92%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 081.8	1 081.8	1.04%	86.97%
18	4 B 1	Cattle	N2O	Gg CC	809.0	809.0	0.78%	87.75%
19	2 B 2	Nitric Acid Production	N2O	Gg CC	807.2	807.2	0.78%	88.52%
20	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	800.2	800.2	0.77%	89.29%
21	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	778.6	778.6	0.75%	90.05%
22	1 A 4 solid	Other Sectors	CO2	Gg	763.3	763.3	0.74%	90.78%
23	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	684.5	684.5	0.66%	91.44%
24	2 A 2	Lime Production	CO2	Gg	546.6	546.6	0.53%	91.97%
25	1 B 2 b	Natural gas	CH4	Gg CC	496.6	496.6	0.48%	92.45%
26	2 B 1	Ammonia Production	CO2	Gg	486.1	486.1	0.47%	92.92%
27	4 B 1	Cattle	CH4	Gg CC	476.4	476.4	0.46%	93.38%
28	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	432.3	432.3	0.42%	93.79%
29	2F7	Semiconductor Manufacture	FCs	GgCO	425.8	425.8	0.41%	94.20%
30	4 B 8	Swine	CH4	Gg CC	403.3	403.3	0.39%	94.59%
31	2 A 7 b	Sinter Production	CO2	Gg	373.5	373.5	0.36%	94.95%
32	5 C 2	Land converted to grassland	CO2	Gg	348.7	348.7	0.34%	95.29%

Table A1.3: Level assessment including LULUCF

Rank	IPCC Source Categories		GHG	Unit	2003	ABS 2003	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-17 536.1	17 536.1	15.69%	15.69%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	16 899.2	16 899.2	15.12%	30.81%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 108.7	15 108.7	13.52%	44.33%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 165.7	8 165.7	7.31%	51.64%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 916.2	6 916.2	6.19%	57.83%
6	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 772.0	6 772.0	6.06%	63.89%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 047.1	5 047.1	4.52%	68.41%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 523.1	4 523.1	4.05%	72.45%
9	4 A 1	Cattle	CH4	Gg CC	3 060.6	3 060.6	2.74%	75.19%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 208.3	2 208.3	1.98%	77.17%
11	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	2 194.7	2 194.7	1.96%	79.13%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 856.3	1 856.3	1.66%	80.79%
13	2 A 1	Cement Production	CO2	Gg	1 754.5	1 754.5	1.57%	82.36%
14	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 570.9	1 570.9	1.41%	83.77%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 416.6	1 416.6	1.27%	85.04%
16	4 D 3	Indirect Emissions	N2O	Gg CC	1 138.4	1 138.4	1.02%	86.06%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 134.8	1 134.8	1.02%	87.07%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 086.9	1 086.9	0.97%	88.04%
19	2 B 2	Nitric Acid Production	N2O	Gg CC	883.4	883.4	0.79%	88.83%
20	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	861.3	861.3	0.77%	89.61%
21	4 B 1	Cattle	N2O	Gg CC	799.8	799.8	0.72%	90.32%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	763.2	763.2	0.68%	91.00%
23	1 A 4 solid	Other Sectors	CO2	Gg	694.6	694.6	0.62%	91.63%
24	2 A 2	Lime Production	CO2	Gg	576.9	576.9	0.52%	92.14%
25	2 B 1	Ammonia Production	CO2	Gg	526.4	526.4	0.47%	92.61%
26	1 B 2 b	Natural gas	CH4	Gg CC	515.3	515.3	0.46%	93.07%
27	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	488.6	488.6	0.44%	93.51%
28	2F7	Semiconductor Manufacture	FCs	GgCO	483.0	483.0	0.43%	93.94%
29	4 B 1	Cattle	CH4	Gg CC	470.9	470.9	0.42%	94.36%
30	4 B 8	Swine	CH4	Gg CC	410.3	410.3	0.37%	94.73%
31	5 C 2	Land converted to grassland	CO2	Gg	369.4	369.4	0.33%	95.06%

Rank		IPCC Source Categories	GHG	Unit	2004	ABS 2004	Level Assessment	Cumulative Total
1	5 A 1	Forest land remaining forest land	CO2	Gg	-17 536.1	17 536.1	16.02%	16.02%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	16 473.4	16 473.4	15.05%	31.06%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	15 803.4	15 803.4	14.43%	45.50%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 797.5	6 797.5	6.21%	51.71%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 674.2	6 674.2	6.10%	57.80%
6	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 586.8	6 586.8	6.02%	63.82%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 121.8	5 121.8	4.68%	68.50%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 446.2	4 446.2	4.06%	72.56%
9	4 A 1	Cattle	CH4	Gg CC	3 072.1	3 072.1	2.81%	75.37%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 507.6	2 507.6	2.29%	77.66%
11	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	2 029.5	2 029.5	1.85%	79.51%
12	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 996.8	1 996.8	1.82%	81.33%
13	2 A 1	Cement Production	CO2	Gg	1 790.0	1 790.0	1.63%	82.97%
14	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 502.3	1 502.3	1.37%	84.34%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 460.8	1 460.8	1.33%	85.68%
16	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 174.3	1 174.3	1.07%	86.75%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 144.4	1 144.4	1.05%	87.79%
18	4 D 3	Indirect Emissions	N2O	Gg CC	1 082.6	1 082.6	0.99%	88.78%
19	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	895.7	895.7	0.82%	89.60%
20	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	895.7	895.7	0.82%	90.42%
21	4 B 1	Cattle	N2O	Gg CC	800.7	800.7	0.73%	91.15%
22	2 A 2	Lime Production	CO2	Gg	601.1	601.1	0.55%	91.70%
23	1 A 4 solid	Other Sectors	CO2	Gg	560.8	560.8	0.51%	92.21%
24	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	548.4	548.4	0.50%	92.71%
25	1 B 2 b	Natural gas	CH4	Gg CC	539.1	539.1	0.49%	93.20%
26	2F7	Semiconductor Manufacture	FCs	GgCO	497.3	497.3	0.45%	93.66%
27	4 B 1	Cattle	CH4	Gg CC	468.8	468.8	0.43%	94.09%
28	2 B 1	Ammonia Production	CO2	Gg	467.7	467.7	0.43%	94.51%
29	4 B 8	Swine	CH4	Gg CC	385.3	385.3	0.35%	94.87%
30	2 A 7 b	Sinter Production	CO2	Gg	328.5	328.5	0.30%	95.17%

Table A1.3: Level assessment including LULUCF

Rank		IPCC Source Categories	GHG	Unit	2005	ABS 2005	Level Assessment	Cumulative Total
1	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	18 509.6	18 509.6	16.57%	16.57%
2	5 A 1	Forest land remaining forest land	CO2	Gg	-17 536.1	17 536.1	15.70%	32.28%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	16 644.6	16 644.6	14.90%	47.18%
4	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 125.3	7 125.3	6.38%	53.56%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 392.7	6 392.7	5.72%	59.29%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 844.0	5 844.0	5.23%	64.52%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 601.5	5 601.5	5.02%	69.54%
8	2 C 1	Iron and Steel Production	CO2	Gg	4 995.0	4 995.0	4.47%	74.01%
9	4 A 1	Cattle	CH4	Gg CC	3 029.3	3 029.3	2.71%	76.72%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 151.0	2 151.0	1.93%	78.65%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 920.4	1 920.4	1.72%	80.37%
12	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	1 879.6	1 879.6	1.68%	82.05%
13	2 A 1	Cement Production	CO2	Gg	1 797.5	1 797.5	1.61%	83.66%
14	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 518.0	1 518.0	1.36%	85.02%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 410.2	1 410.2	1.26%	86.28%
16	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 161.4	1 161.4	1.04%	87.32%
17	4 D 3	Indirect Emissions	N2O	Gg CC	1 086.3	1 086.3	0.97%	88.30%
18	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1082.9	1 082.9	0.97%	89.27%
19	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	907.8	907.8	0.81%	90.08%
20	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	848.8	848.8	0.76%	90.84%
21	4 B 1	Cattle	N2O	Gg CC	789.1	789.1	0.71%	91.54%
22	2 A 2	Lime Production	CO2	Gg	578.7	578.7	0.52%	92.06%
23	1 A 4 solid	Other Sectors	CO2	Gg	562.2	562.2	0.50%	92.57%
24	1 B 2 b	Natural gas	CH4	Gg CC	551.9	551.9	0.49%	93.06%
25	2 B 1	Ammonia Production	CO2	Gg	503.1	503.1	0.45%	93.51%
26	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	490.0	490.0	0.44%	93.95%
27	4 B 1	Cattle	CH4	Gg CC	458.8	458.8	0.41%	94.36%
28	4 B 8	Swine	CH4	Gg CC	396.9	396.9	0.36%	94.72%
29	5 C 2	Land converted to grassland	CO2	Gg	362.8	362.8	0.32%	95.04%

Rank	IPCC Source Categories		GHG	Unit	BY	2005	ABS 2005	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 012.9	16 644.6	16 644.6	14.90%	0.095	26.73%	26.73%
2	1 A gaseous	Fuel Combustion (stationary)	CO2	Gg	11 168.6	18 509.6	18 509.6	16.57%	0.046	12.89%	39.62%
3	5 A 1	Forest land remaining forest land	CO2	Gg	-12 226.0	-17 536.1	17 536.1	15.70%	0.029	8.08%	47.70%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 911.2	6 392.7	6 392.7	5.72%	0.020	5.73%	53.43%
5	1 A 4 solid	Other Sectors	CO2	Gg	2 654.1	562.2	562.2	0.50%	0.019	5.42%	58.85%
6	6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg CC	3 376.6	1 879.6	1 879.6	1.68%	0.015	4.32%	63.17%
7	2C3	Aluminium production	PFCs	GgCO	1 050.2	0.0	0.0	0.00%	0.014	3.86%	67.04%
8	1 A 2 stat-liquid	Manufacturing Industries and Constructic	CO2	Gg	2 883.5	1 920.4	1 920.4	1.72%	0.011	2.99%	70.03%
9	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	5 844.0	5 844.0	5.23%	0.010	2.76%	72.80%
10	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 319.3	7 125.3	7 125.3	6.38%	0.009	2.62%	75.42%
11	4 A 1	Cattle	CH4	Gg CC	3 560.9	3 029.3	3 029.3	2.71%	0.008	2.24%	77.66%
12	2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	4 995.0	4 995.0	4.47%	0.008	2.14%	79.80%
13	2F1/2/3/4/5	ODS Substitutes	HFCs	GgCO	21.1	907.8	907.8	0.81%	0.007	1.95%	81.76%
14	2 B 2	Nitric Acid Production	N2O	Gg CC	912.0	274.2	274.2	0.25%	0.006	1.68%	83.44%
15	2 A 1	Cement Production	CO2	Gg	2 033.4	1 797.5	1 797.5	1.61%	0.004	1.13%	84.57%
16	4 D 1	Direct Soil Emissions	N2O	Gg CC	1 760.0	1 518.0	1 518.0	1.36%	0.004	1.06%	85.64%
17	1 A 2 other	Manufacturing Industries and Constructic	CO2	Gg	374.7	848.8	848.8	0.76%	0.003	0.94%	86.57%
18	2C4	SF6 Used in Al and Mg Foundries	SF6	GgCO	253.3	0.0	0.0	0.00%	0.003	0.93%	87.50%
19	4 D 3	Indirect Emissions	N2O	Gg CC	1 309.7	1 086.3	1 086.3	0.97%	0.003	0.89%	88.39%
20	5 B 1	Cropland remaining cropland	CO2	Gg	-484.7	-155.4	155.4	0.14%	0.003	0.87%	89.27%
21	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	118.0	490.0	490.0	0.44%	0.003	0.79%	90.05%
22	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 082.9	1 082.9	0.97%	0.002	0.69%	90.74%
23	2 C 3	Aluminium production	CO2	Gg	158.4	0.0	0.0	0.00%	0.002	0.58%	91.33%
24	1 B 2 b	Natural gas	CH4	Gg CC	272.7	551.9	551.9	0.49%	0.002	0.54%	91.86%
25	4 B 1	Cattle	N2O	Gg CC	908.1	789.1	789.1	0.71%	0.002	0.54%	92.40%
26	2 A 7 b	Sinter Production	CO2	Gg	481.2	309.5	309.5	0.28%	0.002	0.52%	92.92%
27	4 B 1	Cattle	CH4	Gg CC	587.1	458.8	458.8	0.41%	0.002	0.46%	93.38%
28	1 A 4 other	Other Sectors	CO2	Gg	239.1	71.6	71.6	0.06%	0.002	0.44%	93.82%
29	1 A 3 a jet kerosene	Civil Aviation	CO2	Gg	24.2	208.6	208.6	0.19%	0.001	0.40%	94.22%
30	3	SOLVENT AND OTHER PRODUCT USI	CO2	Gg	282.7	177.4	177.4	0.16%	0.001	0.32%	94.54%
31	2F7	Semiconductor Manufacture	FCs	GgCO	133.1	290.6	290.6	0.26%	0.001	0.31%	94.85%
32	5 C 2	Land converted to grassland	CO2	Gg	439.2	362.8	362.8	0.32%	0.001	0.30%	95.15%

Table A1.4: Trend assessment including LULUCF

IPCC 96	Bezeichnung	Gas	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1 A 1 a liquid	Public Electricity and Heat Production	CH4	Gg C	0.3	0.4	0.4	0.6	0.5	0.4	0.5	0.5	0.6	0.5	0.3	0.3	0.2	0.2	0.3	0.3
1 A 1 a solid	Public Electricity and Heat Production	CH4	Gg C	1.5	1.7	0.9	0.7	0.6	0.5	0.4	0.4	0.1	0.1	0.2	0.3	0.2	0.2	0.3	0.1
1 A 1 a gaseou	Public Electricity and Heat Production	CH4	Gg C	0.5	0.5	0.5	0.6	0.6	0.7	1.1	1.2	1.2	1.0	0.9	0.8	1.2	1.5	1.6	0.9
1 A 1 a biomas	Public Electricity and Heat Production	CH4	Gg C	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.7	0.7	0.8	1.0	0.9
1 A 1 a other	Public Electricity and Heat Production	CH4	Gg C	0.6	0.7	0.9	0.9	1.0	1.0	1.2	1.2	1.2	1.2	1.2	1.4	1.7	2.0	2.3	2.1
1 A 1 c liquid	Manufacture of Solid fuels and Other I	CH4	Gg C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 1 c gaseou	Manufacture of Solid fuels and Other I	CH4	Gg C	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	0.2
1 A 2 mobile-li	Manufacturing Industries and Constru	CH4	Gg C	1.6	1.6	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.3	1.3	1.2	1.2	1.1	1.1	1.0
1 A 2 stat-liqui	Manufacturing Industries and Constru	CH4	Gg C	1.0	1.1	0.8	0.9	0.9	0.8	0.7	0.9	0.8	0.6	0.6	0.6	0.5	0.6	0.7	0.7
1 A 2 solid	Manufacturing Industries and Constru	CH4	Gg C	1.6	1.7	1.7	1.6	1.4	1.4	1.5	1.7	1.7	1.5	1.7	1.6	1.5	2.0	2.0	2.2
1 A 2 gaseous	Manufacturing Industries and Constru	CH4	Gg C	2.2	2.2	2.3	2.2	2.8	2.9	3.0	3.1	3.0	2.9	3.2	3.1	3.2	3.4	3.3	3.3
1 A 2 biomass	Manufacturing Industries and Constru	CH4	Gg C	1.2	1.2	1.2	1.3	1.4	1.4	1.4	1.5	1.3	1.9	1.7	1.8	1.8	1.8	1.8	2.0
1 A 2 other	Manufacturing Industries and Constru	CH4	Gg C	1.1	1.3	1.6	1.2	1.3	1.4	1.6	1.4	1.5	1.5	1.3	2.0	2.3	2.5	3.0	2.8
1 A 3 a jet kero	Civil Aviation	CH4	Gg C	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3
1 A 3 b gasolin	Road Transportation	CH4	Gg C	58.1	57.1	51.6	47.1	42.8	38.6	34.2	30.8	29.0	25.8	23.2	21.3	20.1	18.6	16.8	15.1
1 A 3 b diesel (	Road Transportation	CH4	Gg C	2.5	2.7	2.6	2.7	2.6	2.7	3.3	2.7	3.0	2.6	2.8	2.9	3.0	3.2	3.2	3.3
1 A 3 c liquid	Railways	CH4	Gg C	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1 A 3 c solid	Railways	CH4	Gg C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 3 d gas/die	Navigation	CH4	Gg C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 3 d gasolin	Navigation	CH4	Gg C	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1 A 3 e gaseou	Other	CH4	Gg C	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3
1 A 4 mobile-di	Other Sectors	CH4	Gg C	2.8	2.5	2.6	2.6	2.7	2.5	2.7	2.8	2.6	2.5	2.3	2.3	2.2	2.1	2.1	1.9
1 A 4 mobile-g	Other Sectors	CH4	Gg C	1.2	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.1	1.0	0.9
1 A 4 mobile-li	Other Sectors	CH4	Gg C	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.0	1.8	1.7	1.5	1.3	1.1	0.9
1 A 4 stat-liqui	Other Sectors	CH4	Gg C	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.8	0.7	0.6
1 A 4 solid	Other Sectors	CH4	Gg C	61.8	66.7	54.9	49.1	44.8	43.4	42.3	27.6	24.0	22.2	19.3	18.8	16.3	14.8	12.0	12.0
1 A 4 gaseous	Other Sectors	CH4	Gg C	4.0	4.1	3.5	3.0	1.9	1.2	1.2	1.2	1.2	1.4	1.2	1.5	1.4	1.6	1.5	1.7
1 A 4 biomass	Other Sectors	CH4	Gg C	314.7	341.8	316.5	316.2	286.6	302.5	324.5	249.6	242.4	249.0	234.1	256.0	240.2	241.3	234.7	243.6
1 A 4 other	Other Sectors	CH4	Gg C	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	0.2	0.2
1 A 5 liquid	Other	CH4	Gg C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
1 B 1 a	Coal Mining	CH4	Gg C	11.0	9.4	7.8	7.6	6.2	5.8	5.0	5.1	5.1	5.1	5.6	5.4	6.3	5.2	1.1	0.0
1 B 2 a	Oil	CH4	Gg C	101.0	101.3	101.6	101.0	100.3	98.3	99.7	101.7	98.2	92.8	90.2	91.9	93.8	88.2	112.9	115.3
1 B 2 b	Natural gas	CH4	Gg C	272.7	288.1	307.1	326.7	342.7	368.0	393.9	410.3	424.9	451.7	469.7	476.5	496.6	515.3	539.1	551.9
2 B	CHEMICAL INDUSTRY	CH4	Gg C	14.8	14.6	13.9	14.6	14.9	14.3	14.6	14.8	15.4	14.5	14.6	14.0	14.8	14.6	14.7	15.7
2 C	METAL PRODUCTION	CH4	Gg C	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4 A 1	Cattle	CH4	Gg C	3 560.9	3 503.5	3 340.8	3 330.5	3 350.1	3 372.6	3 320.4	3 253.7	3 226.6	3 204.8	3 190.5	3 140.0	3 086.5	3 060.6	3 072.1	3 029.3
4 A 3	Sheep	CH4	Gg C	52.1	54.8	52.4	56.1	57.5	61.4	64.0	64.5	60.6	59.2	57.0	53.8	51.1	54.7	55.0	54.7
4 A 4	Goats	CH4	Gg C	3.9	4.3	4.1	5.0	5.2	5.7	5.7	6.1	5.7	6.1	5.9	6.2	6.1	5.7	5.8	5.8
4 A 6	Horses	CH4	Gg C	18.6	21.8	23.2	24.5	25.2	27.4	27.7	28.0	28.5	30.8	30.8	30.8	30.8	32.9	32.9	32.9
4 A 8	Swine	CH4	Gg C	116.2	114.6	117.2	120.3	117.5	116.7	115.4	115.9	120.0	108.1	105.5	108.4	104.1	102.2	98.4	99.8
4 A 9	Poultry	CH4	Gg C	3.7	3.9	3.7	3.9	3.8	3.8	3.5	4.0	3.9	3.9	3.2	3.4	3.4	3.5	3.5	3.5
4 A-10	Other	CH4	Gg C	6.2	6.2	6.2	6.2	6.3	6.8	7.0	9.4	8.5	6.6	6.5	6.5	6.5	6.9	6.9	6.9
4 B 1	Cattle	CH4	Gg C	587.1	576.9	552.0	546.3	542.2	532.8	525.7	520.5	517.0	510.4	501.3	486.6	476.4	470.9	468.8	458.8
4 B 3	Sheep	CH4	Gg C	1.2	1.3	1.2	1.3	1.4	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.2	1.3	1.3	1.3
4 B 4	Goats	CH4	Gg C	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4 B 6	Horses	CH4	Gg C	1.4	1.7	1.8	1.9	1.9	2.1	2.1	2.2	2.2	2.4	2.4	2.4	2.4	2.5	2.5	2.5
4 B 8	Swine	CH4	Gg C	447.7	441.7	451.6	463.7	457.1	458.5	447.6	448.3	462.4	416.6	404.3	422.5	403.3	410.3	385.3	396.9
4 B 9	Poultry	CH4	Gg C	22.6	23.6	22.4	23.8	23.2	22.9	21.3	24.2	23.4	23.7	19.3	20.6	20.6	21.3	21.3	21.3
4 B-10	Other	CH4	Gg C	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4 D	AGRICULTURAL SOILS	CH4	Gg C	6.9	6.9	6.6	9.8	8.4	9.3	9.4	9.4	9.4	9.4	9.4	9.1	7.9	8.6	7.7	7.8
4 F	FIELD BURNING OF AGRICULTURA	CH4	Gg C	1.4	1.4	1.3	1.3	1.4	1.4	1.3	1.4	1.4	1.4	1.3	1.4	1.4	1.3	1.9	1.3
6 A	SOLID WASTE DISPOSAL ON LAND	CH4	Gg C	3 376.6	3 370.0	3 281.7	3 235.8	3 061.1	2 893.6	2 737.5	2 607.5	2 511.8	2 406.7	2 303.3	2 207.9	2 168.1	2 194.7	2 029.5	1 879.6
6 B	WASTEWATER HANDLING	CH4	Gg C	101.9	101.6	98.8	95.7	92.1	88.3	81.2	74.1	66.9	61.6	56.2	50.9	45.8	40.6	40.9	41.2
6 C	WASTE INCINERATION	CH4	Gg C	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 D	OTHER WASTE	CH4	Gg C	10.9	11.4	13.7	17.2	20.6	21.9	23.0	22.7	23.5	24.7	25.7	26.3	26.9	29.4	28.2	32.2

Table A1.5: Source/sink categories and emissions/removals for key category analysis

IPCC 96	Bezeichnung	Gas	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 228.7	1 498.0	1 481.6	2 052.0	1 901.8	1 556.3	1 549.9	1 925.2	2 211.2	1 969.0	1 170.4	1 366.8	800.2	1 134.8	1 174.3	1082.9
1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 247.0	6 817.0	4 009.5	3 088.9	3 279.1	4 529.8	4 695.9	5 002.2	3 498.0	3 779.4	5 004.2	5 956.6	5 510.1	6 916.2	6 674.2	5 844.0
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	548.4	490.0
1 A 1 b liquid	Petroleum refining	CO2	Gg	1 956.5	1 907.4	1 915.7	2 184.3	2 325.5	2 169.5	2 182.2	2 155.8	2 172.2	2 056.5	1 991.6	2 011.6	2 156.7	2 208.3	2 507.6	2 151.0
1 A 1 c liquid	Manufacture of Solid fuels and Other I	CO2	Gg	3.9	2.6	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0
1 A 2 stat-liquic	Manufacturing Industries and Constru	CO2	Gg	2 883.5	3 270.2	2 525.7	2 996.2	2 886.7	2 686.4	2 505.6	3 230.5	2 959.4	2 088.2	2 066.6	2 261.5	1 778.5	1 856.3	1 996.8	1 920.4
1 A 2 mobile-lic	Manufacturing Industries and Constru	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	1 161.4
1 A 2 solid	Manufacturing Industries and Constru	CO2	Gg	5 014.4	4 759.8	4 138.9	4 318.3	4 236.8	4 457.6	4 400.0	5 018.7	4 466.6	4 351.1	4 767.9	4 419.3	4 857.8	5 047.1	5 121.8	5 601.5
1 A 2 other	Manufacturing Industries and Constru	CO2	Gg	374.7	468.0	571.0	367.2	486.3	500.0	538.3	506.9	427.3	493.7	384.0	613.4	684.5	763.2	895.7	848.8
1 A 3 a aviatior	Civil Aviation	CO2	Gg	7.8	8.1	8.3	8.6	8.8	7.1	6.8	7.6	8.2	8.7	6.4	5.9	7.5	8.2	7.6	8.8
1 A 3 a jet kerc	Civil Aviation	CO2	Gg	24.2	29.4	34.7	40.0	45.3	50.5	56.7	62.9	69.1	72.4	75.7	72.4	70.4	154.1	184.6	208.6
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	6 149.5	6 621.6	6 772.0	6 586.8	6 392.7
1 A 3 b diesel (	Road Transportation	CO2	Gg	4 012.9	4 829.9	5 156.8	5 677.5	5 914.7	6 553.4	8 688.1	7 968.6	9 738.1	9 525.1	10 771.7	11 962.0	13 526.0	15 108.7	15 803.4	16 644.6
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	176.7	180.1	146.3
1 A 3 c solid	Railways	CO2	Gg	6.6	6.0	6.3	5.7	5.6	5.8	5.8	3.3	2.9	2.8	2.5	2.4	2.3	2.2	2.2	2.1
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	78.2	67.9	72.4
1 A 3 d gasolin	Navigation	CO2	Gg	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.2	9.2	9.1	9.1	9.0	9.0	8.9	8.9	8.8
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	140.0
1 A 4 mobile-di	Other Sectors	CO2	Gg	1 314.8	1 178.2	1 220.1	1 230.9	1 311.6	1 220.0	1 338.7	1 431.8	1 378.2	1 401.4	1 315.7	1 383.9	1 422.2	1 416.6	1 460.8	1 410.2
1 A 4 mobile-gi	Other Sectors	CO2	Gg	45.6	41.3	42.2	42.3	44.5	43.9	45.1	44.8	44.1	44.1	43.0	43.1	44.3	46.3	45.7	43.5
1 A 4 stat-liquic	Other Sectors	CO2	Gg	7 319.3	7 694.7	7 183.7	7 118.9	6 528.8	7 191.2	8 325.4	7 406.9	7 456.3	7 566.8	6 792.8	7 438.1	7 370.6	8 165.7	6 797.5	7 125.3
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	1 041.0	907.8	883.4	763.3	694.6	560.8	562.2
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	92.3	71.6
1 A 5 liquid	Other	CO2	Gg	35.0	37.1	33.7	39.4	41.6	32.6	38.9	37.1	42.4	41.6	45.0	43.1	41.9	89.3	106.6	120.2
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	15 147.2	14 565.8	15 482.8	15 451.4	16 899.2	16 473.4	18 509.6
1 B 2 a	Oil	CO2	Gg	43.0	43.0	40.0	37.0	47.5	38.0	41.0	31.1	61.0	90.0	72.0	88.0	84.0	133.0	122.0	122.0
1 B 2 b	Natural gas	CO2	Gg	59.0	68.0	80.0	75.0	80.0	89.0	30.0	89.4	80.8	80.5	92.5	94.7	83.0	100.0	88.0	83.0
2 A 1	Cement Production	CO2	Gg	2 033.4	2 005.0	2 105.0	2 031.9	2 102.3	1 631.3	1 634.2	1 760.9	1 598.7	1 607.4	1 711.6	1 719.9	1 735.7	1 754.5	1 790.0	1 797.5
2 A 2	Lime Production	CO2	Gg	396.2	361.3	355.1	365.2	390.5	394.6	382.7	412.5	453.8	453.1	497.5	506.6	546.6	576.9	601.1	578.7
2 A 3	Limestone and Dolomite Use	CO2	Gg	222.4	225.2	205.2	205.0	220.0	251.2	227.1	254.2	264.1	247.4	275.6	271.1	290.4	295.6	297.5	290.8
2 A 4	Soda Ash Production and use	CO2	Gg	19.4	22.3	19.7	19.8	21.1	21.2	21.2	19.7	19.7	21.6	18.2	21.4	18.9	18.8	11.9	15.3
2 A 7 a	Bricks and Tiles (decarbonizing)	CO2	Gg	116.5	121.9	126.0	135.4	139.7	148.8	148.8	137.1	133.6	121.5	115.9	123.7	120.3	115.8	133.7	128.0
2 A 7 b	Sinter Production	CO2	Gg	481.2	391.6	336.1	324.6	322.9	409.9	355.4	384.3	345.4	350.0	339.2	334.0	373.5	311.5	328.5	309.5
2 B 1	Ammonia Production	CO2	Gg	516.6	545.7	552.8	538.8	507.0	537.1	538.7	532.1	525.3	530.4	518.0	472.5	486.1	526.4	467.7	503.1
2 B 2	Nitric Acid Production	CO2	Gg	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
2 B 4	Carbide Production	CO2	Gg	37.5	35.2	41.3	32.9	25.1	26.2	32.8	32.8	35.0	32.5	48.1	46.7	40.8	41.5	35.8	35.9
2 B 5	Other	CO2	Gg	30.5	28.0	38.0	33.8	22.6	20.0	18.4	17.6	19.0	19.9	20.8	20.0	24.0	24.2	24.2	18.0
2 C 1	Iron and Steel Production	CO2	Gg	3 545.7	3 509.5	3 074.9	3 144.7	3 411.1	3 921.0	3 702.9	4 099.9	3 900.4	3 759.3	4 201.8	4 159.4	4 606.8	4 523.1	4 446.2	4 995.0
2 C 2	Ferroalloys Production	CO2	Gg	20.8	20.8	20.8	20.8	20.8	20.8	18.8	19.3	19.2	18.9	18.9	18.1	17.1	16.7	16.9	16.3
2 C 3	Aluminium production	CO2	Gg	158.4	158.4	63.0	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	SOLVENT AND OTHER PRODUCT U	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	189.6	185.7	181.7	177.4
6 C	WASTE INCINERATION	CO2	Gg	26.9	23.4	10.9	10.6	10.7	11.0	11.3	11.6	11.9	12.3	12.3	12.3	12.3	12.3	12.3	12.3
1 A 1 a liquid	Public Electricity and Heat Production	N2O	Gg C	6.7	7.8	7.0	9.9	9.5	7.5	7.7	10.0	11.5	10.7	5.8	6.5	4.0	6.0	6.1	5.8
1 A 1 a solid	Public Electricity and Heat Production	N2O	Gg C	23.0	27.3	17.4	15.0	14.9	19.6	15.4	14.2	14.9	16.5	22.1	24.3	22.9	27.4	29.2	9.6
1 A 1 a gaseou	Public Electricity and Heat Production	N2O	Gg C	10.2	10.0	9.2	9.2	10.6	11.2	12.0	8.6	11.2	10.8	9.1	10.2	10.3	11.7	11.2	17.0
1 A 1 a biomas	Public Electricity and Heat Production	N2O	Gg C	2.0	3.2	3.7	3.7	4.0	4.8	6.9	6.8	7.9	9.7	10.9	14.3	16.1	18.4	21.7	21.2
1 A 1 a other	Public Electricity and Heat Production	N2O	Gg C	1.0	1.3	1.5	1.6	1.7	1.7	2.1	2.1	2.1	2.0	2.0	2.5	2.9	3.4	4.0	3.7
1 A 1 b liquid	Petroleum refining	N2O	Gg C	4.4	4.7	4.7	5.4	5.3	5.2	5.1	5.1	5.1	5.0	4.7	5.0	5.6	5.1	5.7	5.1
1 A 1 b gaseou	Petroleum refining	N2O	Gg C	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	0.4
1 A 1 c liquid	Manufacture of Solid fuels and Other I	N2O	Gg C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 1 c gaseou	Manufacture of Solid fuels and Other I	N2O	Gg C	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	0.2
1 A 2 mobile-lic	Manufacturing Industries and Constru	N2O	Gg C	109.9	114.3	115.4	111.7	118.4	115.6	113.5	118.2	121.8	114.9	112.1	109.8	107.3	96.9	89.3	85.5
1 A 2 stat-liquic	Manufacturing Industries and Constru	N2O	Gg C	10.8	12.3	9.5	10.8	10.4	9.6	8.8	11.2	10.7	8.2	8.1	8.7	7.9	8.0	8.9	8.4
1 A 2 solid	Manufacturing Industries and Constru	N2O	Gg C	16.6	17.0	15.2	15.2	14.9	16.5	16.1	18.4	17.8	17.3	19.3	17.5	17.9	18.2	18.0	19.2
1 A 2 gaseous	Manufacturing Industries and Constru	N2O	Gg C	2.4	2.4	2.5	2.4	3.0	3.1	3.3	3.4	3.3	3.2	3.4	3.3	3.4	3.4	3.3	3.4

Table A1.5: Source/sink categories and emissions/removals for key category analysis

IPCC 96	Bezeichnung	Gas	Unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1 A 2 biomass	Manufacturing Industries and Constru	N2O	Gg C	20.3	20.7	21.4	24.6	25.2	24.3	23.1	27.7	20.9	37.8	31.2	34.9	35.2	35.5	33.2	36.9
1 A 2 other	Manufacturing Industries and Constru	N2O	Gg C	1.9	2.3	2.8	2.1	2.3	2.4	2.8	2.4	2.6	2.5	2.2	3.5	3.9	4.3	5.2	4.8
1 A 3 a jet kero	Civil Aviation	N2O	Gg C	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.9	0.9	1.0	0.9	0.9	2.0	2.4	2.6
1 A 3 b gasolin	Road Transportation	N2O	Gg C	219.2	281.9	295.4	307.1	305.1	289.6	259.9	239.0	248.9	217.5	202.4	195.0	200.7	192.0	170.0	148.6
1 A 3 b diesel (	Road Transportation	N2O	Gg C	33.2	39.0	40.8	43.9	45.4	49.2	62.2	58.3	70.0	69.4	77.4	84.5	94.7	104.3	108.6	111.6
1 A 3 c liquid	Railways	N2O	Gg C	6.6	6.9	6.7	6.5	6.4	5.9	5.2	5.2	5.1	6.2	6.1	6.0	5.8	5.9	5.9	4.7
1 A 3 c solid	Railways	N2O	Gg C	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
1 A 3 d gas/die	Navigation	N2O	Gg C	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	5.7	4.9	5.1
1 A 3 d gasolin	Navigation	N2O	Gg C	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
1 A 3 e gaseou	Other	N2O	Gg C	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.3
1 A 4 mobile-di	Other Sectors	N2O	Gg C	137.7	123.5	127.8	129.0	138.4	130.2	144.7	156.8	151.2	151.2	139.2	142.9	142.6	137.5	136.2	126.6
1 A 4 mobile-ga	Other Sectors	N2O	Gg C	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1 A 4 mobile-lic	Other Sectors	N2O	Gg C	7.4	7.4	7.5	7.6	7.8	8.0	7.9	7.9	7.9	7.0	6.9	6.8	6.7	5.8	5.6	5.4
1 A 4 stat-liquic	Other Sectors	N2O	Gg C	25.8	28.3	26.5	27.2	25.3	27.5	31.7	29.0	29.2	29.3	26.1	28.7	28.4	31.6	26.7	28.1
1 A 4 solid	Other Sectors	N2O	Gg C	20.6	22.8	19.6	16.1	14.3	13.4	12.7	10.0	8.6	8.1	7.0	6.7	5.8	5.4	4.3	4.2
1 A 4 gaseous	Other Sectors	N2O	Gg C	14.3	17.7	19.5	22.2	19.5	23.1	22.9	21.7	22.7	25.7	23.0	28.4	25.5	29.1	27.6	31.9
1 A 4 biomass	Other Sectors	N2O	Gg C	85.8	94.6	89.0	90.5	83.0	89.6	97.4	91.5	88.4	90.6	85.4	95.4	91.5	93.8	93.7	97.5
1 A 4 other	Other Sectors	N2O	Gg C	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	0.4	0.3
1 A 5 liquid	Other	N2O	Gg C	0.9	0.9	0.9	1.0	1.0	0.8	1.0	0.9	1.0	0.9	1.1	1.0	1.0	2.1	2.3	2.3
2 B 2	Nitric Acid Production	N2O	Gg C	912.0	927.3	837.5	878.7	825.2	857.2	874.2	862.6	896.7	923.5	951.6	786.5	807.2	883.4	280.9	274.2
3	SOLVENT AND OTHER PRODUCT U	N2O	Gg C	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	220.7	208.9	197.2	185.4	173.6
4 B 1	Cattle	N2O	Gg C	908.1	896.1	858.5	857.4	858.1	879.2	865.0	851.4	848.1	843.6	836.6	824.5	809.0	799.8	800.7	789.1
4 B 3	Sheep	N2O	Gg C	1.9	2.0	1.9	2.0	2.1	2.2	2.3	2.3	2.2	2.1	2.1	1.9	1.8	2.0	2.0	2.0
4 B 4	Goats	N2O	Gg C	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
4 B 6	Horses	N2O	Gg C	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
4 B 8	Swine	N2O	Gg C	77.9	76.9	78.6	80.7	79.6	79.9	78.0	78.1	80.4	72.4	70.3	73.5	70.2	71.3	67.0	68.9
4 B 9	Poultry	N2O	Gg C	16.7	17.7	16.7	17.8	17.4	17.0	15.9	18.0	17.4	17.5	14.4	15.3	15.3	15.8	15.8	15.8
4 B-10	Other	N2O	Gg C	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
4 D 1	Direct Soil Emissions	N2O	Gg C	1 760.0	1 924.6	1 780.0	1 622.0	1 919.4	1 929.4	1 713.6	1 752.9	1 778.5	1 727.7	1 647.6	1 650.5	1 656.6	1 570.9	1 502.3	1 518.0
4 D 2	Animal Production	N2O	Gg C	218.5	222.9	216.1	228.3	230.9	239.4	237.5	237.3	232.1	231.6	226.0	222.1	218.1	220.1	220.0	219.3
4 D 3	Indirect Emissions	N2O	Gg C	1 309.7	1 394.3	1 276.6	1 180.0	1 339.3	1 364.0	1 252.2	1 256.6	1 259.7	1 222.7	1 196.0	1 186.9	1 181.6	1 138.4	1 082.6	1 086.3
4 F	FIELD BURNING OF AGRICULTURA	N2O	Gg C	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.4	0.4	0.3	0.5	0.3
6 B	WASTEWATER HANDLING	N2O	Gg C	108.4	107.8	106.0	105.2	120.2	123.4	141.5	153.1	162.2	178.2	203.2	228.6	229.8	229.9	246.1	247.9
6 C	WASTE INCINERATION	N2O	Gg C	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 D	OTHER WASTE	N2O	Gg C	23.9	25.0	29.7	37.0	43.8	46.3	48.4	47.6	49.2	52.6	55.4	56.3	57.2	62.9	59.4	69.3
2C3	Aluminium production	PFCs	GgC(	1 050.2	1 050.2	417.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2C4	SF6 Used in Al and Mg Foundries	SF6	GgC(	253.3	277.2	253.3	277.2	372.8	443.1	610.6	349.2	164.2	22.2	7.6	7.6	7.6	0.0	0.0	0.0
2F8	Electrical Equipment	SF6	GgC(	20.6	21.7	22.8	23.9	25.0	26.1	26.9	27.1	27.2	28.9	29.1	29.4	30.0	31.5	33.7	36.2
2F7	Semiconductor Manufacture	FCs	GgC(	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	290.6
2F1/2/3/4/5	ODS Substitutes	HFCs	GgC(	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	861.3	895.7	907.8
2F9	Other Sources of SF6	SF6	GgC(	126.6	179.2	183.1	190.6	222.5	241.2	252.2	256.1	286.1	246.4	265.2	268.3	268.0	185.1	100.1	81.7
5 A 1	Forest land remaining forest land	CO2	Gg	-12 226.0	-18 152.2	-12 972.8	-16 818.9	-15 717.5	-15 250.2	-10 518.5	-19 620.5	-17 769.9	-22 263.5	-16 924.7	-19 700.7	-15 982.4	-17 536.1	-17 536.1	-17 536.1
5 A 2	Land converted to forest land	CO2	Gg	-132.8	-132.8	-132.8	-118.3	-118.3	-118.3	-103.8	-103.8	-103.8	-103.8	-103.8	-103.8	-103.8	-103.8	-103.8	-103.8
5 B 1	Cropland remaining cropland	CO2	Gg	-484.7	-488.7	-477.7	-413.0	-420.2	-242.9	-218.5	-205.4	-173.7	-155.7	-146.6	-122.6	-163.6	-118.8	-82.1	-155.4
5 B 2	Land converted to cropland	CO2	Gg	-130.3	-131.5	-131.0	-132.1	-132.2	-130.6	-133.0	-132.9	-132.2	-132.2	-131.2	-160.0	-125.5	-107.6	-140.0	-120.8
5 B	Cropland-LimeApp	CO2	Gg	90.3	91.1	90.7	90.7	90.7	92.0	92.0	92.1	91.6	91.6	90.3	90.3	90.2	90.3	90.2	90.3
5 C 1	Grassland remaining grassland	CO2	Gg	6.1	6.2	6.6	6.6	6.7	6.8	6.7	6.6	7.1	7.5	7.9	9.9	11.1	12.8	13.9	14.5
5 C 2	Land converted to grassland	CO2	Gg	439.2	440.4	439.9	409.4	409.5	407.9	378.6	378.6	377.9	377.9	376.9	412.0	348.7	369.4	326.6	362.8
5 D 2	Land converted to Wetlands	CO2	Gg	212.5	212.5	212.5	210.3	210.3	210.3	226.7	226.7	208.2	208.2	208.2	208.2	208.2	208.2	208.2	77.9
5 E 2	Land converted to Settlements	CO2	Gg	172.4	355.0	182.0	180.1	384.9	178.8	428.3	437.4	229.2	172.1	156.8	133.4	131.6	129.8	138.3	222.7
5 F 2	Land converted to Other land	CO2	Gg	139.8	139.8	139.8	125.4	125.4	125.4	111.0	111.0	111.0	111.0	111.0	111.0	111.0	111.0	111.0	111.0
5	Total land use categories	CH4	Gg C	0.3	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.3	0.1	0.1	0.1
5	Total land use categories	N2O	Gg C	11.4	11.4	11.4	11.3	11.3	11.1	11.1	11.1	11.1	11.1	11.0	13.1	10.6	9.3	11.6	10.3

IPCC Category Description		Gas	LA90	LA91	LA92	LA93	LA94	LA95	LA96	LA97	LA98	LA99	LA00	LA01	LA02	LA03	LA04	LA05	TA05
1 A gaseous	Fuel Combustion (stationary)	CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
1 A 3 b diesel oil	Road Transportation	CO2	6	5	4	4	4	4	2	2	2	2	2	2	2	2	2	2	1
1 A 4 stat-liquid	Other Sectors	CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	7
1 A 3 b gasoline	Road Transportation	CO2	2	2	2	2	2	2	4	4	4	4	4	4	4	5	5	4	3
1 A 1 a solid	Public Electricity and Heat Production	CO2	4	4	6	9	8	5	5	6	7	6	5	5	5	4	4	5	6
1 A 2 solid	Manufacturing Industries and Construction	CO2	5	6	5	5	5	6	6	5	5	5	6	6	6	6	6	6	20
2 C 1	Iron and Steel Production	CO2	8	7	9	8	6	7	7	7	6	7	7	7	7	7	7	7	12
4 A 1	Cattle	CH4	7	8	7	6	7	8	8	8	8	8	8	8	8	8	8	8	10
1 A 1 b liquid	Petroleum refining	CO2	13	14	13	11	11	11	11	11	12	11	11	11	10	9	9	9	29
1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	10	10	10	10	10	10	10	9	9	10	10	9	11	11	11	10	8
6 A	SOLID WASTE DISPOSAL ON LAND	CH4	9	9	8	7	9	9	9	10	10	9	9	10	9	10	10	11	5
2 A 1	Cement Production	CO2	12	12	12	14	12	14	14	13	14	14	12	12	12	12	12	12	14
4 D 1	Direct Soil Emissions	N2O	14	13	14	15	13	12	12	14	13	13	13	13	13	13	13	13	15
1 A 4 mobile-diesel	Other Sectors	CO2	15	17	17	16	17	17	16	15	15	15	14	14	14	14	14	14	31
1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	19	18	18	18	18	18	18	18	18	17	17	17	16	17	16	15	
4 D 3	Indirect Emissions	N2O	16	16	16	17	16	16	17	17	16	16	15	16	15	15	17	16	16
1 A 1 a liquid	Public Electricity and Heat Production	CO2	17	15	15	13	14	15	15	12	11	12	16	15	19	16	15	17	18
2F1/2/3/4/5	ODS Substitutes	HFCs						32	30	26	23	21	21	21	20	19	19	18	11
1 A 2 other	Manufacturing Industries and Construction	CO2	27	24	21	24	23	24	23	24	27	24	28	22	22	21	18	19	17
4 B 1	Cattle	N2O	21	21	19	20	19	19	20	20	20	20	20	19	17	20	20	20	22
2 A 2	Lime Production	CO2	26	27	26	25	26	28	28	27	26	26	24	23	23	23	21	21	
1 A 4 solid	Other Sectors	CO2	11	11	11	12	15	13	13	16	17	18	19	18	21	22	22	22	4
1 B 2 b	Natural gas	CH4	30	29	29	27	28	29	27	28	28	27	25	25	24	25	24	23	25
2 B 1	Ammonia Production	CO2	23	23	22	22	22	21	22	22	21	22	22	26	25	24	27	24	
1 A 1 a other	Public Electricity and Heat Production	CO2												29	27	26	23	25	19
4 B 1	Cattle	CH4	22	22	23	21	21	22	24	23	22	23	23	24	26	28	26	26	24
4 B 8	Swine	CH4	25	25	24	23	24	25	25	25	25	28	27	27	29	29	28	27	
2 A 7 b	Sinter Production	CO2	24	26	27	28	29	27	29	29	29	29	29	30	30		29	28	23
2 A 3	Limestone and Dolomite Use	CO2									31	32	30					29	
2F7	Semiconductor Manufacture	FCs			31	26	25	23	26	21	24	25	26	28	28	27	25		32
2 B 2	Nitric Acid Production	N2O	20	20	20	19	20	20	19	19	19	19	18	20	18	18			13
1 A 4 biomass	Other Sectors	CH4	28	28	28	29	31	30	31			31							
1 A 3 a jet kerosene	Civil Aviation	CO2																	28
3	SOLVENT AND OTHER PRODUCT USE	CO2	29				32												30
1 A 3 b gasoline	Road Transportation	N2O		30	30	30	30	31											
2F9	Other Sources of SF6	SF6								32	30		31						

IPCC Category Description		Gas	**LA90**	LA91	LA92	LA93	LA94	LA95	LA96	LA97	LA98	LA99	LA00	LA01	LA02	LA03	LA04	**LA05**	**TA05**
1 A 4 other	Other Sectors	CO2							32	31		30							**26**
2C3	Aluminium production	PFCs	**18**	19	25														**9**
2C4	SF6 Used in Al and Mg Foundries	SF6	**31**	31	32	31	27	26	21	30									**21**
2 C 3	Aluminium production	CO2																	**27**

IPCC Category Description		Gas	**LA90**	LA91	LA92	LA93	LA94	LA95	LA96	LA97	LA98	LA99	LA00	LA01	LA02	LA03	LA04	**LA05**	**TA05**
1 A gaseous	Fuel Combustion (stationary)	CO2	***2***	2	2	2	2	2	1	2	2	2	2	2	2	2	2	**1**	**2**
5 A 1	Forest land remaining forest land	CO2	***1***	1	1	1	1	1	2	1	1	1	1	1	1	1	1	**2**	**3**
1 A 3 b diesel oil	Road Transportation	CO2	***7***	6	5	5	5	5	3	3	3	3	3	3	3	3	3	**3**	**1**
1 A 4 stat-liquid	Other Sectors	CO2	***4***	4	4	4	4	4	4	4	4	4	4	4	4	4	4	**4**	**10**
1 A 3 b gasoline	Road Transportation	CO2	***3***	3	3	3	3	3	5	5	5	5	5	5	5	6	6	**5**	**4**
1 A 1 a solid	Public Electricity and Heat Production	CO2	***5***	5	7	10	9	6	6	7	8	7	6	6	6	5	5	**6**	**9**
1 A 2 solid	Manufacturing Industries and Construction	CO2	***6***	7	6	6	6	7	7	6	6	6	7	7	7	7	7	**7**	
2 C 1	Iron and Steel Production	CO2	***9***	8	10	9	7	8	8	8	7	8	8	8	8	8	8	**8**	**12**
4 A 1	Cattle	CH4	***8***	9	8	7	8	9	9	9	9	9	9	9	9	9	9	**9**	**11**
1 A 1 b liquid	Petroleum refining	CO2	***14***	15	14	12	12	12	12	12	13	12	12	12	11	10	10	**10**	
1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	***11***	11	11	11	11	11	11	10	10	11	11	10	12	12	12	**11**	**8**
6 A	SOLID WASTE DISPOSAL ON LAND	CH4	***10***	10	9	8	10	10	10	11	11	10	10	11	10	11	11	**12**	**6**
2 A 1	Cement Production	CO2	***13***	13	13	15	13	15	15	14	15	15	13	13	13	13	13	**13**	**15**
4 D 1	Direct Soil Emissions	N2O	***15***	14	15	16	14	13	13	15	14	14	14	14	14	14	14	**14**	**16**
1 A 4 mobile-diesel	Other Sectors	CO2	***16***	18	18	17	18	18	17	16	16	16	15	15	15	15	15	**15**	
1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	***20***	19	19	19	19	19	19	19	19	18	18	18	17	18	17	**16**	
4 D 3	Indirect Emissions	N2O	***17***	17	17	18	17	17	18	18	17	17	16	17	16	16	18	**17**	**19**
1 A 1 a liquid	Public Electricity and Heat Production	CO2	***18***	16	16	14	15	16	16	13	12	13	17	16	20	17	16	**18**	**22**
2F1/2/3/4/5	ODS Substitutes	HFC						34	32	27	24	22	22	22	21	20	20	**19**	**13**
1 A 2 other	Manufacturing Industries and Construction	CO2	***30***	26	22	27	24	25	24	25	28	25	29	23	23	22	19	**20**	**17**
4 B 1	Cattle	N2O	***22***	22	20	21	20	20	21	21	21	21	21	20	18	21	21	**21**	**24**
2 A 2	Lime Production	CO2	***29***	30	29	28	29	30	29	28	27	27	25	24	24	24	22	**22**	
1 A 4 solid	Other Sectors	CO2	***12***	12	12	13	16	14	14	17	18	19	20	19	22	23	23	**23**	**5**
1 B 2 b	Natural gas	CH4	***33***	33	32	30	32	31	28	29	29	28	26	26	25	26	25	**24**	**25**
2 B 1	Ammonia Production	CO2	***24***	24	23	23	23	22	23	23	22	23	23	27	26	25	28	**25**	
1 A 1 a other	Public Electricity and Heat Production	CO2												31	28	27	24	**26**	**21**
4 B 1	Cattle	CH4	***23***	23	24	22	22	23	25	24	23	24	24	25	27	29	27	**27**	**27**
4 B 8	Swine	CH4	***27***	27	26	24	25	26	26	26	26	29	28	28	30	30	29	**28**	
5 C 2	Land converted to grassland	CO2	***28***	28	27	26	28	29	30	31	30	30	30	30	32	31		**29**	**32**
2C3	Aluminium production	PFCs	***19***	20	28														**7**
2 B 2	Nitric Acid Production	N2O	***21***	21	21	20	21	21	20	20	20	20	19	21	19	19			**14**
2C4	SF6 Used in Al and Mg Foundries	SF6	***34***		35	34	31	27	22	32									**18**
5 B 1	Cropland remaining cropland	CO2	***25***	25	25	25	27												**20**
2 C 3	Aluminium production	CO2																	**23**
2 A 7 b	Sinter Production	CO2	***26***	29	30	31	33	28	31	30	31	31	31		31		30		**26**
1 A 4 other	Other Sectors	CO2	***35***						34	33		32							**28**

IPCC Category Description		Gas	**LA90**	LA91	LA92	LA93	LA94	LA95	LA96	LA97	LA98	LA99	LA00	LA01	LA02	LA03	LA04	**LA05**	**TA05**
1 A 3 a jet kerosene	Civil Aviation	CO2																	**29**
3	SOLVENT AND OTHER PRODUCT USE	CO2	***32***		36														**30**
2F7	Semiconductor Manufacture	FCs			34	29	26	24	27	22	25	26	27	29	29	28	26		**31**
1 A 3 b gasoline	Road Transportation	N2O		34	33	33	34	33											
1 A 4 biomass	Other Sectors	CH4	***31***	32	31	32	35	32	33										
2 A 3	Limestone and Dolomite Use	CO2						35					32						
2F9	Other Sources of SF6	SF6									32								
5 E 2	Land converted to Settlements	CO2		31			30												

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	11 002
1998	10 016	0.18	0.15	10 068
1999	9 847	0.16	0.16	9 900
2000	9 749	0.15	0.16	9 802
2001	11 041	0.17	0.19	11 103
2002	10 692	0.19	0.18	10 753
2003	13 039	0.22	0.22	13 111
2004	12 939	0.26	0.23	13 017
2005	12 736	0.21	0.18	12 797
Trend 1990-2005	17.0%	41.2%	33.3%	17.0%

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 2005.

Table 2: Share of fuel types on total CO_2 emissions from Category 1 A 1 a.

	Liquid	Solid	Gaseous	Other

	Liquid	Solid	Gaseous	Other
1990	11%	57%	30%	1%
1991	13%	59%	27%	1%
1992	17%	47%	34%	2%
1993	25%	37%	36%	2%
1994	22%	38%	38%	2%
1995	16%	47%	35%	2%
1996	14%	43%	41%	2%
1997	18%	46%	35%	2%
1998	22%	35%	41%	2%
1999	20%	38%	39%	2%
2000	12%	51%	34%	2%
2001	12%	54%	31%	3%
2002	7%	52%	37%	4%
2003	9%	53%	35%	4%
2004	9%	52%	35%	4%
2005	9%	46%	42%	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	2 463	0.015	2 468
1991	2 495	0.016	2 500
1992	2 451	0.016	2 456
1993	2 732	0.018	2 737
1994	2 709	0.018	2 715
1995	2 591	0.017	2 596
1996	2 647	0.017	2 652
1997	2 640	0.017	2 645
1998	2 633	0.017	2 638
1999	2 463	0.017	2 468
2000	2 344	0.016	2 349
2001	2 420	0.017	2 426
2002	2 565	0.019	2 571
2003	2 687	0.017	2 693
2004	2 844	0.019	2 849
2005	2 827	0.018	2 832
Trend 1990-2005	14.8%	18.5%	14.8%

Table 4 presents the share of CO_2 emissions on the different fuel types.

From 2003 on gaseous fuels include emissions from bitumen blowing and hydrogen production.

Table 4: Share of fuel types on total CO_2 emissions from Category 1 A 1 b.

	Liquid	Gaseous
1990	79%	21%
1991	76%	24%
1992	78%	22%
1993	80%	20%
1994	86%	14%
1995	84%	16%
1996	82%	18%
1997	82%	18%
1998	82%	18%
1999	83%	17%
2000	85%	15%
2001	83%	17%
2002	84%	16%
2003	82%	18%
2004	88%	12%
2005	76%	24%

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	308
1991	312	0.008	0.0006	312
1992	293	0.008	0.0005	293
1993	310	0.008	0.0006	310
1994	303	0.008	0.0005	303
1995	330	0.009	0.0006	330
1996	192	0.005	0.0003	192
1997	236	0.006	0.0004	236
1998	202	0.005	0.0004	202
1999	139	0.004	0.0003	139
2000	198	0.005	0.0004	198
2001	187	0.005	0.0003	187
2002	173	0.005	0.0003	173
2003	252	0.007	0.0005	252
2004	258	0.007	0.0005	258

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
2005	272	0.007	0.0005	272
Trend 1990-2005	-11.9%	-10.9%	-19.7%	-11.9%

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%
2005	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	4 942	0.025	0.043	4 956
1991	4 614	0.023	0.043	4 628
1992	3 932	0.020	0.037	3 944
1993	4 189	0.022	0.038	4 201
1994	4 439	0.026	0.041	4 453
1995	4 772	0.026	0.047	4 787
1996	4 666	0.030	0.043	4 680
1997	5 287	0.034	0.049	5 303
1998	4 905	0.033	0.049	4 921
1999	4 851	0.030	0.049	4 867

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
2000	5 306	0.038	0.056	5 324
2001	5 169	0.035	0.054	5 186
2002	5 498	0.037	0.053	5 515
2003	5 681	0.077	0.054	5 700
2004	5 855	0.079	0.055	5 873
2005	6 393	0.083	0.059	6 414
Trend 1990-2005	29.4%	228.0%	36.3%	29.4%

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	9.1%	77.8%	13.1%
1991	9.7%	75.7%	14.5%
1992	11.1%	72.7%	16.2%
1993	10.9%	74.5%	14.6%
1994	10.9%	73.8%	15.3%
1995	11.7%	72.5%	15.9%
1996	9.9%	70.1%	20.0%
1997	9.8%	69.7%	20.5%
1998	13.6%	64.7%	21.7%
1999	13.6%	65.7%	20.7%
2000	15.6%	66.1%	18.4%
2001	17.1%	64.3%	18.6%
2002	12.0%	69.5%	18.5%
2003	9.8%	72.3%	17.9%
2004	12.0%	71.2%	16.9%
2005	12.4%	72.2%	15.4%

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	132	0.003	0.0009	132
1991	119	0.003	0.0008	119
1992	127	0.003	0.0007	127
1993	158	0.004	0.0008	158

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1994	264	0.007	0.0011	264
1995	170	0.004	0.0008	170
1996	177	0.004	0.0009	177
1997	221	0.005	0.0012	222
1998	205	0.004	0.0011	206
1999	189	0.004	0.0011	190
2000	194	0.004	0.0010	194
2001	205	0.005	0.0010	205
2002	207	0.005	0.0010	208
2003	218	0.005	0.0010	219
2004	216	0.005	0.0009	216
2005	406	0.010	0.0029	407
Trend 1990-2005	208.2%	233.9%	225.5%	208.2%

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	27%	17%	57%
1991	29%	15%	56%
1992	25%	6%	69%
1993	21%	12%	67%
1994	16%	6%	78%
1995	24%	6%	70%
1996	28%	9%	63%
1997	32%	9%	59%
1998	30%	8%	62%
1999	25%	12%	63%
2000	24%	10%	66%
2001	25%	5%	70%
2002	21%	8%	71%
2003	19%	7%	74%
2004	17%	8%	75%
2005	21%	3%	76%

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	961	0.053	0.018	967
1991	965	0.057	0.019	972
1992	1 080	0.068	0.022	1 088
1993	1 088	0.054	0.016	1 094
1994	1 034	0.053	0.014	1 039
1995	1 068	0.056	0.014	1 074
1996	1 116	0.060	0.019	1 123
1997	1 194	0.059	0.020	1 202
1998	1 119	0.054	0.017	1 125
1999	1 393	0.071	0.029	1 404
2000	1 274	0.057	0.023	1 283
2001	1 474	0.069	0.015	1 480
2002	1 533	0.083	0.019	1 541
2003	1 616	0.086	0.018	1 624
2004	1 742	0.104	0.021	1 751
2005	1 361	0.087	0.020	1 369
Trend 1990-2005	41.6%	65.3%	13.3%	41.5%

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 and liquid fossil fuel combustion got less important while CO_2 emissions from industrial waste (reported as "other fuels") strongly increased since 2000.

Table 12: Share of fuel types in total CO_2 emissions from Category 1 A 2 c

	Liquid	Solid	Gaseous	Other
1990	9%	12%	55%	25%
1991	9%	15%	49%	28%
1992	6%	18%	47%	30%
1993	7%	18%	56%	19%
1994	9%	15%	54%	22%
1995	8%	14%	54%	24%
1996	8%	17%	51%	23%
1997	11%	21%	50%	17%
1998	10%	22%	52%	16%
1999	5%	22%	57%	15%
2000	4%	20%	67%	9%
2001	5%	17%	62%	16%
2002	3%	16%	58%	23%
2003	4%	16%	56%	24%
2004	3%	14%	52%	32%
2005	3%	11%	52%	34%

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	2 268	0.12	0.06	2 289
1991	2 619	0.13	0.07	2 642
1992	2 226	0.13	0.06	2 248
1993	2 057	0.13	0.08	2 083
1994	2 574	0.14	0.08	2 602
1995	2 303	0.14	0.08	2 330
1996	2 242	0.13	0.07	2 265
1997	2 818	0.15	0.08	2 846
1998	2 633	0.14	0.07	2 656
1999	2 154	0.13	0.07	2 179
2000	2 174	0.13	0.06	2 195
2001	2 022	0.12	0.06	2 044
2002	1 944	0.12	0.06	1 966
2003	2 019	0.13	0.07	2 043
2004	1 978	0.13	0.07	2 003
2005	2 283	0.14	0.08	2 310
Trend 1990-2005	0.7%	17.4%	30.8%	0.9%

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	Other
1990	38%	17%	42%	3%
1991	42%	20%	36%	2%
1992	30%	20%	47%	4%
1993	33%	21%	44%	2%
1994	25%	14%	58%	2%
1995	23%	16%	59%	2%
1996	18%	16%	62%	4%
1997	18%	16%	66%	0%
1998	17%	17%	66%	0%
1999	11%	16%	72%	1%
2000	8%	19%	72%	1%
2001	9%	18%	72%	1%

	Liquid	Solid	Gaseous	Other
2002	9%	21%	70%	1%
2003	9%	18%	72%	1%
2004	7%	20%	72%	1%
2005	6%	19%	74%	1%

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	870	0.018	0.005	872
1991	933	0.020	0.006	935
1992	854	0.018	0.005	856
1993	885	0.016	0.005	887
1994	912	0.019	0.005	914
1995	950	0.019	0.005	951
1996	888	0.019	0.004	890
1997	1 042	0.022	0.004	1 043
1998	943	0.021	0.004	944
1999	887	0.024	0.009	890
2000	1 127	0.028	0.005	1 129
2001	1 085	0.026	0.005	1 087
2002	1 262	0.033	0.005	1 264
2003	1 064	0.026	0.005	1 066
2004	987	0.024	0.004	989
2005	768	0.020	0.004	770
Trend 1990-2005	-11.7%	8.6%	-17.7%	-11.7%

As can be seen in Table 16, the share of natural gas consumption is increasing and is the main source of CO_2 emissions from category *1 A 2 e*. The share of liquid fossil fuel combustion in total CO_2 emissions decreased since 1990.

Table 16: Share of fuel types in total CO_2 emissions from Category 1 A 2 e.

	Liquid	Solid	Gaseous
1990	40%	2%	58%
1991	42%	2%	55%
1992	40%	1%	59%
1993	44%	2%	54%
1994	38%	2%	60%

	Liquid	Solid	Gaseous
1995	36%	1%	64%
1996	29%	1%	70%
1997	30%	1%	69%
1998	26%	1%	72%
1999	18%	1%	81%
2000	15%	4%	81%
2001	21%	2%	77%
2002	14%	3%	83%
2003	16%	3%	81%
2004	16%	3%	81%
2005	17%	2%	82%

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	4 407	0.188	0.395	4 533
1991	4 597	0.202	0.411	4 728
1992	4 476	0.208	0.412	4 608
1993	4 664	0.202	0.401	4 793
1994	4 799	0.204	0.420	4 933
1995	4 941	0.208	0.408	5 072
1996	5 180	0.218	0.409	5 311
1997	5 278	0.219	0.430	5 416
1998	4 934	0.218	0.434	5 073
1999	4 211	0.202	0.435	4 350
2000	4 237	0.208	0.423	4 372
2001	4 388	0.235	0.437	4 528
2002	4 053	0.222	0.425	4 190
2003	4 268	0.223	0.391	4 394
2004	4 339	0.221	0.357	4 454
2005	4 327	0.226	0.345	4 439
Trend 1990-2005	-1.8%	20.3%	-12.5%	-2.1%

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	49%	14%	36%	2%
1991	49%	12%	35%	3%
1992	46%	14%	36%	4%
1993	51%	12%	35%	2%
1994	49%	9%	39%	4%
1995	44%	9%	43%	4%
1996	44%	11%	42%	4%
1997	51%	11%	32%	6%
1998	50%	12%	33%	5%
1999	47%	11%	36%	6%
2000	44%	12%	38%	6%
2001	44%	10%	38%	8%
2002	44%	8%	41%	8%
2003	45%	6%	40%	8%
2004	47%	6%	39%	7%
2005	44%	9%	39%	9%

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	3 388	0.11	0.04	3 403
1991	3 538	0.12	0.04	3 553
1992	3 405	0.13	0.04	3 420
1993	3 628	0.12	0.04	3 643
1994	3 736	0.13	0.04	3 750
1995	3 902	0.13	0.03	3 916
1996	4 170	0.15	0.04	4 186
1997	4 251	0.15	0.05	4 270
1998	3 893	0.15	0.04	3 908
1999	3 164	0.14	0.06	3 186
2000	3 176	0.15	0.06	3 198
2001	3 312	0.18	0.08	3 341
2002	2 971	0.17	0.08	2 999
2003	3 181	0.17	0.08	3 209
2004	3 194	0.17	0.07	3 219
2005	3 165	0.18	0.07	3 191
Trend	-6.6%	56.6%	72.8%	-6.2%

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990-2005				

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	33%	18%	46%	2%
1991	34%	16%	46%	4%
1992	29%	18%	48%	5%
1993	37%	15%	45%	3%
1994	34%	11%	50%	6%
1995	29%	12%	54%	5%
1996	30%	13%	52%	5%
1997	40%	14%	39%	7%
1998	37%	15%	42%	6%
1999	29%	15%	47%	8%
2000	25%	16%	50%	8%
2001	25%	13%	50%	11%
2002	23%	11%	55%	11%
2003	27%	9%	54%	11%
2004	29%	9%	53%	10%
2005	23%	12%	53%	12%

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	0.06	0.02	1 061
1991	1 038	0.06	0.02	1 044
1992	1 107	0.06	0.02	1 114
1993	1 038	0.06	0.02	1 045
1994	1 089	0.06	0.02	1 095
1995	867	0.05	0.01	872
1996	848	0.06	0.01	853
1997	932	0.06	0.01	938

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1998	853	0.07	0.02	859
1999	826	0.06	0.01	832
2000	866	0.07	0.02	872
2001	807	0.08	0.02	813
2002	830	0.08	0.02	837
2003	821	0.08	0.02	828
2004	839	0.09	0.02	848
2005	884	0.09	0.02	892
Trend 1990-2005	-16.2%	53.5%	24.6%	-15.9%

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

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	1 039	0.07	0.37	1 156
1996	1 010	0.07	0.37	1 125
1997	1 026	0.07	0.38	1 146
1998	1 041	0.07	0.39	1 164
1999	1 048	0.06	0.37	1 164
2000	1 062	0.06	0.36	1 175
2001	1 077	0.06	0.35	1 188
2002	1 082	0.06	0.35	1 190
2003	1 087	0.05	0.31	1 185
2004	1 144	0.05	0.29	1 235
2005	1 161	0.05	0.28	1 248
Trend 1990 - 2005	14.0%	-32.8%	-18.8%	9.3%

1 A 3 e Other Transportation – Pipeline Compressors

The following table present greenhouse gas emissions from *1 A 3 e Other Transportation-Pipeline Compressors*.

Table 23: Greenhouse gas emissions from Category 1 A 3 e.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	224	0.006	0.0004	225
1991	225	0.006	0.0004	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	432	0.012	0.0008	432
2000	535	0.014	0.0010	535
2001	457	0.012	0.0008	458
2002	275	0.007	0.0005	275
2003	367	0.010	0.0007	368
2004	441	0.012	0.0008	442
2005	544	0.015	0.0010	545
Trend 1990-2005	142.6%	142.6%	142.6%	142.6%

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	14 266	18.49	0.94	14 947
1991	15 358	19.99	0.95	16 073
1992	14 805	18.20	0.94	15 478
1993	14 699	17.87	0.95	15 368
1994	13 517	16.22	0.93	14 146
1995	14 615	16.86	0.94	15 262
1996	15 908	17.89	1.03	16 603
1997	14 470	13.61	1.03	15 074
1998	14 368	13.08	1.00	14 952
1999	15 059	13.32	1.01	15 652
2000	13 454	12.42	0.93	14 004
2001	15 031	13.43	1.00	15 623
2002	14 356	12.55	0.97	14 920
2003	15 724	12.52	0.98	16 291
2004	14 036	12.06	0.95	14 584

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
2005	15 046	12.47	0.95	15 602
Trend 1990-2005	5.5%	-32.5%	0.5%	4.4%

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 doubled.

Table 25: Share of fuel types on total CO_2 emissions from Category 1 A 4.

	Liquid	Solid	Gaseous	Other
1990	62%	19%	18%	2%
1991	59%	19%	21%	1%
1992	58%	17%	24%	1%
1993	58%	14%	27%	1%
1994	59%	14%	26%	1%
1995	59%	12%	28%	1%
1996	62%	10%	26%	2%
1997	62%	9%	27%	2%
1998	63%	8%	28%	1%
1999	61%	7%	31%	2%
2000	62%	7%	31%	1%
2001	60%	6%	34%	0%
2002	63%	5%	32%	0%
2003	62%	4%	33%	0%
2004	60%	4%	35%	1%
2005	58%	4%	38%	0%

1 A 4 Other sectors - stationary sources

The following table present greenhouse gas emissions from *1 A 4 Other sectors –stationary sources* and yearly changes on heating degree days.

Table 26: Greenhouse gas emissions from Category 1 A 4 stationary sources.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]	Heating degree days
1990	12 764	18.19	0.48	13 293	3 114.8
1991	13 996	19.71	0.53	14 574	3 618.6
1992	13 399	17.92	0.50	13 930	3 192.8
1993	13 281	17.59	0.50	13 807	3 291.2
1994	12 017	15.92	0.46	12 494	2 918.8
1995	13 206	16.58	0.50	13 709	3 207.8
1996	14 381	17.60	0.54	14 916	3 573.0

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]	Heating degree days
1997	12 851	13.32	0.49	13 284	3 312.3
1998	12 804	12.80	0.48	13 222	3 038.2
1999	13 473	13.04	0.50	13 902	3 015.7
2000	11 955	12.17	0.46	12 353	2 726.0
2001	13 464	13.20	0.51	13 900	3 089.3
2002	13 464	13.20	0.51	13 900	3 001.4
2003	14 121	12.31	0.52	14 540	3 266.8
2004	12 390	11.86	0.49	12 791	3 129.2
2005	13 452	12.29	0.52	13 872	3 323.2
Trend 1990-2005	5.4%	-32.4%	9.9%	4.4%	6.7%

As can be seen in Table 27, liquid fossil fuels are the main stationary source of CO_2 emissions from category *1 A 4* with a quite constant share over time. Since 1990 solid fossil fuels became less important whereas 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	57%	21%	20%	1.9%
1991	55%	21%	23%	1.4%
1992	54%	19%	26%	1.6%
1993	54%	16%	30%	0.9%
1994	54%	15%	29%	1.2%
1995	54%	13%	31%	1.1%
1996	58%	12%	28%	2.1%
1997	58%	10%	30%	2.1%
1998	58%	9%	32%	1.2%
1999	56%	8%	34%	2.0%
2000	57%	8%	34%	1.2%
2001	55%	7%	38%	0.5%
2002	55%	6%	34%	0.5%
2003	58%	5%	37%	0.5%
2004	55%	5%	40%	0.7%
2005	53%	4%	42%	0.5%

Recalculations

In 2006 STATISTIK AUSTRIA revised the energy balance for the years 1999 to 2004. Although revisions did not affect the year 1990 the GHG inventory has been updated for the year 1990 because 1990-2004 energy data has been officially submitted to IEA after preparation of the inventory 2005. Table 28 presents the recalculation difference of fuel consumption for the base year 1990 and the years 2003 and 2004.

Table 28: Recalculation difference of fuel consumption [PJ] with respect to previous submission

	Fuel Consumption [PJ]								
	1990			2003			2004		
IPCC Category / Fuel Group	Subm. 2006	Subm. 2007	Differ-ence	Subm. 2006	Subm. 2007	Differ-ence	Subm. 2006	Subm. 2007	Differ-ence
1 A FUEL COMBUSTION ACTIVITIES	822.48	821.84	-0.64	1 101.33	1 103.75	2.41	1 103.70	1 095.05	-8.66
1 A liquid	377.83	377.04	-0.79	517.98	517.51	-0.47	516.06	513.57	-2.49
1 A solid	139.68	139.83	0.15	128.14	128.42	0.28	124.52	126.03	1.51
1 A gaseous	201.60	201.60	-	301.25	305.04	3.79	306.17	297.35	-8.82
1 A biomass	94.38	94.38	-	136.33	134.52	-1.80	136.91	136.08	-0.82
1 A other	8.99	8.99	-	17.64	18.26	0.62	20.05	22.02	1.97
1 A 1 Energy Industries	186.40	186.40	-	241.49	233.40	-8.09	235.55	237.56	2.01
1 A 1 liquid	46.45	46.45	-	44.72	44.79	0.07	46.01	48.40	2.38
1 A 1 solid	61.40	61.40	-	70.89	70.89	-	69.07	69.07	-
1 A 1 gaseous	74.10	74.10	-	100.84	94.30	-6.54	91.99	92.70	0.72
1 A 1 biomass	2.04	2.04	-	17.28	15.66	-1.62	19.41	18.21	-1.20
1 A 1 other	2.41	2.41	-	7.76	7.76	-	9.07	9.18	0.11
1 A 1 a Public Electricity and Heat Production	140.95	140.95	-	198.39	189.75	-8.63	192.51	193.22	0.71
1 A 1 a liquid	15.63	15.63	-	14.01	14.23	0.22	13.29	14.77	1.48
1 A 1 a solid	61.40	61.40	-	70.89	70.89	-	69.07	69.07	-
1 A 1 a gaseous	59.46	59.46	-	88.46	81.22	-7.23	81.67	81.99	0.32
1 A 1 a biomass	2.04	2.04	-	17.28	15.66	-1.62	19.41	18.21	-1.20
1 A 1 a other	2.41	2.41	-	7.76	7.76	-	9.07	9.18	0.11
1 A 1 b Petroleum refining	39.89	39.89	-	39.28	39.13	-0.15	40.07	39.69	-0.38
1 A 1 b liquid	30.75	30.75	-	30.64	30.48	-0.15	32.72	33.63	0.90
1 A 1 b solid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 1 b gaseous	9.14	9.14	-	8.64	8.64	-	7.35	6.06	-1.29
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	5.56	5.55	-	3.83	4.52	0.70	2.97	4.65	1.69

	Fuel Consumption [PJ]								
	1990			2003			2004		
IPCC Category / Fuel Group	Subm. 2006	Subm. 2007	Differ-ence	Subm. 2006	Subm. 2007	Differ-ence	Subm. 2006	Subm. 2007	Differ-ence
Solid fuels and Other Energy Industries									
1 A 1 c liquid	0.06	0.06	-	0.08	0.08	-	NO	NO	-
1 A 1 c solid	NO	NO	-	NO	NO	-	NO	NO	-
1 A 1 c gaseous	5.49	5.49	-	3.74	4.44	0.70	2.97	4.65	1.69
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	209.20	210.78	1.59	248.99	252.57	3.57	256.09	253.98	-2.11
1 A 2 liquid	49.33	50.95	1.62	38.79	38.35	-0.44	38.77	40.57	1.80
1 A 2 solid	50.08	50.23	0.15	48.75	50.07	1.32	48.82	50.94	2.12
1 A 2 gaseous	77.40	77.40	-	106.98	110.36	3.38	118.83	107.54	-11.29
1 A 2 biomass	28.11	27.93	-0.18	45.24	43.94	-1.30	40.12	42.98	2.86
1 A 2 other	4.28	4.28	-	9.23	9.85	0.62	9.55	11.95	2.40
1 A 2 a Iron and Steel	55.36	55.57	0.21	63.54	65.74	2.19	68.08	67.72	-0.36
1 A 2 a liquid	5.72	5.78	0.06	7.14	7.14	0.00	8.82	9.00	0.18
1 A 2 a solid	37.91	38.05	0.15	38.03	40.24	2.21	39.18	40.91	1.73
1 A 2 a gaseous	11.73	11.73	-	18.38	18.36	-0.02	20.08	17.82	-2.27
1 A 2 a biomass	NO	NO	-	0.00	NO	-	0.00	NO	-
1 A 2 a other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 b Non-ferrous Metals	2.07	2.08	0.01	3.65	3.63	-0.02	3.99	3.61	-0.39
1 A 2 b liquid	0.50	0.51	0.01	0.58	0.56	-0.02	0.48	0.51	0.04
1 A 2 b solid	0.21	0.21	-	0.16	0.16	-	0.20	0.16	-0.04
1 A 2 b gaseous	1.35	1.35	-	2.92	2.92	-0.01	3.32	2.93	-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	16.87	16.94	0.07	22.91	25.63	2.71	26.58	26.96	0.38
1 A 2 c liquid	0.99	1.06	0.07	0.92	0.79	-0.13	0.51	0.67	0.16
1 A 2 c solid	1.14	1.14	-	2.63	2.63	0.00	2.74	2.49	-0.25
1 A 2 c gaseous	9.57	9.57	-	14.82	16.45	1.63	16.99	16.27	-0.72
1 A 2 c biomass	2.90	2.90	-	2.00	1.99	0.00	2.96	2.23	-0.73

IPCC Category / Fuel Group	Fuel Consumption [PJ] 1990 Subm. 2006	1990 Subm. 2007	1990 Differ-ence	2003 Subm. 2006	2003 Subm. 2007	2003 Differ-ence	2004 Subm. 2006	2004 Subm. 2007	2004 Differ-ence
1 A 2 c other	2.27	2.27	-	2.55	3.77	1.22	3.38	5.30	1.92
1 A 2 d Pulp, Paper and Print	54.37	54.76	0.39	62.02	62.02	0.00	62.61	63.15	0.54
1 A 2 d liquid	10.54	10.93	0.39	2.23	2.24	0.01	1.81	1.68	-0.13
1 A 2 d solid	4.08	4.08	-	3.87	3.87	-	3.87	4.27	0.40
1 A 2 d gaseous	17.22	17.22	-	22.46	26.38	3.93	23.69	25.67	1.98
1 A 2 d biomass	21.88	21.88	-	33.31	29.37	-3.95	33.01	31.33	-1.68
1 A 2 d other	0.65	0.65	-	0.15	0.16	0.01	0.23	0.20	-0.03
1 A 2 e Food Processing, Beverages and Tobacco	13.66	13.90	0.24	19.03	18.28	-0.74	20.62	16.97	-3.65
1 A 2 e liquid	4.21	4.45	0.24	2.44	2.27	-0.16	1.67	2.13	0.45
1 A 2 e solid	0.18	0.18	-	0.31	0.31	-	0.40	0.25	-0.15
1 A 2 e gaseous	9.15	9.15	-	16.08	15.50	-0.58	18.23	14.43	-3.80
1 A 2 e biomass	0.13	0.13	-	0.20	0.20	0.00	0.32	0.17	-0.15
1 A 2 e other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 2 f Other	66.87	67.53	0.66	77.84	77.27	-0.57	74.20	75.56	1.37
1 A 2 f liquid	27.36	28.20	0.84	25.49	25.35	-0.14	25.48	26.59	1.11
1 A 2 f solid	6.56	6.56	-	3.75	2.87	-0.89	2.43	2.86	0.43
1 A 2 f gaseous	28.39	28.39	-	32.33	30.76	-1.57	36.51	30.42	-6.10
1 A 2 f biomass	3.21	3.02	-0.18	9.73	12.38	2.65	3.84	9.25	5.41
1 A 2 f other	1.36	1.36	-	6.53	5.92	-0.62	5.94	6.45	0.51
1 A 3 Transport	166.91	166.12	-0.79	312.14	308.84	-3.30	323.28	317.63	-5.65
1 A 3 liquid	162.79	162.00	-0.79	302.36	302.18	-0.17	312.19	309.64	-2.54
1 A 3 solid	0.07	0.07	-	0.02	0.02	-	0.02	0.02	-
1 A 3 gaseous	4.05	4.05	-	9.76	6.63	-3.12	11.07	7.96	-3.11
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	-	2.23	2.23	-	2.64	2.64	-
1 A 3 a aviation gasoline	0.11	0.11	-	0.11	0.11	-	0.10	0.10	-
1 A 3 a jet kerosene	0.33	0.33	-	2.12	2.12	-	2.54	2.54	-
1 A 3 b Road Transportation	159.39	158.60	-0.79	296.56	296.34	-0.22	306.02	303.49	-2.53

	Fuel Consumption [PJ]								
	1990			2003			2004		
IPCC Category / Fuel Group	Subm. 2006	Subm. 2007	Differ-ence	Subm. 2006	Subm. 2007	Differ-ence	Subm. 2006	Subm. 2007	Differ-ence
1 A 3 b gasoline	105.17	104.38	-0.79	91.42	91.25	-0.17	88.94	88.79	-0.15
1 A 3 b diesel oil	54.22	54.22	-	205.14	205.09	-0.05	217.08	214.70	-2.38
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	-	2.44	2.45	0.01	2.36	2.50	0.14
1 A 3 c solid	2.26	2.26	-	2.42	2.43	0.01	2.34	2.47	0.14
1 A 3 c liquid	0.07	0.07	-	0.02	0.02	-	0.02	0.02	-
1 A 3 c gaseous	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 c other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 3 d Navigation	0.70	0.70	-	1.14	1.18	0.04	1.19	1.04	-0.15
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	1.06	0.04	1.07	0.92	-0.15
1 A 3 d gasoline	0.12	0.12	-	0.12	0.12	-	0.12	0.12	-
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	-	9.76	6.63	-3.12	11.07	7.96	-3.11
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	-	9.76	6.63	-3.12	11.07	7.96	-3.11
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	259.49	258.05	-1.44	297.48	307.71	10.23	287.32	284.41	-2.91
1 A 4 liquid	118.79	117.16	-1.62	130.88	130.95	0.07	117.62	113.49	-4.13
1 A 4 solid	28.14	28.14	-	8.48	7.44	-1.04	6.61	6.00	-0.61

	Fuel Consumption [PJ]								
	1990			2003			2004		
IPCC Category / Fuel Group	Subm. 2006	Subm. 2007	Differ-ence	Subm. 2006	Subm. 2007	Differ-ence	Subm. 2006	Subm. 2007	Differ-ence
1 A 4 gaseous	46.05	46.05	-	83.67	93.74	10.07	84.29	89.15	4.86
1 A 4 biomass	64.22	64.40	0.18	73.81	74.93	1.12	77.38	74.89	-2.48
1 A 4 other	2.29	2.29	-	0.65	0.65	-	1.43	0.89	-0.54
1 A 4 a Commecial/Institutional	36.90	37.88	0.99	51.80	77.77	25.97	45.58	60.99	15.41
1 A 4 a liquid	18.12	19.10	0.99	28.00	37.80	9.80	17.82	21.65	3.83
1 A 4 a solid	0.95	0.95	-	1.23	1.01	-0.23	0.65	0.68	0.02
1 A 4 a gaseous	13.36	13.36	-	17.91	34.44	16.53	20.34	32.40	12.06
1 A 4 a biomass	2.18	2.18	-	4.01	3.87	-0.13	5.33	5.37	0.04
1 A 4 a other	2.29	2.29	-	0.65	0.65	-	1.43	0.89	-0.54
1 A 4 b Residential	191.41	191.41	-	216.50	200.53	-15.97	210.66	193.23	-17.43
1 A 4 b liquid	74.40	74.40	-	80.55	70.88	-9.66	76.75	69.13	-7.62
1 A 4 b solid	26.64	26.64	-	7.10	6.33	-0.77	5.84	5.22	-0.62
1 A 4 b gaseous	32.33	32.33	-	65.02	58.64	-6.38	63.23	56.11	-7.12
1 A 4 b biomass	58.05	58.05	-	63.83	64.67	0.85	64.84	62.77	-2.07
1 A 4 b other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 4 c Agriculture/Forestry/Fisheries	31.19	28.76	-2.43	29.19	29.41	0.23	31.09	30.20	-0.89
1 A 4 c liquid	26.28	23.67	-2.61	22.33	22.27	-0.07	23.05	22.71	-0.34
1 A 4 c solid	0.55	0.55	-	0.14	0.10	-0.04	0.11	0.10	-0.02
1 A 4 c gaseous	0.37	0.37	-	0.73	0.66	-0.07	0.71	0.63	-0.08
1 A 4 c biomass	4.00	4.18	0.18	5.98	6.38	0.41	7.21	6.75	-0.45
1 A 4 c other	NO	NO	-	NO	NO	-	NO	NO	-
1 A 5 Other	0.48	0.48	-	1.23	1.23	-	1.47	1.46	-
1 A 5 liquid	0.48	0.48	-	1.23	1.23	-	1.47	1.46	-
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	-	17.94	17.94	-	21.06	21.06	-

A "-" indicates that no recalculations were carried out or recalculations are lower than ± 0.005 PJ.

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 2007.

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 2004 and the new energy balance for 2005 has been submitted to IEA and EUROSTAT in November 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, 2006) and their correspondence to IPCC categories

IEA-Category and ISIC Codes*	Comments	SNAP	IPCC-Category
Production			Reference Approach: Production
Imports			Reference Approach: Import
Exports			Reference Approach: Export
Bunkers	No consumption (1)		
Stock Changes			Reference Approach: Stock Change
Refinery Fuel		0103	1 A 1 b Petroleum Refining
Transformation Sector, of which:			
Public Electricity plants Public CHP plants Public Heat plants	In the inventory plant specific data are considered.	0101 0102	1 A 1 a Public Electricity and Heat Production
Auto Producer Electricity plants Auto Producer CHP plants Auto Producer Heat plants	For autoproducers by sectors see table below.		
Coke Ovens	Transformation from *Coking Coal* to *Coke Oven Coke* .		
Blast furnaces	Coke Oven Coke.	030326	1 A 2 a Iron and Steel
Gas Works	Transformation of *Other Oil Products* to *Gas Works Gas* .		
Petrochemical Industry	No consumption (1)		
Patent Fuel Plants	No consumption (1)		

IEA-Category and ISIC Codes*	Comments	SNAP	IPCC-Category
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 *Lubricants*.	0201	1 A 4 a Commercial/ Institutional
Total Industry, of which:			
Iron and Steel (ISIC 271, 2731)		0301 030301 030326	1 A 2 a Iron and Steel
Chemical incl.Petro-Chemical (ISIC 24)		0301	1 A 2 c Chemicals
Non ferrous Metals (ISIC 272, 2732)		0301	1 A 2 b Non-ferrous Metals
Non metallic Mineral Products (ISIC 26)		0301 030311 030317 030319	1 A 2 f Manuf. Ind. and Constr. - Other
Transportation Equipment (ISIC 34, 35)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Machinery (ISIC 28, 29, 30, 31, 32)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Mining and Quarrying (ISIC 13, 14)		0105	1 A 1 c Manufacture of Solid fuels and Other Energy Industries
Food, Beverages and Tobacco		0301	1 A 2 e Food Processing, Beverages and Tobacco

IEA-Category and ISIC Codes*	Comments	SNAP	IPCC-Category
(ISIC 15, 16)			
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, 2006) 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		
Code [(1)]	Category	Category	Average Net Calorific Value[(2)]	IPCC Fuel Category [(3)]
102 A	Hard Coal	Bituminous Coal and Anthracite	28.60	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	29.00	Solid (coal)
113 A	Peat	Peat	8.80	Solid
304 A	Coke Oven Gas	Coke Oven Gas	17.90	Solid
305 A	Blast Furnace Gas	Blast Furnace Gas	36.50	Solid
110 A	Petrol Coke	Petrol Coke	31.30	Liquid
203 B	Light Fuel Oil Sulphur Content < 0,2 %	Residual Fuel Oil	41.23	Liquid (residual oil)
203 C	Medium Fuel Oil Sulphur Content < 0,4%	Residual Fuel Oil	41.23	Liquid (residual oil)
203 D	Heavy Fuel Oil Sulphur Content >= 1%	Residual Fuel Oil	41.23	Liquid (residual oil)
204 A	Gasoil	Heating and other Gasoil	42.80	Liquid (gas/diesel oil)
205 0	Diesel	Transport Diesel	42.80	Liquid (diesel oil; gas/diesel oil)
206 A	Petroleum	Other Kerosene	43.30	Liquid
206 B	Kerosene	Kerosene Type Jet Fuel	43.30	Liquid (jet kerosene)
207 A	Aviation Gasoline	Gasoline Type Jet Fuel	42.49	Liquid (aviation gasoline)
208 0	Motor Gasoline	Motor Gasoline	42.49	Liquid (gasoline)
224 A	Other Petroleum Products	Other Products	44.01	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	36.37	Gaseous (natural gas)
114 B	Municipal Waste	Municipal Solid Waste Renewable	8.93	Other Fuels

Inventory Fuel Category Code (1)	Category	IEA Fuel Category Category	Average Net Calorific Value(2)	IPCC Fuel Category (3)
		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 2005 Note that for some fuels sector specific calorific values are taken. The energy balance reports some fuels (e.g. renewables) in [TJ] so that unit conversion by means of calorific values is not necessary.

(3) Fuel subcategories are shown in parenthesis

Specific remark to natural gas NCV

Natural gas NCV is calculated by GCV / 1.1 (=GCV*0.909) whereas the IEA calculates it by GCV*0.9. This follows the methodology used by the Austrian energy statistics agency and leads to different apparent consumption (1%) between the national and IEA reference approach.

Energy Consumption and CO_2 Emissions by Sectors and Fuel Types

Table 32 to Table 47 show detailed data on fuel consumption and CO_2 emissions for each fuel type according to Table 31 and each sector of *1 A Fuel Combustion* are provided for the period from 1990 to 2005 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: 2005 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**61.63**	**55.89**	**0.02**	**6.03**	**123.58**	**5.84**	**5.60**	**0.00**	**0.56**	**12.01**
102A	Hard Coal	51.51	7.62	0.02	1.27	60.43	4.81	0.71	0.00	0.12	5.63
104A	Hard Coal Briquettes				0.03	0.03				0.00	0.00
105A	Brown Coal	10.12	2.27		0.08	12.47	1.04	0.22		0.01	1.27
106A	Brown Coal Briquettes				0.92	0.92				0.09	0.09
107A	Coke		34.30		3.71	38.01		3.57		0.34	3.91
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		11.70			11.70		1.11			1.11
	Total Liquid	**43.43**	**40.55**	**323.40**	**117.58**	**524.95**	**3.23**	**3.08**	**23.48**	**8.72**	**38.64**
110A	Petrol Coke	2.07	2.05			4.12	0.21	0.19			0.40
203B	Light Fuel Oil	0.17	3.88		12.23	16.28	0.01	0.30		0.94	1.26
203C	Medium Fuel Oil	2.29	0.00			2.29	0.18	0.00			0.18
203D	Heavy Fuel Oil	12.13	14.42			26.55	0.96	1.12			2.09
204A	Gasoil	0.19	2.89		76.66	79.74	0.01	0.22		5.75	5.98
2050	Diesel	0.02	15.92	232.53	20.30	268.77	0.00	1.15	16.86	1.47	19.49
206A	Other Kerosene		0.01		0.14	0.15		0.00		0.01	0.01
206B	Jet Kerosene			4.49		4.49			0.21		0.33
207A	Aviation Gasoline			0.12		0.12			0.01		0.01
2080	Motor Gasoline		0.09	86.26	1.64	87.99		0.01	6.40	0.12	6.53
224A	Other Petroleum Products	10.08				10.08	0.79				0.79
303A	Liquified Petroleum Gas (LPG)	2.29	1.27		6.61	10.17	0.15	0.08		0.42	0.65
308A	Refinery Gas	14.21				14.21	0.92				0.92
301A	**Total Gaseous** (Natural Gas)	**113.11**	**108.49**	**9.83**	**102.76**	**334.19**	**6.27**	**6.01**	**0.54**	**5.69**	**18.51**
	Total Other Fuel	**8.51**	**11.10**		**0.69**	**20.29**	**0.49**	**0.85**		**0.07**	**1.41**
114B	Municipal Waste	7.17				7.17	0.35				0.35
115A	Industrial Waste	1.34	11.10		0.69	13.12	0.14	0.85		0.07	1.06
	Total Biomass[1]	**17.94**	**47.88**		**77.99**	**143.81**	**(1.97)**	**(5.26)**		**(7.94)**	**(15.17)**
111A	Fuel Wood	0.05	0.94		63.80	64.79	0.01	0.09		6.38	6.48
116A	Wood Wastes	16.71	19.25		13.83	49.79	1.84	2.12		1.52	5.48
118A	Sewage Sludge	0.75	0.04			0.79	0.08	0.00			0.09
215A	Black Liquor		26.72			26.72		2.94			2.94
309A	Biogas	0.33	0.35			0.68	0.04	0.04			0.08
309B	Sewage Sludge Gas	0.05	0.59		0.06	0.70	0.01	0.07		0.01	0.08
310A	Landfill Gas	0.04			0.30	0.35	0.00			0.03	0.04
	Total[1]	**244.62**	**263.91**	**333.25**	**305.05**	**1 146.82**	**15.83**	**15.54**	**24.03**	**15.05**	**70.57**

(1) CO_2 emissions of Biomass are not included in Total.

Table 33: 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**	**50.94**	**0.02**	**6.00**	**126.03**	**6.67**	**5.12**	**0.00**	**0.56**	**12.36**
102A	Hard Coal	59.70	7.48	0.02	1.68	68.89	5.64	0.70	0.00	0.16	6.51
104A	Hard Coal Briquettes				0.04	0.04				0.00	0.00
105A	Brown Coal	9.37	1.71		0.11	11.19	1.03	0.17		0.01	1.21
106A	Brown Coal Briquettes		0.00		1.13	1.13		0.00		0.11	0.11
107A	Coke		32.31		3.03	35.34		3.36		0.28	3.64
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		9.43			9.43		0.89			0.89
	Total Liquid	**48.40**	**40.57**	**311.11**	**113.49**	**513.57**	**3.68**	**3.14**	**22.84**	**8.44**	**38.21**
110A	Petrol Coke	2.00	3.11			5.10	0.20	0.31			0.51
203B	Light Fuel Oil	1.40	5.99		12.63	20.01	0.11	0.47		0.97	1.55
203C	Medium Fuel Oil				2.29	2.29				0.18	0.18
203D	Heavy Fuel Oil	13.59	11.73			25.33	1.08	0.92			2.00
204A	Gasoil	0.06	2.79		69.50	72.36	0.00	0.21		5.21	5.43
2050	Diesel	0.03	15.43	218.12	20.66	254.24	0.00	1.14	16.05	1.52	18.72
206A	Other Kerosene		0.01		0.15	0.17		0.00		0.01	0.01
206B	Jet Kerosene			3.98		3.98			0.18		0.29
207A	Aviation Gasoline			0.10		0.10			0.01		0.01
2080	Motor Gasoline		0.09	88.91	1.67	90.67		0.01	6.60	0.12	6.73
224A	Other Petroleum Products	17.72				17.72	1.38				1.38
303A	Liquified Petroleum Gas (LPG)	0.15	1.41		6.59	8.15	0.01	0.09		0.42	0.52
308A	Refinery Gas	13.46				13.46	0.89				0.89
301A	**Total Gaseous** (Natural Gas)	**92.70**	**107.54**	**7.96**	**89.15**	**297.35**	**5.14**	**5.96**	**0.44**	**4.94**	**16.47**
	Total Other Fuel	**9.18**	**11.95**		**0.89**	**22.02**	**0.55**	**0.90**		**0.09**	**1.54**
114B	Municipal Waste	7.38				7.38	0.36				0.36
115A	Industrial Waste	1.80	11.95		0.89	14.64	0.19	0.90		0.09	1.18
	Total Biomass[1]	**18.21**	**42.98**		**74.89**	**136.08**	**(2)**	**(4.72)**		**(7.63)**	**(14.36)**
111A	Fuel Wood	0.05	0.89		60.46	61.40	0.00	0.09		6.05	6.14
116A	Wood Wastes	17.08	17.31		13.98	48.38	1.88	1.90		1.54	5.32
118A	Sewage Sludge	0.81				0.81	0.09				0.09
215A	Black Liquor		24.31			24.31		2.67			2.67
309A	Biogas	0.16	0.32			0.48	0.02	0.04			0.05
309B	Sewage Sludge Gas	0.06	0.15		0.03	0.25	0.01	0.02		0.00	0.03
310A	Landfill Gas	0.05			0.41	0.46	0.01			0.05	0.05
	Total[1]	**237.56**	**253.98**	**319.10**	**284.41**	**1 095.05**	**16.04**	**15.12**	**23.28**	**14.04**	**68.58**

(2) CO_2 emissions of Biomass are not included in Total.

Table 34: 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**	**50.07**	**0.02**	**7.44**	**128.42**	**6.92**	**5.05**	**0.00**	**0.69**	**12.66**
102A	Hard Coal	57.19	7.13	0.02	1.75	66.10	5.41	0.67	0.00	0.16	6.24
104A	Hard Coal Briquettes				0.06	0.06				0.01	0.01
105A	Brown Coal	13.70	1.70		0.10	15.50	1.51	0.17		0.01	1.68
106A	Brown Coal Briquettes		0.00		1.38	1.38		0.00		0.13	0.13
107A	Coke		33.05		4.14	37.19		3.44		0.38	3.82
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		8.19			8.19		0.77			0.77
	Total Liquid	**44.79**	**38.35**	**303.41**	**130.95**	**517.51**	**3.35**	**2.94**	**22.31**	**9.77**	**38.46**
110A	Petrol Coke	1.85	2.13			3.98	0.19	0.21			0.40
203B	Light Fuel Oil	0.77	5.27		17.98	24.01	0.06	0.41		1.38	1.86
203C	Medium Fuel Oil				2.25	2.25				0.18	0.18
203D	Heavy Fuel Oil	14.42	11.49			25.90	1.15	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
207A	Aviation Gasoline			0.11		0.11			0.01		0.01
2080	Motor Gasoline		0.09	91.37	1.68	93.14		0.01	6.78	0.12	6.91
224A	Other Petroleum Products	14.83				14.83	1.16				1.16
303A	Liquified Petroleum Gas (LPG)	0.06	1.81		6.29	8.15	0.00	0.12		0.40	0.52
308A	Refinery Gas	12.53				12.53	0.76				0.76
301A	**Total Gaseous** (Natural Gas)	**94.30**	**110.36**	**6.63**	**93.74**	**305.04**	**5.22**	**6.11**	**0.37**	**5.19**	**16.90**
	Total Other Fuel	**7.76**	**9.85**		**0.65**	**18.26**	**0.49**	**0.76**		**0.07**	**1.32**
114B	Municipal Waste	5.78				5.78	0.28				0.28
115A	Industrial Waste	1.98	9.85		0.65	12.47	0.21	0.76		0.07	1.04
	Total Biomass[(1)]	**15.66**	**43.94**		**74.93**	**134.52**	**(1.72)**	**(4.82)**		**(7.62)**	**(14.17)**
111A	Fuel Wood		1.06		62.00	63.06		0.11		6.20	6.31
116A	Wood Wastes	14.49	19.38		12.64	46.51	1.59	2.13		1.39	5.12
118A	Sewage Sludge	0.89				0.89	0.10				0.10
215A	Black Liquor		22.97			22.97		2.53			2.53
309A	Biogas		0.33			0.33		0.04			0.04
309B	Sewage Sludge Gas	0.05	0.19		0.02	0.26	0.01	0.02		0.00	0.03
310A	Landfill Gas	0.23			0.27	0.49	0.03			0.03	0.05
	Total[(1)]	**233.40**	**252.57**	**310.07**	**307.71**	**1 103.75**	**15.98**	**14.87**	**22.68**	**15.72**	**69.34**

(1) CO_2 emissions of Biomass are not included in Total.

Table 35: 2002 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**56.13**	**48.25**	**0.02**	**8.15**	**112.56**	**5.51**	**4.86**	**0.00**	**0.76**	**11.13**
102A	Hard Coal	42.89	8.36	0.02	1.89	53.16	4.05	0.79	0.00	0.18	5.02
104A	Hard Coal Briquettes				0.02	0.02				0.00	0.00
105A	Brown Coal	13.24	1.60		0.33	15.17	1.46	0.16		0.04	1.65
106A	Brown Coal Briquettes		0.00		1.26	1.26		0.00		0.12	0.12
107A	Coke		31.31		4.64	35.95		3.26		0.43	3.68
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		6.98			6.98		0.66			0.66
	Total Liquid	**41.93**	**37.32**	**277.93**	**120.37**	**477.55**	**2.96**	**2.86**	**20.48**	**8.98**	**35.31**
110A	Petrol Coke	2.54	2.05			4.59	0.26	0.21			0.46
203B	Light Fuel Oil	0.81	2.94		17.16	20.92	0.06	0.23		1.32	1.61
203C	Medium Fuel Oil				1.91	1.91				0.15	0.15
203D	Heavy Fuel Oil	9.41	12.98			22.39	0.75	1.01			1.76
204A	Gasoil	0.13	2.75		73.52	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			1.52		1.52			0.07		0.11
207A	Aviation Gasoline			0.10		0.10			0.01		0.01
2080	Motor Gasoline		0.09	89.35	1.65	91.09		0.01	6.63	0.12	6.76
224A	Other Petroleum Products	14.82				14.82	1.16				1.16
303A	Liquified Petroleum Gas (LPG)	0.13	1.90		5.80	7.84	0.01	0.12		0.37	0.50
308A	Refinery Gas	14.07				14.07	0.71				0.71
301A	**Total Gaseous** (Natural Gas)	**81.79**	**110.01**	**4.97**	**82.14**	**278.91**	**4.53**	**6.09**	**0.28**	**4.55**	**15.45**
	Total Other Fuel	**6.76**	**9.09**		**0.62**	**16.47**	**0.43**	**0.68**		**0.06**	**1.18**
114B	Municipal Waste	4.91				4.91	0.24				0.24
115A	Industrial Waste	1.84	9.09		0.62	11.55	0.19	0.68		0.06	0.94
	Total Biomass(1)	**13.60**	**43.72**		**73.05**	**130.37**	**(1.5)**	**(4.8)**		**(7.42)**	**(13.71)**
111A	Fuel Wood		1.42		61.94	63.36		0.14		6.19	6.34
116A	Wood Wastes	12.70	18.83		10.76	42.29	1.40	2.07		1.18	4.65
118A	Sewage Sludge	0.79				0.79	0.09				0.09
215A	Black Liquor		22.78			22.78		2.51			2.51
309A	Biogas		0.67			0.67		0.07			0.07
309B	Sewage Sludge Gas	0.06			0.06	0.11	0.01			0.01	0.01
310A	Landfill Gas	0.06	0.03		0.30	0.38	0.01	0.00		0.03	0.04
	Total(1)	**200.21**	**248.39**	**282.92**	**284.33**	**1 015.85**	**13.43**	**14.50**	**20.75**	**14.36**	**63.08**

(1) CO_2 emissions of Biomass are not included in Total.

Table 36: 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**	**43.80**	**0.03**	**9.42**	**113.97**	**5.96**	**4.42**	**0.00**	**0.88**	**11.26**
102A	Hard Coal	46.12	9.38	0.03	2.11	57.64	4.36	0.88	0.00	0.20	5.44
104A	Hard Coal Briquettes				0.02	0.02				0.00	0.00
105A	Brown Coal	14.05	1.39		0.44	15.87	1.54	0.13		0.05	1.72
106A	Brown Coal Briquettes	0.56	0.00		1.52	2.09	0.05	0.00		0.15	0.20
107A	Coke		29.63		5.32	34.95		3.08		0.49	3.57
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		3.40			3.40		0.32			0.32
	Total Liquid	**47.66**	**43.92**	**250.35**	**120.55**	**462.48**	**3.38**	**3.34**	**18.44**	**9.01**	**34.20**
110A	Petrol Coke	2.27	0.67			2.94	0.23	0.07			0.30
203B	Light Fuel Oil	2.58	6.80		17.09	26.48	0.20	0.53		1.32	2.05
203C	Medium Fuel Oil				1.40	1.40				0.11	0.11
203D	Heavy Fuel Oil	14.21	16.21		0.03	30.45	1.13	1.26		0.00	2.40
204A	Gasoil	0.79	3.45		76.36	80.60	0.06	0.26		5.73	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			1.56		1.56			0.07		0.11
207A	Aviation Gasoline			0.08		0.08			0.01		0.01
2080	Motor Gasoline		0.09	83.04	1.63	84.76		0.01	6.16	0.12	6.29
224A	Other Petroleum Products	12.82				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)	**71.79**	**107.80**	**8.25**	**91.64**	**279.47**	**3.98**	**5.97**	**0.46**	**5.08**	**15.48**
	Total Other Fuel	**5.68**	**8.11**		**0.63**	**14.42**	**0.34**	**0.61**		**0.07**	**1.02**
114B	Municipal Waste	4.61				4.61	0.23				0.23
115A	Industrial Waste	1.07	8.11		0.63	9.81	0.11	0.61		0.07	0.79
	Total Biomass(1)	**12.25**	**43.74**		**76.54**	**132.54**	**(1.35)**	**(4.8)**		**(7.77)**	**(13.92)**
111A	Fuel Wood		1.14		64.92	66.07		0.11		6.49	6.61
116A	Wood Wastes	11.21	18.70		10.79	40.70	1.23	2.06		1.19	4.48
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	0.20		0.04	0.26	0.00	0.02		0.00	0.03
309B	Sewage Sludge Gas	0.05	0.30		0.10	0.45	0.01	0.03		0.01	0.05
310A	Landfill Gas	0.07	0.10		0.69	0.86	0.01	0.01		0.08	0.10
	Total(1)	**198.11**	**247.37**	**258.63**	**298.78**	**1 002.89**	**13.65**	**14.34**	**18.90**	**15.03**	**61.96**

(1) CO_2 emissions of Biomass are not included in Total.

Table 37: 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**	**47.19**	**0.03**	**9.68**	**107.96**	**5.00**	**4.77**	**0.00**	**0.91**	**10.68**
102A	Hard Coal	39.11	10.38	0.03	2.18	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		0.39	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		32.62		5.29	37.91		3.39		0.49	3.88
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		2.79			2.79		0.26			0.26
	Total Liquid	**44.90**	**41.17**	**233.52**	**111.03**	**430.63**	**3.16**	**3.13**	**17.20**	**8.29**	**31.82**
110A	Petrol Coke	1.61	0.81			2.43	0.16	0.08			0.24
203B	Light Fuel Oil	1.72	5.47		15.96	23.15	0.13	0.43		1.23	1.79
203C	Medium Fuel Oil				1.48	1.48				0.12	0.12
203D	Heavy Fuel Oil	14.55	16.30		0.15	31.00	1.16	1.27		0.01	2.44
204A	Gasoil	0.01	1.59		68.50	70.09	0.00	0.12		5.14	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
207A	Aviation Gasoline			0.09		0.09			0.01		0.01
2080	Motor Gasoline		0.09	82.41	1.63	84.13		0.01	6.11	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	0.72				0.72
301A	**Total Gaseous** (Natural Gas)	**70.20**	**108.88**	**9.65**	**74.19**	**262.92**	**3.89**	**6.03**	**0.53**	**4.11**	**14.57**
	Total Other Fuel	**4.65**	**5.18**		**1.39**	**11.22**	**0.23**	**0.38**		**0.14**	**0.76**
114B	Municipal Waste	4.52				4.52	0.22				0.22
115A	Industrial Waste	0.13	5.18		1.39	6.70	0.01	0.38		0.14	0.54
	Total Biomass(1)	**9.52**	**41.04**		**68.38**	**118.95**	**(1.05)**	**(4.51)**		**(6.93)**	**(12.48)**
111A	Fuel Wood		0.95		59.21	60.16		0.09		5.92	6.02
116A	Wood Wastes	8.43	15.68		8.66	32.77	0.93	1.72		0.95	3.60
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	0.29		0.02	0.33	0.00	0.03		0.00	0.04
309B	Sewage Sludge Gas	0.05			0.09	0.14	0.01			0.01	0.02
310A	Landfill Gas	0.06			0.40	0.46	0.01			0.04	0.05
	Total(1)	**180.35**	**243.46**	**243.20**	**264.67**	**931.68**	**12.29**	**14.31**	**17.73**	**13.45**	**57.84**

(1) CO_2 emissions of Biomass are not included in Total.

Table 38: 1999 energy consumption and CO2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**37.79**	**43.08**	**0.03**	**11.08**	**91.99**	**3.78**	**4.35**	**0.00**	**1.04**	**9.17**
102A	Hard Coal	24.14	9.00	0.03	2.49	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		0.53	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		29.59		5.89	35.49		3.08		0.54	3.62
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		3.33			3.33		0.31			0.31
	Total Liquid	**54.71**	**41.12**	**219.40**	**122.48**	**437.72**	**4.03**	**3.14**	**16.16**	**9.15**	**32.52**
110A	Petrol Coke	2.14	1.19			3.32	0.22	0.12			0.34
203B	Light Fuel Oil	1.17	6.81		15.48	23.46	0.09	0.53		1.19	1.81
203C	Medium Fuel Oil	0.09	0.00		2.13	2.22	0.01	0.00		0.17	0.17
203D	Heavy Fuel Oil	24.27	15.29		0.17	39.73	1.93	1.19		0.01	3.14
204A	Gasoil	0.29	1.03		78.29	79.62	0.02	0.08		5.87	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		0.04		0.66	0.70		0.00		0.05	0.05
206B	Jet Kerosene			1.54		1.54			0.07		0.11
207A	Aviation Gasoline			0.12		0.12			0.01		0.01
2080	Motor Gasoline		0.09	85.28	1.64	87.02		0.01	6.33	0.12	6.46
224A	Other Petroleum Products	12.17				12.17	0.95				0.95
303A	Liquified Petroleum Gas (LPG)	0.20	2.49		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)	**79.58**	**102.98**	**7.80**	**83.06**	**273.41**	**4.41**	**5.70**	**0.43**	**4.60**	**15.15**
	Total Other Fuel	**4.66**	**5.84**		**2.53**	**13.04**	**0.24**	**0.49**		**0.26**	**0.99**
114B	Municipal Waste	4.52				4.52	0.22				0.22
115A	Industrial Waste	0.15	5.84		2.53	8.52	0.02	0.49		0.26	0.77
	Total Biomass(1)	**8.51**	**46.04**		**72.68**	**127.22**	**(0.94)**	**(5.05)**		**(7.35)**	**(13.34)**
111A	Fuel Wood		1.86		64.11	65.96		0.19		6.41	6.60
116A	Wood Wastes	7.47	20.33		8.01	35.82	0.82	2.24		0.88	3.94
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	0.20		0.03	0.24	0.00	0.02		0.00	0.03
309B	Sewage Sludge Gas	0.02			0.05	0.07	0.00			0.01	0.01
310A	Landfill Gas	0.04			0.48	0.52	0.00			0.05	0.06
	Total(1)	**185.26**	**239.06**	**227.23**	**291.83**	**943.38**	**12.45**	**13.69**	**16.60**	**15.06**	**57.83**

(1) CO_2 emissions of Biomass are not included in Total.

Table 39: 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**	**44.46**	**0.03**	**12.01**	**92.31**	**3.50**	**4.47**	**0.00**	**1.13**	**9.09**
102A	Hard Coal	28.48	11.94	0.03	3.06	43.51	2.69	1.12	0.00	0.28	4.10
104A	Hard Coal Briquettes				0.12	0.12				0.01	0.01
105A	Brown Coal	7.33	0.66		0.57	8.57	0.81	0.06		0.06	0.93
106A	Brown Coal Briquettes		0.00		1.99	1.99		0.00		0.19	0.19
107A	Coke		28.33		6.26	34.60		2.95		0.58	3.52
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		3.51			3.51		0.33			0.33
	Total Liquid	**60.95**	**52.42**	**227.95**	**120.62**	**461.94**	**4.38**	**4.00**	**16.82**	**9.02**	**34.26**
110A	Petrol Coke	2.20	0.67			2.87	0.22	0.07			0.29
203B	Light Fuel Oil	2.11	12.95		12.82	27.88	0.16	1.01		0.99	2.16
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	20.61		0.26	48.86	2.22	1.61		0.02	3.85
204A	Gasoil	0.20	1.04		79.97	81.21	0.02	0.08		6.00	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	91.76	1.64	93.49		0.01	6.81	0.12	6.94
224A	Other Petroleum Products	11.05				11.05	0.86				0.86
303A	Liquified Petroleum Gas (LPG)	0.13	3.05		3.57	6.74	0.01	0.19		0.23	0.43
308A	Refinery Gas	17.05				17.05	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**	**109.60**	**(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
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**	**240.47**	**234.32**	**277.94**	**946.79**	**12.85**	**14.74**	**17.17**	**14.37**	**59.17**

(1) CO_2 emissions of Biomass are not included in Total.

Table 40: 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		29.63		7.01	36.63		3.08		0.64	3.73
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		7.68			7.68		0.73			0.73
	Total Liquid	**57.29**	**55.70**	**199.77**	**120.69**	**433.45**	**4.08**	**4.26**	**14.74**	**9.03**	**32.14**
110A	Petrol Coke	2.15	0.49			2.64	0.22	0.05			0.27
203B	Light Fuel Oil	2.54	16.33		12.59	31.46	0.20	1.27		0.97	2.44
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	21.01		0.17	44.39	1.84	1.64		0.01	3.50
204A	Gasoil	0.11	1.19		80.30	81.60	0.01	0.09		6.02	6.12
2050	Diesel	0.31	13.80	110.62	20.24	144.97	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	87.70	1.66	89.44		0.01	6.51	0.12	6.64
224A	Other Petroleum Products	11.60				11.60	0.90				0.90
303A	Liquified Petroleum Gas (LPG)	0.09	2.78		3.25	6.12	0.01	0.18		0.21	0.39
308A	Refinery Gas	17.18				17.18	0.87				0.87
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)	**6.09**	**36.81**		**72.24**	**115.14**	**(0.67)**	**(4.05)**		**(7.28)**	**(12)**
111A	Fuel Wood		0.27		66.93	67.21		0.03		6.69	6.72
116A	Wood Wastes	5.23	14.33		4.67	24.22	0.58	1.58		0.51	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)	**200.65**	**257.65**	**204.00**	**279.32**	**941.62**	**13.83**	**15.84**	**14.98**	**14.47**	**59.15**

(1) CO_2 emissions of Biomass are not included in Total.

Table 41: 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**	**43.95**	**0.06**	**17.65**	**109.18**	**4.70**	**4.40**	**0.01**	**1.66**	**10.76**
102A	Hard Coal	33.51	9.72	0.06	4.30	47.60	3.17	0.91	0.01	0.40	4.49
104A	Hard Coal Briquettes										
105A	Brown Coal	14.01	1.12		0.92	16.05	1.52	0.11		0.10	1.73
106A	Brown Coal Briquettes		0.26		2.96	3.22		0.02		0.29	0.31
107A	Coke		26.03		9.46	35.49		2.71		0.87	3.58
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		6.82			6.82		0.65			0.65
	Total Liquid	**52.92**	**46.26**	**214.16**	**131.53**	**444.87**	**3.73**	**3.52**	**15.80**	**9.85**	**32.94**
110A	Petrol Coke	2.13	0.32			2.44	0.21	0.03			0.25
203B	Light Fuel Oil	1.88	12.45		21.43	35.76	0.15	0.97		1.65	2.77
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	16.20		0.25	35.86	1.54	1.26		0.02	2.82
204A	Gasoil	0.07	0.49		83.18	83.74	0.00	0.04		6.24	6.28
2050	Diesel	0.14	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	92.53	1.66	94.29		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)	**6.10**	**32.56**		**76.31**	**114.97**	**(0.67)**	**(3.57)**		**(7.67)**	**(11.92)**
111A	Fuel Wood		0.78		72.50	73.29		0.08		7.25	7.33
116A	Wood Wastes	5.30	10.33		3.13	18.76	0.58	1.14		0.34	2.06
118A	Sewage Sludge	0.74				0.74	0.08				0.08
215A	Black Liquor		21.17			21.17		2.33			2.33
309A	Biogas		0.04			0.04		0.00			0.00
309B	Sewage Sludge Gas	0.03			0.64	0.67	0.00			0.07	0.07
310A	Landfill Gas	0.03	0.24		0.04	0.31	0.00	0.03		0.00	0.03
	Total(1)	**202.91**	**234.08**	**218.43**	**302.32**	**957.75**	**13.74**	**14.27**	**16.04**	**15.91**	**59.99**

(1) CO_2 emissions of Biomass are not included in Total.

Table 42: 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		27.96		10.30	38.25		2.91		0.95	3.85
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		6.36			6.36		0.60			0.60
	Total Liquid	**51.92**	**48.90**	**192.77**	**115.00**	**408.59**	**3.73**	**3.72**	**14.23**	**8.60**	**30.31**
110A	Petrol Coke	1.87	0.36			2.23	0.19	0.04			0.22
203B	Light Fuel Oil	1.39	11.53		17.77	30.69	0.11	0.90		1.37	2.38
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	19.81		0.46	43.57	1.85	1.55		0.04	3.43
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	100.02	1.65	101.77		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**	**33.62**		**69.87**	**107.86**	**(0.48)**	**(3.69)**		**(7.02)**	**(11.19)**
111A	Fuel Wood		1.07		66.28	67.35		0.11		6.63	6.74
116A	Wood Wastes	3.60	11.00		2.93	17.54	0.40	1.21		0.32	1.93
118A	Sewage Sludge	0.73				0.73	0.08				0.08
215A	Black Liquor		21.39			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**	**232.08**	**196.93**	**279.24**	**889.59**	**12.64**	**14.20**	**14.46**	**14.61**	**55.95**

(1) CO_2 emissions of Biomass are not included in Total.

Table 43: 1994 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**32.97**	**42.25**	**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		25.23		11.20	36.43		2.62		1.03	3.65
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		7.97			7.97		0.75			0.75
	Total Liquid	**59.12**	**51.79**	**187.73**	**107.49**	**406.12**	**4.23**	**3.95**	**13.86**	**8.03**	**30.11**
110A	Petrol Coke	1.79	0.36			2.16	0.18	0.04			0.22
203B	Light Fuel Oil	1.88	11.31		14.23	27.43	0.15	0.88		1.10	2.13
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	22.57		0.37	50.56	2.20	1.76		0.03	3.99
204A	Gasoil	0.08	0.20		64.72	65.00	0.01	0.01		4.85	4.88
2050	Diesel	0.21	14.27	82.88	18.57	115.92	0.02	1.06	6.13	1.38	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	103.55	1.67	105.31		0.01	7.68	0.12	7.81
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**	**33.06**		**64.60**	**101.37**	**(0.41)**	**(3.63)**		**(6.49)**	**(10.53)**
111A	Fuel Wood		0.90		61.49	62.39		0.09		6.15	6.24
116A	Wood Wastes	2.97	12.55		2.39	17.91	0.33	1.38		0.26	1.97
118A	Sewage Sludge	0.74				0.74	0.08				0.08
215A	Black Liquor		19.61			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**	**228.93**	**191.57**	**256.14**	**847.00**	**11.61**	**14.02**	**14.08**	**13.52**	**53.27**

(1) CO_2 emissions of Biomass are not included in Total.

Table 44: 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**	**43.27**	**0.06**	**22.10**	**96.23**	**3.09**	**4.32**	**0.01**	**2.08**	**9.49**
102A	Hard Coal	19.93	8.35	0.06	4.23	32.58	1.92	0.79	0.01	0.39	3.10
104A	Hard Coal Briquettes										
105A	Brown Coal	10.64	2.48		1.54	14.66	1.15	0.24		0.17	1.55
106A	Brown Coal Briquettes	0.23	0.34		3.61	4.18	0.02	0.03		0.35	0.41
107A	Coke		23.75		12.71	36.46		2.47		1.17	3.64
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		8.34			8.34		0.79			0.79
	Total Liquid	**59.10**	**52.62**	**188.12**	**114.14**	**413.98**	**4.24**	**4.03**	**13.90**	**8.54**	**30.74**
110A	Petrol Coke	2.22	0.78			3.01	0.22	0.08			0.30
203B	Light Fuel Oil	2.22	13.32		17.41	32.95	0.17	1.04		1.34	2.55
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	21.66		0.42	50.27	2.23	1.69		0.03	3.96
204A	Gasoil	0.11	0.26		67.95	68.32	0.01	0.02		5.10	5.12
2050	Diesel	0.24	13.92	79.53	17.49	111.19	0.02	1.03	5.88	1.30	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	107.40	1.63	109.13		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**	**31.92**		**69.73**	**105.16**	**(0.39)**	**(3.5)**		**(7.01)**	**(10.9)**
111A	Fuel Wood		0.80		66.37	67.18		0.08		6.64	6.72
116A	Wood Wastes	2.74	12.57		2.65	17.96	0.30	1.38		0.29	1.98
118A	Sewage Sludge	0.77				0.77	0.09				0.09
215A	Black Liquor		18.54			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**	**210.68**	**192.05**	**278.61**	**847.89**	**11.35**	**13.04**	**14.12**	**14.70**	**53.25**

(1) CO_2 emissions of Biomass are not included in Total.

Table 45: 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**	**41.55**	**0.07**	**26.69**	**108.28**	**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		22.08		17.22	39.30		2.30		1.58	3.88
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		6.62			6.62		0.63			0.63
	Total Liquid	**48.41**	**46.95**	**183.17**	**114.56**	**393.09**	**3.40**	**3.60**	**13.71**	**8.59**	**29.33**
110A	Petrol Coke	2.30	0.93			3.23	0.23	0.09			0.33
203B	Light Fuel Oil	1.88	9.15		24.10	35.13	0.15	0.71		1.86	2.72
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	19.92		1.13	40.91	1.57	1.55		0.09	3.21
204A	Gasoil	0.04	0.18		60.38	60.61	0.00	0.01		4.53	4.55
2050	Diesel	0.00	14.34	72.55	17.32	104.21	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	109.59	1.60	111.28		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	0.84				0.84
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**	**28.97**		**67.68**	**100.05**	**(0.37)**	**(3.18)**		**(6.79)**	**(10.35)**
111A	Fuel Wood		0.71		65.28	65.98		0.07		6.53	6.60
116A	Wood Wastes	2.74	10.19		2.40	15.34	0.30	1.12		0.26	1.69
118A	Sewage Sludge	0.66				0.66	0.07				0.07
215A	Black Liquor		18.07			18.07		1.99			1.99
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total[(1)]	**162.72**	**203.14**	**187.21**	**273.98**	**827.04**	**11.31**	**12.69**	**13.94**	**14.80**	**52.78**

(1) CO_2 emissions of Biomass are not included in Total.

Table 46: 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	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**67.34**	**47.55**	**0.06**	**31.15**	**146.11**	**6.82**	**4.76**	**0.01**	**2.93**	**14.52**
102A	Hard Coal	41.79	8.24	0.06	5.51	55.60	4.13	0.77	0.01	0.51	5.42
104A	Hard Coal Briquettes										
105A	Brown Coal	24.92	2.89		2.38	30.19	2.62	0.28		0.26	3.16
106A	Brown Coal Briquettes	0.63	0.62		4.90	6.15	0.06	0.06		0.47	0.60
107A	Coke		27.41		18.36	45.77		2.85		1.69	4.54
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		8.40			8.40		0.79			0.79
	Total Liquid	**48.53**	**56.54**	**183.78**	**120.54**	**409.40**	**3.41**	**4.33**	**13.76**	**9.06**	**30.59**
110A	Petrol Coke	2.20	1.02			3.22	0.22	0.10			0.32
203B	Light Fuel Oil	2.08	11.75		26.29	40.12	0.16	0.92		2.02	3.10
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	25.76		0.79	46.43	1.57	2.01		0.06	3.64
204A	Gasoil	0.01	0.19		64.86	65.07	0.00	0.01		4.86	4.88
2050	Diesel	0.00	14.19	68.15	16.74	99.08	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
2080	Motor Gasoline		0.09	114.63	1.58	116.30		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**	**28.25**		**71.57**	**102.84**	**(0.33)**	**(3.1)**		**(7.18)**	**(10.61)**
111A	Fuel Wood		0.73		69.23	69.96		0.07		6.92	7.00
116A	Wood Wastes	2.36	9.78		2.34	14.48	0.26	1.08		0.26	1.59
118A	Sewage Sludge	0.66				0.66	0.07				0.07
215A	Black Liquor		17.74			17.74		1.95			1.95
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**195.54**	**215.08**	**187.91**	**282.38**	**880.90**	**14.45**	**13.85**	**13.99**	**15.36**	**57.69**

(1) CO_2 emissions of Biomass are not included in Total.

Table 47: 1990 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Transport	Other Sectors	Total	Energy Ind.	Industry	Transport	Other Sectors	Total
	Total Solid	**61.40**	**50.23**	**0.07**	**28.14**	**139.83**	**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		27.57		16.04	43.60		2.87		1.48	4.34
113A	Peat				0.00	0.00				0.00	0.00
304A	Coke Oven Gas		12.07			12.07		1.14			1.14
	Total Liquid	**46.45**	**50.95**	**162.48**	**117.16**	**377.04**	**3.19**	**3.90**	**12.17**	**8.82**	**28.12**
110A	Petrol Coke	1.95	0.98			2.92	0.20	0.10			0.29
203B	Light Fuel Oil	1.61	10.99		33.54	46.14	0.13	0.86		2.58	3.57
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	22.17		1.63	40.78	1.34	1.73		0.13	3.19
204A	Gasoil	0.00	0.06		52.94	53.00	0.00	0.00		3.97	3.97
2050	Diesel	0.01	13.64	57.09	18.58	89.32	0.00	1.01	4.22	1.38	6.61
206A	Other Kerosene				0.77	0.77				0.06	0.06
206B	Jet Kerosene			0.79		0.79			0.02		0.06
207A	Aviation Gasoline			0.11		0.11			0.01		0.01
2080	Motor Gasoline		0.08	104.50	1.63	106.22		0.01	7.92	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	0.94				0.94
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**	**27.93**		**64.40**	**94.38**	**(0.22)**	**(3.07)**		**(6.46)**	**(9.75)**
111A	Fuel Wood		0.66		62.46	63.12		0.07		6.25	6.31
116A	Wood Wastes	1.38	9.47		1.95	12.80	0.15	1.04		0.21	1.41
118A	Sewage Sludge	0.66				0.66	0.07				0.07
215A	Black Liquor		17.80			17.80		1.96			1.96
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**186.40**	**210.78**	**166.60**	**258.05**	**821.84**	**13.66**	**13.58**	**12.40**	**14.27**	**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 2006) (see Annex 2 and Annex 4). The reference approach requires more detailed fuel categories than provided in the national energy balance. Some fuel categories are aggregations of the detailed fuel categories the reference approach asks for. 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

<u>Activity data</u>

Imports, Exports and Production are updated according to the new version of the energy balance (IEA JQ 2006). 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	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Crude Oil	24 681	25 675	26 751	27 168	29 094	28 522	26 802	25 573	27 308	27 771	27 371	26 201	27 135
Orimulsion	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Liquids	116	116	121	150	122	637	199	302	154	149	261	249	309
Gasoline	-240	1 221	386	-235	-933	-90	-278	514	221	669	1 217	1 294	855
Jet Kerosene	-843	-967	-1 206	-1 379	-1 464	-1 536	-1 445	-1 550	-1 458	-1 374	-1 126	-1 101	-1 491
Other Kerosene	-44	-39	-8	21	31	47	48	16	-1	10	11	9	8
Shale Oil	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas / Diesel Oil	1 815	2 048	3 719	6 143	4 404	6 165	6 599	6 916	8 237	9 471	12 198	13 018	13 337
Residuel Fuel Oil	995	749	1 212	1 183	1 222	1 893	922	1 097	1 079	242	865	375	358
LPG	252	364	373	409	259	341	389	405	422	434	373	349	327
Ethane	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
Bitumen	-864	-902	-815	-838	-960	-950	-1 046	-1 100	-1 291	-1 336	-1 276	-1 391	-1 496
Lubricants	165	120	-85	-165	-172	-158	-156	-166	-183	-165	-226	-204	-210
Petroleum Coke	88	92	39	30	46	61	108	74	61	203	210	307	203
Refinery Feedstocks	3 031	3 467	1 643	2 366	2 589	1 719	2 592	1 600	1 870	1 513	620	1 011	999
OtherOil	-737	-987	-1 228	-1 489	-1 394	-1 554	-1 597	-1 411	-1 738	-1 783	-1 762	-1 841	-1 434
Liquid Fossil Totals	**28 416**	**30 956**	**30 903**	**33 365**	**32 845**	**35 097**	**33 136**	**32 268**	**34 683**	**35 803**	**38 735**	**38 276**	**38 899**
Anthracite	0	0	0	0	0	0	0	0	0	0	0	0	0
Coking Coal	5 926	5 246	4 766	5 301	5 313	5 500	5 560	4 658	4 720	4 681	4 695	4 718	4 635
Other Bit. Coal	4 727	5 157	3 849	4 414	5 084	4 035	3 385	4 795	5 332	4 989	6 276	6 341	5 551
Sub- Bit. Coal	0	0	0	0	0	0	0	0	0	0	0	0	0
Lignite	2 705	2 995	1 885	1 592	1 292	850	1 520	1 325	1 592	1 500	1 528	1 089	1 143

Fuel Type	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Oil Shale	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
BKB & Patent Fuel	548	570	308	299	250	192	197	197	195	118	132	107	87
Coke Oven / Gas Coke	2 008	2 804	2 687	1 898	2 376	1 970	1 839	3 118	2 746	3 546	3 331	3 268	4 226
Solid Fuel Totals	**15 914**	**16 773**	**13 496**	**13 504**	**14 316**	**12 548**	**12 503**	**14 094**	**14 584**	**14 835**	**15 962**	**15 523**	**15 643**
Gaseous Fossil	12 238	12 939	15 048	16 017	15 437	15 848	16 125	15 388	16 309	16 494	17 833	17 492	19 507
TOTAL	**56 568**	**60 667**	**59 447**	**62 886**	**62 597**	**63 493**	**61 764**	**61 751**	**65 575**	**67 132**	**72 530**	**71 290**	**74 049**
Biomass Total	**9 105**	**9 921**	**10 416**	**11 104**	**11 124**	**10 589**	**12 284**	**11 487**	**12 806**	**12 592**	**12 992**	**13 120**	**13 695**
Solid Biomass	9 105	9 921	10 324	10 994	10 987	10 451	12 194	11 386	12 635	12 466	12 874	12 991	13 555
Liquid Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Biomass	0	0	92	110	137	138	90	101	170	126	117	129	140

Table 2 presents the apparent fuel consumption for each fuel type of the Reference Approach.

Table 2: Apparent Consumption (TJ)

Fuel Type	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Crude Oil	339 954	353 655	368 466	374 218	400 743	392 864	369 171	352 242	376 144	382 524	377 005	360 896	373 757
Orimulsion	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Liquids	1 854	1 854	1 944	2 400	1 961	10 206	3 194	4 842	2 473	2 394	4 182	3 987	4 954
Gasoline	-3 341	17 855	5 621	-3 419	-13 593	-1 311	-4 059	7 489	3 222	9 745	17 738	18 863	12 465
Jet Kerosene	-11 906	-13 667	-17 043	-19 483	-20 685	-21 705	-20 411	-21 904	-20 601	-19 415	-15 913	-15 553	-21 071
Other Kerosene	-623	-551	-106	290	439	666	674	218	-14	137	154	133	113
Shale Oil	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas / Diesel Oil	24 755	27 930	50 721	83 771	60 057	84 071	90 000	94 318	112 339	129 157	166 359	177 541	181 887
Residuel Fuel Oil	12 990	9 782	15 825	15 450	15 949	24 720	12 033	14 316	14 090	3 158	11 291	4 892	4 669
LPG	4 029	5 825	5 975	6 545	4 147	5 464	6 224	6 486	6 763	6 956	6 025	5 682	5 373
Ethane	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
Bitumen	10 804	8 480	7 475	9 324	9 766	11 092	9 407	9 798	8 685	7 412	8 668	8 554	7 445
Lubricants	5 804	4 541	563	-161	-201	-40	-82	-111	-355	-538	-1 270	-1 308	-1 229
Petroleum Coke	2 611	2 322	883	1 167	1 190	1 450	2 074	1 890	1 777	3 311	3 609	4 551	3 244
Refinery Feedstocks	41 754	47 758	22 633	32 591	35 661	23 678	35 705	22 032	25 762	20 836	8 536	13 922	13 761
OtherOil	3 682	837	-934	-1 892	4 637	-1 757	-1 991	-1 113	-3 878	-4 660	-4 343	-2 806	-2 233
Liquid Fossil Totals	**432 368**	**466 621**	**462 024**	**500 801**	**500 070**	**529 397**	**501 940**	**490 504**	**526 408**	**541 016**	**582 042**	**579 354**	**583 136**
Anthracite	0	0	0	0	0	0	0	0	0	0	0	0	0
Coking Coal	65 423	58 690	53 427	58 604	59 096	60 811	61 358	52 579	52 969	53 149	53 140	53 337	53 158
Other Bit. Coal	51 016	55 653	41 542	47 629	54 857	43 541	36 531	51 740	57 530	53 839	67 713	68 412	59 894
Sub- Bit. Coal	0	0	0	0	0	0	0	0	0	0	0	0	0

Fuel Type	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Lignite	27 278	30 194	19 004	16 049	13 031	8 574	15 328	13 365	16 051	15 123	15 412	10 978	11 525
Oil Shale	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
BKB & Patent Fuel	5 912	6 146	3 323	3 221	2 694	2 066	2 126	2 127	2 099	1 277	1 422	1 153	943
Coke Oven / Gas Coke	19 100	26 624	25 549	18 090	22 622	18 769	17 540	29 618	26 103	33 668	31 628	31 020	40 114
Solid Fuel Totals	**168 733**	**177 312**	**142 850**	**143 598**	**152 305**	**133 764**	**132 887**	**149 434**	**154 757**	**157 061**	**169 319**	**164 905**	**165 638**
Gaseous Fossil	219 239	231 794	269 583	286 941	276 551	283 920	288 876	275 681	292 169	295 485	319 481	313 362	349 470
TOTAL	**820 341**	**875 727**	**874 457**	**931 339**	**928 926**	**947 082**	**923 702**	**915 619**	**973 333**	**993 562**	**1 070 842**	**1 057 621**	**1 098 245**
Biomass Total	**94 376**	**102 837**	**107 860**	**114 968**	**115 144**	**109 596**	**127 222**	**118 945**	**132 536**	**130 369**	**134 524**	**135 843**	**141 788**
Solid Biomass	94 376	102 837	107 011	113 954	113 881	108 327	126 391	118 013	130 967	129 207	133 445	134 654	140 498
Liquid Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Biomass	0	0	849	1 014	1 263	1 269	831	932	1 570	1 163	1 079	1 189	1 290

Table 3 presents the carbon stored for each fuel type of the Reference Approach.

Table 3: Carbon Stored (Gg C)

Fuel Type	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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
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
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
Gasoline	2.9	1.1	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
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
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
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
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
LPG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.6	2.4
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
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
Bitumen	475.7	435.0	389.0	435.9	479.2	505.8	495.1	518.7	546.7	531.0	542.3	571.4	575.9
Lubricants	70.5	57.9	34.6	42.2	43.4	42.6	41.4	43.4	43.3	34.7	36.9	30.2	33.3
Petroleum Coke	47.5	38.6	13.5	23.7	20.0	23.2	27.3	31.5	32.1	35.2	41.3	40.6	33.4
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
OtherOil	276.6	288.7	319.5	372.2	476.6	392.9	400.2	366.4	401.2	398.0	398.7	451.1	350.4
Liquid Fossil Totals	**873.2**	**821.3**	**756.5**	**874.1**	**1 019.3**	**964.4**	**964.0**	**960.0**	**1 023.3**	**999.0**	**1 020.0**	**1 094.9**	**995.5**
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
Coking Coal	38.8	54.1	52.0	36.8	46.0	38.2	35.7	60.2	53.1	68.5	64.3	63.1	81.6

Fuel Type	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Other Bit. Coal	0.6	0.6	0.5	0.4	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.3
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
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
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
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
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
Coke Oven / Gas Coke	4.8	5.0	5.9	5.4	6.2	5.5	5.5	6.0	6.0	6.5	6.2	5.7	7.4
Solid Fuel Totals	**44.2**	**59.7**	**58.4**	**42.6**	**52.7**	**44.1**	**41.6**	**66.7**	**59.5**	**75.5**	**71.0**	**69.3**	**89.3**
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
TOTAL	**917.5**	**881.0**	**814.9**	**916.7**	**1 072.0**	**1 008.5**	**1 005.6**	**1 026.7**	**1 082.8**	**1 074.5**	**1 091.0**	**1 164.2**	**1 084.8**
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**
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
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
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

Table 4 presents international bunker fuels for the relevant fuel types of the Reference Approach.

Table 4: International Bunkers [Gg fuel]

Fuel Type	1990	1991	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Jet Kerosene	275	309	409	453	471	488	475	516	502	470	402	472	534

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	-	-	-

Fuel Type	Conversion Factor [TJ/t] [TJ/1000 m3]	Carbon emission factor [t C/TJ]	Fraction ob carbon oxidised [t C/t C]
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 2006

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 1990-2005 Coking Coal [1000 tons].

101A Coking Coal	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	2 376	2 071	2 120	1 778	2 013	2 167	2 089	2 146	1 738	1 861	1 864	1 858	1 789	2 063
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-39	25	-125	130	80	-57	83	45	139	30	34	40	115	-164
Gross Inland Deliveries (Obs.)	2 337	2 096	1 995	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898	1 898	1 905	1 899
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 337	2 096	1 995	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898	1 898	1 905	1 899
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	2 337	2 096	1 995	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898	1 898	1 905	1 899
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

101A Coking Coal	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2: National Energy Balance 1990-2005 Bituminous Coal & Anthracite [1000 tons].

102A Bitominous Coal & Anthracite	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	1 233	1 717	1 692	1 216	1 724	1 616	1 653	1 211	1 672	1 862	2 167	2 101	2 659	2 262
Total Exports (Balance)	0	0	9	1	2	4	0	0	0	0	0	0	21	3
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	589	270	-197	268	-21	348	-97	94	176	192	-225	310	-212	-119
Gross Inland Deliveries (Obs.)	1 822	1 988	1 487	1 484	1 701	1 959	1 555	1 305	1 848	2 055	1 942	2 411	2 426	2 140
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1 421	1 561	1 075	1 082	1 238	1 437	1 061	915	1 422	1 684	1 618	2 136	2 147	1 885
Public Electricity	964	957	647	550	1 069	1 275	890	740	1 203	1 390	1 373	1 908	1 908	1 665
Public Combined Heat and Power	409	535	352	518	128	127	127	140	161	244	194	177	193	178
Public Heat Plants	0	0	0	0	0	0	0	0	0	6	0	0	0	0
Auto Producers of Electricity	0	0	0	0	19	5	4	4	10	13	11	13	4	4

102A Bitominous Coal & Anthracite	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Auto Producers for CHP	48	68	76	14	22	31	40	32	48	31	39	38	42	39
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	7	33	2	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	7	33	2	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	400	425	410	400	462	521	493	381	392	367	323	273	278	254
Total Transport	3	0	1	0	1	1	1	1	1	1	1	1	0	0
Rail	3	0	1	0	1	1	1	1	1	1	1	1	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	208	226	288	251	306	400	383	290	313	291	254	208	218	208
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	7	13	36	45	50	73	70	88	57	70	71	68	62	35
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	199	175	223	164	196	208	199	131	170	151	98	74	72	86
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	2	38	29	43	59	118	113	72	86	70	85	66	83	87
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	189	199	122	148	155	120	109	90	78	76	69	64	60	46
Commerce - Public Services	11	17	11	10	12	10	11	10	10	7	11	13	11	9
Residential	177	181	110	137	142	108	98	80	68	68	58	50	49	36
Agriculture	1	1	1	1	1	1	1	1	0	0	0	0	0	0

102A Bitominous Coal & Anthracite	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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	2	2	1	1

Table 3: National Energy Balance 1990-2005. Patent Fuel [1000 tons].

104A Patent Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indigenous Production	0	0	0	0	0	7	4	4	4	1	1	2	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	7	4	4	4	1	1	2	1	1
Gross Inland Deliveries (Obs.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	7	4	4	4	1	1	2	1	1
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

104A Patent Fuel	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	7	4	4	4	1	1	2	1	1
Total Other Sectors	0	0	0	0	0	1	1	1	1	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	6	3	3	3	0	1	2	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4: National Energy Balance 1990-2005. Lignite and Brown Coal [1000 tons].

105A Lignite and brown coal	**1990**	**1991**	**1992**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Indigenous Production	2 448	2 081	1 771	1 297	1 108	1 130	1 140	1 137	1 249	1 206	1 412	1 152	235	0
Total Imports (Balance)	36	53	22	29	43	23	13	14	34	42	5	70	88	113
Total Exports (Balance)	3	3	3	0	0	0	0	1	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	23	639	-330	417	470	163	-287	418	78	387	140	407	870	1 157
Gross Inland Deliveries (Obs.)	2 503	2 770	1 459	1 743	1 621	1 316	866	1 569	1 361	1 635	1 557	1 629	1 194	1 270
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 133	2 338	1 167	1 524	1 495	1 205	763	1 417	1 212	1 481	1 390	1 477	1 039	1 136
Public Electricity	1 182	1 445	583	1 081	1 358	1 164	737	1 372	1 168	1 418	1 316	1 393	967	1 061
Public Combined Heat and Power	881	830	484	339	48	13	3	9	8	30	43	52	41	54
Public Heat Plants	16	8	9	9	9	4	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	4	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	54	54	91	95	76	23	22	35	35	33	31	32	31	20
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

105A Lignite and brown coal	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	6	3	1	0	0	1	0	15	2	0	1	0	0	0
Coal Mines	3	1	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	3	2	1	0	0	1	0	15	2	0	1	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	364	429	291	219	126	111	103	137	147	153	166	152	155	134
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	147	211	118	115	33	46	45	83	107	109	133	142	144	126
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	11	14	4	4	6	3	3	15	40	43	59	72	68	70
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	193	112	111	27	43	42	68	67	66	74	70	76	56
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	2	3	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	218	173	104	93	65	58	54	40	45	34	10	11	9
Commerce - Public Services	9	14	6	5	3	3	3	4	4	5	6	3	4	2
Residential	208	205	168	99	90	62	55	50	35	39	28	7	7	7
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	1	2
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5: National Energy Balance 1990-2005. Brown Coal Briquettes [1000 tons].

106A BKB-PB	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	295	286	239	173	167	133	103	106	95	108	65	72	59	53
Total Exports (Balance)	0	0	0	1	1	0	0	0	0	0	0	0	1	5
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	12	32	13	1	0	0	0	0	11	0	0	0	0	0
Gross Inland Deliveries (Obs.)	306	318	252	172	167	133	103	106	107	108	65	72	58	48
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	12	32	13	0	0	0	0	0	18	29	0	0	0	0
Public Electricity	7	13	6	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	18	29	0	0	0	0
Public Heat Plants	5	19	8	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	295	286	239	172	167	133	103	106	88	79	65	72	58	48
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	64	32	20	14	13	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

106A BKB-PB	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	1	2	1	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	63	30	19	14	13	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	230	254	219	158	154	132	103	106	88	79	65	72	58	48
Commerce - Public Services	8	14	9	6	6	20	11	11	13	6	8	23	11	2
Residential	214	231	202	146	142	108	88	91	72	70	55	47	46	43
Agriculture	8	9	8	6	6	5	4	4	3	3	2	2	2	2
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6: National Energy Balance 1990-2005. Coke Oven Coke [1000 tons].

107A Coke Oven Coke	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	1 725	1 540	1 487	1 448	1 559	1 566	1 598	1 608	1 385	1 394	1 395	1 395	1 400	1 388
Total Imports (Balance)	815	893	685	718	652	764	642	654	981	1 091	1 073	1 173	1 266	1 402
Total Exports (Balance)	1	2	2	1	0	0	0	2	1	1	2	3	42	7
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-136	53	2	189	-10	39	24	-30	71	-164	124	-48	-124	27
Gross Inland Deliveries (Obs.)	2 402	2 484	2 171	2 354	2 200	2 369	2 264	2 230	2 435	2 320	2 589	2 517	2 500	2 810
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	623	591	562	711	652	758	830	783	909	899	1 049	1 019	1 059	1 035
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	623	591	562	711	652	758	830	783	909	899	1 049	1 019	1 059	1 035
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	107	116	84	77	88	73	68	48	53	52	58	55	50	65
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	107	116	84	77	88	73	68	48	53	52	58	55	50	65

107A Coke Oven Coke	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	853	924	763	557	528	469	422	453	436	344	366	385	409	445
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	290	280	159	196	192	220	200	245	252	158	205	241	303	317
Iron and Steel	235	229	137	178	164	179	164	176	202	133	173	206	274	285
Chemical (incl.Petro-Chemical)	14	11	5	6	11	13	11	17	16	12	11	14	10	9
Non ferrous Metals	7	6	3	3	5	7	6	8	7	3	6	5	6	4
Non metallic Mineral Products	23	18	9	4	5	15	13	39	11	2	5	4	5	14
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	5	3	2	2	3	3	2	3	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	5	5	3	2	4	5	4	3	16	8	11	11	9	4
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	1	7	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	563	644	604	361	335	248	222	207	185	185	161	144	106	128
Commerce - Public Services	13	15	14	9	8	6	5	5	5	5	5	6	5	5
Residential	537	615	576	345	320	237	212	198	176	177	154	136	99	121
Agriculture	12	14	13	8	7	5	5	5	4	3	3	2	2	2
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	820	852	763	1 010	932	1 069	944	946	1 037	1 025	1 115	1 058	982	1 265

Table 7: National Energy Balance 1990-2005. Peat [1000 tons].

113A Peat	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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

113A Peat	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	1	1	1	1	1	1	1	1	1	1	1	1	1	1

113A Peat	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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 1990-2005. Coke Oven Gas [TJ].

304A Coke Oven Gas	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	13 117	12 276	11 164	10 906	11 419	11 605	12 166	12 220	10 466	9 776	9 579	10 722	10 911	9 871
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	13 117	12 276	11 164	10 906	11 419	11 605	12 166	12 220	10 466	9 776	9 579	10 722	10 911	9 871
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	3 385	2 763	2 885	6 228	3 545	3 270	3 087	4 005	3 794	3 984	3 092	1 871	2 436	2 336
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	2 183	2 002	2 033	2 649	3 256	3 449	2 639	1 255	2 193	2 027
Auto Producers for CHP	3 385	2 763	2 885	6 228	1 362	1 268	1 054	1 357	489	535	453	617	243	309
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	50	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	4 136	3 871	3 520	3 439	3 601	3 659	3 836	3 853	3 300	3 083	3 020	4 187	4 326	4 171
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	1 072	1 004	913	892	934	949	995	999	856	799	783	708	595	699
Blast Furnaces (Energy)	3 064	2 867	2 607	2 547	2 667	2 710	2 841	2 854	2 444	2 283	2 237	3 479	3 730	3 472
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	1 023	1 171	1 204	841
Final Consumption	5 596	5 642	4 759	1 239	4 273	4 675	5 243	4 361	3 372	2 710	2 444	3 493	2 946	2 523
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0

304A Coke Oven Gas	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	5 596	5 642	4 759	1 239	4 273	4 675	5 243	4 361	3 372	2 710	2 444	3 493	2 946	2 523
Iron and Steel	5 596	5 642	4 759	1 239	4 273	4 675	5 243	4 361	3 372	2 710	2 444	3 493	2 946	2 523
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 9: National Energy Balance 1990-2005. Blast Furnace Gas [TJ].

305A Blast Furnace Gas	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	17 094	16 232	15 411	19 503	17 719	20 582	22 528	21 873	25 385	25 098	29 309	28 463	29 577	28 902
Total Imports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	17 094	16 232	15 411	19 503	17 719	20 582	22 528	21 873	25 385	25 098	29 309	28 463	29 577	28 902
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	4 822	4 352	4 405	6 213	6 259	7 906	7 625	6 703	6 260	6 273	8 027	7 958	11 128	11 936
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	4 493	5 447	5 320	4 530	5 257	5 404	7 240	6 784	10 437	10 937
Auto Producers for CHP	4 822	4 352	4 405	6 213	1 766	2 459	2 305	2 173	1 003	869	786	1 174	690	998
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

305A Blast Furnace Gas	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BKB (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	9 682	9 164	8 732	11 685	10 613	12 332	13 536	13 156	15 254	15 077	17 613	17 325	16 175	16 290
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	2 391	2 223	2 160	2 642	2 508	2 787	3 256	3 231	3 675	3 609	4 251	4 161	4 282	3 647
Blast Furnaces (Energy)	7 291	6 941	6 572	9 044	8 105	9 545	10 280	9 924	11 579	11 468	13 363	13 164	11 894	12 643
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	1 111	653	967	676
Final Consumption	2 590	2 716	2 274	1 605	846	344	1 367	2 014	3 871	3 749	2 558	2 527	1 307	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	2 590	2 716	2 274	1 605	846	344	1 367	2 014	3 871	3 749	2 558	2 527	1 307	0
Iron and Steel	2 590	2 716	2 274	1 605	846	344	1 367	2 014	3 871	3 749	2 558	2 527	1 307	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Oil

Table 10: National Energy Balance 1990-2005. Crude Oil [1000 tons]

Crude Oil	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	1 149	1 280	1 180	1 035	992	972	959	1 003	971	957	957	1 113	971	855
Refinery Losses	120	128	179	153	75	82	156	226	122	210	121	115	32	-16
Refinery Intake (Calculated)	7 952	8 273	8 732	8 619	8 754	9 374	9 190	8 636	8 240	8 799	8 947	8 819	8 442	8 743
Refinery Intake (Observed)	7 952	8 273	8 732	8 619	8 754	9 374	9 190	8 636	8 240	8 799	8 947	8 819	8 442	8 743
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Total Imports (Balance)	6 797	7 000	7 550	7 590	7 737	8 450	8 269	7 698	7 315	7 940	8 118	7 819	7 562	7 833
Total Exports (Balance)	0	0	0	0	51	25	44	51	61	63	0	0	0	0
Stock Change (National Territory)	6	-8	3	-6	75	-23	6	-14	16	-36	-128	-114	-91	55
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11: National Energy Balance 1990-2005. Natural Gas Liquids [1000 tons]

Natural Gas Liquids	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	41	41	40	43	53	55	88	60	101	55	53	92	88	110
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	41	41	40	43	53	43	226	71	107	55	53	92	88	76
Refinery Intake (Observed)	41	41	40	43	53	43	226	71	107	55	53	92	88	76
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	33
Total Imports (Balance)	0	0	0	0	0	0	135	0	6	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	-12	2	10	0	0	0	0	0	0
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 12: National Energy Balance 1990-2005. Refinery Feedstocks [1000 tons]

Refinery Feedstocks	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	1 069	1 225	1 001	582	858	853	564	873	540	616	492	203	341	370
Refinery Intake (Observed)	1 069	1 225	1 001	582	858	853	564	873	540	616	492	203	341	370
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	1 009	1 154	902	600	916	761	746	740	627	534	593	374	222	265
Total Exports (Balance)	0	0	0	39	62	14	7	15	76	42	6	25	5	58
Stock Change (National Territory)	-26	-30	19	-28	-88	92	-182	115	-32	115	-96	-148	110	117

Table 13: National Energy Balance 1990-2005. Residual Fuel Oil [1000 tons]

203X; Residual Fuel Oil	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	1 913	1 981	1 821	1 502	1 441	1 540	1 347	1 308	979	1 047	1 012	978	1 031	992
Refinery Fuel	81	77	80	139	56	49	63	22	37	7	7	25	7	26
Total Imports (Balance)	602	480	376	532	386	449	671	468	262	317	241	328	306	182
Total Exports (Balance)	185	149	65	38	121	53	18	37	152	228	146	55	55	72
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-93	-88	-188	-100	119	1	-38	-131	246	262	-17	8	-129	7
Gross Inland Deliveries (Obs.)	2 156	2 147	1 865	1 757	1 770	1 888	1 899	1 586	1 298	1 391	1 083	1 234	1 146	1 081
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	608	740	610	573	537	636	732	633	375	416	255	360	367	350
Public Electricity	28	37	10	88	194	313	348	271	110	79	34	104	94	79
Public Combined Heat and Power	253	297	338	316	178	151	234	281	161	191	168	203	196	182
Public Heat Plants	99	124	104	70	109	129	106	54	82	125	37	33	66	71
Auto Producers of Electricity	0	0	0	0	22	11	10	5	6	4	2	10	1	3
Auto Producers for CHP	227	281	156	97	33	31	33	20	15	16	13	8	10	14
Auto Producer Heat Plants	1	1	2	1	1	1	1	2	1	1	1	3	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	116	117	118	150	110	143	191	191	231	256	154	159	203	234
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	116	117	118	150	110	143	191	191	231	256	154	159	203	234
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1 432	1 290	1 136	1 035	1 123	1 109	976	762	691	719	674	714	576	498
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	518	539	470	550	557	749	611	333	277	276	214	226	215	201
Iron and Steel	19	18	14	23	26	11	9	10	21	15	8	6	10	10
Chemical (incl.Petro-Chemical)	23	24	17	27	28	40	33	21	13	16	9	10	13	10

203X; Residual Fuel Oil	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Non ferrous Metals	4	4	4	7	10	18	15	9	9	8	7	7	7	6
Non metallic Mineral Products	115	110	109	135	127	195	159	79	50	42	35	38	40	39
Transportation Equipment	13	15	13	17	6	6	5	4	4	5	3	3	4	3
Machinery	29	31	27	32	42	66	54	30	30	31	25	28	27	24
Mining and Quarrying	6	6	5	7	10	11	9	12	12	14	11	11	8	9
Food, Beverages and Tobacco	78	86	79	89	68	85	69	38	37	42	34	34	34	25
Pulp, Paper and Printing	126	133	117	108	95	140	114	58	39	39	34	41	29	37
Wood and Wood Products	15	15	13	21	26	41	33	19	9	5	12	13	13	12
Construction	32	34	22	22	35	44	36	16	16	13	10	12	10	10
Textiles and Leather	27	31	24	25	35	48	39	16	12	19	12	10	8	8
Non Specified (Industry)	30	32	26	36	49	44	36	21	23	27	13	13	12	9
Total Other Sectors	914	750	667	485	566	359	365	429	415	443	460	488	361	297
Commerce - Public Services	316	229	201	239	288	71	58	99	99	183	218	233	121	94
Residential	471	410	367	194	219	227	241	259	250	206	192	202	191	161
Agriculture	127	111	99	53	59	61	65	70	65	53	50	53	50	42
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	116	117	118	150	110	143	191	191	231	256	154	159	203	234

Table 14: National Energy Balance 1990-2005. Heating and Oher Gas Oil [1000 tons]

204A Heating and Other Gas Oil	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	1 239	1 575	1 412	1 454	1 598	1 604	1 280	1 245	1 062	1 301	1 062	1 103	928	997
Refinery Fuel	0	0	1	0	0	1	2	6	0	0	0	0	0	0
Total Imports (Balance)	0	0	0	165	376	355	577	615	533	626	734	860	805	926
Total Exports (Balance)	0	28	0	0	0	0	0	0	1	3	0	0	17	20
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	5	-20	11	39	-17	-53	41	1	44	-41	-11	37	-25	-40
Gross Inland Deliveries (Obs.)	1 244	1 527	1 422	1 658	1 956	1 906	1 895	1 854	1 638	1 883	1 785	1 999	1 691	1 863
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	2	1	2	3	1	0	19	3	4	2	5
Public Electricity	0	0	0	0	0	0	0	0	0	15	1	0	0	1
Public Combined Heat and Power	0	0	0	2	0	0	0	0	0	4	2	1	0	3
Public Heat Plants	0	0	0	0	1	2	2	0	0	0	0	3	1	1
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

204A Heating and Other Gas Oil	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1 244	1 527	1 422	1 656	1 955	1 904	1 893	1 853	1 637	1 864	1 782	1 996	1 689	1 859
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	1	5	4	5	11	28	24	24	37	80	64	68	65	68
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	1	1	1	2	4	4	2	1	1
Non ferrous Metals	0	0	0	0	0	0	0	2	2	4	3	1	1	1
Non metallic Mineral Products	0	1	1	1	2	5	5	2	2	3	2	3	3	4
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Machinery	0	1	1	1	3	7	6	4	5	12	9	9	7	7
Mining and Quarrying	0	0	0	0	1	1	1	1	1	3	3	2	3	3
Food, Beverages and Tobacco	0	0	0	1	1	3	3	6	10	23	19	17	13	12
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Wood and Wood Products	0	0	0	0	0	1	1	1	1	2	2	3	3	4
Construction	0	1	1	1	3	6	6	5	10	21	17	23	28	29
Textiles and Leather	0	0	0	0	0	1	1	1	1	3	2	2	2	2
Non Specified (Industry)	0	0	0	0	1	2	2	1	2	4	3	3	3	3
Total Other Sectors	1 243	1 523	1 417	1 651	1 944	1 876	1 868	1 829	1 600	1 784	1 718	1 928	1 624	1 791
Commerce - Public Services	26	87	84	92	222	538	471	417	235	482	468	565	288	341
Residential	1 216	1 434	1 333	1 558	1 720	1 337	1 396	1 411	1 364	1 301	1 249	1 362	1 335	1 449
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 1990-2005. Diesel [1000 tons]

2050 Diesel	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	1 531	1 634	1 833	1 920	2 008	2 311	2 615	2 430	2 662	2 658	2 922	2 746	2 601	2 931
Refinery Fuel	0	0	0	1	1	1	1	0	0	0	0	4	0	0
Total Imports (Balance)	576	686	589	937	1 777	1 159	1 898	1 877	2 075	2 433	2 728	3 491	4 078	4 129
Total Exports (Balance)	3	68	73	83	97	271	467	459	415	415	520	539	563	889
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-7	74	97	112	-106	195	-108	44	-59	-8	49	-9	-179	91
Gross Inland Deliveries (Obs.)	2 097	2 326	2 446	2 885	3 581	3 394	3 937	3 892	4 263	4 668	5 180	5 685	5 936	6 262
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	8	4	7	1	3	1	0	0	0	0	0
Public Electricity	0	0	0	6	2	6	1	2	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	1	0	0	1	1	0	0	0	0	0
Auto Producers for CHP	0	0	0	2	1	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	2 096	2 326	2 446	2 877	3 578	3 388	3 936	3 889	4 261	4 668	5 179	5 685	5 935	6 262
Total Transport	1 533	1 710	1 804	2 140	2 692	2 542	2 977	2 879	3 238	3 560	3 971	4 373	4 573	4 842
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	1 472	1 654	1 748	2 088	2 645	2 495	2 931	2 831	3 190	3 513	3 919	4 321	4 520	4 788
Rail	54	50	49	45	41	41	41	42	42	41	44	44	44	44
Inland Waterways	7	7	7	6	6	6	6	6	6	7	8	8	9	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	335	357	440	574	539	640	686	700	776	867	960	1 005	1 058
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2050 Diesel	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Chemical (incl.Petro-Chemical)	3	4	4	5	7	6	7	8	8	9	10	11	12	12
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	4	5	5	7	9	8	10	10	10	12	13	14	15	16
Transportation Equipment	20	23	25	30	40	37	44	47	48	54	60	66	69	73
Machinery	1	1	1	1	2	2	2	2	2	2	3	3	3	3
Mining and Quarrying	20	24	25	31	41	38	45	49	50	55	61	68	71	75
Food, Beverages and Tobacco	1	1	1	2	2	2	3	3	3	3	3	4	4	4
Pulp, Paper and Printing	1	1	1	1	1	1	1	1	2	2	2	2	2	2
Wood and Wood Products	4	4	5	6	8	7	9	9	9	10	12	13	14	14
Construction	230	267	285	351	458	430	511	548	558	619	692	766	802	844
Textiles and Leather	3	4	4	5	6	6	7	7	8	8	9	10	11	12
Non Specified (Industry)	0	1	1	1	1	1	1	1	1	1	1	2	2	2
Total Other Sectors	275	281	285	297	312	307	318	323	324	332	342	352	357	363
Commerce - Public Services	34	40	42	52	68	64	76	81	83	92	103	114	119	125
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	241	242	242	245	244	243	242	242	241	240	240	239	238	237
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 1990-2005. Other Kerosene [1000 tons]

206A Other Kerosene	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	31	43	49	8	5	0	2	1	1	1	1	1	1	1
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	14	4	18	4	10	10	16	15	5	0	3	4	3	3
Total Exports (Balance)	21	13	31	6	5	2	2	0	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-7	-4	-6	0	1	2	1	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	18	31	30	6	12	10	17	16	6	1	4	5	4	3
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

206A Other Kerosene	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	18	31	30	6	12	10	17	16	6	1	4	5	4	3
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	1	0	0	0	0	1	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	1	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	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	18	31	29	6	12	10	17	15	6	1	4	4	4	3
Commerce - Public Services	18	31	29	6	12	10	17	15	6	1	4	4	4	3
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 17: National Energy Balance 1990-2005. Kerosene Type Jet Fuel [1000 tons]

206B Kerosene Type Jet Fuel	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	291	334	371	420	479	508	540	508	544	513	484	446	455	592
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	13	8	9	23	24	12	9	21	35	37	38	47	132	85
Total Exports (Balance)	5	5	10	0	0	0	6	5	5	1	1	5	4	2
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	-1	-7	4	-8	-4	-2	2	-4	4	-3	4	-4	-22
Gross Inland Deliveries (Obs.)	299	336	363	447	495	515	541	525	569	553	519	491	578	653
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	299	336	363	447	495	515	541	525	569	553	519	491	578	653
Total Transport	299	336	363	447	495	515	541	525	569	553	519	491	578	653
International Civil Aviation	269	307	335	425	466	493	511	489	537	447	484	414	486	549
Domestic Air Transport	30	29	28	22	29	22	30	36	32	106	34	77	92	104
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

206B Kerosene Type Jet Fuel	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 18: National Energy Balance 1990-2001. Gasoline Type Jet Fuel [1000 tons]

207A Gasoline Type Jet Fuel	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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)	-256	3	3	4	2	3	3	3	3	4	4	5	7	6
Total Exports (Balance)	0	0	0	0	1	1	0	1	1	1	2	3	3	3
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	259	0	0	-2	1	0	0	0	0	-1	0	1	-1	0
Gross Inland Deliveries (Obs.)	3	3	3	2	2	2	3	3	2	2	2	3	2	3
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

207A Gasoline Type Jet Fuel	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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	2	2	2	3	3	2	2	2	3	2	3
Total Transport	3	3	3	2	2	2	3	3	2	2	2	3	2	3
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	3	3	3	2	2	2	3	3	2	2	2	3	2	3
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 19: National Energy Balance 1990-2005. Motor Gasoline [1000 tons]

2080 Motor Gasoline	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	2 631	2 400	2 462	2 271	2 297	2 410	2 232	2 141	1 815	1 922	1 927	1 799	1 715	1 798
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	516	387	506	698	612	547	759	762	670	603	706	879	1 043	1 090
Total Exports (Balance)	281	127	214	596	700	831	824	824	472	582	496	474	614	767
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-313	136	-79	21	10	-23	33	-31	-33	49	6	-12	-11	-48
Gross Inland Deliveries (Obs.)	2 553	2 796	2 675	2 395	2 219	2 104	2 200	2 047	1 980	1 993	2 143	2 192	2 133	2 073
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	2 553	2 796	2 675	2 395	2 219	2 104	2 200	2 047	1 980	1 993	2 143	2 192	2 133	2 073
Total Transport	2 457	2 695	2 585	2 312	2 144	2 033	2 128	1 976	1 911	1 925	2 067	2 115	2 058	2 001
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	2 457	2 695	2 585	2 312	2 144	2 033	2 128	1 976	1 911	1 925	2 067	2 115	2 058	2 001
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	93	97	86	79	72	68	68	68	66	65	72	73	71	69
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2080 Motor Gasoline	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Chemical (incl.Petro-Chemical)	7	3	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	70	77	70	64	58	55	55	55	54	52	58	59	57	55
Machinery	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	12	13	12	11	10	10	10	10	9	9	10	11	11	10
Textiles and Leather	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	4	4	4	3	3	3	3	3	3	3	3	3	3	3
Commerce - Public Services	4	4	4	3	3	3	3	3	3	3	3	3	3	3
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	7	3	0	0	0	0	0	0	0	0	0	0	0	0

Table 20: National Energy Balance 1990-2005. Lubricants [1000 tons]

219A Lubricants	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	31	31	27	73	109	113	107	105	111	117	100	123	108	113
Refinery Fuel	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	177	171	115	51	50	51	53	52	57	51	47	44	43	53
Total Exports (Balance)	32	30	48	41	49	57	53	51	58	65	62	80	70	85
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-1	-28	21	4	-5	1	-1	-3	-1	5	2	4	-6	1
Gross Inland Deliveries (Obs.)	175	144	115	86	105	108	106	103	108	108	86	92	75	83
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

219A Lubricants	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Energy Sector	19	16	13	9	11	12	12	11	12	12	9	10	10	9
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	1	1	1	0	1	1	1	1	1	1	0	1	1	0
Coke Ovens (Energy)	6	5	4	3	3	4	3	3	4	4	3	3	3	3
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Power Plants	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Non Specified (Energy)	11	9	7	5	6	7	6	6	6	6	5	6	6	5
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	156	128	102	77	94	96	94	92	96	96	77	82	65	74
Total Transport	72	59	47	35	43	44	43	42	44	44	36	38	20	33
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	71	58	46	34	42	43	42	41	43	43	35	37	37	33
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	1	1	1	1	1	1	1	1	1	1	1	1	-17	0
Total Industry	81	66	53	40	48	50	49	48	50	50	40	42	43	39
Iron and Steel	15	12	10	7	9	9	9	9	9	9	7	7	8	7
Chemical (incl.Petro-Chemical)	7	6	4	3	4	4	4	4	4	4	3	4	4	3
Non ferrous Metals	2	2	2	1	1	2	1	1	2	2	1	1	1	1
Non metallic Mineral Products	11	9	7	5	6	7	6	6	7	7	5	6	6	5
Transportation Equipment	2	2	1	1	1	1	1	1	1	1	1	1	1	1
Machinery	3	3	2	2	2	2	2	2	2	4	3	3	3	3
Mining and Quarrying	3	3	2	2	2	2	2	2	2	2	2	2	2	1
Food, Beverages and Tobacco	11	9	7	5	7	7	7	7	7	7	5	6	6	5
Pulp, Paper and Printing	9	7	6	4	5	5	5	5	5	5	4	5	5	4
Wood and Wood Products	3	2	2	1	2	2	2	2	2	2	1	1	1	1
Construction	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Textiles and Leather	5	4	3	2	3	3	3	3	3	3	2	2	2	2
Non Specified (Industry)	9	7	6	4	5	6	5	5	6	4	3	3	3	3
Total Other Sectors	3	3	2	2	2	2	2	2	2	2	2	2	2	2
Commerce - Public Services	3	3	2	2	2	2	2	2	2	2	1	1	1	1
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	175	144	115	86	105	108	106	103	108	108	86	92	75	83

Table 21: National Energy Balance 1990-2005. White Spirit [1000 tons]

220A White Spirit	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	0	7	8	5	5	0	0	0	0	0	0	0	18	12
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	11	9	8	8	8	11	12	12	7	6	9	11	10	11
Total Exports (Balance)	0	2	3	0	1	1	1	0	0	0	1	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	1	-1	0	1	0	1	1	0	0	0	-18	-12
Gross Inland Deliveries (Obs.)	11	14	14	12	12	11	11	13	7	6	8	10	10	12
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	11	14	14	12	12	11	11	13	7	6	8	10	10	12
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	11	14	14	12	12	11	11	13	7	6	8	10	10	12
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0

220A White Spirit	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Chemical (incl.Petro-Chemical)	11	14	10	10	9	8	5	4	3	2	4	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	0	4	2	3	3	6	8	3	4	4	6	6	8
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	1	1	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	11	14	14	12	12	11	11	13	7	6	8	10	10	12

Table 22: National Energy Balance 1990-2005. Bitumen [1000 tons]

222A Bitumen	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	269	281	380	254	263	299	300	326	343	402	416	398	433	466
Refinery Fuel	0	0	0	0	2	0	4	0	0	0	0	0	0	0
Total Imports (Balance)	292	232	70	187	250	242	279	231	292	296	248	296	295	335
Total Exports (Balance)	1	21	15	5	11	6	1	1	45	78	62	82	81	147
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-22	0	6	4	-7	7	-2	4	-3	-1	-1	1	-2	-3
Gross Inland Deliveries (Obs.)	538	492	441	440	493	542	572	560	587	618	601	613	646	651
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

222A Bitumen	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	538	492	441	440	493	542	572	560	587	618	601	613	646	651
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	538	492	441	440	493	542	572	560	587	618	601	613	646	651
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	538	492	441	440	493	542	572	560	587	618	601	613	646	651
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	538	492	441	440	493	542	572	560	587	618	601	613	646	651

Table 23: National Energy Balance 1990-2005. Other Oil Products [1000 tons]

224A Other Oil Products	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	499	649	743	761	923	953	960	927	859	988	1 030	1 048	1 143	854
Refinery Fuel	164	184	176	212	264	277	264	213	223	226	254	278	343	229
Total Imports (Balance)	126	44	31	13	-14	121	77	69	111	47	45	43	107	45
Total Exports (Balance)	3	-1	3	39	54	6	137	131	139	162	168	149	163	93
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-42	-31	64	-3	14	-10	6	0	-7	11	-1	-13	-6	-7
Gross Inland Deliveries (Obs.)	471	479	659	518	605	780	641	651	601	659	652	651	738	570
Statistical Difference	-56	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	23	14	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	23	14	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	448	465	659	518	605	780	641	651	601	659	652	651	738	570
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	448	465	659	518	605	780	641	651	601	659	652	651	738	570
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0

224A Other Oil Products	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Chemical (incl.Petro-Chemical)	448	465	659	518	605	780	641	651	601	659	652	651	738	570
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	448	465	659	518	605	780	641	651	601	659	652	651	738	570

Table 24: National Energy Balance 1990-2005. LPG [1000 tons]

303A LPG	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	47	43	51	60	20	45	30	19	34	0	23	50	57	107
Refinery Fuel	8	8	1	19	6	0	1	4	20	0	2	1	3	49
Total Imports (Balance)	97	149	151	149	184	148	132	152	159	140	155	137	132	133
Total Exports (Balance)	14	44	40	42	42	55	19	20	17	4	7	9	17	20
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	2	18	1	20	-3	-5	3	0	-5	6	-2	-1	5	0
Gross Inland Deliveries (Obs.)	125	158	162	166	152	132	144	147	150	143	168	176	174	172
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1	4	4	3	3	2	1	1	0	0	1	0	0	0
Public Electricity	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Public Heat Plants	1	4	4	3	3	1	1	1	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

303A LPG	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	124	153	158	163	150	130	143	147	150	143	168	176	174	171
Total Transport	9	9	10	11	15	11	13	14	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	9	10	11	15	11	13	14	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	76	48	62	67	60	66	54	55	48	41	39	31	28
Iron and Steel	4	5	4	3	12	12	13	6	1	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	8	7	6	6	6	4	5	4	4	4	4	5	4	4
Non metallic Mineral Products	12	14	12	23	21	13	14	15	15	14	10	11	2	2
Transportation Equipment	1	2	1	3	2	10	11	0	1	1	1	1	3	2
Machinery	11	13	11	13	12	10	11	11	14	13	13	11	8	7
Mining and Quarrying	1	1	0	1	1	1	1	1	1	1	1	1	1	1
Food, Beverages and Tobacco	3	4	4	3	2	2	2	5	4	5	3	3	4	3
Pulp, Paper and Printing	1	1	1	1	2	1	1	1	2	1	2	1	1	1
Wood and Wood Products	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Construction	23	30	9	9	8	7	7	9	13	6	5	5	5	5
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	0	1	1	0	1	1	0	0	0
Total Other Sectors	50	68	101	90	68	59	64	79	81	81	112	123	129	129
Commerce - Public Services	32	47	80	61	34	19	21	31	29	30	62	68	77	73
Residential	16	19	19	26	31	36	39	43	48	48	46	50	49	51
Agriculture	2	2	2	3	3	4	4	4	5	4	4	4	4	4
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	1	2	3

Table 25: National Energy Balance 1990-2005. Refinery Gas [1000 tons]

308A Refinery Gas	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Refinery Gross Output	373	327	339	305	359	351	348	341	312	328	306	273	293	309
Refinery Fuel	373	327	339	305	359	351	348	338	310	326	306	273	293	309
Total Imports (Balance)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Exports (Balance)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	0	0	0	0	2	2	2	0	0	0	0
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Electricity	0	0	0	0	0	0	0	2	2	2	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	1	0	0	0	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Petrochemical Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation	0	0	0	0	0	0	0	2	2	1	0	0	0	0
Domestic Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inland Waterways	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0

308A Refinery Gas	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	2	2	1	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	2	2	1	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Natural Gas

Table 26: National Energy Balance 1990-2005. Natural Gas [TJ NCV].

	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	46 376	47 729	51 722	53 336	53 701	51 404	56 440	62 524	64 826	62 194	67 541	75 094	70 500	59 347
Total Imports (Balance)	187 917	184 138	183 846	229 114	236 579	216 911	224 009	219 484	222 784	225 593	234 797	288 439	301 229	343 591
Total Exports (Balance)	0	0	12	576	0	0	698	0	633	14 713	19 139	36 879	56 032	35 379
Stock Change (National Territory)	-15 054	-73	-7 946	-12 291	-3 339	8 236	4 169	6 867	-11 295	19 095	12 287	-7 172	-2 335	-18 089
Gross Inland Deliveries (Obs.)	219 239	231 794	227 610	269 583	286 942	276 551	283 920	288 876	275 681	292 169	295 485	319 481	313 362	349 470
Statistical Difference	0	0	0	0	-1	0	0	0	0	0	0	0	0	0
Total Transformation Sector	74 710	76 968	74 215	95 817	108 680	96 912	100 569	99 290	81 901	81 874	89 352	106 232	102 663	117 762
Public Electricity	28 100	25 602	20 818	21 731	36 919	28 715	35 366	30 144	23 694	24 379	24 784	29 981	23 785	41 031
Public Combined Heat and Power	23 810	24 752	24 529	30 757	33 803	31 061	29 381	32 247	28 672	31 457	38 694	43 335	50 877	47 003
Public Heat Plants	7 552	7 200	7 148	9 579	9 022	8 641	8 780	7 337	7 912	5 198	7 816	7 906	7 324	8 862
Auto Producers of Electricity	9 596	12 218	13 670	21 241	18 211	20 694	19 173	18 436	12 715	14 655	6 814	11 022	7 413	7 248
Auto Producers for CHP	5 651	7 195	8 050	12 509	10 725	7 801	7 870	10 526	8 508	6 014	11 237	12 847	12 911	13 224
Auto Producer Heat Plants	0	0	0	0	0	0	0	600	400	172	6	1 142	353	394
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	13 410	13 437	12 495	13 351	10 257	11 607	10 294	8 951	9 384	10 135	9 340	11 091	9 059	14 475
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	5 338	5 395	5 026	5 745	3 022	3 709	2 989	1 612	3 027	2 915	2 811	3 824	4 247	3 640
Inputs to Oil Refineries	8 045	8 041	7 469	7 605	7 235	7 898	7 305	7 339	6 356	7 220	6 529	7 267	4 812	10 835
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	27	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	2 727	3 352	3 259	5 294	1 449	920	2 702	4 817	2 256	2 751	6 245	6 952	3 741	2 909
Final Consumption	113 479	122 072	126 906	144 603	155 775	156 443	159 801	165 173	171 637	187 465	180 215	187 716	185 632	201 893
Total Transport	4 050	4 065	3 968	4 092	4 216	4 199	6 344	7 796	9 650	8 255	4 966	6 632	7 964	9 827

Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	4 050	4 065	3 968	4 092	4 216	4 199	6 344	7 796	9 650	8 255	4 966	6 632	7 964	9 827
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	73 484	77 788	82 591	80 259	76 058	88 232	92 307	93 146	87 341	88 540	89 302
Iron and Steel	10 524	9 571	9 549	11 243	12 115	14 576	14 165	13 583	13 483	13 672	12 433	13 872	13 431	12 947
Chemical (incl.Petro-Chemical)	7 710	7 125	7 408	8 250	8 330	10 116	9 830	13 964	14 934	14 954	14 400	14 799	13 799	15 625
Non ferrous Metals	1 352	1 205	1 580	2 154	2 015	2 366	2 299	2 145	2 296	2 583	2 649	2 915	2 934	2 648
Non metallic Mineral Products	10 085	10 280	9 374	11 097	11 927	13 248	12 874	10 968	11 719	11 941	13 082	13 054	12 964	12 882
Transportation Equipment	1 535	1 772	1 931	2 555	2 408	1 162	1 130	746	934	1 475	1 178	1 652	2 177	2 195
Machinery	4 348	4 396	4 775	6 133	6 283	5 521	5 365	4 532	5 066	5 503	5 013	5 498	5 427	5 504
Mining and Quarrying	2 631	2 481	1 826	2 519	2 639	2 524	2 453	1 730	2 344	2 593	2 673	2 570	2 574	2 712
Food, Beverages and Tobacco	8 879	8 862	8 250	9 418	9 182	9 634	9 362	8 993	14 407	14 209	17 666	14 234	12 983	10 119
Pulp, Paper and Printing	12 862	12 230	12 288	9 783	10 920	16 855	16 379	12 642	15 917	17 351	16 734	11 552	15 625	15 202
Wood and Wood Products	1 717	1 702	1 790	2 044	2 250	1 657	1 610	1 771	1 675	1 902	1 867	2 093	1 792	3 297
Construction	731	709	878	1 533	1 475	550	534	1 670	1 461	1 828	1 594	1 497	1 229	1 299
Textiles and Leather	3 508	3 261	3 511	3 395	3 699	2 404	2 336	2 252	2 782	2 976	2 577	2 154	1 957	1 937
Non Specified (Industry)	3 142	3 120	3 019	3 358	4 545	1 977	1 921	1 062	1 213	1 320	1 280	1 451	1 648	2 935
Total Other Sectors	40 405	51 290	56 759	67 027	73 770	69 654	73 198	81 319	73 754	86 903	82 103	93 742	89 129	102 764
Commerce - Public Services	7 713	12 074	18 190	23 359	24 605	19 177	18 636	27 305	24 049	30 980	27 117	34 435	32 382	41 148
Residential	32 327	38 779	38 138	43 180	48 616	49 912	53 952	53 409	49 149	55 297	54 372	58 644	56 112	60 927
Agriculture	365	438	431	488	549	564	610	605	556	626	614	663	634	688
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	10 518	10 781	10 669	10 554	10 644	10 504	9 945	10 336	11 278	10 253	10 795

Renewable Fuels

Table 27: National Energy Balance 1990-2005. Fuel Wood [TJ].

111A Fuel Wood	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	61 401	66 501	63 235	65 763	70 726	65 357	63 418	64 510	58 533	64 443	61 633	61 464	59 393	62 699
Total Imports (Balance)	2 288	2 832	2 421	1 623	2 423	2 017	1 604	1 486	1 803	1 803	2 104	2 530	3 211	3 151
Total Exports (Balance)	28	80	57	222	107	114	140	34	180	180	379	931	1 205	1 060
Stock Change (National Territory)	-545	706	382	190	243	-54	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	63 116	69 960	65 982	67 354	73 285	67 206	64 882	65 963	60 156	66 066	63 358	63 063	61 399	64 790
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	210	0	0	0	0	0	49	54
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	210	0	0	0	0	0	49	54
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	69 960	65 982	67 354	73 285	67 206	64 672	65 963	60 156	66 065	63 358	63 063	61 350	64 737
Total Transport	2	2	1	1	1	0	0	0	0	0	0	0	0	0
Rail	2	2	1	1	1	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	661	734	706	1 074	783	272	151	1 858	946	1 144	1 423	1 065	887	941
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	47	44	43	62	7	1	1	0	0	0	0	7	8	9
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Machinery	47	52	60	62	12	17	9	28	31	32	30	28	34	26
Mining and Quarrying	0	9	0	0	2	0	0	1	1	1	1	1	1	2

Food, Beverages and Tobacco	121	114	77	93	23	15	8	18	17	21	21	21	20	21
Pulp, Paper and Printing	9	26	0	0	54	1	1	0	0	0	0	0	0	0
Wood and Wood Products	233	253	221	300	319	76	42	1 610	706	862	1 147	779	615	689
Construction	0	0	102	289	142	79	44	117	112	128	133	134	126	114
Textiles and Leather	19	26	17	21	5	0	0	2	2	2	2	2	1	1
Non Specified (Industry)	186	210	187	248	219	83	46	81	77	98	88	92	80	78
Total Other Sectors	62 454	69 225	65 275	66 278	72 501	66 934	64 521	64 105	59 210	64 921	61 935	61 998	60 463	63 795
Commerce - Public Services	1 330	1 294	1 177	1 167	1 063	873	486	479	342	499	486	486	527	511
Residential	57 500	63 902	60 298	61 250	67 202	62 144	60 238	59 853	55 377	60 601	57 805	57 865	56 381	59 532
Agriculture	3 625	4 028	3 801	3 861	4 236	3 917	3 797	3 773	3 491	3 820	3 644	3 648	3 554	3 753
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 28: National Energy Balance 1990-2005. Wood Waste [TJ].

116A Wood waste; Other	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	13 668	14 819	15 705	18 738	20 571	27 344	23 220	40 276	37 426	45 486	45 455	53 582	53 935	58 352
Total Imports (Balance)	1 864	2 437	2 536	2 144	1 744	2 838	2 344	2 641	2 819	4 095	4 472	4 239	6 717	7 930
Total Exports (Balance)	2 072	2 116	2 240	2 617	2 819	5 181	5 034	6 137	6 509	7 978	6 855	10 413	11 443	14 448
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	-261	65
Gross Inland Deliveries (Obs.)	13 461	15 139	16 001	18 265	19 496	25 001	20 530	36 781	33 736	41 602	43 072	47 408	48 948	51 900
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 269	3 684	4 138	8 636	9 778	12 756	9 180	13 618	13 438	14 668	17 665	19 341	21 212	21 833
Public Electricity	0	0	0	0	0	0	13	17	9	517	1 377	1 155	2 267	2 769
Public Combined Heat and Power	0	0	0	0	47	101	98	81	179	625	736	1 013	2 833	4 429
Public Heat Plants	2 045	3 020	3 404	4 332	5 988	5 904	6 616	8 336	9 207	10 971	11 369	13 214	12 078	10 264
Auto Producers of Electricity	0	0	0	189	2 493	3 041	272	2 713	1 872	824	2 502	2 371	1 728	1 351
Auto Producers for CHP	224	664	734	4 115	1 250	3 638	2 102	2 379	2 088	1 522	1 554	1 403	2 218	2 865
Auto Producer Heat Plants	0	0	0	0	0	72	79	92	83	209	125	185	87	154
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0	1 450
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	1 450
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	11 192	11 455	11 863	9 629	9 718	12 245	11 350	23 163	20 298	26 934	25 408	28 067	27 736	28 617
Total Transport	79	87	113	233	250	272	291	340	367	404	426	436	537	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)	79	87	113	233	250	272	291	340	367	404	426	436	537	0
Total Industry	9 243	9 116	9 460	6 699	6 584	7 577	6 459	15 574	11 708	16 236	14 653	15 424	13 817	15 020
Iron and Steel	0	0	0	0	20	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	2 898	2 902	3 258	1 722	2 062	2 413	1 575	3 949	2 882	1 257	1 124	1 326	1 634	2 010
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	2	0	0	0	0	0	10	68	64	64
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Machinery	0	0	0	0	22	18	17	44	49	137	155	225	267	236
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	3	9	12
Food, Beverages and Tobacco	10	10	10	9	6	1	1	187	204	236	226	154	68	72
Pulp, Paper and Printing	3 660	3 468	3 920	3 901	2 502	2 761	3 746	4 730	1 778	3 690	2 710	3 170	4 318	5 162
Wood and Wood Products	2 569	2 620	2 185	968	1 810	2 076	910	5 791	5 810	9 756	9 230	9 308	6 332	6 254
Construction	39	39	29	27	47	71	55	303	361	406	399	391	410	438
Textiles and Leather	0	0	0	0	0	0	0	3	3	3	3	6	9	10
Non Specified (Industry)	68	78	58	72	114	236	154	567	621	751	797	774	703	758
Total Other Sectors	1 870	2 251	2 290	2 697	2 884	4 396	4 600	7 248	8 223	10 294	10 328	12 207	13 382	13 597
Commerce - Public Services	765	854	793	698	581	1 425	1 351	1 716	2 126	2 262	2 241	2 663	3 798	4 021
Residential	551	739	804	1 137	1 330	1 795	2 198	3 894	4 286	5 703	5 728	6 809	6 387	6 603
Agriculture	554	659	693	862	972	1 176	1 051	1 639	1 811	2 329	2 359	2 735	3 197	2 972
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 29: National Energy Balance 1990-2005. Black Liquor [TJ].

215A Black Liquor	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	17 799	17 737	18 067	21 392	21 174	21 675	22 916	23 647	24 121	23 299	22 776	22 973	24 307	23 808
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	17 737	18 067	21 392	21 174	21 675	22 916	23 647	24 121	23 299	22 776	22 973	24 307	23 808
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	5 260	5 670	6 076	9 267	9 505	8 580	11 354	10 234	7 621	7 612	9 961	11 036	10 731	11 743
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	2 822	3 024	5 271	5 406	5 140	8 867	6 156	2 001	3 116	2 782	6 647	6 193	6 558

Auto Producers for CHP	2 642	2 848	3 052	3 997	4 099	3 440	2 487	4 079	5 620	4 496	7 179	4 390	4 538	5 185
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	12 067	11 991	12 125	11 669	13 094	11 562	13 413	16 500	15 687	12 815	11 937	13 576	12 065
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	12 067	11 991	12 125	11 669	13 094	11 562	13 413	16 500	15 687	12 815	11 937	13 576	12 065
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	9	9
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	12 540	12 067	11 991	12 125	11 669	13 094	11 562	13 367	16 439	15 626	12 757	11 880	13 508	11 997
Wood and Wood Products	0	0	0	0	0	0	0	46	61	61	56	57	51	51
Construction	0	0	0	0	0	0	0	0	0	0	1	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	8	8
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 1990-2005. Biogas [TJ].

309A Biogas	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	0	0	0	35	39	48	27	237	331	265	667	330	482	676
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	35	39	48	27	237	331	265	667	330	482	676
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	35	39	48	27	130	184	149	204	199	285	471
Public Electricity	0	0	0	0	0	0	0	13	20	20	0	0	77	130
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	85	198
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	29	69	64	106	106	60	49
Auto Producers for CHP	0	0	0	35	39	48	27	88	95	64	98	93	64	95
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	107	146	116	463	131	197	205
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	102	146	95	463	131	197	205
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	310	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	21	26	84	93
Pulp, Paper and Printing	0	0	0	0	0	0	0	102	116	95	131	105	112	112
Wood and Wood Products	0	0	0	0	0	0	0	0	30	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	5	0	20	0	0	0	0
Commerce - Public Services	0	0	0	0	0	0	0	5	0	20	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 1990-2005. Sewage Sludge Gas [TJ].

309B Sewage sludge gas	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	0	0	0	619	668	691	715	70	144	445	114	259	249	268
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	619	668	691	715	70	144	445	114	259	249	268
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	619	668	691	715	70	144	148	114	72	96	115
Public Electricity	0	0	0	10	31	52	50	17	49	52	57	49	61	50
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	4	2	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	39	40	0	0	11	21
Auto Producers for CHP	0	0	0	609	637	635	663	53	56	56	57	22	23	43
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	297	0	187	153	153
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	297	0	187	153	153
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	297	0	187	153	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	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 1990-2005. Landfill Gas [TJ].

310A Landfill Gas	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	0	0	0	195	307	524	527	524	457	860	381	491	458	346
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	195	307	524	527	524	457	860	381	491	458	346
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	146	271	519	520	524	457	859	381	491	458	346
Public Electricity	0	0	0	0	0	0	0	43	58	63	58	207	47	43
Public Combined Heat and Power	0	0	0	29	31	27	30	0	0	4	0	18	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	117	240	492	490	481	399	752	298	266	398	225
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	39	26	0	13	78
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	49	36	5	7	0	0	1	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	1	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	1	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	49	36	5	7	0	0	0	0	0	0	0
Commerce - Public Services	0	0	0	49	36	5	7	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 33: National Energy Balance 1990-2005. Municipal Solid Waste [TJ].

114B Municipal Solid Waste	**1990**	**1991**	**1992**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Indigenous Production	2 414	2 899	3 485	3 911	4 769	4 895	4 782	4 519	4 520	4 609	4 915	5 785	7 581	7 165
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	2 899	3 485	3 911	4 769	4 895	4 782	4 519	4 520	4 609	4 915	5 785	7 581	7 165
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 414	2 899	3 485	3 911	4 769	4 895	4 782	4 519	4 520	4 609	4 915	5 785	7 581	7 165
Public Electricity	0	0	0	0	0	0	0	513	595	595	667	1 551	2 888	2 781
Public Combined Heat and Power	1 724	2 179	2 314	2 318	2 499	2 594	2 579	2 340	2 233	2 235	2 283	2 426	2 598	2 410
Public Heat Plants	690	720	1 170	1 593	2 269	2 301	2 203	1 666	1 692	1 779	1 965	1 807	1 890	1 974
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	67	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	0	138	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	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 1990-2005. Industrial Waste [TJ].

115A Industrial Waste	1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Indigenous Production	6 576	7 180	8 525	7 005	9 246	8 227	7 503	8 517	6 704	9 813	11 551	12 471	14 435	13 125
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	7 180	8 525	7 005	9 246	8 227	7 503	8 517	6 704	9 813	11 551	12 471	14 435	13 125
Statistical Difference	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Total Transformation Sector	2 542	1 941	2 945	1 929	4 735	3 614	2 152	3 614	1 966	1 855	2 902	2 875	3 166	2 509

Public Electricity	0	0	0	0	0	0	0	133	134	134	796	1 164	993	672
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	937	1 047	812	807	667
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	3	2
Auto Producers of Electricity	0	0	0	0	1 613	1 274	543	1 152	814	193	466	294	181	180
Auto Producers for CHP	2 542	1 941	2 945	1 929	3 122	2 340	1 609	2 329	1 018	591	593	605	1 181	988
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	4 034	5 239	5 580	5 076	4 511	4 614	5 351	4 903	4 738	7 958	8 649	9 595	11 268	10 615
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	4 269	4 888	4 556	3 958	4 031	4 738	4 298	4 183	7 327	8 031	8 947	10 588	9 928
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	1 567	2 024	2 303	1 908	989	1 168	1 102	546	171	1 920	2 410	2 980	4 107	3 791
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	1 311	1 665	1 876	1 976	2 165	2 101	2 664	2 877	3 557	4 545	4 965	5 305	5 338	5 005
Transportation Equipment	0	9	9	10	6	7	7	1	1	0	0	0	0	0
Machinery	0	0	0	0	1	1	2	0	0	0	1	9	9	30
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	5	6	6	0	0	0	0	0	0	0
Pulp, Paper and Printing	0	0	0	0	60	66	70	136	132	113	89	112	128	125
Wood and Wood Products	37	478	580	553	645	587	787	692	277	688	503	475	937	900
Construction	0	9	18	10	8	9	10	16	16	22	23	22	25	30
Textiles and Leather	0	0	0	10	5	6	6	5	5	9	7	8	0	0
Non Specified (Industry)	9	83	101	90	73	81	85	24	24	30	34	36	44	47
Total Other Sectors	1 110	970	692	520	553	582	613	605	555	630	618	648	681	687
Commerce - Public Services	1 110	970	692	520	553	582	613	605	555	630	618	648	681	687
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 2006) which are used for unit conversion.

Table 35: Net calorific values for 1990-2005 in [MJ/kg], [MJ/m³] taken from (IEA JQ 2006).

Fuel Code	Fuel Name		1990	1991	1992	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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	27.66	27.99	27.99	27.50	27.50	28.32	28.32
		T	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	27.99
104A	Hard Coal Briquettes	A	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	31.00
105A	Brown Coal	FC	10.90	10.90	10.90	10.90	9.90	9.90	9.90	9.77	9.82	9.82	9.82	9.82	9.91	9.91
		T	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	9.09
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	28.20	28.20	28.20	29.00	29.00	29.00	29.00	29.00	29.00	29.00
113A	Peat	FC	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80
304A	Coke Oven Gas	P	17.90	17.90	17.90	17.90	17.90	17.90	17.90	17.90	17.90	17.90	17.60	17.90	17.90	17.90
305A	Blast Furnace Gas	P	3.10	3.10	3.10	3.10	3.10	3.10	3.10	4.10	4.10	4.10	4.27	3.70	3.69	3.65
110A	Petrol Coke	A	34.30	34.30	34.30	28.35	32.15	32.80	33.99	33.92	33.93	33.93	31.33	31.33	31.33	31.33
201A	Crude Oil	A	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	42.51
203X	Residual Fuel Oil	A	41.00	41.10	41.10	40.46	40.33	40.28	40.27	40.69	41.66	41.72	41.48	41.44	41.30	41.23
204A	Gasoil	A	42.60	42.60	42.60	42.70	42.80	42.80	42.80	42.80	42.80	42.80	42.80	42.80	42.80	42.80
2050	Diesel	A	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	42.80
206A	Petroleum	A	43.60	43.60	43.60	43.30	43.38	43.40	43.41	43.31	43.30	43.30	43.30	43.30	43.30	43.30
206B	Kerosene	A	43.60	43.60	43.60	43.30	43.38	43.40	43.41	43.31	43.30	43.30	43.30	43.30	43.30	43.30
207A	Aviation Gasoline	A	41.60	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.51	42.49	42.49	42.50	42.49
2080	Motor Gasoline	A	41.60	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.51	42.49	42.49	42.50	42.49
217A	Refinery Feedstocks	A	41.87	42.24	42.30	42.56	42.63	42.68	42.25	42.27	42.56	42.65	42.77	41.95	42.41	42.24

219A	Lubricants	A	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	43.95
220A	White Spirit	A	41.60	41.60	41.60	42.49	42.47	42.52	42.55	44.10	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	44.04	43.62	43.84	44.28	43.95	43.52	44.01
224A	Other Petroleum Products	FC	34.30	34.30	34.30	28.35	32.15	32.80	33.99	33.92	33.93	33.93	31.33	31.33	31.33	31.33
		NEU	41.80	41.80	41.80	41.80	41.80	41.80	41.80	44.04	43.62	43.84	44.28	43.95	43.52	44.01
302A	Natural Gas Liquids (NGL)	A	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	42.51
303A	Liquified Petroleum Gas (LPG)	A	46.30	46.20	46.20	46.30	46.31	46.31	46.32	46.00	46.00	46.00	46.00	46.00	46.00	46.00
308A	Refinery Gas	A	49.00	49.00	49.00	49.00	49.00	49.00	49.00	42.23	45.93	45.93	45.93	45.93	45.93	45.93
301A	Natural Gas	A	36.00	36.00	36.00	36.00	36.00	36.00	36.00	35.85	35.85	35.85	35.85	35.85	35.85	36.37

Legend: A:….Average; T. ...Transformation; FC. ... Final Consumption; P……Production; NEU….non-energy use;

Table 36 presents the net calorific values from STATISTIK AUSTRIA that 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	2 C 2	Ferroalloys Production
1	ENERGY	3	SOLVENT AND OTHER PRODUCT USE
1 A	FUEL COMBUSTION ACTIVITIES	4	AGRICULTURE
1 A 1	Energy Industries	4 D	AGRICULTURAL SOILS
1 A 2	Manufacturing Industries and Construction	4 D 1	Direct Soil Emissions
1 A 3	Transport	4 D 2	Animal Production
1 A 4	Other Sectors	4 D 3	Indirect Emissions
1 A 5	Other	4 D 4	Other
1 B	FUGITIVE EMISSIONS FROM FUELS	5	LAND USE, LAND USE CHANGE AND FORESTRY
2	INDUSTRIAL PROCESSES	6	WASTE
2 A 1	Cement Production	6 A 1	Managed Waste disposal
2 A 2	Lime Production	6 B 1	Industrial Wastewater
2 B 1	Ammonia Production	6 B 2	Domestic and Commercial Wastewater
2 C 1	Iron and Steel Production	6 D 2	Compost production

Recalculation of CO_2 Emissions by Categories

Explanations are provided in Chapter 9 Recalculations and Improvements and in the sector specific chapters of this report.

Table 2: Recalculation Difference of CO_2 Emissions 1990-1999

IPCC Cat.	CO_2 [Gg]; Differences with respect to Submission 2006									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	-3.05	-2.52	-2.27	-3.98	-3.08	-3.42	-3.45	-7.43	-25.39	-107.49
1	-2.32	-2.84	-2.62	-3.19	-2.19	-2.43	-2.54	-6.44	-24.41	-106.67
1 A 1	-3.71	-4.24	-3.85	-4.02	-2.77	-2.96	-3.36	-3.62	-3.21	-29.54
1 A 2	126.36	124.99	111.28	83.02	58.63	57.56	61.37	-164.05	-210.22	-287.31
1 A 3	0.02	-0.02	0.00	-0.01	0.02	0.02	0.04	-0.02	0.03	-0.62
1 A 4	-124.99	-123.56	-110.05	-82.17	-58.07	-57.05	-60.59	161.25	189.00	210.80
1 A 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	-0.73	0.32	0.35	-0.79	-0.90	-0.98	-0.91	-0.99	-0.99	-0.82
2 A 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 A 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 B 1	-0.74	-0.77	-0.69	-0.79	-0.90	-0.98	-0.91	-0.99	-0.99	-0.82
2 C 1	0.01	1.09	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 C 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	-121.67	58.97	-114.09	-108.61	95.72	-482.06	-207.61	-199.92	-426.42	-484.28
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 3: Recalculation Difference of CO_2 Emissions 2000-2004

IPCC Cat.	CO_2 [Gg]; Differences with respect to Submission 2006				
	2000	2001	2002	2003	2004
Total	-225.83	-134.46	-233.79	410.63	36.50
1	-225.03	-133.67	-230.12	414.62	-23.28
1 A 1	-111.39	-11.41	-10.37	-186.45	505.11
1 A 2	-213.96	252.74	-252.90	308.53	-211.54
1 A 3	-0.06	-140.89	-231.59	-173.16	-172.05
1 A 4	100.39	-154.30	263.86	465.70	-144.81
1 A 5	0.00	-79.81	0.89	0.00	0.00
2	-0.80	-0.78	-0.95	1.45	67.94
2 A 1	0.00	0.00	0.00	0.00	35.53
2 A 2	0.00	0.00	0.00	2.21	1.61
2 B 1	-0.80	-0.78	-0.95	-0.75	-0.76
2 C 1	0.00	0.00	0.00	0.00	31.42
2 C 2	0.00	0.00	0.00	0.00	0.14
3	0.00	0.00	-2.72	-5.44	-8.16

IPCC Cat.	CO_2 [Gg]; Differences with respect to Submission 2006				
	2000	2001	2002	2003	2004
5	-499.06	-527.44	-518.02	-519.00	-512.79
6	0.00	0.00	0.00	0.00	0.00

Recalculation of CH_4 Emissions by Categories

Explanations are provided in Chapter 9 Recalculations and Improvements and in the sector specific chapters of this report.

Table 4: Recalculation Difference of CH_4 Emissions 1990-1999

IPCC Cat.	CH_4 [Gg]; Differences with respect to Submission 2006									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.13	0.08	0.24
1	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.04	0.00	0.15
1 A 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 4	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.15
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	NA=	NA=	NA=	NA=	NA=	NA=	NA=	NA=	NA=	NA=
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 D 1	NA->0,33	NA->0,33	NA->0,31	NA->0,47	NA->0,4	NA->0,44	NA->0,45	NA->0,45	NA->0,45	NA->0,45
4 D 4	0,33->NO	0,33->NO	0,31->NO	0,47->NO	0,4->NO	0,44->NO	0,45->NO	0,45->NO	0,45->NO	0,45->NO
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09
6 A 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09
6 B 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 D 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5: Recalculation Difference of CH_4 Emissions 2000-2004

IPCC Cat.	CH_4 [Gg]; Differences with respect to Submission 2006				
	2000	2001	2002	2003	2004
Total	0.29	0.46	0.95	0.41	-9.15
1	0.18	0.33	0.84	0.19	-0.25
1 A 1	0.00	0.00	0.00	-0.02	-0.01
1 A 2	-0.01	0.03	0.02	0.05	0.07
1 A 3	0.00	-0.01	-0.01	-0.01	-0.01

IPCC Cat.	CH_4 [Gg]; Differences with respect to Submission 2006				
	2000	2001	2002	2003	2004
1 A 4	0.19	0.33	0.83	0.17	-0.30
2	0.00	0.00	0.00	0.00	0.00
3	NA=	NA=	NA=	NA=	NA=
4	0.00	0.00	0.00	0.00	-0.06
4 D 1	NA->0,45	NA->0,43	NA->0,38	NA->0,41	NA->0,37
4 D 4	0,45->NO	0,43->NO	0,38->NO	0,41->NO	0,42->NO
5	0.00	0.00	0.00	0.00	0.00
6	0.11	0.13	0.12	0.22	-8.85
6 A 1	0.06	0.04	0.01	0.01	-9.01
6 B 2	0.00	0.00	0.00	0.00	0.01
6 D 2	0.06	0.09	0.11	0.21	0.15

Recalculation of N_2O Emissions by Categories

Explanations are provided in Chapter 9 Recalculations and in the sector specific chapters of this report.

Table 6: Recalculation Difference of N_2O Emissions 1990-1999

IPCC Cat.	N_2O [Gg]; Differences with respect to Submission 2006									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	0.31	0.34	0.30	0.29	0.27	0.20	0.19	0.19	0.15	0.17
1	0.01	0.04	0.02	0.00	-0.01	-0.01	-0.01	0.00	0.01	0.03
1 A 1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1 A 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
1 A 3	0.00	0.03	0.01	-0.01	-0.01	-0.02	-0.01	-0.01	0.00	0.00
1 A 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 D 1	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03
4 D 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 D 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 D 4	0,02->NO	0,02->NO	0,02->NO	0,03->NO	0,03->NO	0,03->NO	0,03->NO	0,03->NO	0,03->NO	0,03->NO
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.29	0.29	0.28	0.28	0.27	0.20	0.19	0.20	0.14	0.14
6 B 1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

6 B 2	0.29	0.29	0.28	0.28	0.27	0.20	0.19	0.20	0.14	0.14
6 D 2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 7: Recalculation Difference of N_2O Emissions 2000-2004

IPCC Cat.	N_2O [Gg]; Differences with respect to Submission 2006				
	2000	2001	2002	2003	2004
Total	0.18	0.12	0.11	0.02	0.02
1	0.03	0.03	0.06	0.02	0.03
1 A 1	0.01	0.01	0.01	0.00	0.01
1 A 2	0.01	0.02	0.02	-0.01	0.02
1 A 3	0.01	0.00	0.01	0.01	0.01
1 A 4	0.01	0.01	0.02	0.01	-0.01
1 A 5	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00
3	0.00	-0.04	-0.08	-0.11	-0.15
4	0.00	0.00	-0.01	-0.01	-0.02
4 D 1	0.03	0.03	0.02	0.03	0.02
4 D 2	0.00	0.00	0.00	0.00	0.00
4 D 3	0.00	0.00	0.00	-0.01	-0.01
4 D 4	0,03->NO	0,03->NO	0,03->NO	0,03->NO	0,03->NO
5	0.00	0.00	0.00	0.00	0.00
6	0.15	0.13	0.14	0.13	0.16
6 B 1	0.00	0.00	0.00	0.00	0.01
6 B 2	0.14	0.11	0.12	0.10	0.13
6 D 2	0.01	0.01	0.01	0.03	0.02

Recalculation of National Total GHG Emissions

Table 8 compares national total GHG emissions of UNFCCC submission 2007 with UNFCCC submission 2006. Explanations are provided in Chapter 9 Recalculations and in the sector specific chapters of this report.

Table 8: Recalculation Difference of National Total GHG Emissions

Year	National Total GHG emissions without LUCF		
	Submission 2006 [Gg CO_2e]	Submission 2007 [Gg CO_2e]	Recalculation Difference [%]
1990*	78 959.40	79 052.98	0.12%
1991	82 997.57	83 100.95	0.12%
1992	76 300.77	76 394.16	0.12%
1993	76 270.69	76 357.33	0.11%
1994	77 113.09	77 194.64	0.11%
1995	80 234.57	80 294.47	0.07%
1996	83 567.37	83 624.02	0.07%
1997	83 146.28	83 201.23	0.07%
1998	82 605.15	82 626.96	0.03%
1999	80 800.09	80 748.89	-0.06%
2000	81 278.83	81 115.72	-0.20%
2001	85 145.37	85 056.29	-0.10%
2002	86 858.79	86 679.76	-0.21%
2003	92 526.59	92 953.45	0.46%
2004	91 332.60	91 177.27	-0.17%

*Base year is 1990 for all gases

Table 9 and Table 10 present recalculation differences per gas.

Table 9: Recalculation Difference of National CO_2 and CH_4 Emissions.

Year	CO_2 [Gg CO_2e]			CH_4 [Gg CO_2e]		
	Submission 2006	Submission 2007	Recalculation Difference [%]	Submission 2006	Submission 2007	Recalculation Difference [%]
1990*	61 933.39	61 930.34	0.00%	9 178.82	9 180.67	0.02%
1991	65 485.82	65 483.30	0.00%	9 150.38	9 152.25	0.02%
1992	60 043.91	60 041.64	0.00%	8 857.19	8 859.08	0.02%
1993	60 415.32	60 411.34	-0.01%	8 829.83	8 831.72	0.02%
1994	60 766.35	60 763.27	-0.01%	8 636.77	8 638.61	0.02%
1995	63 664.36	63 660.94	-0.01%	8 520.12	8 522.03	0.02%
1996	67 330.66	67 327.21	-0.01%	8 333.02	8 334.90	0.02%
1997	67 155.39	67 147.96	-0.01%	8 057.19	8 059.81	0.03%
1998	66 837.28	66 811.89	-0.04%	7 936.47	7 938.25	0.02%

Year	CO_2 [Gg CO_2e]			CH_4 [Gg CO_2e]		
	Submission 2006	Submission 2007	Recalculation Difference [%]	Submission 2006	Submission 2007	Recalculation Difference [%]
1999	65 444.12	65 336.62	-0.16%	7 759.62	7 764.56	0.06%
2000	66 185.96	65 960.13	-0.34%	7 598.87	7 604.98	0.08%
2001	70 179.02	70 044.56	-0.19%	7 477.62	7 487.32	0.13%
2002	71 943.21	71 709.42	-0.32%	7 336.10	7 356.12	0.27%
2003	77 561.83	77 972.46	0.53%	7 364.43	7 373.07	0.12%
2004	77 103.43	77 139.93	0.05%	7 414.06	7 221.97	-2.59%

*Base year is 1990 for all gases

Table 10: Recalculation Difference of National N_2O and HFC, PFC, SF_6 Emissions

Year	N_2O [Gg]			HFC, PFC, SF_6 [Gg CO_2-equivalent]		
	Submission 2006	Submission 2007	Recalculation Difference [%]	Submission 2006	Submission 2007	Recalculation Difference [%]
1990*	6 242.34	6 337.12	1.52%	1 604.86	1 604.86	0.00%
1991	6 575.71	6 679.74	1.58%	1 785.66	1 785.66	0.00%
1992	6 190.48	6 284.25	1.51%	1 209.19	1 209.19	0.00%
1993	6 021.58	6 110.31	1.47%	1 003.96	1 003.96	0.00%
1994	6 458.80	6 541.59	1.28%	1 251.17	1 251.17	0.00%
1995	6 574.85	6 636.25	0.93%	1 475.24	1 475.24	0.00%
1996	6 272.52	6 330.75	0.93%	1 631.16	1 631.16	0.00%
1997	6 289.29	6 349.04	0.95%	1 644.41	1 644.41	0.00%
1998	6 383.76	6 429.18	0.71%	1 447.63	1 447.63	0.00%
1999	6 305.65	6 357.00	0.81%	1 290.70	1 290.70	0.00%
2000	6 192.10	6 248.71	0.91%	1 301.90	1 301.90	0.00%
2001	6 074.87	6 110.55	0.59%	1 413.86	1 413.86	0.00%
2002	6 069.33	6 104.10	0.57%	1 510.15	1 510.12	0.00%
2003	6 039.35	6 047.04	0.13%	1 560.98	1 560.87	-0.01%
2004	5 283.48	5 288.51	0.10%	1 531.62	1 526.86	-0.31%

*Base year is 1990 for all gases

ANNEX 6: TIER 1 UNCERTAINTY ASSESSMENT

This Annex includes the Tier 1 Uncertainty assessment that complies with Table 6.1 of the IPCC GPG as well as the Tier 2 Uncertainty assessment that complies with Table 6.2 of the IPCC GPG.

A	B	C	D	E	F
IPCC Source category	Gas	Base year emissions 1990	Year 2005 emissions	Activity data uncertainty	Emission factor uncertainty
		Gg CO2 equivalent		%	%
1 A 1 a liquid: Public Electricity and Heat Production	CO2	1229	1083	0.5	0.5
1 A 1 a other: Public Electricity and Heat Production	CO2	118	490	10.0	0.5
1 A 1 a solid: Public Electricity and Heat Production	CO2	6247	5844	0.5	0.5
1 A 1 b liquid: Petroleum refining	CO2	1957	2151	0.5	0.3
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO2	1018	1161	1.0	0.5
1 A 2 other: Manufacturing Industries and Construction	CO2	375	849	10.0	0.5
1 A 2 solid: Manufacturing Industries and Construction	CO2	5014	5602	1.0	0.5
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO2	2883	1920	1.0	0.5
1 A 3 a jet kerosene: Civil Aviation	CO2	24	209	5.0	3.0
1 A 3 b diesel oil: Road	CO2	4013	16645	5.0	3.0
1 A 3 b gasoline: Road	CO2	7911	6393	5.0	3.0
1 A 3 b gasoline: Road	N2O	219	149	5.0	70.0
1 A 4 biomass: Other Sectors	CH4	315	244	10.0	50.0
1 A 4 mobile-diesel: Other Sectors	CO2	1379	1472	1.0	0.5
1 A 4 other: Other Sectors	CO2	239	72	10.0	0.5
1 A 4 solid: Other Sectors	CO2	2654	562	1.0	0.5
1 A 4 stat-liquid: Other Sectors	CO2	7319	7125	1.0	0.5
1 A gaseous: Fuel Combustion (stationary)	CO2	11169	18510	2.0	0.5
1 B 2 b: Natural gas	CH4	273	552	6.0	25.0
2 A 1: Cement Production	CO2	2033	1797	5.0	2.0
2 A 2: Lime Production	CO2	396	579	20.0	5.0
2 A 3: Limestone and Dolomite Use	CO2	222	291	19.6	2.0
2 A 7 b: Sinter Production	CO2	481	310	2.0	5.0
2 B 1: Ammonia Production	CO2	517	503	2.0	4.6
2 B 2: Nitric Acid Production	N2O	912	274	3.0	20.0
2 C 1: Iron and Steel Production	CO2	3546	4995	0.5	0.5
2 C 3: Aluminium production	CO2	158	0	2.0	0.5
2C3: Aluminium production	PFCs	1050	0	0.0	50.0
2C4: SF6 Used in Al and Mg Foundries	SF6	253	0	0.0	5.0
2F1/2/3/4/5: ODS Substitutes	HFCs	21	908	0.0	54.0
2F7: Semiconductor Manufacture	FCs	133	291	0.0	11.2
2F9: Other Sources of SF6	SF6	127	82	0.0	56.0
3: Solvent and other product use	CO2	283	177	5.0	10.0
4 A 1: Cattle	CH4	3561	3029	10.0	20.0
4 B 1: Cattle	N2O	908	789	10.0	100.0
4 B 1: Cattle	CH4	587	459	10.0	70.0
4 B 8: Swine	CH4	448	397	10.0	70.0
4 D 1: Direct Soil Emissions	N2O	1760	1518	5.0	150.0
4 D 3: Indirect Emissions	N2O	1310	1086	5.0	150.0
6 A: Solid waste disposal on land	CH4	3377	1880	12.0	25.0
Total		76439	90395		
% of National Total		96.7%	96.9%		
National Total without LULUCF		**79053**	**93280**		

A	B	G	H	I	J
IPCC Source category	Gas	Combined uncertainty	Combined uncertainty as % of total national emissions in year t	Type A sensitivity	Type B sensitivity
		%	%	%	%
1 A 1 a liquid: Public Electricity and Heat Production	CO2	0.7	0.01	- 0.00	0.01
1 A 1 a other: Public Electricity and Heat Production	CO2	10.0	0.05	0.00	0.01
1 A 1 a solid: Public Electricity and Heat Production	CO2	0.7	0.05	- 0.02	0.08
1 A 1 b liquid: Petroleum refining	CO2	0.6	0.01	- 0.00	0.03
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO2	1.1	0.01	- 0.00	0.02
1 A 2 other: Manufacturing Industries and Construction	CO2	10.0	0.09	0.01	0.01
1 A 2 solid: Manufacturing Industries and Construction	CO2	1.1	0.07	- 0.00	0.07
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO2	1.1	0.02	- 0.02	0.03
1 A 3 a jet kerosene: Civil Aviation	CO2	5.8	0.01	0.00	0.00
1 A 3 b diesel oil: Road	CO2	5.8	1.07	0.16	0.22
1 A 3 b gasoline: Road	CO2	5.8	0.41	- 0.04	0.08
1 A 3 b gasoline: Road	N2O	70.2	0.12	- 0.00	0.00
1 A 4 biomass: Other Sectors	CH4	51.0	0.14	- 0.00	0.00
1 A 4 mobile-diesel: Other Sectors	CO2	1.1	0.02	- 0.00	0.02
1 A 4 other: Other Sectors	CO2	10.0	0.01	- 0.00	0.00
1 A 4 solid: Other Sectors	CO2	1.1	0.01	- 0.03	0.01
1 A 4 stat-liquid: Other Sectors	CO2	1.1	0.09	- 0.02	0.09
1 A gaseous: Fuel Combustion (stationary)	CO2	2.1	0.42	0.07	0.24
1 B 2 b: Natural gas	CH4	25.7	0.16	0.00	0.01
2 A 1: Cement Production	CO2	5.4	0.11	- 0.01	0.02
2 A 2: Lime Production	CO2	20.6	0.13	0.00	0.01
2 A 3: Limestone and Dolomite Use	CO2	19.7	0.06	0.00	0.00
2 A 7 b: Sinter Production	CO2	5.4	0.02	- 0.00	0.00
2 B 1: Ammonia Production	CO2	5.0	0.03	- 0.00	0.01
2 B 2: Nitric Acid Production	N2O	20.2	0.06	- 0.01	0.00
2 C 1: Iron and Steel Production	CO2	0.7	0.04	0.01	0.07
2 C 3: Aluminium production	CO2	2.1	0.00	- 0.00	0.00
2C3: Aluminium production	PFCs	50.0	0.00	- 0.02	0.00
2C4: SF6 Used in Al and Mg Foundries	SF6	5.0	0.00	- 0.00	0.00
2F1/2/3/4/5: ODS Substitutes	HFCs	54.0	0.54	0.01	0.01
2F7: Semiconductor Manufacture	FCs	11.2	0.04	0.00	0.00
2F9: Other Sources of SF6	SF6	56.0	0.05	- 0.00	0.00
3: Solvent and other product use	CO2	11.2	0.02	- 0.00	0.00
4 A 1: Cattle	CH4	22.4	0.75	- 0.02	0.04
4 B 1: Cattle	N2O	100.5	0.88	- 0.00	0.01
4 B 1: Cattle	CH4	70.7	0.36	- 0.00	0.01
4 B 8: Swine	CH4	70.7	0.31	- 0.00	0.01
4 D 1: Direct Soil Emissions	N2O	150.1	2.52	- 0.01	0.02
4 D 3: Indirect Emissions	N2O	150.1	1.80	- 0.01	0.01
6 A: Solid waste disposal on land	CH4	27.7	0.58	- 0.03	0.02
Total			**3.66**		
% of National Total					
National Total without LULUCF					

A	B	K	L	M
IPCC Source category	Gas	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activiyt data uncertainty	Uncertainty introduced into the trend in total national emissions
		%	%	%
1 A 1 a liquid: Public Electricity and Heat Production	CO2	- 0.00242	0.01002	0.01
1 A 1 a other: Public Electricity and Heat Production	CO2	0.00229	0.09066	0.09
1 A 1 a solid: Public Electricity and Heat Production	CO2	- 0.01009	0.05406	0.05
1 A 1 b liquid: Petroleum refining	CO2	- 0.00064	0.01990	0.02
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO2	- 0.00028	0.02149	0.02
1 A 2 other: Manufacturing Industries and Construction	CO2	0.00265	0.15704	0.16
1 A 2 solid: Manufacturing Industries and Construction	CO2	- 0.00215	0.10364	0.10
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO2	- 0.00974	0.03553	0.04
1 A 3 a jet kerosene: Civil Aviation	CO2	0.00707	0.01930	0.02
1 A 3 b diesel oil: Road	CO2	0.46675	1.53972	1.61
1 A 3 b gasoline: Road	CO2	- 0.11616	0.59136	0.60
1 A 3 b gasoline: Road	N2O	- 0.10128	0.01375	0.10
1 A 4 biomass: Other Sectors	CH4	- 0.08415	0.04506	0.10
1 A 4 mobile-diesel: Other Sectors	CO2	- 0.00104	0.02724	0.03
1 A 4 other: Other Sectors	CO2	- 0.00138	0.01325	0.01
1 A 4 solid: Other Sectors	CO2	- 0.01685	0.01040	0.02
1 A 4 stat-liquid: Other Sectors	CO2	- 0.01000	0.13183	0.13
1 A gaseous: Fuel Combustion (stationary)	CO2	0.03463	0.68490	0.69
1 B 2 b: Natural gas	CH4	0.07505	0.06127	0.10
2 A 1: Cement Production	CO2	- 0.01588	0.16628	0.17
2 A 2: Lime Production	CO2	0.00721	0.21414	0.21
2 A 3: Limestone and Dolomite Use	CO2	0.00073	0.10535	0.11
2 A 7 b: Sinter Production	CO2	- 0.01698	0.01145	0.02
2 B 1: Ammonia Production	CO2	- 0.00649	0.01861	0.02
2 B 2: Nitric Acid Production	N2O	- 0.21044	0.01522	0.21
2 C 1: Iron and Steel Production	CO2	0.00524	0.04621	0.05
2 C 3: Aluminium production	CO2	- 0.00123	-	0.00
2C3: Aluminium production	PFCs	- 0.81226	-	0.81
2C4: SF6 Used in Al and Mg Foundries	SF6	- 0.01961	-	0.02
2F1/2/3/4/5: ODS Substitutes	HFCs	0.62370	-	0.62
2F7: Semiconductor Manufacture	FCs	0.01952	-	0.02
2F9: Other Sources of SF6	SF6	- 0.04982	-	0.05
3: Solvent and other product use	CO2	- 0.02052	0.01641	0.03
4 A 1: Cattle	CH4	- 0.30906	0.56046	0.64
4 B 1: Cattle	N2O	- 0.37265	0.14599	0.40
4 B 1: Cattle	CH4	- 0.21562	0.08488	0.23
4 B 8: Swine	CH4	- 0.12145	0.07342	0.14
4 D 1: Direct Soil Emissions	N2O	- 1.10511	0.14043	1.11
4 D 3: Indirect Emissions	N2O	- 0.90766	0.10048	0.91
6 A: Solid waste disposal on land	CH4	- 0.69095	0.41729	0.81
Total				**2.84**
% of National Total				
National Total without LULUCF				

A	B	C	D	E	F	G
IPCC Source category	Gas	Base year emissions 1990	2005 emissions	Uncertainty in 2005 emissions as % of emissions in the category		Uncertainty introduced on national total in 2005
		Gg CO2 equivalent		% below (2.5 percentile)	% above (97.5 percentile)	%
1 A 1 a liquid: Public Electricity and Heat Production	CO2	1229	1083	0.7	0.7	0.01
1 A 1 a other: Public Electricity and Heat Production	CO2	118	490	10.0	9.8	0.05
1 A 1 a solid: Public Electricity and Heat Production	CO2	6247	5844	0.7	0.7	0.04
1 A 1 b liquid: Petroleum refining	CO2	1956	2151	0.6	0.6	0.01
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO2	1018	1162	1.1	1.1	0.01
1 A 2 other: Manufacturing Industries and Construction	CO2	375	849	9.8	9.7	0.09
1 A 2 solid: Manufacturing Industries and Construction	CO2	5015	5601	1.3	1.3	0.08
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO2	2884	1920	1.0	1.0	0.02
1 A 3 a jet kerosene: Civil Aviation	CO2	24	209	5.7	5.8	0.01
1 A 3 b diesel oil: Road	CO2	4015	16646	5.7	5.8	1.04
1 A 3 b gasoline: Road	CO2	7916	6393	5.7	5.8	0.40
1 A 3 b gasoline: Road	N2O	218	148	30.3	72.6	0.09
1 A 4 biomass: Other Sectors	CH4	315	244	13.5	14.3	0.04
1 A 4 mobile-diesel: Other Sectors	CO2	1379	1472	1.1	1.1	0.02
1 A 4 other: Other Sectors	CO2	239	72	9.8	9.7	0.01
1 A 4 solid: Other Sectors	CO2	2654	562	1.1	1.1	0.01
1 A 4 stat-liquid: Other Sectors	CO2	7319	7126	1.1	1.1	0.08
1 A gaseous: Fuel Combustion (stationary)	CO2	11170	18508	3.2	3.2	0.65
1 B 2 b: Natural gas	CH4	273	552	14.4	14.6	0.09
2 A 1: Cement Production	CO2	2033	1796	5.2	5.3	0.10
2 A 2: Lime Production	CO2	397	579	19.8	20.8	0.13
2 A 3: Limestone and Dolomite Use	CO2	223	294	19.3	19.4	0.06
2 A 7 b: Sinter Production	CO2	481	310	5.2	5.2	0.02
2 B 1: Ammonia Production	CO2	517	504	4.9	5.0	0.03
2 B 2: Nitric Acid Production	N2O	912	274	20.0	19.8	0.06
2 C 1: Iron and Steel Production	CO2	3546	4995	0.7	0.7	0.04
2 C 3: Aluminium production	CO2	158	0	-	-	0.00
2C3: Aluminium production	PFC	1047	0	-	-	0.00
2C4: SF6 Used in Al and Mg Foundries	SF6	253	0	-	-	0.00
2F1/2/3/4/5: ODS Substitutes	HFC	21	911	52.3	53.2	0.53
2F7: Semiconductor Manufacture	SF6	102	169	11.1	10.8	0.02
2F9: Other Sources of SF6	SF6	127	82	55.2	55.4	0.05
3: Solvent and other product use	CO2	283	177	4.6	4.7	0.01
4 A 1: Cattle	CH4	3560	3028	21.3	20.8	0.69
4 B 1: Cattle	CH4	588	459	68.4	68.9	0.34
4 B 1: Cattle	N2O	905	786	49.8	101.9	0.66
4 B 8: Swine	CH4	448	397	68.1	69.2	0.30
4 D 1: Direct Soil Emissions	N2O	1772	1528	70.0	203.2	2.55
4 D 3: Indirect Emissions	N2O	1318	1093	70.0	203.2	1.82
6 A: Solid waste disposal on land	CH4	3381	1884	26.5	27.7	0.56
Total		76437	90297			
% of National Total		96.7%	96.8%			
National Total without LULUCF		**79053**	**93280**			**5.14**

A	B	C	D	E	F	G
IPCC Source category	Gas	Base year emissions 1990	2005 emissions	Uncertainty in 2005 emissions as % of emissions in the category		Uncertainty introduced on national total in 2005
		Gg CO2 equivalent		% below (2.5 percentile)	% above (97.5 percentile)	%
Non-Key Sources	CO2	744	911	1.8	1.8	0.02
Non-Key Sources	CH4	621	497	11.1	11.1	0.06
Non-Key Sources	N2O	1137	1409	17.7	31.6	0.40
Non-Key Sources	PFC	29	118	11.2	10.9	0.01
Non-Key Sources	HFC	2	4	11.2	10.9	0.00
Non-Key Sources	SF6	21	36	55.4	54.9	0.02

A	B	H	I	J	K
IPCC Source category	Gas	% change in emissions between 2005 and base year	Range of likely % change between 2005 and base year		Uncertainty introduced into the trend in total national emissions
		%	Lower % (2.5 percentile)	Upper % (97.5 percentile)	%-points
1 A 1 a liquid: Public Electricity and Heat Production	CO2	-11.9	-13.3	-10.6	0.01
1 A 1 a other: Public Electricity and Heat Production	CO2	314.9	238.2	399.2	0.06
1 A 1 a solid: Public Electricity and Heat Production	CO2	-6.5	-7.6	-4.8	0.05
1 A 1 b liquid: Petroleum refining	CO2	9.9	8.4	11.3	0.02
1 A 2 mobile-liquid: Manufacturing Industries and Construction	CO2	14.1	11.1	17.1	0.02
1 A 2 other: Manufacturing Industries and Construction	CO2	126.4	77.9	175.5	0.12
1 A 2 solid: Manufacturing Industries and Construction	CO2	11.7	8.0	15.2	0.13
1 A 2 stat-liquid: Manufacturing Industries and Construction	CO2	-33.4	-35.5	-31.2	0.04
1 A 3 a jet kerosene: Civil Aviation	CO2	762.8	667.9	864.8	0.02
1 A 3 b diesel oil: Road	CO2	314.6	269.9	362.2	1.19
1 A 3 b gasoline: Road	CO2	-19.2	-30.5	-5.8	0.65
1 A 3 b gasoline: Road	N2O	-32.2	-141.2	-16.5	0.05
1 A 4 biomass: Other Sectors	CH4	-22.7	-47.1	2.7	0.05
1 A 4 mobile-diesel: Other Sectors	CO2	6.8	3.9	9.7	0.03
1 A 4 other: Other Sectors	CO2	-70.1	-89.9	-50.4	0.03
1 A 4 solid: Other Sectors	CO2	-78.8	-81.0	-77.1	0.04
1 A 4 stat-liquid: Other Sectors	CO2	-2.6	-5.4	0.0	0.13
1 A gaseous: Fuel Combustion (stationary)	CO2	65.7	54.6	81.5	0.89
1 B 2 b: Natural gas	CH4	102.5	72.1	138.1	0.06
2 A 1: Cement Production	CO2	-11.6	-23.4	-0.2	0.17
2 A 2: Lime Production	CO2	45.7	-28.2	115.4	0.18
2 A 3: Limestone and Dolomite Use	CO2	32.1	-27.0	96.8	0.09
2 A 7 b: Sinter Production	CO2	-35.7	-41.4	-29.8	0.02
2 B 1: Ammonia Production	CO2	-2.6	-7.7	2.6	0.02
2 B 2: Nitric Acid Production	N2O	-69.9	-93.7	-40.6	0.16
2 C 1: Iron and Steel Production	CO2	40.9	39.2	42.7	0.04
2 C 3: Aluminium production	CO2	-100.0	-103.8	-96.5	0.00
2C3: Aluminium production	PFC	-100.0	-188.3	-5.2	0.66
2C4: SF6 Used in Al and Mg Foundries	SF6	-100.0	-110.3	-89.9	0.02
2F1/2/3/4/5: ODS Substitutes	HFC	4224.2	-651.4	8565.7	0.63
2F7: Semiconductor Manufacture	SF6	65.5	20.2	104.5	0.03
2F9: Other Sources of SF6	SF6	-35.7	-162.4	97.2	0.11
3: Solvent and other product use	CO2	-37.2	-47.6	-28.4	0.02
4 A 1: Cattle	CH4	-15.0	-35.4	0.9	0.45
4 B 1: Cattle	CH4	-21.9	-65.2	5.8	0.13
4 B 1: Cattle	N2O	-13.1	-81.6	3.0	0.17
4 B 8: Swine	CH4	-11.4	-46.0	11.1	0.07
4 D 1: Direct Soil Emissions	N2O	-13.8	-177.3	-1.3	0.51
4 D 3: Indirect Emissions	N2O	-17.1	-213.5	-2.2	0.46
6 A: Solid waste disposal on land	CH4	-44.3	-77.8	-17.2	0.75
Total					
% of National Total					
National Total without LULUCF					**2.69**

A	B	H	I	J	K
IPCC Source category	Gas	% change in emissions between 2005 and base year	Range of likely % change between 2005 and base year		Uncertainty introduced into the trend in total national emissions
		%	Lower % (2.5 percentile)	Upper % (97.5 percentile)	%-points
Non-Key Sources	CO2	22.5	16.9	27.5	0.02
Non-Key Sources	CH4	-20.0	-33.6	-9.7	0.05
Non-Key Sources	N2O	24.0	11.4	37.2	0.10
Non-Key Sources	PFC	305.6	198.2	405.6	0.02
Non-Key Sources	HFC	111.1	49.5	163.2	0.00
Non-Key Sources	SF6	75.5	-123.7	272.1	0.03

ANNEX 7: CRF FOR 2005

This Annex includes the CRF-Tables for the year 2005 as included in Austria's data submission 2007 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	70 772.15	45.95	2.55	218.50	688.99	72.01	25.13
A. Fuel Combustion Activities (Sectoral Approach)	70 567.12	14.18	2.55	218.50	688.99	68.92	25.00
1. Energy Industries	15 834.21	0.22	0.20	12.69	3.38	1.19	6.90
a. Public Electricity and Heat Production	12 735.68	0.21	0.18	8.90	2.91	1.19	3.55
b. Petroleum Refining	2 826.92	IE,NO	0.02	3.05	0.42	IE	3.35
c. Manufacture of Solid Fuels and Other Energy Industries	271.61	0.01	0.00	0.74	0.05	0.00	NA
2. Manufacturing Industries and Construction	15 537.98	0.57	0.51	34.73	158.83	3.02	9.19
a. Iron and Steel	6 393.45	0.08	0.06	5.02	138.44	0.25	4.43
b. Non-Ferrous Metals	406.34	0.01	0.00	1.17	0.14	0.01	0.16
c. Chemicals	1 360.52	0.09	0.02	1.29	1.40	0.22	0.67
d. Pulp, Paper and Print	2 283.02	0.14	0.08	5.23	1.98	0.25	1.17
e. Food Processing, Beverages and Tobacco	767.84	0.02	0.00	0.76	0.13	0.01	0.30
f. Other *(as specified in table 1.A(a) sheet 2)*	4 326.81	0.23	0.35	21.27	16.75	2.28	2.46
Other non-specified	4 326.81	0.23	0.35	21.27	16.75	2.28	2.46
3. Transport	24 028.75	0.92	0.88	135.30	162.71	20.93	0.30
a. Civil Aviation	217.39	0.01	0.01	0.73	2.72	0.27	0.07
b. Road Transportation	23 037.28	0.87	0.84	131.02	156.62	19.84	0.15
c. Railways	148.44	0.00	0.02	1.38	0.37	0.18	0.06
d. Navigation	81.25	0.01	0.02	0.70	2.90	0.65	0.02
e. Other Transportation *(as specified in table 1.A(a) sheet 3)*	544.39	0.01	0.00	1.47	0.10	0.00	NA
Pipeline transport	544.39	0.01	0.00	1.47	0.10	0.00	NA

TABLE 1 SECTORAL REPORT FOR ENERGY
(Sheet 2 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_X	CO	NMVOC	SO_2
	(Gg)						
4. Other Sectors	15 046.02	12.47	0.95	35.58	363.35	43.72	8.57
a. Commercial/Institutional	4 056.20	0.58	0.08	3.41	13.61	1.46	1.43
b. Residential	9 337.81	10.92	0.43	13.89	307.63	34.15	6.80
c. Agriculture/Forestry/Fisheries	1 652.01	0.97	0.44	18.28	42.11	8.12	0.34
5. Other *(as specified in table 1.A(a) sheet 4)*	120.15	0.00	0.01	0.20	0.72	0.04	0.04
a. Stationary	NA	NA	NA	NA	NA	NA	NA
b. Mobile	120.15	0.00	0.01	0.20	0.72	0.04	0.04
Military use	120.15	0.00	0.01	0.20	0.72	0.04	0.04
B. Fugitive Emissions from Fuels	205.04	31.77	IE,NA	IE,NA	IE,NA	3.09	0.13
1. Solid Fuels	IE,NA,NO	IE,NA,NO	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
a. Coal Mining and Handling	IE,NA,NO	IE,NO	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	205.04	31.77	IE,NA	IE,NA	IE,NA	3.09	0.13
a. Oil	122.00	5.49	IE,NA	NA	NA	2.84	NA
b. Natural Gas	83.04	26.28				0.25	0.13
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	1 730.71	0.03	0.06	5.53	1.71	0.72	0.55
Aviation	1 730.71	0.03	0.06	5.53	1.71	0.72	0.55
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	15 174.23						

(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/2005:Usage of "NO" notation keys in table 1.A(a)s1 to s4 : Energy statistics does not inquire all consumers but is limited to statistical samples. In the case that a statistical inquiry results in zero consumption of a specific sector and fuel group it is not always possible to decide if there occurs a consumption of a specific fuel category in a specific sector and year. However, as the energy statistics is based on a top down/bottom up approach it is assured that total national fuel consumption is equivalent to category 1A fuel consumption. Thus "NO" may be sometimes interpreted as "included elsewhere".
1.B.1 Solid Fuels/2005:1 B 1 b: Emissions from coke ovens are included in 1 A 2 a Iron and Steel.
1 B 1 a ii: emissions from Post-Mining are included in Mining.
1.B.2 Oil and Natural Gas/2005:1 B 2 a i, 1 B 2 b i and 1 B 2 b ii exept CO2 emissions from processing of sour gas are included in 1 B 2 a ii.
1 B 2 a v also includes storage in storage tanks and refinery dispatch station - only NMVOC emissions are estimated.
1 B 2 a iv CO2 is included in 1 A 1 b, flaring in the refinery is also included in 1 A 1 b.
1 B 2 b iiiTransmission includes fugitve and venting.
1.C1 International Bunkers/2005:Kerosene consumption in Austria is divided into national and international transport by using national LTO-statistics.

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 1 of 4)

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	1 146 820.35	NCV				70 567.12	14.18	2.55
Liquid Fuels	524 953.89	NCV	73.60	2.31	3.32	38 637.15	1.21	1.74
Solid Fuels	123 580.52	NCV	97.18	5.51	0.86	12 009.95	0.68	0.11
Gaseous Fuels	334 189.45	NCV	55.39	0.91	0.51	18 509.60	0.30	0.17
Biomass	143 806.14	NCV	105.52	81.62	3.49 [3]		11.74	0.50
Other Fuels	20 290.35	NCV	69.51	12.00	1.40	1 410.42	0.24	0.03
1.A.1. Energy Industries	244 619.14	NCV				15 834.21	0.22	0.20
Liquid Fuels	43 432.51	NCV	74.46	0.33	0.82	3 233.93	0.01	0.04
Solid Fuels	61 633.74	NCV	94.82	0.10	0.50	5 844.02	0.01	0.03
Gaseous Fuels	113 108.87	NCV	55.40	0.45	0.50	6 266.23	0.05	0.06
Biomass	17 936.90	NCV	110.02	2.46	3.82 [3]	1 973.36	0.04	0.07
Other Fuels	8 507.13	NCV	57.60	12.00	1.40	490.03	0.10	0.01
a. Public Electricity and Heat Production	197 792.28	NCV				12 735.68	0.21	0.18
Liquid Fuels	13 708.62	NCV	78.99	1.05	1.38	1 082.90	0.01	0.02
Solid Fuels	61 633.74	NCV	94.82	0.10	0.50	5 844.02	0.01	0.03
Gaseous Fuels	96 005.89	NCV	55.40	0.45	0.57	5 318.73	0.04	0.05
Biomass	17 936.90	NCV	110.02	2.46	3.82 [3]	1 973.36	0.04	0.07
Other Fuels	8 507.13	NCV	57.60	12.00	1.40	490.03	0.10	0.01
b. Petroleum Refining	41 924.10	NCV				2 826.92	IE,NO	0.02
Liquid Fuels	29 723.89	NCV	72.37	IE	0.56	2 151.03	IE	0.02
Solid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Gaseous Fuels	12 200.21	NCV	55.40	IE	0.10	675.89	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	4 902.76	NCV				271.61	0.01	0.00
Liquid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Solid Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
Gaseous Fuels	4 902.76	NCV	55.40	1.50	0.10	271.61	0.01	0.00
Biomass	NO	NCV	NO	NO	NO [3]	NO	NO	NO
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO

Note: All footnotes for this table are given at the end of the table on sheet 4.

Note: For the coverage of fuel categories, refer to the IPCC Guidelines (Volume 1. Reporting Instructions - Common Reporting Framework, section 1.2, p. 1.19). If some derived gases (e.g. gas works, gas, coke oven gas, blast furnace gas are considered, Parties should provide information on the allocation of these derived gases under the above fuel categories (liquid, solid, gaseous, biomass and other fuels) in the NIR (see also documentation box at the end of sheet 4 of this table)

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 2 of 4)

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	263 905.09	NCV				15 537.98	0.57	0.51
Liquid Fuels	40 546.03	NCV	76.01	2.03	7.47	3 081.81	0.08	0.30
Solid Fuels	55 892.71	NCV	100.22	1.84	1.11	5 601.55	0.10	0.06
Gaseous Fuels	108 489.81	NCV	55.36	1.45	0.10	6 005.84	0.16	0.01
Biomass	47 880.73	NCV	109.84	2.00	2.49 [3]	5 259.35	0.10	0.12
Other Fuels	11 095.81	NCV	76.50	12.00	1.40	848.78	0.13	0.02
a. Iron and Steel	73 484.12	NCV				6 393.45	0.08	0.06
Liquid Fuels	10 158.70	NCV	77.98	1.42	0.99	792.23	0.01	0.01
Solid Fuels	45 422.19	NCV	101.58	1.04	1.04	4 613.89	0.05	0.05
Gaseous Fuels	17 903.23	NCV	55.15	1.18	0.10	987.34	0.02	0.00
Biomass	NO	NCV	NO	NO	NO [3]	NO	NO	NO
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
b. Non-Ferrous Metals	6 733.87	NCV				406.34	0.01	0.00
Liquid Fuels	994.82	NCV	84.30	1.59	2.06	83.87	0.00	0.00
Solid Fuels	129.83	NCV	104.00	2.00	1.40	13.50	0.00	0.00
Gaseous Fuels	5 577.15	NCV	55.40	1.50	0.10	308.97	0.01	0.00
Biomass	32.08	NCV	110.00	2.00	4.00 [3]	3.53	0.00	0.00
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
c. Chemicals	22 318.71	NCV				1 360.52	0.09	0.02
Liquid Fuels	537.50	NCV	77.53	0.76	0.75	41.67	0.00	0.00
Solid Fuels	1 573.41	NCV	94.97	4.48	1.40	149.42	0.01	0.00
Gaseous Fuels	12 741.39	NCV	55.40	1.50	0.10	705.87	0.02	0.00
Biomass	2 894.54	NCV	110.32	1.92	3.52 [3]	319.33	0.01	0.01
Other Fuels	4 571.87	NCV	101.39	12.00	1.40	463.56	0.05	0.01
d. Pulp, Paper and Print	71 499.73	NCV				2 283.02	0.14	0.08
Liquid Fuels	1 760.32	NCV	77.61	1.78	0.96	136.61	0.00	0.00
Solid Fuels	4 717.76	NCV	92.75	5.33	1.40	437.56	0.03	0.01
Gaseous Fuels	30 584.88	NCV	55.40	1.50	0.10	1 694.40	0.05	0.00
Biomass	34 255.51	NCV	110.02	2.00	1.95 [3]	3 768.76	0.07	0.07
Other Fuels	181.26	NCV	79.71	12.00	1.40	14.45	0.00	0.00
e. Food Processing, Beverages and Tobacco	13 579.16	NCV				767.84	0.02	0.00
Liquid Fuels	1 686.76	NCV	75.89	0.95	0.83	128.01	0.00	0.00
Solid Fuels	130.77	NCV	103.21	2.42	1.40	13.50	0.00	0.00
Gaseous Fuels	11 305.50	NCV	55.40	1.50	0.10	626.32	0.02	0.00
Biomass	456.13	NCV	110.17	1.84	3.04 [3]	50.25	0.00	0.00
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
f. Other *(please specify)* [4]	76 289.49	NCV				4 326.81	0.23	0.35
Other non-specified								
Liquid Fuels	25 407.94	NCV	74.76	2.40	11.31	1 899.42	0.06	0.29
Solid Fuels	3 918.74	NCV	95.36	5.71	1.40	373.68	0.02	0.01
Gaseous Fuels	30 377.66	NCV	55.40	1.50	0.10	1 682.92	0.05	0.00
Biomass	10 242.47	NCV	109.10	2.03	3.97 [3]	1 117.48	0.02	0.04
Other Fuels	6 342.68	NCV	58.46	12.00	1.40	370.78	0.08	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	331 597.56	NCV					24 028.75	0.92	0.88
Liquid Fuels	321 748.47	NCV	72.98	2.81	2.73		23 482.22	0.90	0.88
Solid Fuels	22.55	NCV	95.00	6.83	6.83		2.14	0.00	0.00
Gaseous Fuels	9 826.54	NCV	55.40	1.50	0.10		544.39	0.01	0.00
Biomass	NO	NCV	NO	NO	NO		NO	NO	NO
Other Fuels	NA,NO	NCV	NA,NO	NA,NO	NA,NO	(3)	NA,NO	NA,NO	NA,NO
a. Civil Aviation	2 988.36	NCV					217.39	0.01	0.01
Aviation Gasoline	120.67	NCV	72.75	NO	NO		8.78	NO	NO
Jet Kerosene	2 867.69	NCV	72.75	5.19	2.89		208.61	0.01	0.01
b. Road Transportation	315 596.36	NCV					23 037.28	0.87	0.84
Gasoline	86 140.23	NCV	74.21	8.34	5.56		6 392.72	0.72	0.48
Diesel Oil	229 456.13	NCV	72.54	0.68	1.57		16 644.55	0.15	0.36
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	2 068.94	NCV					148.44	0.00	0.02
Liquid Fuels	2 046.39	NCV	71.49	2.02	7.38		146.30	0.00	0.02
Solid Fuels	22.55	NCV	95.00	6.83	6.83		2.14	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	1 117.37	NCV					81.25	0.01	0.02
Residual Oil (Residual Fuel Oil)	NO	NCV	NO	NO	NO		NO	NO	NO
Gas/Diesel Oil	998.76	NCV	72.54	1.46	16.59		72.45	0.00	0.02
Gasoline	118.61	NCV	74.21	88.69	1.94		8.80	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]	9 826.54	NCV					544.39	0.01	0.00
Pipeline transport	9 826.54	NCV					544.39	0.01	0.00
Liquid Fuels	NO	NCV	NO	NO	NO		NO	NO	NO
Solid Fuels	NO	NCV	NO	NO	NO		NO	NO	NO
Gaseous Fuels	9 826.54	NCV	55.40	1.50	0.10		544.39	0.01	0.00
Biomass	NO	NCV	NO	NO	NO	(3)	NO	NO	NO
Other Fuels	NO	NCV	NO	NO	NO		NO	NO	NO

Note: All footnotes for this table are given at the end of the table on sheet 4.

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 4 of 4)

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	305 046.79	NCV				15 046.02	12.47	0.95
Liquid Fuels	117 575.12	NCV	74.16	1.77	4.40	8 719.04	0.21	0.52
Solid Fuels	6 031.53	NCV	93.22	94.91	2.27	562.24	0.57	0.01
Gaseous Fuels	102 764.23	NCV	55.40	0.80	1.00	5 693.14	0.08	0.10
Biomass	77 988.50	NCV	101.83	148.72	4.03 [3]	7 941.51	11.60	0.31
Other Fuels	687.40	NCV	104.17	12.00	1.40	71.61	0.01	0.00
a. Commercial/Institutional	70 067.95	NCV				4 056.20	0.58	0.08
Liquid Fuels	22 641.20	NCV	73.39	0.44	0.93	1 661.68	0.01	0.02
Solid Fuels	461.94	NCV	93.70	90.00	2.29	43.28	0.04	0.00
Gaseous Fuels	41 148.56	NCV	55.40	0.80	1.00	2 279.63	0.03	0.04
Biomass	5 128.85	NCV	109.15	94.77	2.86 [3]	559.79	0.49	0.01
Other Fuels	687.40	NCV	104.17	12.00	1.40	71.61	0.01	0.00
b. Residential	205 448.07	NCV				9 337.81	10.92	0.43
Liquid Fuels	72 926.96	NCV	74.78	0.89	1.17	5 453.82	0.06	0.09
Solid Fuels	5 459.34	NCV	93.17	95.43	2.26	508.62	0.52	0.01
Gaseous Fuels	60 927.20	NCV	55.40	0.80	1.00	3 375.37	0.05	0.06
Biomass	66 134.57	NCV	101.00	155.47	4.05 [3]	6 679.49	10.28	0.27
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
c. Agriculture/Forestry/Fisheries	29 530.77	NCV				1 652.01	0.97	0.44
Liquid Fuels	22 006.95	NCV	72.87	6.08	18.65	1 603.54	0.13	0.41
Solid Fuels	110.25	NCV	93.72	90.00	2.67	10.33	0.01	0.00
Gaseous Fuels	688.48	NCV	55.40	0.80	1.00	38.14	0.00	0.00
Biomass	6 725.09	NCV	104.42	123.39	4.77 [3]	702.23	0.83	0.03
Other Fuels	NO	NCV	NO	NO	NO	NO	NO	NO
1.A.5 Other *(Not specified elsewhere)* [6]	1 651.77	NCV				120.15	0.00	0.01
a. Stationary *(please specify)* [7]	NA	NCV				NA	NA	NA
b. Mobile *(please specify)* [8]	1 651.77	NCV				120.15	0.00	0.01
Military use								
Liquid Fuels	1 651.77	NCV	72.74	2.39	4.56	120.15	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/2005:Usage of "NO" notation keys in table 1.A(a)s1 to s4 : Energy statistics does not inquire all consumers but is limited to statistical samples. In the case that a statistical inquiry results in zero consumption of a specific sector and fuel group it is not always possible to decide if there occurs a consumption of a specific fuel category in a specific sector and year. However, as the energy statistics is based on a top down/bottom up approach it is assured that total national fuel consumption is equivalent to category 1A fuel consumption. Thus "NO" may be sometimes interpreted as "included elsewhere".

TABLE 1.A(b) SECTORAL BACKGROUND DATA FOR ENERGY Inventory 2005

CO_2 from Fuel Combustion Activities - Reference Approach (IPCC Worksheet 1-1) Submission 2007 v1.2

(Sheet 1 of 1) AUSTRIA

FUEL TYPES			Unit	Production	Imports	Exports	International bunkers	Stock change	Apparent consumption	Conversion factor (TJ/Unit)	NCV/ GCV [1]	Apparent consumption (TJ)	Carbon emission factor (t C/TJ)	Carbon content (Gg C)	Carbon stored (Gg C)	Net carbon emissions (Gg C)	Fraction of carbon oxidized	Actual CO_2 emissions (Gg CO_2)
Liquid Fossil	Primary Fuels	Crude Oil	Gg	854.78	7 832.91	NO		-55.17	8 742.86	42.75	NCV	373 757.21	20.00	7 475.14	NO	7 475.14	0.99	27 134.77
		Orimulsion		NO	NO	NO		NO	NO	NA	NCV	NA,NO	NA	NA,NO	NA	NA,NO	NA	NA,NO
		Natural Gas Liquids	Gg	109.54	NO	NO		NO	109.54	45.22	NCV	4 953.60	17.20	85.20	NO	85.20	0.99	309.28
	Secondary Fuels	Gasoline	Gg		1 095.39	770.05	NO	47.09	278.25	44.80	NCV	12 465.46	18.90	235.60	NO	235.60	0.99	855.22
		Jet Kerosene	Gg		84.84	2.09	533.56	21.73	-472.54	44.59	NCV	-21 070.70	19.50	-410.88	NO	-410.88	0.99	-1 491.49
		Other Kerosene	Gg		2.68	0.03	NO	0.13	2.52	44.75	NCV	112.81	19.60	2.21	NO	2.21	0.99	8.03
		Shale Oil			NO	NO		NO	NO	NA	NCV	NA,NO	NA	NA,NO	NA	NA,NO	NA	NA,NO
		Gas / Diesel Oil	Gg		5 055.43	908.88	NO	-51.18	4 197.73	43.33	NCV	181 887.43	20.20	3 674.13	NO	3 674.13	0.99	13 337.08
		Residual Fuel Oil	Gg		181.71	72.11	NO	-6.59	116.18	40.19	NCV	4 669.45	21.10	98.53	NO	98.53	0.99	357.65
		Liquefied Petroleum Gas (LPG)	Gg		133.02	19.59		-0.14	113.57	47.31	NCV	5 372.94	17.20	92.41	2.44	89.97	0.99	326.60
		Ethane			IE	IE		IE	IE	NA	NCV	IE,NA	NA	IE,NA	IE	IE,NA	NA	IE,NA
		Naphtha			IE	IE		IE	IE	NA	NCV	IE,NA	NA	IE,NA	IE	IE,NA	NA	IE,NA
		Bitumen	Gg		335.07	146.84		2.97	185.26	40.19	NCV	7 445.49	22.00	163.80	575.91	-412.11	0.99	-1 495.96
		Lubricants	Gg		52.87	84.76	NO	-1.30	-30.58	40.19	NCV	-1 229.08	20.00	-24.58	33.30	-57.89	0.99	-210.13
		Petroleum Coke	Gg		104.49	1.73		-1.87	104.63	31.00	NCV	3 243.64	27.50	89.20	33.37	55.83	0.99	202.65
		Refinery Feedstocks	Gg		264.75	57.53		-116.57	323.80	42.50	NCV	13 761.31	20.00	275.23	NO	275.23	0.99	999.07
		Other Oil	Gg		56.14	92.93		18.77	-55.57	40.19	NCV	-2 233.35	20.00	-44.67	350.43	-395.09	0.99	-1 434.19
Other Liquid Fossil												NA		NA	NA	NA		NA
Liquid Fossil Totals												583 136.22		11 711.32	995.46	10 715.86		38 898.59
Solid Fossil	Primary Fuels	Anthracite [2]		IE	IE	IE		IE	IE	NA	NCV	IE,NA	NA	IE,NA	NA	IE,NA	NA	IE,NA
		Coking Coal	Gg	NO	2 062.83	NO		164.33	1 898.50	28.00	NCV	53 158.00	25.80	1 371.48	81.59	1 289.89	0.98	4 635.00
		Other Bituminous Coal	Gg	NO	2 261.99	2.89	NO	119.34	2 139.75	27.99	NCV	59 894.25	25.80	1 545.27	0.35	1 544.92	0.98	5 551.42
		Sub-bituminous Coal		NO	NO	NO	NO	NO	NO	NA	NCV	NA,NO	NA	NA,NO	NA	NA,NO	NA	NA,NO
		Lignite	Gg	NO	113.43	NO		-1 156.81	1 270.24	9.07	NCV	11 524.91	27.60	318.09	NO	318.09	0.98	1 142.99
		Oil Shale		NO	NO	NO		NO	NO	NA	NCV	NA,NO	NA	NA,NO	NA	NA,NO	NA	NA,NO
		Peat	Gg	0.50	NO	NO		NO	0.50	8.80	NCV	4.40	28.90	0.13	NO	0.13	0.98	0.46
	Secondary Fuels	BKB [3] and Patent Fuel	Gg		54.08	5.21		NO	48.87	19.30	NCV	943.17	25.80	24.33	NO	24.33	0.98	87.44
		Coke Oven/Gas Coke	Gg		1 401.92	6.88		-27.43	1 422.47	28.20	NCV	40 113.71	29.50	1 183.35	7.37	1 175.99	0.98	4 225.71
Other Solid Fossil												NA		NA	NA	NA		NA
Solid Fossil Totals												165 638.44		4 442.65	89.30	4 353.35		15 643.03
Gaseous Fossil		Natural Gas (Dry)	TJ	59 346.61	343 591.07	35 378.61		18 089.12	349 469.95	1.00	NCV	349 469.95	15.30	5 346.89	NO	5 346.89	1.00	19 507.24
Other Gaseous Fossil												NA		NA	NA	NA		NA
Gaseous Fossil Totals												349 469.95		5 346.89	NA,NO	5 346.89		19 507.24
Total												1 098 244.61		21 500.86	1 084.76	20 416.10		74 048.85
Biomass total												141 787.90		4 239.46	NA,NO	4 239.46		13 694.87
		Solid Biomass	TJ	144 859.79	11 080.62	15 507.37		-65.12	140 498.17	1.00	NCV	140 498.17	29.90	4 200.90	NO	4 200.90	0.88	13 554.89
		Liquid Biomass		IE	IE	IE		IE	IE	NA	NCV	IE,NA	NA	IE,NA	NA	IE,NA	NA	IE,NA
		Gas Biomass	TJ	1 289.73	NO	NO		NO	1 289.73	1.00	NCV	1 289.73	29.90	38.56	NO	38.56	0.99	139.98

(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)

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)	583.14	513.75	38 898.59	524.95	38 637.15	-2.13	0.68
Solid Fuels (excluding international bunkers) [5]	165.64	128.92	15 643.03	123.58	12 009.95	4.32	30.25
Gaseous Fuels	349.47	335.77	19 507.24	334.19	18 509.60	0.47	5.39
Other [5]	NA	NE	NA	20.29	1 410.42	-100.00	-100.00
Total [5]	***1 098.24***	***978.44***	***74 048.85***	***1 003.01***	***70 567.12***	***-2.45***	***4.93***

[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/2005: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.AC Difference - Reference and Sectoral Approach/2005:Solid fuels:

CO2 emissions: Reference Approach includes process emissions from blast furnaces which are included in category 2 C 1 and process emissions from carbide production which are included in category 2 B 4.

Liquid fuels:

CO2 emissions: Heat values and carbon contents are sector and fuel specific. The reference approach considers a share of feedstocks used for plastics production and solvent production as non-carbon-stored. In the sectoral approach a share of emissions from waste incineration of plastics and solvents use (including imported products) is included in category 1A1a and category 3. In the sectoral approach a share of municipal solid waste without energy recovery is considered in category 6C for the years 1990 and1991.

Gaseous fuels:

CO2 emissions: National aproach uses sector specific carbon contents and heating values (different from IPCC reference factors). Process emissions from ammonia-production are included in category 2 B 1.

Other fuels:

The sectoral approach considers waste as an additional fuel type (e.g. municipal solid waste and industrial fuel waste).

TABLE 1.A(d) SECTORAL BACKGROUND DATA FOR ENERGY
Feedstocks and Non-Energy Use of Fuels
(Sheet 1 of 1)

FUEL TYPE	ACTIVITY DATA AND RELATED INFORMATION: Fuel quantity (TJ)	ACTIVITY DATA AND RELATED INFORMATION: Fraction of carbon stored	IMPLIED EMISSION FACTOR: Carbon emission factor (t C/TJ)	ESTIMATE: Carbon stored in non-energy use of fuels (Gg C)	Additional information [(a)]: 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	0.00	NE	0.00
Lubricants	3 330.46	0.50	20.00	33.30	122.12	0.00	NE	0.00
Bitumen	26 177.77	1.00	22.00	575.91	2 111.67	0.00	NE	0.00
Coal Oils and Tars (from Coking Coal)	2 406.82	0.75	45.20	81.59	299.15	0.00	NE	0.00
Natural Gas[(1)]	10 794.70	NO	NO	NO	NO	0.00	NE	0.00
Gas/Diesel Oil [(1)]	NO	0.50	NO	NO	NO	0.00	NE	0.00
LPG [(1)]	141.93	1.00	17.20	2.44	8.95	0.00	NE	0.00
Ethane [(1)]	IE	NA	IE	IE	IE	0.00	NE	0.00
Other *(please specify)*				358.14				
Coal	27.06	0.50	25.80	0.35	1.28	0.00	NE	0.00
Gasoline	NO	0.50	NO	NO	NO	0.00	NE	0.00
Butane	NO	0.75	NO	NO	NO	0.00	NE	0.00
Coke	35 680.69	0.01	29.50	7.37	27.02	0.00	NE	0.00
Other petroleum products	23 361.80	0.75	20.00	350.43	1 284.90	0.00	NE	0.00

	Carbon stored (Gg C)	CO_2 not emitted ($Gg\ CO_2$)
Total	1 051.39	3 855.09
Total amount of C and CO_2 from feedstocks and non-energy use of fuels that is included as emitted CO_2 in the Reference approach	1 222.87	4 483.86

[(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:

TABLE 1.B.1 SECTORAL BACKGROUND DATA FOR ENERGY

Fugitive Emissions from Solid Fuels
(Sheet 1 of 1)

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	NO			NO	IE,NO	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)	NO	IE,NO	IE,NA	NO	IE,NO	IE,NA
Mining Activities		NO	NA	NO	NO	NA
Post-Mining Activities		IE	IE	NO	IE	IE
1. B. 1. b. Solid Fuel Transformation	1.39	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	5.49	IE,NA
I. Exploration	*number of wells drilled*	number	767.00	IE	IE	IE	IE	IE	IE
ii. Production (4)	*Oil throughput*	Mt	0.86	142 690 058.48	6 097 076.02		122.00	5.21	
iii. Transport	*oil loaded in tankers*	number	NA	IE	IE		IE	IE	
iv. Refining / Storage	*Oil refined (SNAP 0401)*	Mt	8 755.02	NA	31.66	NA	NA	0.28	NA
v. Distribution of Oil Products	*Gasoline Consumption (SNAP 0505)*	Mt	2.07	NA	NA		NA	NA	
vi. Other	*(specify)*		NO	NO	NO		NO	NO	
1. B. 2. b. Natural Gas							83.04	26.28	
i. Exploration	*(specify)*		1 637.03	NA	IE		NA	IE	
ii. Production (4) / Processing	*Gas throughput (a)*	10^6 m^3	1 637.00	50 702.50	IE		83.00	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	34 450.00	NA	642.55		NA	22.14	
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)

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	23 791.25				1 730.71	0.03	0.06
Jet Kerosene	23 791.25	72.75	0.00	0.00	1 730.71	0.03	0.06
Gasoline	NO	NO	NO	NO	NO	NO	NO
Marine Bunkers	NA,NO				NA,NO	NA,NO	NA,NO
Gasoline	NO	NO	NO	NO	NO	NO	NO
Gas/Diesel Oil	NO	NO	NO	NO	NO	NO	NO
Residual Fuel Oil	NO	NO	NO	NO	NO	NO	NO
Lubricants	NO	NO	NO	NO	NO	NO	NO
Coal	NO	NO	NO	NO	NO	NO	NO
Other *(please specify)*	NA				NA	NA	NA
Multilateral Operations [(1)]	NO	IE	IE	IE	IE	IE	IE

Additional information

Fuel consumption	Distribution [(a)] (per cent)	
	Domestic	International
Aviation	11.16	88.84
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	8 688.54	0.75	0.88	1 462.39	911.55	332.79	117.97	0.02	0.01	1.29	23.89	4.40	1.22
A. Mineral Products	3 119.86	IE,NA	IE,NA							IE,NA	9.78	IE,NA	IE,NA
1. Cement Production	1 797.48												NA
2. Lime Production	578.71												
3. Limestone and Dolomite Use	290.83												
4. Soda Ash Production and Use	15.28												
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)*	437.55	IE,NA	IE,NA							IE,NA	IE,NA	IE,NA	IE,NA
Glass Production	IE	IE	IE							IE	IE	IE	IE
Sinter Production	309.53	NA	NA							NA	NA	NA	NA
Bricks and Tiles (decarbonizing)	128.02	NA	NA							NA	NA	NA	NA
B. Chemical Industry	557.38	0.75	0.88	NO	NO	NO	NO	NO	NO	0.57	11.12	1.32	0.77
1. Ammonia Production	503.06	0.09	NA							0.24	0.05	IE	NA
2. Nitric Acid Production			0.88							0.24			
3. Adipic Acid Production	NO		NO							NO	NO	NO	
4. Carbide Production	35.86	NA,NO								NA	NA	NA	NA
5. Other *(as specified in table 2(I).A-G)*	18.46	0.65	NA,NO	NO	NA,NO	NO	NA,NO	NO	NO	0.09	11.07	1.32	0.77
Carbon Black		NO											
Ethylene	NA	0.35	NA										
Dichloroethylene		NO											
Styrene		NO											
Methanol		NO											
Other Chemical Industry	18.05	0.30	NA	NO	NO	NO	NO	NO	NO	0.09	11.07	1.32	0.77
CO2 from nitric acid production	0.41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Production	5 011.31	0.00	NA	NO	NO	NO	NO	NA,NO	NO	0.10	2.54	0.45	0.45
1. Iron and Steel Production	4 994.96	0.00								0.08	2.22	0.27	0.05
2. Ferroalloys Production	16.34	NA								NA	NA	NA	NA
3. Aluminium Production	NO	NO				NO	NO			NO	NO	NO	NO
4. SF_6 Used in Aluminium and Magnesium Foundries								NA	NO				
5. Other *(as specified in table 2(I).A-G)*	NA	NA	NA	NO	NA,NO	NO	NA,NO	NO	NO	0.02	0.32	0.17	0.40
Non-ferrous metals	NA	NA	NA	NO	NO	NO	NO	NO	NO	0.02	0.32	0.17	0.40

Note: P = Potential emissions based on Tier 1 approach of the IPCC Guidelines. A = Actual emissions based on Tier 2 approach of the IPCC Guidelines. This applies only to source categories where methods exist for both tiers.

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									0.61	0.45	2.62	NA
1. Pulp and Paper										0.61	0.45	0.45	NA
2. Food and Drink[2]	NA											2.17	
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				1 462.39	911.55	332.79	117.97	0.02	0.01				
1. Refrigeration and Air Conditioning Equipment				NA	590.60	NA	NO	NA	NA				
2. Foam Blowing				NA	243.20	NA	NO	NA	NA				
3. Fire Extinguishers				NA	28.22	NA	0.35	NA	NA				
4. Aerosols/ Metered Dose Inhalers				NA	43.57	NA	NO	NA	NA				
5. Solvents				NA	1.89	NA	NO	NA	NA				
6. Other applications using ODS[3] substitutes				NA	NO	NA	NO	NA	NA				
7. Semiconductor Manufacture				NA	4.07	NA	117.62	NA	0.01				
8. Electrical Equipment				NA	NO	NA	NO	NA	0.00				
9. Other *(as specified in table 2(II)*				NA	NA,NO	NA	NA,NO	NA	0.00				
Double glaze windows				NA	NA,NO	NA	NO	NA	0.00				
Research and other use				NA	NA,NO	NA	NO	NA	0.00				
G. Other *(as specified in tables 2(I).A-G and 2(II))*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: P = Potential emissions based on Tier 1 approach of the IPCC Guidelines. A = Actual emissions based on Tier 2 approach of the IPCC Guidelines. This applies only to source categories where methods exist for both tie

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II).

(2) CO_2 from Food and Drink Production (e.g. gasification of water) can be of biogenic or non-biogenic origin. Only information on CO_2 emissions of non-biogenic origin should be reported.

(3) ODS: ozone-depleting substances.

Documentation box:
Parties should provide detailed explanations on the industrial processes sector in Chapter 4: Industrial processes (CRF sector 2) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
2.A Mineral Products/2005:Emissions from 2A5 Asphalt Roofingand 2A6 Road Paving with Asphalt are included in the Solvent Sector.
Soda ash is produced in the Solvay process only which is CO2-neutral except for coke used for calcination of limestone. This coke used in soda ash production is considered as fuel in the energy sector (subcategory 1 A 2 c), that's why CO2 emissions of soda ash production is reported as "IE".
2.C Metal Production/2005:Emissions from Sinter and Coke Production is included in 1 A 2 a Iron and Steel.

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						3 119.86	IE,NO	IE,NA	NO	IE,NA	NO
1. Cement Production	Clinker Production [kt]	3 221.17	0.56			1 797.48	NO				
2. Lime Production	Lime Produced [kt]	760.46	0.76			578.71	NO				
3. Limestone and Dolomite Use	Limestone and Dolomite used [kt]	666.16	0.44			290.83	NO				
4. Soda Ash						15.28	IE,NO				
Soda Ash Production	Soda Ash Production	NA	IE			IE	IE				
Soda Ash Use	Soda Ash Used [kt]	36.88	0.41			15.28	NO				
5. Asphalt Roofing	Roofing Material Production [Mio m2]	27.95	IE			IE	NO				
6. Road Paving with Asphalt	Asphalt Production [kt]	1 292.26	IE			IE	NO				
7. Other *(please specify)*						437.55	NO	IE,NA	NO	IE,NA	NO
Glass Production	(specify)	IE	IE	IE	IE	IE	NO	IE	NO	IE	NO
Sinter Production	MgCO3 sintered [kt]	638.75	0.48	NA	NA	309.53	NO	NA	NO	NA	NO
Bricks and Tiles (decarbonizing)	Bricks Production [kt]	2 083.07	0.06	NA	NA	128.02	NO	NA	NO	NA	NO
B. Chemical Industry						557.38	NO	0.75	NO	0.88	NO
1. Ammonia Production[(5)]	Ammonia Production [kt]	478.43	1.05	0.00	NA	503.06	NO	0.09	NO	NA	NO
2. Nitric Acid Production	Nitric Acid Production [kt]	557.87			0.00					0.88	NO
3. Adipic Acid Production	Adipic Acid Production	NO	NO		NO	NO	NO			NO	NO
4. Carbide Production	Carbide Production	27.68	1.30	NA,NO		35.86	NO	NA,NO	NO		
Silicon Carbide	Silicon Carbide Production	NO	NO	NO		NO	NO	NO	NO		
Calcium Carbide	Calcium Carbide Production	27.68	1.30	NA		35.86	NO	NA	NO		
5. Other *(please specify)*						18.46	NO	0.65	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	NO		NO				NO	NO		
Other Chemical Industry	Other Chemical Products [kt]	NA	NA	NA	NA	18.05	NO	0.30	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.

(3) Final emissions are to be reported (after subtracting the amounts of emission recovery, oxidation, destruction or transformation).

TABLE 2(I).A-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO_2, CH_4 and N_2O
(Sheet 2 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]			EMISSIONS					
	Production/Consumption quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
						Emissions[3]	Recovery[4]	Emissions[3]	Recovery[4]	Emissions[3]	Recovery[4]
	Description [1]	(kt)	(t/t)			(Gg)					
C. Metal Production						5 011.31	NO	0.00	NO	NA	NO
1. Iron and Steel Production			0.31	0.00		4 994.96	NO	0.00	NO		
Steel	Steel Production [kt]	7 032.00	0.11	IE		763.36	NO	IE	NO		
Pig Iron	Iron Production [kt]	5 457.76	0.77	IE		4 186.47	NO	IE	NO		
Sinter	Sinter Production [kt]	3 527.74	IE	IE		IE	NO	IE	NO		
Coke	Coke Production [kt]	1.39	IE	IE		IE	NO	IE	NO		
Other *(please specify)*						45.14	NO	0.00	NO		
Electric Furnace Steel production	Electric Furnace Steel Production	624.26	0.07	0.00		45.14	NO	0.00	NO		
Rolling mills	Product	6 407.74	NA	0.00		NA	NO	0.00	NO		
Foundries	Product	196.02	NA	NA		NA	NO	NA	NO		
2. Ferroalloys Production	Ferroalloys Production [kt]	12.02	1.36	NA		16.34	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]	128.38	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]	1 490.67	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 Mineral Products/2005:Emissions from 2A5 Asphalt Roofingand 2A6 Road Paving with Asphalt are included in the Solvent Sector.
Soda ash is produced in the Solvay process only which is CO2-neutral except for coke used for calcination of limestone. This coke used in soda ash production is considered as fuel in the energy sector (subcategory 1 A 2 c), that's why CO2 emissions of soda ash production is reported as "IE".
2.C Metal Production/2005:Emissions from Sinter and Coke Production is included in 1 A 2 a Iron and Steel.

TABLE 2(II) SECTORAL REPORT FOR INDUSTRIAL PROCESSES - EMISSIONS OF HFCs, PFCs AND SF_6
(Sheet 1 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFC-23	HFC-32	HFC-41	HFC-43-10mee	HFC-125	HFC-134	HFC-134a	HFC-152a	HFC-143	HFC-143a	HFC-227ea	HFC-236fa	HFC-245ca	Unspecified mix of listed HFCs (1)	Total HFCs	CF_4	C_2F_6	C_3F_8	C_4F_{10}	$c-C_4F_8$	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	2.25	5.53	NA,NO	1.45	53.52	NA,NO	328.63	573.67	NA,NO	44.47	2.07	NA,NO	NA,NO	47.37		5.69	7.67	1.44	0.05	NA,NO	NA,NO	NA,NO	NA,NO		12.00
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	2.25	5.53	NO	1.45	53.52	NO	328.63	573.67	NO	44.47	2.07	NO	NO	47.37		5.69	7.67	1.44	0.05	NO	NO	NO	NO		12.00
1. Refrigeration and Air Conditioning Equipment	NO	5.53	NO	NO	53.52	NO	206.17	0.84	NO	44.47	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		NA
2. Foam Blowing	NO	NO	NO	NO	NO	NO	122.46	572.83	NO	NO	NO	NO	NO	3.80		NO	NO	NO	NO	NO	NO	NO	NO		NA
3. Fire Extinguishers	1.90	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.07	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	43.57		NO	NO	NO	NO	NO	NO	NO	NO		NA
5. Solvents	NO	NO	NO	1.45	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	0.35	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		5.69	7.67	1.44	0.00	NO	NO	NO	NO		7.07
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		1.51
9. Other *(as specified in table 2(II)F)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA		NO	NO	NO	NO	NO	NO	NO	NO		3.42
Double glaze windows	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA		NO	NO	NO	NO	NO	NO	NO	NO		3.33
Research and other use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA		NO	NO	NO	NO	NO	NO	NO	NO		0.09
G. Other *(please specify)*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA		NA

Note: All footnotes for this table are given at the end of the table on sheet 2.

Note: Gases with global warming potential (GWP) values not yet agreed upon by the Conference of the Parties should be reported in table 9(b).

TABLE 2(II) SECTORAL REPORT FOR INDUSTRIAL PROCESSES - EMISSIONS OF HFCs, PFCs AND SF_6
(Sheet 2 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFC-23	HFC-32	HFC-41	HFC-43-10mee	HFC-125	HFC-134	HFC-134a	HFC-152a	HFC-143	HFC-143a	HFC-227ea	HFC-236fa	HFC-245ca	Unspecified mix of listed HFCs [(1)]	Total HFCs	CF_4	C_2F_6	C_3F_8	C_4F_{10}	$c\text{-}C_4F_8$	C_5F_{12}	C_6F_{14}	Unspecified mix of listed PFCs [(1)]	Total PFCs	SF_6
	(t)[(2)]													CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(t)[(2)]							CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(t)[(2)]
F(p). Total Potential Emissions of Halocarbons (by chemical) and SF_6 [(4)]	3.19	15.25	NE,NO	1.47	121.57	NE,NO	431.18	297.79	NE,NO	106.35	8.00	NE,NO	NE,NO	43.23		14.51	24.70	1.60	0.01	NO	NO	NO	NO		19.82
Production[(5)]	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO		NO
Import:	3.19	15.25	NE,NO	1.47	121.57	NE,NO	431.18	297.79	NE,NO	106.35	8.00	NE,NO	NE,NO	43.23		14.51	24.70	1.60	0.01	NO	NO	NO	NO		19.82
In bulk	3.19	15.25	NO	1.47	121.57	NO	431.18	297.79	NO	106.35	8.00	NO	NO	43.23		14.51	24.70	1.60	0.01	NO	NO	NO	NO		19.82
In products[(6)]	IE	IE	NE	NE	IE	NE	IE	IE	NE	IE	IE	NE	NE	NO		NO	NO	NO	NO	NO	NO	NO	NO		IE
Export:	IE	IE	NE,NO	NE,NO	IE	NE,NO	IE	IE	NE,NO	IE	IE	NE,NO	NE,NO	NO		IE,NO	IE,NO	IE,NO	IE,NO	NO	NO	NO	NO		IE
In bulk	IE	IE	NO	NO	IE	NO	IE	IE	NO	IE	IE	NO	NO	NO		IE	IE	IE	IE	NO	NO	NO	NO		IE
In products[(6)]	IE	IE	NE	NE	IE	NE	IE	IE	NE	IE	IE	NE	NE	NO		NO	NO	NO	NO	NO	NO	NO	NO		IE
Destroyed amount	NE	NE	NO	NO	NE	NO	NE	NE	NO	NE	NE	NO	NO	NO		NE	NE	NE	NE	NO	NO	NO	NO		NE
GWP values used	**11700**	**650**	**150**	**1300**	**2800**	**1000**	**1300**	**140**	**300**	**3800**	**2900**	**6300**	**560**			**6500**	**9200**	**7000**	**7000**	**8700**	**7500**	**7400**			**23900**
Total Actual Emissions[(7)] (CO_2 equivalent (Gg))	26.29	3.60	NA,NO	1.89	149.86	NA,NO	427.23	80.31	NA,NO	169.00	6.00	NA,NO	NA,NO	47.37	911.55	36.98	70.55	10.08	0.36	NA,NO	NA,NO	NA,NO	NA,NO	117.97	286.77
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF_6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F(a). Consumption of Halocarbons and SF_6	26.29	3.60	NO	1.89	149.86	NO	427.23	80.31	NO	169.00	6.00	NO	NO	47.37	911.55	36.98	70.55	10.08	0.36	NO	NO	NO	NO	117.97	286.77
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.)	26.29	3.60	NO	1.89	149.86	NO	427.23	80.31	NO	169.00	6.00	NO	NO	47.37	911.55	36.98	70.55	10.08	0.36	NO	NO	NO	NO	117.97	286.77
Potential emissions - F(p)[(8)] (Gg CO_2 eq.)	37.37	9.91	NE,NO	1.91	340.39	NE,NO	560.54	41.69	NE,NO	404.15	23.20	NE,NO	NE,NO	43.23	1 462.39	94.33	227.19	11.20	0.07	NO	NO	NO	NO	332.79	473.65
Potential/Actual emissions ratio	1.42	2.76	NE,NO	1.01	2.27	NE,NO	1.31	0.52	NE,NO	2.39	3.87	NE,NO	NE,NO	0.91	1.60	2.55	3.22	1.11	0.20	NO	NO	NO	NO	2.82	1.65

(1) In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), these columns could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for these columns is Gg of CO_2 equivalent.

(2) Note that the units used in this table differ from those used in the rest of the Sectoral report tables, i.e. t instead of *Gg* .

(3) ODS: ozone-depleting substances.

(4) Potential emissions of each chemical of halocarbons and SF_6 estimated using Tier 1a or Tier 1b of the IPCC Guidelines (Volume 3. Reference Manual, pp. 2.47-2.50). Where potential emission estimates are available in a disaggregated manner for the source categories F.1 to F.9, these should be reported in the NIR and a reference should be provided in the documentation box. Use table Summary 3 to indicate whether Tier 1a or Tier 1b was used.

(5) Production refers to production of new chemicals. Recycled substances could be included here, but avoid double counting of emissions. An indication as to whether recycled substances are included should be provided in the documentation box to this table.

(6) Relevant only for Tier 1b

(7) Total actual emissions equal the sum of the actual emissions of each halocarbon and SF_6 from the source categories 2.C, 2.E, 2.F and 2.G as reported in sheet 1 of this table multiplied by the corresponding GWP values.

(8) Potential emissions of each halocarbon and SF_6 taken from row F(p) multiplied by the corresponding GWP values.

Note: As stated in the UNFCCC reporting guidelines, Parties should report actual emissions of HFCs, PFCs and SF_6, where data are available, providing disaggregated data by chemical and source category in units of mass and in CO_2 equivalent. Parties reporting actual emissions should also report potential emissions for the sources where the concept of potential emissions applies, for reasons of transparency and comparability. Gases with GWP values not yet agreed upon by the COP should be reported in Table 9 (b).

Documentation box:
• Parties should provide detailed explanations on the industrial processes sector in Chapter 4: Industrial processes (CRF sector 2) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
• If estimates are reported under "2.G Other", use this documentation box to provide information regarding activities covered under this category and to provide reference to the section in the NIR where background information can be found.
2.C Metal Production/2005:Emissions from Sinter and Coke Production is included in 1 A 2 a Iron and Steel.

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.

2.C Metal Production/2005:Emissions from Sinter and Coke Production is included in 1 A 2 a Iron and Steel.

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	63.41	28.10	NA	1.50	20.00	NA	0.95	5.62
Commercial Refrigeration									
HFC-134a	4.00	40.74	3.44	NA	1.50	20.00	NA	0.61	0.69
Transport Refrigeration									
HFC-134a	5.00	29.30	2.15	NA	10.00	20.00	NA	2.93	0.43
Industrial Refrigeration									
HFC-125	107.88	609.64	NO	NA	8.00	NA	IE	48.77	NO
HFC-152a	1.17	10.46	NO	NA	8.00	NA	IE	0.84	NO
HFC-134a	126.40	843.79	NO	NA	8.00	NA	IE	67.50	NO
HFC-143a	105.04	549.13	NO	NA	8.00	NA	IE	43.93	NO
HFC-32	3.68	19.83	NO	NA	8.00	NA	IE	1.59	NO
Stationary Air-Conditioning									
HFC-143a	1.31	15.02	NO	NA	3.62	NA	IE	0.54	NO
HFC-32	11.57	73.93	NO	NA	5.34	NA	IE	3.95	NO
HFC-125	13.69	93.07	NO	NA	5.10	NA	IE	4.75	NO
HFC-134a	36.34	331.59	NO	NA	5.08	NA	IE	16.85	NO
Mobile Air-Conditioning									
HFC-134a	172.91	797.27	7.98	NA	13.62	25.00	NA	108.60	1.99
2. Foam Blowing[(1)]									
Hard Foam									
HFC-152a	49.52	1 559.38	NO	NA	24.21	NA	IE	377.59	NO
HFC-134a	24.76	1 557.00	NO	NA	0.65	NA	IE	10.17	NO
Unspecified mix of HFCs	NO	166 304.48	NO	NA	2.28	NA	IE	3 798.40	NO
Soft Foam									
HFC-134a	61.78	219.99	NO	NA	51.04	NO	NA	112.29	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	41.38	NE	NE	5.00	NE	NE	2.07	NE
C4F10	NO	1.00	NE	NE	5.00	NE	NE	0.05	NE
HFC-23	1.85	37.98	NE	NE	5.00	NE	NE	1.90	NE
4. Aerosols [(1)]									
Metered Dose Inhalers									
Unspecified mix of HFCs	43 227.63	NA	NA	NA	NA	NA	NA	43 574.82	NA
Other									
5. Solvents [(1)]									
HFC-43-10 mee	1.47	NA	NA	NA	NA	NA	NA	1.45	NA
6. Other applications using ODS[(2)] substitutes [(1)]									
7. Semiconductor Manufacture[(1)]									
HFC-23	C	NA	NA	C	NA	NA	0.35	NA	NA
C2F6	C	NA	NA	C	NA	NA	7.67	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	7.07	NA	NA
CF4	C	NA	NA	C	NA	NA	5.69	NA	NA
8. Electrical Equipment[(1)]									
SF6	12.15	151.46	NE	NE	1.00	NE	NE	1.51	NE
9. Other *(please specify)* [(1)]									
Double glaze windows									
SF6	NO	287.77	NO	NO	1.16	NA	NO	3.33	NO
Research and other use									
SF6	0.02	0.57	NA	NE	NA	NA	NE	0.09	NA

(1) Under each of the listed source categories, specify the chemical consumed (e.g. HFC-32) as indicated under category Fire Extinguishers; use one row per chemical.
(2) ODS: ozone-depleting substances.

Documentation box:

TABLE 3 SECTORAL REPORT FOR SOLVENT AND OTHER PRODUCT USE
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	N_2O	NMVOC
	(Gg)		
Total Solvent and Other Product Use	177.40	0.56	75.77
A. Paint Application	52.82		20.81
B. Degreasing and Dry Cleaning	24.60	NA	9.17
C. Chemical Products, Manufacture and Processing	24.66		11.31
D. Other	75.32	0.56	34.48
1. Use of N_2O for Anaesthesia		0.16	
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)*	75.32	NA	34.48
Other non-specified	75.32	NA	34.48

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]	45.73	1.16	
B. Degreasing and Dry Cleaning	Solvents used [kt]	16.44	1.50	NA
C. Chemical Products, Manufacture and Processing	Solvents used [kt]	91.50	0.27	
D. Other				
1. Use of N_2O for Anaesthesia	Use of N2O for Anaesthesia [kt]	0.16		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]	47.41	1.59	NA

(1) The implied emission factors will not be calculated until the corresponding emission estimates are entered directly into table 3.

(2) Some probable sources to be reported under 3.D Other are listed in this table. Complement the list with other relevant sources, as appropriate.

Documentation box:
Parties should provide detailed explanations on the Solvent and Other Product Use sector in Chapter 5: Solvent and Other Product Use (CRF sector 3) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 4 SECTORAL REPORT FOR AGRICULTURE
(Sheet 1 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4	N_2O	NO_x	CO	NMVOC
	(Gg)				
Total Agriculture	**196.34**	11.94	5.22	1.12	1.87
A. Enteric Fermentation	153.95				
1. Cattle [(1)]	144.25				
Option A:					
Dairy Cattle	61.48				
Non-Dairy Cattle	82.78				
Option B:					
Mature Dairy Cattle					
Mature Non-Dairy Cattle					
Young Cattle					
2. Buffalo	NO				
3. Sheep	2.61				
4. Goats	0.28				
5. Camels and Llamas	NO				
6. Horses	1.57				
7. Mules and Asses	IE				
8. Swine	4.75				
9. Poultry	0.17				
10. Other *(as specified in table 4.A)*	0.33				
Deer	0.33				
B. Manure Management	41.96	2.83			NE,NO
1. Cattle [(1)]	21.85				
Option A:					
Dairy Cattle	10.88				
Non-Dairy Cattle	10.97				
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	18.90				
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			NO
12. Liquid Systems		0.07			NE
13. Solid Storage and Dry Lot		2.71			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)	0.37	9.11			1.76
1. Direct Soil Emissions	0.37	4.90			1.76
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)*	NA	NA			NA
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.06	0.00	0.03	1.12	0.11
1 . Cereals	0.04	0.00	0.03	0.91	0.06
2. Pulses	NA,NO	NA,NO	NO	NO	NO
3 . Tubers and Roots	NA,NO	NA,NO	NO	NO	NO
4 . Sugar Cane	NO	NO	NO	NO	NO
5 . Other *(as specified in table 4.F)*	0.02	0.00	0.00	0.21	0.05
Vine	0.02	0.00	0.00	0.21	0.05
G. Other *(please specify)*	**NA**	**NA**	**5.19**	**NA**	**NA**
NOX from Agricultural Soils	NA	NA	5.19	NA	NA

(1) The sum for cattle would be calculated on the basis of entries made under either option A (dairy and non-dairy cattle) or option B (mature dairy cattle, mature non-dairy cattle and young cattle).

(2) See footnote 4 to Summary 1.A of this common reporting format. Parties which choose to report CO_2 emissions and removals from agricultural soils under 4.D Agricultural Soils of the sector Agriculture should report the amount (in Gg) of these emissions or removals in table Summary 1.A of the CRF. References to additional information (activity data, emissions factors) reported in the NIR should be provided in the documentation box to table 4.D. In line with the corresponding table in the IPCC Guidelines (i.e. IPCC Sectoral Report for Agriculture), this table does not include provisions for reporting CO_2 estimates.

(3) Direct N_2O emissions from pasture, range and paddock manure are to be reported in the "4.D Agricultural Soils" category. All other N_2O emissions from animal manure are to be reported in the "4.B Manure Management" category. See also chapter 4.4 of the IPCC good practice guidance report.

Note: The IPCC Guidelines do not provide methodologies for the calculation of CH_4 emissions and CH_4 and N_2O removals from agricultural soils, or CO_2 emissions from prescribed burning of savannas and field burning of agricultural residues. Parties that have estimated such emissions should provide, in the NIR, additional information (activity data and emission factors) used to derive these estimates and include a reference to the section of the NIR in the documentation box of the corresponding Sectoral background data tables.

Documentation box: • Parties should provide detailed explanations on the agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table. • If estimates are reported under "4.G Other", use this documentation box to provide information regarding activities covered under this category and to provide reference to the section in the NIR where background information can be found.
4.A Enteric Fermentation/2005:Population statistics are on a yearly basis.
Population size of category 4 A 8 Swine includes young swine.
4.A Dairy Cattle/2005:Daily milk yield: annual milk production divided by 365 days.
4.A Mules and Asses/2005:"4.A.7. Mules and Asses" are included in "4.A.6. Horses".
4.B Mules and Asses/2005:"4.A.7. Mules and Asses" are included in "4.A.6. Horses".
4.B Swine:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.
4.B Swine/2005:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.
4.C Rice Cultivation/2005:There is no rice cultivation in Austria.
4.E Prescribed Burning of Savannas/2005:No occurrance of savannas in Austria.
4.F.1 Cereals/2005:Wheat includes cereals total.

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	2 010.68			71.74
Option A:				
Dairy Cattle [4]	534.42	292.32	6.00	115.04
Non-Dairy Cattle	1 476.26	142.48	6.00	56.07
Option B:				
Mature Dairy Cattle				
Mature Non-Dairy Cattle				
Young Cattle				
2. Buffalo	NO	NO	NO	NO
3. Sheep	325.73	20.00	6.00	8.00
4. Goats	55.10	14.00	5.00	5.00
5. Camels and Llamas	NO	NO	NO	NO
6. Horses	87.07	110.00	2.50	18.00
7. Mules and Asses	IE	IE	IE	IE
8. Swine	3 169.54	38.00	0.60	1.50
9. Poultry	13 027.15	2.18	0.09	0.01
10. Other *(please specify)*				
Deer	41.19	20.00	6.00	8.00

[1] Parties are encouraged to provide detailed livestock population data by animal type and region, if available, in the NIR, and provide in the documentation box below a reference to the relevant section. Parties should use the same animal population statistics to estimate CH4 emissions from enteric fermentation, CH4 and N2O from manure management, N2O direct emissions from soil and N2O emissions associated with manure production, as well as emissions from the use of manure as fuel, and sewage-related emissions reported in the Waste sector.

[2] Y_m refers to the fraction of gross energy in feed converted to methane and should be given in per cent in this table.

[3] The implied emission factors will not be calculated until the corresponding emission estimates are entered directly into Table 4.

[4] Including data on dairy heifers, if available.

Documentation box:

• Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

• Indicate in this documentation box whether the activity data used are one-year estimates or a three-year averages.

• Provide a reference to the relevant section in the NIR, in particular with regard to:

(a) disaggregation of livestock population (e.g. according to the classification recommended in the IPCC good practice guidance), including information on whether these data are one-year estimates

(b) parameters relevant to the application of IPCC good practice guidance.

4.A Enteric Fermentation/2005:Population statistics are on a yearly basis.

Population size of category 4 A 8 Swine includes young swine.

4.A Dairy Cattle/2005:Daily milk yield: annual milk production divided by 365 days.

4.A Mules and Asses/2005:"4.A.7. Mules and Asses" are included in "4.A.6. Horses".

Additional information (only for those livestock types for which Tier 2 was used) [a]

Disaggregated list of animals [b] / Indicators:		Dairy Cattle	Non-Dairy Cattle	Mature Dairy Cattle	Mature Non-Dairy Cattle	Young Cattle	Buffalo	Sheep	Goats	Camels and Llamas	Horses	Mules and Asses	Swine	Poultry	Other *(specify)*	Deer
Weight	(kg)	700.00	427.92				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)	15.84	NO				NO	NE	NE	NO	NE	NE	NE	NE		NE
Work	(h/day)	NO	NO				NO	NE	NE	NO	NE	NE	NE	NE		NE
Pregnant	(%)	90.00	16.49	0.00	0.00	0.00	NO	NE	NE	NO	NE	NE	NE	NE		NE
Digestibility of feed	(%)	70.00	72.35	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	Allocation by climate region (1)			Typical animal mass (average)	VS(2) daily excretion (average)	CH_4 producing potential (Bo)(2) (average)	CH_4
		Cool	Temperate	Warm				
	(1000s)	(%)			(kg)	(kg dm/head/day)	(m^3 CH_4/kg VS)	(kg CH_4/head/yr)
1. Cattle	2 010.68							10.87
Option A:								
Dairy Cattle (3)	534.42	100.00	NO	NO	700.00	4.23	0.24	20.36
Non-Dairy Cattle	1 476.26	100.00	NO	NO	427.92	1.95	0.17	7.43
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	325.73	100.00	NO	NO	43.00	0.40	0.19	0.19
4. Goats	55.10	100.00	NO	NO	30.00	0.28	0.17	0.12
5. Camels and Llamas	NO	NO	NO	NO	NO	NO	NO	NO
6. Horses	87.07	100.00	NO	NO	238.00	1.72	0.33	1.39
7. Mules and Asses	IE	IE	NO	NO	238.00	627.80	0.33	IE
8. Swine	3 169.54	100.00	NA	NA	82.00	0.40	0.45	5.96
9. Poultry	13 027.15	100.00	NA	NA	1.10	0.10	0.32	0.08
10. Other livestock *(please specify)*								
Deer	41.19	NA	NA	NA	43.00	0.40	0.19	0.19

(1) Climate regions are defined in terms of annual average temperature as follows: Cool = less than 15°C; Temperate = 15 - 25°C inclusive; and Warm = greater than 25°C (see table 4.2 of the IPCC Guidelines (Volume 3, Reference Manual, p. 4.8)).

(2) VS = Volatile Solids; Bo = maximum methane producing capacity for manure IPCC Guidelines (Volume 3, Reference Manual, p.4.23 and p.4.15); dm = dry matter. Provide average values for VS and Bo where original calculations were made at a more disaggregated level of these livestock categories.

(3) Including data on dairy heifers, if available

(4) The implied emission factors will not be calculated until the corresponding emission estimates are entered directly into table 4

Documentation box:

- Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.
- Indicate in this documentation box whether the activity data used are one-year estimates or three-year averages.
- Provide a reference to the relevant section in the NIR, in particular with regard to:
  (a) disaggregation of livestock population (e.g. according to the classification recommended in the IPCC good practice guidance), including information on whether these data are one-year estimates or three-year averages.
  (b) parameters relevant to the application of IPCC good practice guidance;
  (c) information on how the MCFs are derived, if relevant data could not be provided in the additional information box.

4.B Mules and Asses/2005:"4.A.7. Mules and Asses" are included in "4.A.6. Horses".
4.B Swine:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.
4.B Swine/2005:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.

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	NO	70,4	NO	10,65	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[b]	Cool	90.00	39.00	NO	1.00	NO	1.00	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
Non-Dairy Cattle	Allocation (%)	Cool	0.00	23,89	NO	66,42	NO	9,69	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[b]	Cool	90.00	39.00	NO	1.00	NO	1.00	NO
		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	IE	IE	IE	IE	NO	IE	IE
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[b]	Cool	IE	IE	IE	IE	NO	IE	IE
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
Swine	Allocation (%)	Cool	NO	71,51	NO	28,49	NO	NO	NO
		Temperate	NO	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO	NO
	MCF[b]	Cool	NO	39.00	NO	1.00	NO	NO	NO
		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	2 010.68		NO	25 310 775.53	NO	79 724 051.17	13 475 523.50	NO
Option A:								
Dairy Cattle	534.42	94.55	NO	9 600 229.58	NO	35 571 376.97	5 355 917.55	NO
Non-Dairy Cattle	1 476.26	46.05	NO	15 710 545.95	NO	44 152 674.20	8 119 605.94	NO
Option B:								
Mature Dairy Cattle								
Mature Non-Dairy Cattle								
Young Cattle								
Sheep	325.73	13.10	NO	NO	NO	85 340.74	3 712 322.02	469 374.05
Swine	3 169.54	14.15	NO	15 496 409.77	NO	6 299 108.23	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	55.10	12.30	NO	NO	NO	NO	650 620.80	27 109.20
Camels and Liamas	NO	NO	NO	NO	NO	NO	NO	NO
Horses	87.07	47.90	NO	NO	NO	NO	4 003 918.85	166 829.95
Mules and Asses	IE	IE	IE	IE	IE	IE	IE	IE
Other livestock *(please specify)*								
Deer	41.19	13.10	NO	NO	NO	NO	518 005.44	21 583.56
Total per AWMS			IE,NO	41 738 548.45	IE,NO	86 180 143.45	22 503 677.24	6 702 935.52

IMPLIED EMISSION FACTORS (1)	
Emission factor per animal waste management system	
(kg N_2O-N/kg N)	
Anaerobic lagoon	NO
Liquid system	0.00
Solid storage and dry lot	0.02
Other AWMS	0.00

(1) The implied emission factor will not be calculated until the emissions are entered directly into table

Documentation box:

• Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

• Indicate in this documentation box whether the activity data used are one-year estimates or three-year averages.

• Provide a reference to the relevant section in the NIR, in particular with regard to:

(a) disaggregation of livestock population (e.g. according to the classification recommended in the IPCC good practice guidance), including information on whether these data are one-year estimates or three-year averages.

(b) information on other AWMS, if reported.

4.B Swine:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine.
4.B Swine/2005:For calculation of 4.B.8 emissions only fattening pigs and breeding sows are considered as activity data but (for reasons of consistency with category "4.A.8. Swine")
population size of "4.B.8. Swine" includes young swine.
However, the emission factor of breeding sows considers emissions of young swine

TABLE 4.C SECTORAL BACKGROUND DATA FOR AGRICULTURE
Rice Cultivation
(Sheet 1 of 1)

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.
4.C Rice Cultivation/2005:There is no rice cultivation in Austria.

TABLE 4.D SECTORAL BACKGROUND DATA FOR AGRICULTURE

Agricultural Soils

(Sheet 1 of 2)

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**			4.90
1. Synthetic Fertilizers	Nitrogen input from application of synthetic fertilizers	96 971 453.50	0.01	1.90
2. Animal Manure Applied to Soils	Nitrogen input from manure applied to soils	103 611 735.37	0.01	2.04
3. N-fixing Crops	Nitrogen fixed by N-fixing crops	21 557 432.79	0.01	0.42
4. Crop Residue	Nitrogen in crop residues returned to soils	25 762 885.32	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)*				0.03
Sewage Sludge Spreading	(specify)	1 390 591.41	0.01	0.03
2. Pasture, Range and Paddock Manure	**N excretion on pasture range and paddock**	22 503 677.24	0.02	0.71
3. Indirect Emissions				3.50
1. Atmospheric Deposition	Volatized N from fertilizers, animal manures and other	35 327 498.45	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	75 062 884.20	0.02	2.95
4. Other *(please specify)*				NA

(1) To convert from N_2O-N to N_2O emissions, multiply by 44/28. Note that for cultivation of Histosols the unit of the IEF is kg N_2O-N/ha.

Documentation box:

• Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

• Provide a reference to the relevant section in the NIR, in particular with regard to:

(a) Background information on CH_4 emissions from agricultural soils, if accounted for under the Agriculture sector;

(b) Disaggregated values for $Frac_{GRAZ}$ according to animal type, and for $Frac_{BURN}$ according to crop types;

(c) Full list of assumptions and fractions used.

TABLE 4.D SECTORAL BACKGROUND DATA FOR AGRICULTURE
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	0.01
$Frac_{NCRO}$	Fraction of residue dry biomass that is N	0.02
$Frac_{R}$	Fraction of total above-ground crop biomass that is removed from the field as a crop product	0.34
Other fractions *(please specify)*		NO

[(a)] Use the definitions for fractions as specified in the IPCC Guidelines (Volume 3. Reference Manual, pp. 4.92-4.113) as elaborated by the IPCC good practice guidance (pp. 4.54-4.74).

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION					IMPLIED EMISSION FACTORS		EMISSIONS	
	Area of savanna burned (k ha/yr)	Average above-ground biomass density (t dm/ha)	Fraction of savanna burned	Biomass burned (Gg dm)	Nitrogen fraction in biomass	CH_4 (kg/t dm)	N_2O (kg/t dm)	CH_4 (Gg)	N_2O (Gg)
(specify ecological zone)								NO	NO
Other non-specified	NO	NO	NO	NO	NO	NO	NO	NO	NO

Additional information

	Living Biomass	Dead Biomass
Fraction of above-ground biomass	NO	NO
Fraction oxidized	NO	NO
Carbon fraction	NO	NO

Documentation box: Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
4.E Prescribed Burning of Savannas/2005:No occurrance of savannas in Austria.

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 (t)	Residue/ Crop ratio	Dry matter (dm) fraction of residue	Fraction burned in fields	Fraction oxidized	Total biomass burned (Gg dm)	C fraction of residue	N-C ratio in biomass residues	CH_4 (kg/t dm)	N_2O (kg/t dm)	CH_4 (Gg)	N_2O (Gg)
1. Cereals											0.04	0.00
Wheat	4 879 765.36	1.30	0.86	0.00	0.90	14.89	0.49	0.01	2.91	0.06	0.04	0.00
Barley	NA	NA	NA	NA	NO	IE	NO	NA	IE	IE	IE	IE
Maize	NA	NA	NA	NA	NO	IE	IE	NA	IE	IE	IE	IE
Oats	NA	NA	NA	NA	NO	IE	IE	NA	IE	IE	IE	IE
Rye	NA	NA	NA	NA	NO	IE	IE	NA	IE	IE	IE	IE
Rice	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other *(please specify)*											NA	NA
2. Pulses											NA,NO	NA,NO
Dry bean	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Peas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Soybeans	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other *(please specify)*											NA	NA
3 Tubers and Roots											NA,NO	NA,NO
Potatoes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Other *(please specify)*											NA	NA
4 Sugar Cane	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 Other *(please specify)*											0.02	0.00
Vine	NA	NA	NA	NA	NA	2.85	NA	NA	6.04	0.06	0.02	0.00

Documentation box:
Parties should provide detailed explanations on the Agriculture sector in Chapter 6: Agriculture (CRF sector 4) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.
4.F.1 Cereals/2005:Wheat includes cereals total.

TABLE 5 SECTORAL REPORT FOR LAND USE, LAND-USE CHANGE AND FORESTRY
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals[(1), (2)]	CH_4 [(2)]	N_2O [(2)]	NO_x	CO	NMVOC
	(Gg)					
Total Land-Use Categories	**-17 036.93**	**0.00**	**0.03**	**IE,NA,NE**	**IE,NA,NE**	**NA,NE**
A. Forest Land	**-17 639.88**	**0.00**	**0.00**	**NE**	**NE**	**NE**
1. Forest Land remaining Forest Land	-17 536.08	0.00	0.00	NE	NE	NE
2. Land converted to Forest Land	-103.80	NO	NO	NE	NE	NE
B. Cropland	**-185.90**	**NA,NO**	**0.03**	**IE**	**IE**	**NE**
1. Cropland remaining Cropland	-65.14	NA	NA	IE	IE	NE
2. Land converted to Cropland	-120.77	NO	0.03	IE	IE	NE
C. Grassland	**377.29**	**NO**	**NO**	**IE**	**IE**	**NE**
1. Grassland remaining Grassland	14.47	NO	NO	IE	IE	NE
2. Land converted to Grassland	362.81	NO	NO	IE	IE	NE
D. Wetlands	**77.87**	**NO**	**NO**	**NA**	**NA**	**NA**
1. Wetlands remaining Wetlands [(3)]	NE,NO	NO	NO	NA	NA	NA
2. Land converted to Wetlands	77.87	NO	NO	NA	NA	NA
E. Settlements	**222.71**	**NA,NO**	**NA,NO**	**NA**	**NA**	**NA**
1. Settlements remaining Settlements [(3)]	NE,NO	NA	NA	NA	NA	NA
2. Land converted to Settlements	222.71	NA	NA	NA	NA	NA
F. Other Land	**110.99**	**NA,NO**	**NA,NO**	**NA**	**NA**	**NA**
1. Other Land remaining Other Land [(4)]						
2. Land converted to Other Land	110.99	NA	NA	NA	NA	NA
G. Other *(please specify)* [(5)]	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**
Harvested Wood Products [(6)]	NE	NA	NA	NA	NA	NA
Information items[(7)]						
Forest Land converted to other Land-Use Categories	486.51	NA	NA	NA	NA	NA
Grassland converted to other Land-Use Categories	-170.44	NE	0.03	NA	NA	NA

(1) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) For each land-use category and sub-category, this table sums net CO_2 emissions and removals shown in tables 5.A to 5.F, and the CO_2, CH_4 and N_2O emissions showing in tables 5(I) to 5(V).

(3) Parties may decide not to prepare estimates for these categories contained in appendices 3a.3 and 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

(4) This land-use category is to allow the total of identified land area to match the national area.

(5) The total for category 5.G Other includes items specified only under category 5.G in this table as well as sources and sinks specified in category 5.G in tables 5(I) to 5(V).

(6) Parties may decide not to prepare estimates for this category contained in appendix 3a.1 of the IPCC good practice guidance for LULUCF, although they may do so if they wish and report in this row.

(7) These items are listed for information only and will not be added to the totals, because they are already included in subcategories 5.A.2 to 5.F.2.

Documentation box:

• Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

• If estimates are reported under 5.G Other, use this documentation box to provide information regarding activities covered under this category and to provide reference to the section in the NIR where background information can be found.

TABLE 5.A SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Forest Land

(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA		IMPLIED CARBON-STOCK-CHANGE FACTORS						CHANGES IN CARBON STOCK						Net CO_2 emissions/ removals [8] [9]
Land-Use Category	Sub-division[1]	Area[2] (kha)	Area of organic soil[2] (kha)	Carbon stock change in living biomass per area[3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]		Carbon stock change in living biomass[3] [4]			Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils [4] [6]		
				Gains	Losses	Net change		Mineral soils[5]	Organic soils	Gains	Losses	Net change		Mineral soils	Organic soils[7]	
				(Mg C/ha)						(Gg C)						(Gg)
A. Total Forest Land		3 376.44	NA,NO	3.18	-1.81	1.37	0.05	0.00	NO	10 742.53	-6 111.55	4 630.98	163.95	15.94	NO	-17 639.88
1. Forest Land remaining Forest Land		3 365.06	NA	3.19	-1.82	1.37	0.05	NO	NO	10 729.15	-6 110.53	4 618.62	163.95	NO	NO	-17 536.08
	Coniferous	2 483.41	NA	3.18	-1.98	1.20	0.05	NO	NO	7 896.33	-4 924.24	2 972.09	124.51	NO	NO	-11 354.23
	Deciduous	881.65	NA	3.21	-1.35	1.87	0.04	NO	NO	2 832.81	-1 186.29	1 646.52	39.44	NO	NO	-6 181.85
2. Land converted to Forest Land[10]		11.38	NO	1.18	-0.09	1.09	NO	1.40	NO	13.38	-1.02	12.37	NO	15.94	NO	-103.80
2.1 Cropland converted to Forest Land		1.82	NO	1.18	IE	1.18	NO	2.01	NO	2.14	IE	2.14	NO	3.66	NO	-21.28
	Total	1.82	NO	1.18	IE	1.18	NO	2.01	NO	2.14	IE	2.14	NO	3.66	NO	-21.28
2.2 Grassland converted to Forest Land		6.72	NO	1.18	IE	1.18	NO	0.65	NO	7.90	IE	7.90	NO	4.34	NO	-44.90
	Total	6.72	NO	1.18	IE	1.18	NO	0.65	NO	7.90	IE	7.90	NO	4.34	NO	-44.90
2.3 Wetlands converted to Forest Land		0.57	NO	1.18	IE	1.18	NO	3.04	NO	0.67	IE	0.67	NO	1.73	NO	-8.80
	Total	0.57	NO	1.18	IE	1.18	NO	3.04	NO	0.67	IE	0.67	NO	1.73	NO	-8.80
2.4 Settlements converted to Forest Land		1.59	NO	1.18	-0.64	0.53	NO	2.60	NO	1.87	-1.02	0.85	NO	4.14	NO	-18.30
	Total	1.59	NO	1.18	-0.64	0.53	NO	2.60	NO	1.87	-1.02	0.85	NO	4.14	NO	-18.30
2.5 Other Land converted to Forest Land		0.68	NO	1.18	IE	1.18	NO	3.04	NO	0.80	IE	0.80	NO	2.07	NO	-10.52
	Total	0.68	NO	1.18	IE	1.18	NO	3.04	NO	0.80	IE	0.80	NO	2.07	NO	-10.52

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

(2) The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Forest Land report the cumulative area remaining in the category in the reporting year.

(3) Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

(4) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

(5) Implied carbon-stock-change factors for mineral soils are calculated by dividing the net C stock change estimate for mineral soil by the difference between the area and the area of organic soil.

(6) When Parties are estimating fluxes for organic soils but cannot separate these fluxes from mineral soils, these fluxes should be reported under mineral soils.

(7) The value reported for organic soils is estimated as a flux. For consistency with other entries in this column, these fluxes should be expressed in the unit required in this column, i.e. in Gg C.

(8) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

(9) Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change columns.

(10) A Party may report aggregate estimates for all conversions of land to forest land when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for grassland conversion should be provided in table 5 as an information item.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5.B SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY Inventory 2005

Cropland Submission 2007 v1.2

(Sheet 1 of 1) AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA		IMPLIED CARBON-STOCK-CHANGE FACTORS						CHANGES IN CARBON STOCK						Net CO_2 emissions/ removals [10] [11]
Land-Use Category	Sub-division [1]	Area[2] (kha)	Area of organic soil[2] (kha)	Carbon stock change in living biomass per area[3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]		Carbon stock change in living biomass[3], [4], [6]			Net carbon stock change in dead organic matter[4] [7]	Net carbon stock change in soils [4] [8]		
				Gains	Losses	Net change		Mineral soils[5]	Organic soils	Gains	Losses	Net change		Mineral soils	Organic soils[9]	
				(Mg C/ha)						(Gg C)						(Gg)
B. Total Cropland		1 455.98	NO	0.04	-0.04	0.00	NO	0.05	NO	59.40	-63.76	-4.36	NO	79.68	NO	-276.18
1. Cropland remaining Cropland		1 425.31	NO	IE	-0.04	-0.04	NO	0.07	NO	IE	-58.04	-58.04	NO	100.43	NO	-155.41
	Annual remaining ann	1 424.42	NO	IE	-0.02	-0.02	NO	0.07	NO	IE	-31.48	-31.48	NO	100.42	NO	-252.79
	Annual converted to p	0.46	NO	IE	-2.90	-2.90	NO	0.35	NO	IE	-1.32	-1.32	NO	0.16	NO	4.26
	Perennial converted to	0.44	NO	IE	-58.00	-58.00	NO	-0.35	NO	IE	-25.24	-25.24	NO	-0.15	NO	93.12
2. Land converted to Cropland[12]		30.68	NO	1.94	-0.19	1.75	NO	-0.68	NO	59.40	-5.72	53.68	NO	-20.75	NO	-120.77
2.1 Forest Land converted to Cropland		0.27	NO	IE	-21.17	-21.17	NO	-1.96	NO	IE	-5.72	-5.72	NO	-0.53	NO	22.90
	Total	0.27	NO	IE	-21.17	-21.17	NO	-1.96	NO	IE	-5.72	-5.72	NO	-0.53	NO	22.90
2.2 Grassland converted to Cropland		30.41	NO	1.95	IE	1.95	NO	-0.66	NO	59.40	IE	59.40	NO	-20.22	NO	-143.66
	Total	30.41	NO	1.95	IE	1.95	NO	-0.66	NO	59.40	IE	59.40	NO	-20.22	NO	-143.66
2.3 Wetlands converted to Cropland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.4 Settlements converted to Cropland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Cropland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

[1] Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

[2] The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Cropland report the cumulative area remaining in the category in the reporting year.

[3] Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

[4] The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

[5] Implied carbon-stock-change factors for mineral soils are calculated by dividing the net C stock change estimate for mineral soil by the difference between the area and the area of organic soil.

[6] For category 5.B.1 Cropland remaining Cropland this column only includes changes in perennial woody biomass.

[7] No reporting on dead organic matter pools is required for category 5.B.1. Cropland remaining Cropland.

[8] When Parties are estimating fluxes for organic soils but cannot separate these fluxes from mineral soils, these fluxes should be reported under mineral soils.

[9] The value reported for organic soils is estimated as a flux. For consistency with other entries in this column, these fluxes should be expressed in the unit required in this column, i.e. in Gg C.

[10] According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

[11] Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change colu

[12] A Party may report aggregate estimates for all land conversions to cropland, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land and grassland conversion should be provided in table 5 as an information item.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5.C SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Grassland

(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA		IMPLIED CARBON-STOCK-CHANGE FACTORS						CHANGES IN CARBON STOCK						Net CO_2 emissions/ removals [10] [11]
Land-Use Category	Sub-division [1]	Area[2] (kha)	Area of organic soil[2] (kha)	Carbon stock change in living biomass per area[3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]		Carbon stock change in living biomass[3], [4], [6]			Net carbon stock change in dead organic matter[4] [7]	Net carbon stock change in soils [4] [8]		
				Gains	Losses	Net change		Mineral soils[5]	Organic soils	Gains	Losses	Net change		Mineral soils	Organic soils[9]	
				(Mg C/ha)						(Gg C)						(Gg)
C. Total Grassland		1 848.10	12.95	IE,NO	-0.06	-0.06	NO	0.02	-2.50	IE,NO	-115.14	-115.14	NO	44.63	-32.39	377.29
1. Grassland remaining Grassland		1 818.54	12.95	NO	NO	NO	NO	0.02	-2.50	NO	NO	NO	NO	28.44	-32.39	14.47
	Total	1 818.54	12.95	NO	NO	NO	NO	0.02	-2.50	NO	NO	NO	NO	28.44	-32.39	14.47
2. Land converted to Grassland[12]		29.56	NO	IE,NO	-3.90	-3.90	NO	0.55	NO	IE,NO	-115.14	-115.14	NO	16.19	NO	362.81
2.1 Forest Land converted to Grassland		2.81	NO	IE	-21.17	-21.17	NO	-0.57	NO	IE	-59.48	-59.48	NO	-1.60	NO	223.96
	Total	2.81	NO	IE	-21.17	-21.17	NO	-0.57	NO	IE	-59.48	-59.48	NO	-1.60	NO	223.96
2.2 Cropland converted to Grassland		26.75	NO	IE	-2.08	-2.08	NO	0.66	NO	IE	-55.66	-55.66	NO	17.79	NO	138.85
	Total	26.75	NO	IE	-2.08	-2.08	NO	0.66	NO	IE	-55.66	-55.66	NO	17.79	NO	138.85
2.3 Wetlands converted to Grassland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.4 Settlements converted to Grassland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Grassland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.
(2) The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Grassland report the cumulative area remaining in the category in the reporting year.
(3) Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.
(4) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).
(5) Implied carbon-stock-change factors for mineral soils are calculated by dividing the net C stock change estimate for mineral soil by the difference between the area and the area of organic soil.
(6) For category 5.C.1 Grassland remaining Grassland this column only includes changes in perennial woody biomass.
(7) No reporting on dead organic matter pools is required for category 5.C.1 Grassland remaining Grassland.
(8) When Parties are estimating fluxes for organic soils but cannot separate these fluxes from mineral soils, these fluxes should be reported under mineral soils.
(9) The value reported for organic soils is estimated as a flux. For consistency with other entries in this column, these fluxes should be expressed in the unit required in this column, i.e. in Gg C.
(10) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.
(11) Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change colu
(12) A Party may report aggregate estimates for all land conversions to grassland, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land conversion should be provided in table 5 as an information item.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5.D SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Wetlands
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED CARBON-STOCK-CHANGE FACTORS					CHANGES IN CARBON STOCK					Net CO_2 emissions/ removals [5] [6]
Land-Use Category	Sub-division [1]	Area[2] (kha)	Carbon stock change in living biomass per area [3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]	Carbon stock change in living biomass[3] [4]			Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils [4]	
			Gains	Losses	Net change			Gains	Losses	Net change			
			(Mg C/ha)					(Gg C)					(Gg)
D. Total Wetlands		142.25	IE,NE,NO	-0.03	-0.03	NE,NO	-0.12	IE,NE,NO	-3.59	-3.59	NE,NO	-17.64	77.87
1. Wetlands remaining Wetlands [7]		142.02	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Total	142.02	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Land converted to Wetlands [8]		0.23	IE,NO	-15.78	-15.78	NO	-77.50	IE,NO	-3.59	-3.59	NO	-17.64	77.87
2.1 Forest Land converted to Wetlands		0.16	IE	-21.17	-21.17	NO	-80.67	IE	-3.39	-3.39	NO	-12.91	59.74
	Total	0.16	IE	-21.17	-21.17	NO	-80.67	IE	-3.39	-3.39	NO	-12.91	59.74
2.2 Cropland converted to Wetlands		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.3 Grassland converted to Wetlands		0.07	IE	-3.04	-3.04	NO	-70.00	IE	-0.21	-0.21	NO	-4.74	18.13
	Total	0.07	IE	-3.04	-3.04	NO	-70.00	IE	-0.21	-0.21	NO	-4.74	18.13
2.4 Settlements converted to Wetlands		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Wetlands		NO	IE	NO	IE,NO	NO	NO	IE	NO	IE,NO	NO	NO	IE,NO
	Total	NO	IE	NO	IE,NO	NO	NO	IE	NO	IE,NO	NO	NO	IE,NO

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

(2) The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Wetlands report the cumulative area remaining in the category in the reporting year.

(3) Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

(4) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

(5) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

(6) Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change columns.

(7) Parties may decide not to prepare estimates for this category contained in appendix 3a.3 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

(8) A Party may report aggregate estimates for all land conversions to wetlands, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land and grassland conversion should be provided in table 5 as an information item.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED CARBON-STOCK-CHANGE FACTORS					CHANGES IN CARBON STOCK					Net CO_2 emissions/ removals [6] [7]
Land-Use Category	Sub-division [1]	Area[2] (kha)	Carbon stock change in living biomass per area [3] [4] Gains	Losses	Net change	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] Gains	Losses	Net change	Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils [4]	
			(Mg C/ha)					(Gg C)					(Gg)
E. Total Settlements		489.19	0.02	-0.13	-0.11	NO	-0.01	10.02	-65.24	-55.22	NO	-5.51	222.71
1. Settlements remaining Settlements [8]		483.95	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE	NE,NO
	Total	483.95	NE	NE	NE	NO	NE	NE	NE	NE	NO	NE	NE,NO
2. Land converted to Settlements [9]		5.24	1.91	-12.46	-10.55	NO	-1.05	10.02	-65.24	-55.22	NO	-5.51	222.71
2.1 Forest Land converted to Settlements		0.80	0.64	-21.17	-20.53	NO	-2.97	0.51	-16.93	-16.42	NO	-2.37	68.92
	Total	0.80	0.64	-21.17	-20.53	NO	-2.97	0.51	-16.93	-16.42	NO	-2.37	68.92
2.2 Cropland converted to Settlements		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.3 Grassland converted to Settlements		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.4 Wetlands converted to Settlements		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Other Land converted to Settlements		4.44	2.14	-10.89	-8.75	NO	-0.71	9.51	-48.31	-38.80	NO	-3.14	153.79
	Total	4.44	2.14	-10.89	-8.75	NO	-0.71	9.51	-48.31	-38.80	NO	-3.14	153.79

[1] Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

[2] The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Settlements report the cumulative area remaining in the category in the reporting year.

[3] Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

[4] The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

[5] For category 5.E.1 Settlements remaining Settlements this column only includes changes in perennial woody biomass.

[6] According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

[7] Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change columns.

[8] Parties may decide not to prepare estimates for this category contained in appendix 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

[9] A Party may report aggregate estimates for all land conversions to settlements, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land and grassland conversion should be provided in table 5 as an information item.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5.F SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Other land

(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED CARBON-STOCK-CHANGE FACTORS					CHANGES IN CARBON STOCK					Net CO_2 emissions/ removals [5] [6]
Land-Use Category	Sub-division [1]	Area[2] (kha)	Carbon stock change in living biomass per area [3] [4]			Net carbon stock change in dead organic matter per area[4]	Net carbon stock change in soils per area [4]	Carbon stock change in living biomass[3] [4]			Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils [4]	
			Gains	Losses	Net change			Gains	Losses	Net change			
			(Mg C/ha)					(Gg C)					(Gg)
F. Total Other Land		1.27	IE,NO	-21.17	-21.17	NO	-2.67	IE,NO	-26.88	-26.88	NO	-3.39	110.99
1. Other Land remaining Other Land [7]		NE											
2. Land converted to Other Land [8]		1.27	IE,NO	-21.17	-21.17	NO	-2.67	IE,NO	-26.88	-26.88	NO	-3.39	110.99
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	110.99
	Total	1.27	IE	-21.17	-21.17	NO	-2.67	IE	-26.88	-26.88	NO	-3.39	110.99
2.2 Cropland converted to Other Land		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.3 Grassland converted to Other Land		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.4 Wetlands converted to Other Land		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.5 Settlements converted to Other Land		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

(1) Land categories may be further divided according to climate zone, management system, soil type, vegetation type, tree species, ecological zone or national land classification.

(2) The total area of the subcategories, in accordance with the sub-division used, should be entered here. For lands converted to Other Land report the cumulative area remaining in the category in the reporting year.

(3) Carbon stock gains and losses should be listed separately except in cases where, due to the methods used, it is technically impossible to separate information on gains and losses.

(4) The signs for estimates of gains in carbon stocks are positive (+) and of losses in carbon stocks are negative (-).

(5) According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+). Net changes in carbon stocks are converted to CO_2 by multiplying C by 44/12 and changing the sign for net CO_2 removals to be negative (-) and for net CO_2 emissions to be positive (+). Note that carbon stock changes in a single pool are not necessarily equal to emissions or removals, because some carbon stock changes result from carbon transfers among pools rather than exchanges with the atmosphere.

(6) Where Parties directly estimate emissions and removals rather than carbon stock changes, they may report emissions/removals directly in this column and use notation keys in the stock change columns.

(7) This land-use category is to allow the total of identified land area to match the national area.

(8) A Party may report aggregate estimates for all land conversions to other land, when data are not available to report them separately. A Party should specify in the documentation box which types of land conversion are included. Separate estimates for forest land and grassland conversion should be provided in table 5 as an information item.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (I) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Direct N_2O emissions from N fertilization[1] of Forest Land and Other
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS [4]
Land-Use Category [2]	Total amount of fertilizer applied	N_2O-N emissions per unit of fertilizer	N_2O
	(Gg N/yr)	(kg N_2O-N/kg N)[3]	(Gg)
Total for all Land Use Categories	**NO**	**NO**	**NO**
A. Forest Land [5] [6]	**NO**	**NO**	**NO**
1. Forest Land remaining Forest Land	NO	NO	NO
2. Land converted to Forest Land	NO	NO	NO
G. Other *(please specify)*			

(1) Direct N_2O emissions from fertilization are estimated using equations 3.2.17 and 3.2.18 of the IPCC good practice guidance for LULUCF based on the amounts of fertilizers applied to forest land.

(2) N_2O emissions from N fertilization of cropland and grassland are reported in the Agriculture sector; therefore only Forest Land is included in this table.

(3) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

(4) Emissions are reported with a positive sign.

(5) If a Party is not able to separate the fertilizer applied to forest land from that applied to agriculture, it may report all N_2O emissions from fertilization in the Agriculture sector. This should be explicitly indicated in the documentation box.

(6) A Party may report aggregate estimates for all N fertilization on forest land in the category Forest Land remaining Forest Land when data are not available to report Forest Land remaining Forest Land and Land converted to Forest Land separately.

Documentation box:

Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (II) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

Non-CO_2 emissions from drainage of soils and wetlands[1]
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED EMISSION FACTORS		EMISSIONS [5]	
Land-Use Category [2]	Sub-division [3]	Area (kha)	N_2O-N per area [4] (kg N_2O-N/ha)	CH_4 per area (kg CH_4/ha)	N_2O (Gg)	CH_4 (Gg)
Total all Land-Use Categories					**NO**	**NO**
A. Forest Land [6]			**NO**	**NO**	**NO**	**NO**
Organic Soil		NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO
Mineral Soil		NO	NO	NO	NO	NO
	Total	NO	NO	NO	NO	NO
D. Wetlands			**NO**	**NO**	**NO**	**NO**
Peatland [7]		NO	NO	NO	NO	NO
Flooded Lands [7]		NO	NO	NO	NO	NO
G. Other (please specify)						

(1) Parties may decide not to prepare estimates for these categories contained in appendices 3a.2 and 3a.3 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.

(2) N_2O emissions from drained cropland and grassland soils are covered in the Agriculture tables of the CRF under Cultivation of Histosols.

(3) A Party should report further disaggregations of drained soils corresponding to the methods used. Tier 1 disaggregates soils into "nutrient rich" and "nutrient poor" areas, whereas higher-tier methods can further disaggregate into different peatland types, soil

(4) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

(5) Emissions are reported with a positive sign.

(6) In table 5, these emissions will be added to 5.A.1 Forest Land remaining Forest Land.

(7) In table 5, these emissions will be added to 5.D.2 Land converted to Wetlands.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (III) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

N_2O emissions from disturbance associated with land-use conversion to cropland [1]

(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS [4]
Land-Use Category [2]	Land area converted	N_2O-N emissions per area converted[3]	N_2O
	(kha)	(kg N_2O-N/ha)	(Gg)
Total all Land-Use Categories [5]	**30.41**	**0.69**	**0.03**
B. Cropland	**30.41**	**0.69**	**0.03**
2. Lands converted to Cropland [6]	30.41	0.69	0.03
Organic Soils	NO	NO	NO
Mineral Soils	30.41	0.69	0.03
2.1 Forest Land converted to Cropland	NE,NO	NE,NO	NE,NO
Organic Soils	NO	NO	NO
Mineral Soils	NE	NE	NE
2.2 Grassland converted to Cropland	30.41	0.69	0.03
Organic Soils	NO	NO	NO
Mineral Soils	30.41	0.69	0.03
2.3 Wetlands converted to Cropland [7]	NO	NO	NO
Organic Soils	NO	NO	NO
Mineral Soils	NO	NO	NO
2.5 Other Land converted to Cropland	NO	NO	NO
Organic Soils	NO	NO	NO
Mineral Soils	NO	NO	NO
G. Other *(please specify)*			

(1) Methodologies for N_2O emissions from disturbance associated with land-use conversion are based on equations 3.3.14 and 3.3.15 of the IPCC good practice guidance for LULUCF. N_2O emissions from fertilization in the preceding land use and new land use should not be reported.

(2) According to the IPCC good practice guidance for LULUCF, N_2O emissions from disturbance of soils are only relevant for land conversions to cropland. N_2O emissions from Cropland remaining Cropland are included in the Agriculture sector of the good practice guidance. The good practice guidance provides methodologies only for mineral soils.

(3) In the calculation of the implied emission factor, N_2O emissions are converted to N_2O-N by multiplying by 28/44.

(4) Emissions are reported with a positive sign.

(5) Parties can separate between organic and mineral soils, if they have data available

(6) If activity data cannot be disaggregated to all initial land uses, Parties may report some initial land uses aggregated under Other Land converted to Cropland (indicate in the documentation box what this category includes).

(7) Parties should avoid double counting with N_2O emissions from drainage and from cultivation of organic soils reported in Agriculture under Cultivation of Histosols

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF Sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (IV) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY

CO_2 emissions from agricultural lime application [1]

(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	EMISSIONS [3]
Land-Use Category	Total amount of lime applied (Mg/yr)	CO_2-C per unit of lime [2] (Mg CO_2-C /Mg)	CO_2 (Gg)
Total all Land-Use Categories [4], [5], [6]	**205 173.96**	**0.12**	**90.28**
B. Cropland [6] [7]	**205 173.96**	**0.12**	**90.28**
Limestone $CaCO_3$	205 173.96	0.12	90.28
Dolomite $CaMg(CO_3)_2$	IE	IE	IE
C. Grassland [6] [8]	**IE**	**IE**	**IE**
Limestone $CaCO_3$	IE	IE	IE
Dolomite $CaMg(CO_3)_2$	IE	IE	IE
G. Other *(please specify)* [6] [9]			

[1] CO_2 emissions from agricultural lime application are addressed in equations 3.3.6 and 3.4.11 of the IPCC good practice guidance for LULUCF.
[2] The implied emission factor is expressed in unit of carbon to faciliate comparison with published emission factors.
[3] Emissions are reported with a positive sign.
[4] If Parties are not able to separate liming application for different land-use categories, they should include liming for all land-use categories in the category 5.G Other.
[5] Parties that are able to provide data for lime application to forest land should provide this information under 5.G Other and specify in the documentation box that forest land application is included in this category.
[6] A Party may report aggregate estimates for total lime applications when data are not available for limestone and dolomite.
[7] In table 5, these CO_2 emissions will be added to 5.B.1 Cropland remaining Cropland.
[8] In table 5, these CO_2 emissions will be added to 5.C.1 Grassland remaining Grassland.
[9] If a Party has data broken down to limestone and dolomite at national level, it can report these data under 5.G Other.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 5 (V) SECTORAL BACKGROUND DATA FOR LAND USE, LAND-USE CHANGE AND FORESTRY
Biomass Burning [1]
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA			IMPLIED EMISSION FACTOR			EMISSIONS [5]		
	Description[3]	Unit	Values	CO_2	CH_4	N_2O	CO_2 [4]	CH_4	N_2O
Land-Use Category[2]		**(ha or kg dm)**		**(Mg/activity data unit)**			**(Gg)**		
Total for Land-Use Categories	**Area burned**		**NA**	**IE,NA,NO**	**NA**	**NA**	**IE,NA,NO**	**0.00**	**0.00**
A. Forest Land	**Area burned**	**ha**	**67.00**	**IE,NO**	**0.06**	**0.00**	**IE,NO**	**0.00**	**0.00**
1. Forest land remaining Forest Land	Area burned	ha	67.00	IE,NO	0.06	0.00	IE,NO	0.00	0.00
Controlled Burning	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,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**	**NA,NO**
1. Cropland remaining Cropland[6]			NA	NA	NA	NA	NA	NA	NA
Controlled Burning	(specify)		NA	NA	NA	NA	NA	NA	NA
Wildfires	(specify)		NA	NA	NA	NA	NA	NA	NA
2. Land converted to Cropland			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2.1. Forest Land converted to Cropland	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Controlled Burning	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Wildfires	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
C. Grassland			**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1. Grassland remaining grassland[7]			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2. Land converted to Grassland			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2.1. Forest Land converted to Grassland	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Controlled Burning	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Wildfires	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
D. Wetlands			**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1. Wetlands remaining Wetlands[8]			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2. Land converted to Wetlands			NO	NO	NO	NO	NO	NO	NO
Controlled Burning	(specify)		NO	NO	NO	NO	NO	NO	NO
Wildfires	(specify)		NO	NO	NO	NO	NO	NO	NO
2.1. Forest Land converted to Wetlands	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Controlled Burning	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
Wildfires	Area burned	ha	NO	NO	NO	NO	NO	NO	NO
E. Settlements [8]	Area burned	ha	NO	**NO**	**NO**	**NO**	NO	NO	NO
F. Other Land [9]	Area burned	ha	NO	**NO**	**NO**	**NO**	NO	NO	NO
G. Other (please specify)									

[1] Methodological guidance on burning can be found in sections 3.2.1.4 and 3.4.1.3 of the IPCC good practice guidance for LULUCF.
[2] Parties should report both controlled/prescribed burning and wildfires emissions, where appropriate, in a separate manner.
[3] For each category activity data should be selected between area burned or biomass burned. Units for area will be ha and for biomass burned kg dm. The implied emission factor will refer to the selected activity data with an automatic change in the units.
[4] If CO_2 emissions from biomass burning are not already included in tables 5.A - 5.F, they should be reported here. This should be clearly documented in the documentation box and in the NIR. Double counting should be avoided. Parties that include all carbon stock changes in the carbon stock tables (5.A, 5.B, 5.C, 5.D, 5.E and 5.F), should report IE (included elsewhere) in this column.
[5] Emissions are reported with a positive sign.
[6] In-situ above-ground woody biomass burning is reported here. Agricultural residue burning is reported in the Agriculture sector.
[7] Includes only emissions from controlled biomass burning on grasslands outside the tropics (prescribed savanna burning is reported under the Agriculture sector).
[8] Parties may decide not to prepare estimates for these categories contained in appendices 3a.2, 3a.3 and 3a.4 of the IPCC good practice guidance for LULUCF, although they may do so if they wish.
[9] This land-use category is to allow the total of identified land area to match the national area.

Documentation box:
Parties should provide detailed explanations on the Land Use, Land-Use Change and Forestry sector in Chapter 7: Land Use, Land-Use Change and Forestry (CRF sector 5) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and/or further details are needed to understand the content of this table.

TABLE 6 SECTORAL REPORT FOR WASTE
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [(1)]	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
	(Gg)						
Total Waste	**12.26**	**93.00**	**1.02**	**0.05**	**6.31**	**0.09**	**0.06**
A. Solid Waste Disposal on Land	**NA,NO**	**89.50**		**NA,NO**	**6.30**	**0.08**	
1. Managed Waste Disposal on Land	NA	89.50		NA	6.30	0.08	
2. Unmanaged Waste Disposal Sites	NO	NO		NO	NO	NO	
3. Other *(as specified in table 6.A)*	NA	NA		NA	NA	NA	
B. Waste Water Handling		**1.96**	**0.80**	**NA**	**NA**	**NA**	
1. Industrial Wastewater		IE,NA	0.16	NA	NA	NA	
2. Domestic and Commercial Waste Water		1.96	0.64	NA	NA	NA	
3. Other *(as specified in table 6.B)*		NA	NA	NA	NA	NA	
C. Waste Incineration	**12.26**	**0.00**	**0.00**	**0.05**	**0.01**	**0.00**	**0.06**
D. Other *(please specify)*	**NA**	**1.54**	**0.22**	**NA**	**NA**	**NA**	**NA**
Compost production	NA	1.54	0.22	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 Emissions [(2)]	CH_4 Recovery [(3)]	CO_2 [(4)]
	(Gg)		%	(t /t MSW)		(Gg)		
1 Managed Waste Disposal on Land	649.96	1.00	128.16	0.17	NA	89.50	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)]	**8 233.31**
Urban population (1000s)[(a)]	5 368.69
Waste generation rate (kg/capita/day)	0.22
Fraction of MSW disposed to SWDS	0.15
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)]	56.00

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	9 143.10				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	9 137.00	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	0.16
a. Waste Water	510.00	NA	0.00	NA	NA	0.16
b. Sludge	NA	IE	NA	IE	NA	IE
2. Domestic and Commercial Wastewater				1.96	NA	0.64
a. Waste Water	330.57	0.01	NA	1.96	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]	8 233.31	43.07	0.16	0.01	0.64

(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 (kg COD/m^3)
Industrial waste water	NA	NA
Iron and steel	NA	NA
Non-ferrous	NE	NE
Fertilizers	NE	NE
Food and beverage	NE	NE
Paper and pulp	NE	NE
Organic chemicals	NE	NE
Other (please specify)	NE	NE
Textile		
Rubber		
Poultry		
Wood and wood production		
Wool Scouring		
Other agricultural		
Chemical		
Dairy Processing		
Electricity, steam, water production		
Leather industry		
Leather and Skins		
Iron and steel		
Meat industry		
Fuels		
Machinery and equipment		
Mining and quarrying		
	DC (kg BOD/1000 person/yr)	
Domestic and Commercial	NE	
Other (please specify)		

Handling systems:	Industrial waste water treated (%)	Industrial sludge treated (%)	Domestic waste water treated (%)	Domestic sludge treated (%)
Aerobic	NE	NA	NA	NE
Anaerobic	NE	NA	NA	NE
Other (please specify)	NE	NA	NA	NE

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 1 of 3)

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	**62 613.44**	**336.06**	**16.99**	**1 462.39**	**911.55**	**332.79**	**117.97**	**0.02**	**0.01**	**225.06**	**720.31**	**154.14**	**26.41**
1. Energy	**70 772.15**	**45.95**	**2.55**							**218.50**	**688.99**	**72.01**	**25.13**
A. Fuel Combustion — Reference Approach[2]	74 048.85												
Sectoral Approach[2]	70 567.12	14.18	2.55							218.50	688.99	68.92	25.00
1. Energy Industries	15 834.21	0.22	0.20							12.69	3.38	1.19	6.90
2. Manufacturing Industries and Construction	15 537.98	0.57	0.51							34.73	158.83	3.02	9.19
3. Transport	24 028.75	0.92	0.88							135.30	162.71	20.93	0.30
4. Other Sectors	15 046.02	12.47	0.95							35.58	363.35	43.72	8.57
5. Other	120.15	0.00	0.01							0.20	0.72	0.04	0.04
B. Fugitive Emissions from Fuels	205.04	31.77	IE,NA							IE,NA	IE,NA	3.09	0.13
1. Solid Fuels	IE,NA,NO	IE,NA,NO	IE,NA							IE,NA	IE,NA	IE,NA	IE,NA
2. Oil and Natural Gas	205.04	31.77	IE,NA							IE,NA	IE,NA	3.09	0.13
2. Industrial Processes	**8 688.54**	**0.75**	**0.88**	**1 462.39**	**911.55**	**332.79**	**117.97**	**0.02**	**0.01**	**1.29**	**23.89**	**4.40**	**1.22**
A. Mineral Products	3 119.86	IE,NA	IE,NA							IE,NA	9.78	IE,NA	IE,NA
B. Chemical Industry	557.38	0.75	0.88	NO	NO	NO	NO	NO	NO	0.57	11.12	1.32	0.77
C. Metal Production	5 011.31	0.00	NA				NO		NO	0.10	2.54	0.45	0.45
D. Other Production[3]	NA									0.61	0.45	2.62	NA
E. Production of Halocarbons and SF_6					NA		NA		NA				
F. Consumption of Halocarbons and SF_6				1 462.39	911.55	332.79	117.97	0.02	0.01				
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	**177.40**		**0.56**							**NA**	**NA**	**75.77**	**NA**
4. Agriculture		**196.34**	**11.94**							**5.22**	**1.12**	**1.87**	**0.00**
A. Enteric Fermentation		153.95											
B. Manure Management		41.96	2.83									NE,NO	
C. Rice Cultivation		NO										NO	
D. Agricultural Soils[4]		0.37	9.11									1.76	
E. Prescribed Burning of Savannas		NO	NO							NO	NO	NO	
F. Field Burning of Agricultural Residues		0.06	0.00							0.03	1.12	0.11	
G. Other		NA	NA							5.19	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	(5) **-17 036.93**	**0.00**	**0.03**							**IE,NA,NE**	**IE,NA,NE**	**NA,NE**	**NA**
A. Forest Land	(5) -17 639.88	0.00	0.00							NE	NE	NE	
B. Cropland	(5) -185.90	NA,NO	0.03							IE	IE	NE	
C. Grassland	(5) 377.29	NO	NO							IE	IE	NE	
D. Wetlands	(5) 77.87	NO	NO							NA	NA	NA	
E. Settlements	(5) 222.71	NA,NO	NA,NO							NA	NA	NA	
F. Other Land	(5) 110.99	NA,NO	NA,NO							NA	NA	NA	
G. Other	(5) NE	NA	NA							NA	NA	NA	NA
6. Waste	**12.26**	**93.00**	**1.02**							**0.05**	**6.31**	**0.09**	**0.06**
A. Solid Waste Disposal on Land	(6) NA,NO	89.50								NA,NO	6.30	0.08	
B. Waste-water Handling		1.96	0.80							NA	NA	NA	
C. Waste Incineration	(6) 12.26	0.00	0.00							0.05	0.01	0.00	0.06
D. Other	NA	1.54	0.22							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	**1 730.71**	**0.03**	**0.06**							**5.53**	**1.71**	**0.72**	**0.55**
Aviation	1 730.71	0.03	0.06							5.53	1.71	0.72	0.55
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	**15 174.23**												

(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 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		**62 613.44**	**336.06**	**16.99**	**1 462.39**	**911.55**	**332.79**	**117.97**	**0.02**	**0.01**	**225.06**	**720.31**	**154.14**	**26.41**
1. Energy		**70 772.15**	**45.95**	**2.55**							**218.50**	**688.99**	**72.01**	**25.13**
A. Fuel Combustion	Reference Approach[2]	74 048.85												
	Sectoral Approach[2]	70 567.12	14.18	2.55							218.50	688.99	68.92	25.00
B. Fugitive Emissions from Fuels		205.04	31.77	IE,NA							IE,NA	IE,NA	3.09	0.13
2. Industrial Processes		**8 688.54**	**0.75**	**0.88**	**1 462.39**	**911.55**	**332.79**	**117.97**	**0.02**	**0.01**	**1.29**	**23.89**	**4.40**	**1.22**
3. Solvent and Other Product Use		**177.40**		**0.56**							**NA**	**NA**	**75.77**	**NA**
4. Agriculture [3]			**196.34**	**11.94**							**5.22**	**1.12**	**1.87**	**0.00**
5. Land Use, Land-Use Change and Forestry		[4] **-17 036.93**	**0.00**	**0.03**							**IE,NA,NE**	**IE,NA,NE**	**NA,NE**	**NA**
6. Waste		**12.26**	**93.00**	**1.02**							**0.05**	**6.31**	**0.09**	**0.06**
7. Other		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items: [5]														
International Bunkers		**1 730.71**	**0.03**	**0.06**							**5.53**	**1.71**	**0.72**	**0.55**
Aviation		1 730.71	0.03	0.06							5.53	1.71	0.72	0.55
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		**15 174.23**												

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)	**62 613.44**	**7 057.18**	**5 266.09**	**911.55**	**117.97**	**286.77**	**76 252.98**
1. Energy	**70 772.15**	**965.04**	**790.69**				**72 527.89**
A. Fuel Combustion (Sectoral Approach)	70 567.12	297.81	790.69				71 655.62
1. Energy Industries	15 834.21	4.57	63.01				15 901.79
2. Manufacturing Industries and Construction	15 537.98	11.98	158.15				15 708.12
3. Transport	24 028.75	19.31	272.97				24 321.04
4. Other Sectors	15 046.02	261.85	294.22				15 602.10
5. Other	120.15	0.08	2.34				122.57
B. Fugitive Emissions from Fuels	205.04	667.24	IE,NA				872.27
1. Solid Fuels	IE,NA,NO	IE,NA,NO	IE,NA				IE,NA,NO
2. Oil and Natural Gas	205.04	667.24	IE,NA				872.27
2. Industrial Processes	**8 688.54**	**15.79**	**274.16**	**911.55**	**117.97**	**286.77**	**10 294.78**
A. Mineral Products	3 119.86	IE,NA	IE,NA				3 119.86
B. Chemical Industry	557.38	15.71	274.16	NO	NO	NO	847.25
C. Metal Production	5 011.31	0.08	NA	NO	NO	NA,NO	5 011.39
D. Other Production	NA						NA
E. Production of Halocarbons and SF_6				NA	NA	NA	NA
F. Consumption of Halocarbons and SF_6 (2)				911.55	117.97	286.77	1 316.29
G. Other	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	**177.40**		**173.60**				**351.00**
4. Agriculture		**4 123.22**	**3 700.15**				**7 823.37**
A. Enteric Fermentation		3 233.02					3 233.02
B. Manure Management		881.15	876.30				1 757.45
C. Rice Cultivation		NO					NO
D. Agricultural Soils (3)		7.79	2 823.53				2 831.31
E. Prescribed Burning of Savannas		NO	NO				NO
F. Field Burning of Agricultural Residues		1.27	0.32				1.59
G. Other		NA	NA				NA
5. Land Use, Land-Use Change and Forestry (1)	**-17 036.93**	**0.09**	**10.28**				**-17 026.56**
A. Forest Land	-17 639.88	0.09	0.02				-17 639.77
B. Cropland	-185.90	NA,NO	10.26				-175.65
C. Grassland	377.29	NO	NO				377.29
D. Wetlands	77.87	NO	NO				77.87
E. Settlements	222.71	NA,NO	NA,NO				222.71
F. Other Land	110.99	NA,NO	NA,NO				110.99
G. Other	NE	NA	NA				NA,NE
6. Waste	**12.26**	**1 953.03**	**317.20**				**2 282.49**
A. Solid Waste Disposal on Land	NA,NO	1 879.59					1 879.59
B. Waste-water Handling		41.20	247.86				289.06
C. Waste Incineration	12.26	0.01	0.03				12.30
D. Other	NA	32.24	69.31				101.55
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Memo Items: (4)							
International Bunkers	1 730.71	0.62	18.77				1 750.11
Aviation	1 730.71	0.62	18.77				1 750.11
Marine	NA,NO	NA,NO	NA,NO				NA,NO
Multilateral Operations	**IE**	**IE**	**IE**				**IE**
CO_2 Emissions from Biomass	**15 174.23**						**15 174.23**

Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	93 279.54
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	76 252.98

(1) For CO_2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(4) See footnote 8 to table Summary 1.A.

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED
(Sheet 1 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
1. Energy	**CS,M,T1,T2**	**CS,PS**	**CS,M,T1,T2**	**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	CS,D	NA	NA						
1. Solid Fuels	NA	NA	NA	NA	NA	NA						
2. Oil and Natural Gas	CS,T1	CS,PS	T1	CS,D	NA	NA						
2. Industrial Processes	**CS,T1,T2**	**CS,D,PS**	**CR,CS**	**CS,PS**	**CS**	**PS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**
A. Mineral Products	CS,T1	CS,D	NA	NA	NA	NA						
B. Chemical Industry	CS	CS,PS	CS	PS	CS	PS					NA	NA
C. Metal Production	CS,T2	D,PS	CR	CS	NA	NA	NA	NA	NA	NA	NA	NA
D. Other Production	NA	NA										
E. Production of Halocarbons and SF_6							NA	NA	NA	NA	NA	NA
F. Consumption of Halocarbons and SF_6							CS	CS	CS	CS	CS	CS
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Use the following notation keys to specify the method applied:

D (IPCC default) **T1a, T1b, T1c** (IPCC Tier 1a, Tier 1b and Tier 1c, respectively) **CR** (CORINAIR)
RA (Reference Approach) **T2** (IPCC Tier 2) **CS** (Country Specific)
T1 (IPCC Tier 1) **T3** (IPCC Tier 3) **OTH** (Other)

If using more than one method within one source category, list all the relevant methods. Explanations regarding country-specific methods, other methods or any modifications to the default IPCC methods, as well as informatic

Use the following notation keys to specify the emission factor used:

D (IPCC default) **CS** (Country Specific) **OTH** (Other)
CR (CORINAIR) **PS** (Plant Specific)

Where a mix of emission factors has been used, list all the methods in the relevant cells and give further explanations in the documentation box. Also use the documentation box to explain the use of notation OTH.

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED
(Sheet 2 of 2)

Inventory 2005
Submission 2007 v1.2
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method applied	**Emission factor**	**Method applied**	**Emission factor**	**Method applied**	**Emission factor**	**Method applied**	**Emission factor**	**Method applied**	**Emission factor**	**Method applied**	**Emission factor**
3. Solvent and Other Product Use	**CR,CS**	**CS**			**CS**	**D**						
4. Agriculture			**CS,D,T1,T2**	**CS,D**	**D,T1**	**CS,D**						
A. Enteric Fermentation			T1,T2	CS,D								
B. Manure Management			T1,T2	CS,D	T1	CS						
C. Rice Cultivation			NA	NA								
D. Agricultural Soils			CS	CS	T1	D						
E. Prescribed Burning of Savannas			NA	NA	NA	NA						
F. Field Burning of Agricultural Residues			D	D	D	D						
G. Other			NA	NA	NA	NA						
5. Land Use, Land-Use Change and Forestry	**T1,T3**	**CS,D**	**T1**	**CS,D**	**T1**	**CS,D**						
A. Forest Land	T1,T3	CS	T1	CS,D	T1	CS,D						
B. Cropland	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	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	N2O						
1 A 4 biomass	CH4						
1 A 4 mobile, diesel	CO2	x			x	x	
1 A 4 other	CO2		x		x	x	
1 A 4 solid	CO2	x	x		x	x	
1 A 4 stationary, liquid	CO2	x	x		x	x	
1 A gaseous	CO2	x	x		x	x	
1 B 2 b	CH4	x	x		x	x	
2 A 1	CO2	x	x		x	x	
2 A 2	CO2	x			x	x	
2 A 3	CO2	x			x		
2 A 7 b	CO2	x	x		x	x	
2 B 1	CO2	x			x	x	
2 B 2	N2O		x		x	x	
2 C 1	CO2	x	x		x	x	
2 C 3	PFCs		x		x	x	
2 C 4	SF6		x		x	x	
2 F 1 to 2 F 5	HFCs	x	x		x	x	
2 F 7	HFC, PFC, SF6		x			x	
2 F 9	SF6						
3.	CO2		x		x	x	
4 A 1	CH4	x	x		x	x	
4 B 1	CH4	x	x		x	x	
4 B 1	N2O	x	x		x	x	
4 B 8	CH4	x	x		x	x	
4 D 1	N2O	x	x		x	x	
4 D 3	N2O	x	x		x	x	
5 A 1	CO2	x	x			x	
5 B 1	CO2		x			x	
5 C 2	CO2	x				x	
5 E 2.	CO2						
6 A	CH4	x	x		x	x	
6 B	N2O		x		x	x	

Note: L = Level assessment; T = Trend assessment; Q = Qualitative assessment.
[1] The term “key categories” refers to both the key source categories as addressed in the IPCC good practice guidance and the key categories as addressed in the IPCC good practice guidance for LULUCF
[2] For estimating key categories Parties may chose the disaggregation level presented as an example in table 7.1 of the IPCC good practice guidance (page 7.6) and table 5.4.1 (page 5.31) of the IPCC good practice guidance for LULUCF, the level used in 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: Inventory 2005
Submission 2007 v1.2
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2						CH_4						N_2O					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**62 613.44**						7 057.18						5 266.09				
1. Energy		**70 772.15**						965.04						790.69				
1.A. Fuel Combustion Activities		70 567.12						297.81						790.69				
1.A.1. Energy Industries		15 834.21						4.57						63.01				
1.A.2. Manufacturing Industries and Construction		15 537.98						11.98						158.15				
1.A.3. Transport		24 028.75						19.31						272.97				
1.A.4. Other Sectors		15 046.02						261.85						294.22				
1.A.5. Other		120.15						0.08						2.34				
1.B. Fugitive Emissions from Fuels		205.04						667.24						IE,NA				
1.B.1. Solid fuel		IE,NA,NO						IE,NA,NO						IE,NA				
1.B.2. Oil and Natural Gas		205.04						667.24						IE,NA				
2. Industrial Processes		**8 688.54**						**15.79**						**274.16**				
2.A. Mineral Products		3 119.86						IE,NA						IE,NA				
2.B. Chemical Industry		557.38						15.71						274.16				
2.C. Metal Production		5 011.31						0.08						NA				
2.D. Other Production		NA																
2.G. Other		NA						NA						NA				
3. Solvent and Other Product Use		**177.40**												**173.60**				
4. Agriculture								**4 123.22**						**3 700.15**				
4.A. Enteric Fermentation								3 233.02										
4.B. Manure Management								881.15						876.30				
4.C. Rice Cultivation								NO										
4.D. Agricultural Soils [(4)]								7.79						2 823.53				
4.E. Prescribed Burning of Savannas								NO						NO				
4.F. Field Burning of Agricultural Residues								1.27						0.32				
4.G. Other								NA						NA				
5. Land Use, Land-Use Change and Forestry (net) [(5)]		**-17 036.93**						0.09						10.28				
5.A. Forest Land		-17 639.88						0.09						0.02				
5.B. Cropland		-185.90						NA,NO						10.26				
5.C. Grassland		377.29						NO						NO				
5.D. Wetlands		77.87						NO						NO				
5.E. Settlements		222.71						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: Inventory 2005
Submission 2007 v1.2
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2						CH_4						N_2O					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
6. Waste		**12.26**						1 953.03						317.20				
6.A. Solid Waste Disposal on Land		NA,NO						1 879.59										
6.B. Waste-water Handling								41.20						247.86				
6.C. Waste Incineration		12.26						0.01						0.03				
6.D. Other		NA						32.24						69.31				
7. Other *(as specified in Summary 1.A)*		NA						NA						NA				
Memo Items:																		
International Bunkers		**1 730.71**						**0.62**						**18.77**				
Multilateral Operations		**IE**						**IE**						**IE**				
CO_2 Emissions from Biomass		**15 174.23**																

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs						PFCs						SF_6					
	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]	Previous submission	Latest submission	Difference	Difference[(1)]	Impact of recalculation on total emissions excluding LULUCF [(2)]	Impact of recalculation on total emissions including LULUCF[(3)]
	CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**911.55**						**117.97**						**286.77**				
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		911.55						117.97						286.77				
2.G. Other		NA						NA						NA				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**1 462.39**						**332.79**						**473.65**				

	Previous submission	Latest submission	Difference	Difference[(1)]
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry		76 252.98		
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry		93 279.54		

(1) Estimate the percentage change due to recalculation with respect to the previous submission (percentage change = 100 x [(LS-PS)/PS], where LS = latest submission and PS = previous submission. All cases of recalculation of the estimate of the source/sink category should be addressed and explained in table 8(b).

(2) Total emissions refer to total aggregate GHG emissions expressed in terms of CO_2 equivalent, excluding GHGs from the LULUCF sector. The impact of the recalculation on the total emissions is calculated as follows: impact of recalculation (%) = 100 x [(source (LS) - source (PS))/total emissions (LS)], where LS = latest submission, PS = previous submission.

(3) Total emissions refer to total aggregate GHG emissions expressed in terms of CO_2 equivalent, including GHGs from the LULUCF sector. The impact of the recalculation on the total emissions is calculated as follows: impact of recalculation (%) = 100 x [(source (LS) - source (PS))/total emissions (LS)], where LS = latest submission, PS = previous submission.

(4) Parties which previously reported CO_2 from soils in the Agriculture sector should note this in the NIR.

(5) Net CO_2 emissions/removals to be reported.

Documentation box:
Parties should provide detailed information on recalculations in Chapter 10: Recalculations and Improvements, and in the relevant sections of Chapters 3 to 9 (see section 2.5 of each of Chapters 3 - 9) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.

TABLE 8(b) RECALCULATION - EXPLANATORY INFORMATION
(Sheet 1 of 1)

Specify the sector and source/sink category[1] where changes in estimates have occurred:		GHG	RECALCULATION DUE TO				
			CHANGES IN:			Addition/removal/ reallocation of source/sink categories	Other changes in data (e.g. statistical or editorial changes, correction of errors)
			Methods [2]	Emission factors [2]	Activity data [2]		

[1] Enter the identification code of the source/sink category (e.g. 1.B.1) in the first column and the name of the category (e.g. Fugitive Emissions from Solid Fuels) in the second column of the table. Note that the source categories entered in this table should match those used in table 8(a).

[2] Explain changes in methods, emission factors and activity data that have resulted in recalculation of the estimate of the source/sink as indicated in table 8(a). Include changes in the assumptions and coefficients in the Methods column.

Documentation box:

Parties should provide the full information on recalculations in Chapter 10: Recalculations and Improvements, and in the relevant sections of Chapters 3 to 9 (see section 2.5 of each of Chapters 3 to 9) of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table. References should point particularly to the sections of the NIR in which justifications of the changes as to improvements in the accuracy, completeness and consistency of the inventory are reported.

TABLE 9(a) COMPLETENESS - INFORMATION ON NOTATION KEYS
(Sheet 1 of 1)

Sources and sinks not estimated (NE)[1]			
GHG	**Sector[2]**	**Source/sink category [2]**	**Explanation**
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
Carbon	5 LULUCF	Total	no sufficient data for estimates.
CH4	5 LULUCF	Grassland converted to Other Land-Use Categories	No information available
CO2	5 LULUCF	Harvested Wood Products	Parties do not have to prepare estimates for this category contained in appendix 3a.1 of the IPCC good practice guidance for LULUCF.
N2O	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	no sufficient data for estimates.
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No information available
SF6	2 Industrial Processes	2.F.P4 Destroyed amount	No information available
SF6	2 Industrial Processes	Research and other use	No information available
SF6	2 Industrial Processes	Research and other use	No information available

Sources and sinks reported elsewhere (IE)[3]				
GHG	**Source/sink category**	**Allocation as per IPCC Guidelines**	**Allocation used by the Party**	**Explanation**
Carbon	Perennial converted to annual	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Total	Increase	Decrease	Only net figures are reported.
Carbon	Total	Increase	Decrease	Only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
Carbon	Annual remaining annual	Increase	Decrease	only net figures are reported.
Carbon	Annual converted to perennial	Increase	Decrease	only net figures are reported.
Carbon	Total	5 A 2 1 Cropland converted to Forest Land -Total - Decrease	d converted to Forest Land -Total - Increase	only net figures are reported.
Carbon	Total	5 A 2 2 Grassland converted to Forest Land -Total - Decrease	d converted to Forest Land -Total - Increase	only net figures are reported.
Carbon	Total	5 A 2 3 Wetlands converted to Forest Land -Total - Decrease	s converted to Forest Land -Total - Increase	only net figures are reported.
Carbon	Total	5 A 2 5 Other Land converted to Forest Land -Total - Decrease	d converted to Forest Land -Total - Increase	only net figures are reported.
Carbon	Total	Increase	Decrease	only net figures are reported.
CH4	B.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	B.1.B Solid Fuel Transformation	1 B 1 B Solid Fuel Transformation	1 A 2 a Iron and Steel	Emissions from coke ovens are included in 1 A 2 a Iron and Steel
CH4	1.B.2.A.1 Exploration	1 B 2 A 1 Oil Exploration	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CH4	1.B.2.A.3 Transport	1 B 2 A 3 Oil Transport	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CH4	1.B.2.B.1 Exploration	1 B 2 A 3 Oil Transport	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CH4	B.2.B.2 Production / Processing	1 B 2 A 3 Oil Transport	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CH4	1.B.2.C.1 Venting	1.B.2.C.1	1 B 2 b iv Refining Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.1.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.1.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.1.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.2 Flaring	1.B.2.C.1	1 B 2 b iv Refining Storage	The emission declaration of the refinery includes all emissions from all sources.
CH4	1.B.2.C.2.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.2.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	1.B.2.C.2.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CH4	4.A Enteric Fermentation	4 A Enteric Fermentation / Mules and Asses	4 A Enteric Fermentation / Horses	In the national statistics mules, asses and horses are published together.
CH4	4.B Manure Management	4 A Manure Managment / Mules and Asses	4 A Manure Managment / Horses	In the national statistics mules, asses and horses are published together.
CH4	2.A.7.1 Glass Production	2.A.7.1 Glass Production	2A3 Limestone Use, 2A4 Soda ash use	emissions are reported under 2A3 Limestone and dolomite use and under 2A4 Soda ash use
CH4	2.C.1.1 Steel	2 C 1 1 Steel	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CH4	2.C.1.2 Pig Iron	2 C 1 2 Pig Iron	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CH4	2.C.1.3 Sinter	2 C 1 3 Sinter	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CH4	2.C.1.4 Coke	2 C 1 4 Coke	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CH4	4.F.1.2 Barley	4 F 1 2 Barlay	4 F 1 1 Wheat	Wheat includes cereals total
CH4	4.F.1.3 Maize	4 F 1 3 Maize	4 F 1 1 Wheat	Wheat includes cereals total
CH4	4.F.1.4 Oats	4 F 1 4 Oats	4 F 1 1 Wheat	Wheat includes cereals total
CH4	4.F.1.5 Rye	4 F 1 5 Rye	4 F 1 1 Wheat	Wheat includes cereals total
CH4	6.B.1 Industrial Wastewater	6 B 1 Industrial Wastewater / Sludge	6 B 1 Industrial Wastewater / Wastewater	Emissions from sludge are reported together with emissions from wastewater
CH4	ommercial (w/o human sewage)	6 B 2 Dometic and Commercial Wastewater / Sludge	and Commercial Wastewater / Wastewater	Emissions from sludge are reported together with emissions from wastewater
CH4	1.AA.1.B Petroleum Refining	1 A 1 b Petroleum Refining / Liquid Fuels.	1 B 2 fugitive Emissions from fuels.	ed. CH4 emissions from fuel combustion are a minor source of total CH4 emisions from refinery.
CH4	1.AA.1.B Petroleum Refining	1 A 1 b Petroleum Refining / Gaseous Fuels.	1 B 2 fugitive Emissions from fuels.	ed. CH4 emissions from fuel combustion are a minor source of total CH4 emisions from refinery.
CH4	1.C2 Multilateral Operations	1 C 2 Multilateral Operations	1 A 4 a Commercial /Institutional	e the emissions of this sector are very low they are included in the residential/commercial sector.
CO2	B.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	B.1.B Solid Fuel Transformation	1 B 1 B Solid Fuel Transformation	1 A 2 a Iron and Steel	Emissions from coke ovens are included in 1 A 2 a Iron and Steel
CO2	1.B.2.A.1 Exploration	1 B 2 A 1 Oil Exploration	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CO2	1.B.2.A.3 Transport	1 B 2 A 3 Oil Transport	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
CO2	1.B.2.C.1 Venting	1.B.2.C.1	1 A 1 b Petroleum Refining	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.1.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.1.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.1.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.2 Flaring	1.B.2.C.1	1 A 1 b Petroleum Refining	The emission declaration of the refinery includes all emissions from all sources.
CO2	1.B.2.C.2.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.2.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	1.B.2.C.2.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
CO2	2.A.4.1 Soda Ash Production	2 A 4 1 Soda Ash Production	1 A 2 c Chemicals	sector (subcategory 1 A 2 c), that's why CO2 emissions of soda ash production is reported as "IE".
CO2	2.A.4.1 Soda Ash Production	2 A 4 1 Soda Ash Production	1 A 2 c Chemicals	sector (subcategory 1 A 2 c), that's why CO2 emissions of soda ash production is reported as "IE".
CO2	2.A.5 Asphalt Roofing	2 A 5 Asphalt Roofing	3 Solvent Use	from 2A5 Asphalt Roofing and 2A6 Road Paving with Asphalt are included in the Solvent Sector.
CO2	2.A.6 Road Paving with Asphalt	2 A 6 Road Paving	3 Solvent Use	from 2A5 Asphalt Roofing and 2A6 Road Paving with Asphalt are included in the Solvent Sector.
CO2	2.A.7.1 Glass Production	2.A.7.1 Glass Production	2A3 Limestone Use, 2A4 Soda ash use	emissions are reported under 2A3 Limestone and dolomite use and under 2A4 Soda ash use
CO2	2.C.1.3 Sinter	2 C 1 3 Sinter	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CO2	2.C.1.4 Coke	2 C 1 4 Coke	1 A 2 a Iron and Steel	ns from all activities of integrated iron and steel plants are reported under 1 A 2 a Iron and Steel.
CO2	1.C2 Multilateral Operations	1 C 2 Multilateral Operations	1 A 4 a Commercial /Institutional	e 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	arbon stock change due to wildfires at forest land is included in figures of table 5.A Sektor 5.A.1.
CO2	1 Cropland remaining Cropland	5 B Cropland / lime application / Dolomite	5 B Cropland / lime application / Limestone	Emissions from dolomite liming include emissions from limestone liming
CO2	Grassland remaining Grassland	5 C Grassland / lime application	5 B Cropland / lime application / Limestone	Emissions from cropland dolomite liming include emissions from grassland liming.
CO2	Grassland remaining Grassland	5 C Grassland / lime application	5 B Cropland / lime application / Limestone	Emissions from cropland dolomite liming include emissions from grassland liming.
N2O	B.1.B Solid Fuel Transformation	1 B 1 B Solid Fuel Transformation	1 A 2 a Iron and Steel	Emissions from coke ovens are included in 1 A 2 a Iron and Steel
N2O	1.B.2.A.1 Exploration	1 B 2 A 1 Oil Exploration	1 B 2 A 2 Oil Production	oduction fields are reported here (total figures are reported from the Association of Oil Industry).
N2O	1.B.2.C.2 Flaring	1.B.2.C.1	1 A 1 b Petroleum Refining	The emission declaration of the refinery includes all emissions from all sources.
N2O	1.B.2.C.2.1 Oil	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
N2O	1.B.2.C.2.2 Gas	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
N2O	1.B.2.C.2.3 Combined	1 B 2 c Venting and Flaring	1 B 2 A 4 Oil Refining/Storage	The emission declaration of the refinery includes all emissions from the plant.
N2O	2.A.7.1 Glass Production	2.A.7.1 Glass Production	2A3 Limestone Use, 2A4 Soda ash use	emissions are reported under 2A3 Limestone and dolomite use and under 2A4 Soda ash use
N2O	4.F.1.2 Barley	4 F 1 2 Barlay	4 F 1 1 Wheat	Wheat includes cereals total
N2O	4.F.1.3 Maize	4 F 1 3 Maize	4 F 1 1 Wheat	Wheat includes cereals total
N2O	4.F.1.4 Oats	4 F 1 4 Oats	4 F 1 1 Wheat	Wheat includes cereals total
N2O	4.F.1.5 Rye	4 F 1 5 Rye	4 F 1 1 Wheat	Wheat includes cereals total
N2O	6.B.1 Industrial Wastewater	6 B 1 Industrial Wastewater / Sludge	6 B 1 Industrial Wastewater / Wastewater	Emissions from sludge are reported together with emissions from wastewater
N2O	ommercial (w/o human sewage)	6 B 2 Dometic and Commercial Wastewater / Sludge	and Commercial Wastewater / Wastewater	Emissions from sludge are reported together with emissions from wastewater
N2O	1.C2 Multilateral Operations	1 C 2 Multilateral Operations	1 A 4 a Commercial /Institutional	e 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	calculation is based on consumption data of halocarbons and SF6 or products (net import/export).
SF6	2.F.P3.1 In bulk	2 F P 3 1 Export in Bulk	2 F P 2 1 Import in Bulk	calculation is based on consumption data of halocarbons and SF6 or products (net import/export).
SF6	2.F.P3.2 In products	2 F P 3 2 Export in Products	2 F P 2 1 Import in Bulk	calculation is based on consumption data of halocarbons and SF6 or products (net import/export).

(1) Clearly indicate sources and sinks which are considered in the IPCC Guidelines but are not considered in the submitted inventory. Explain the reason for excluding these sources and sinks, in order to avoid arbitrary interpretations. An entry should be made for each source/sink
(2) Indicate omitted source/sink following the IPCC source/sink category structure (e.g. sector: Waste, source category: Waste-Water Handling)
(3) Clearly indicate sources and sinks in the submitted inventory that are allocated to a sector other than that indicated by the IPCC Guidelines. Show the sector indicated in the IPCC Guidelines and the sector to which the source or sink is allocated in the submitted inventory. Explain

TABLE 9(b) COMPLETENESS - INFORMATION ON ADDITIONAL GREENHOUSE GASES
(Sheet 1 of 1)

Inventory 2005
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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 EMISSION TRENDS
CO_2
(Part 1 of 2)

Inventory 2005
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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	**54 041.66**	**57 797.89**	**52 904.51**	**53 360.11**	**53 397.58**	**56 077.66**	**60 061.85**	**59 275.50**	**59 313.08**	**58 003.55**
A. Fuel Combustion (Sectoral Approach)	53 939.64	57 686.86	52 784.49	53 248.08	53 270.06	55 950.63	59 990.82	59 154.99	59 171.25	57 833.02
1. Energy Industries	13 659.06	14 452.36	11 314.21	11 352.32	11 611.85	12 637.20	13 735.74	13 832.73	12 851.80	12 449.96
2. Manufacturing Industries and Construction	13 578.92	13 846.53	12 694.46	13 041.62	14 021.53	14 203.42	14 269.01	15 839.83	14 738.00	13 685.86
3. Transport	12 400.36	13 993.25	13 937.18	14 115.57	14 078.38	14 462.62	16 038.82	14 975.67	17 170.98	16 596.21
4. Other Sectors	14 266.28	15 357.61	14 804.93	14 699.14	13 516.70	14 614.79	15 908.30	14 469.61	14 368.02	15 059.36
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	**7 579.11**	**7 425.25**	**6 938.52**	**6 853.28**	**7 183.49**	**7 382.43**	**7 081.26**	**7 670.76**	**7 314.62**	**7 162.44**
A. Mineral Products	3 269.05	3 127.22	3 147.24	3 081.86	3 196.46	2 856.93	2 769.36	2 968.65	2 815.30	2 801.11
B. Chemical Industry	585.10	609.31	632.54	605.93	555.09	583.66	590.25	582.87	579.70	583.12
C. Metal Production	3 724.96	3 688.72	3 158.74	3 165.49	3 431.94	3 941.84	3 721.65	4 119.24	3 919.62	3 778.22
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	282.67	236.77	187.74	187.35	171.54	189.88	172.81	190.09	172.24	158.37
4. Agriculture										
A. Enteric Fermentation										
B. Manure Management										
C. Rice Cultivation										
D. Agricultural Soils										
E. Prescribed Burning of Savannas										
F. Field Burning of Agricultural Residues										
G. Other										
5. Land Use, Land-Use Change and Forestry[(2)]	**-11 913.42**	**-17 660.29**	**-12 642.86**	**-16 459.82**	**-15 160.52**	**-14 720.69**	**-9 730.34**	**-18 810.19**	**-17 154.60**	**-21 686.90**
A. Forest Land	-12 358.80	-18 284.99	-13 105.65	-16 937.23	-15 835.76	-15 368.49	-10 622.26	-19 724.27	-17 873.70	-22 367.35
B. Cropland	-524.72	-529.17	-517.94	-454.47	-461.63	-281.51	-259.50	-246.20	-214.30	-196.25
C. Grassland	445.37	446.55	446.45	415.99	416.20	414.70	385.38	385.20	384.97	385.40
D. Wetlands	212.46	212.46	212.46	210.35	210.35	210.35	226.72	226.72	208.24	208.24
E. Settlements	172.43	355.03	181.99	180.14	384.91	178.84	428.34	437.37	229.21	172.07
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 CO_2 emissions including net CO_2 from LULUCF	**50 016.92**	**47 823.01**	**47 398.78**	**43 951.52**	**45 602.75**	**48 940.25**	**57 596.88**	**48 337.77**	**49 657.29**	**43 649.72**
Total CO_2 emissions excluding net CO_2 from LULUCF	**61 930.34**	**65 483.30**	**60 041.64**	**60 411.34**	**60 763.27**	**63 660.94**	**67 327.21**	**67 147.96**	**66 811.89**	**65 336.62**
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	10 897.75	10 528.79	11 192.73	11 915.68	11 996.33	11 409.23	13 336.47

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CO_2
(Part 2 of 2)

Inventory 2005
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	**58 000.73**	**62 144.96**	**63 246.97**	**69 569.23**	**68 792.24**	**70 772.15**	**30.96**
A. Fuel Combustion (Sectoral Approach)	57 836.20	61 962.23	63 079.93	69 336.20	68 582.20	70 567.12	30.83
1. Energy Industries	12 290.43	13 648.74	13 430.52	15 978.73	16 040.31	15 834.21	15.92
2. Manufacturing Industries and Construction	14 311.93	14 342.59	14 497.23	14 867.38	15 116.41	15 537.98	14.43
3. Transport	17 734.48	18 896.56	20 754.58	22 676.50	23 282.73	24 028.75	93.77
4. Other Sectors	13 454.41	15 031.27	14 355.69	15 724.28	14 036.16	15 046.02	5.47
5. Other	44.95	43.07	41.91	89.31	106.59	120.15	243.06
B. Fugitive Emissions from Fuels	164.53	182.73	167.03	233.04	210.04	205.04	100.96
1. Solid Fuels	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00
2. Oil and Natural Gas	164.53	182.73	167.03	233.04	210.04	205.04	100.96
2. Industrial Processes	**7 766.11**	**7 693.74**	**8 260.57**	**8 205.30**	**8 153.74**	**8 688.54**	**14.64**
A. Mineral Products	2 958.13	2 976.77	3 085.41	3 072.98	3 162.59	3 119.86	-4.56
B. Chemical Industry	587.27	539.50	551.22	592.50	528.09	557.38	-4.74
C. Metal Production	4 220.70	4 177.48	4 623.93	4 539.83	4 463.06	5 011.31	34.53
D. Other Production	NA	NA	NA	NA	NA	NA	0.00
E. Production of Halocarbons and SF_6							
F. Consumption of Halocarbons and SF_6							
G. Other	NA	NA	NA	NA	NA	NA	0.00
3. Solvent and Other Product Use	181.02	193.60	189.63	185.66	181.69	177.40	-37.24
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)]	**-16 355.08**	**-19 122.26**	**-15 474.46**	**-16 944.85**	**-16 973.65**	**-17 036.93**	**43.01**
A. Forest Land	-17 028.48	-19 804.49	-16 086.16	-17 639.88	-17 639.88	-17 639.88	42.73
B. Cropland	-187.46	-192.33	-198.95	-136.14	-131.85	-185.90	-64.57
C. Grassland	384.84	421.94	359.84	382.13	340.54	377.29	-15.29
D. Wetlands	208.24	208.24	208.24	208.24	208.24	77.87	-63.35
E. Settlements	156.79	133.39	131.58	129.81	138.31	222.71	29.16
F. Other Land	110.99	110.99	110.99	110.99	110.99	110.99	-20.62
G. Other	NE	NE	NE	NE	NE	NE	0.00
6. Waste	**12.26**	**12.26**	**12.26**	**12.26**	**12.26**	**12.26**	**-54.39**
A. Solid Waste Disposal on Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
B. Waste-water Handling							
C. Waste Incineration	12.26	12.26	12.26	12.26	12.26	12.26	-54.39
D. Other	NA	NA	NA	NA	NA	NA	0.00
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total CO_2 emissions including net CO_2 from LULUCF	**49 605.05**	**50 922.31**	**56 234.96**	**61 027.61**	**60 166.28**	**62 613.44**	**25.18**
Total CO_2 emissions excluding net CO_2 from LULUCF	**65 960.13**	**70 044.56**	**71 709.42**	**77 972.46**	**77 139.93**	**79 650.36**	**28.61**
Memo Items:							
International Bunkers	**1 674.93**	**1 628.55**	**1 526.13**	**1 305.01**	**1 531.80**	**1 730.71**	**95.35**
Aviation	1 674.93	1 628.55	1 526.13	1 305.01	1 531.80	1 730.71	95.35
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Multilateral Operations	IE	IE	IE	IE	IE	IE	0.00
CO_2 Emissions from Biomass	12 484.27	13 921.46	13 709.37	14 169.17	14 357.48	15 174.23	55.63

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
CH_4
(Part 1 of 2)

Inventory 2005
Submission 2007 v1.2
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	40.29	42.47	41.24	41.59	40.40	41.94	44.08	40.53	40.44	41.51
A. Fuel Combustion (Sectoral Approach)	21.97	23.48	21.41	20.86	19.01	19.46	20.34	15.91	15.28	15.34
1. Energy Industries	0.16	0.18	0.15	0.16	0.15	0.15	0.18	0.19	0.18	0.17
2. Manufacturing Industries and Construction	0.41	0.44	0.44	0.43	0.45	0.45	0.46	0.49	0.47	0.46
3. Transport	2.91	2.88	2.61	2.40	2.19	1.99	1.81	1.62	1.55	1.39
4. Other Sectors	18.49	19.99	18.20	17.87	16.22	16.86	17.89	13.61	13.08	13.32
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	18.32	18.99	19.84	20.73	21.39	22.48	23.74	24.62	25.15	26.17
1. Solid Fuels	0.52	0.45	0.37	0.36	0.29	0.28	0.24	0.24	0.24	0.24
2. Oil and Natural Gas	17.80	18.54	19.46	20.37	21.10	22.21	23.50	24.38	24.91	25.93
2. Industrial Processes	**0.71**	**0.70**	**0.67**	**0.70**	**0.71**	**0.69**	**0.70**	**0.71**	**0.74**	**0.70**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
B. Chemical Industry	0.70	0.70	0.66	0.70	0.71	0.68	0.69	0.70	0.73	0.69
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use										
4. Agriculture	**230.02**	**226.80**	**218.33**	**218.81**	**219.12**	**220.14**	**216.81**	**213.78**	**212.92**	**208.82**
A. Enteric Fermentation	179.13	176.62	168.94	168.88	169.79	171.16	168.75	165.79	164.47	162.83
B. Manure Management	50.49	49.78	49.02	49.39	48.86	48.48	47.55	47.48	47.94	45.47
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	0.33	0.33	0.31	0.47	0.40	0.44	0.45	0.45	0.45	0.45
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.07	0.07	0.06	0.06	0.06	0.07	0.06	0.07	0.07	0.07
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.01**	**0.00**	**0.01**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.00**
A. Forest Land	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00
B. Cropland	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Waste	**166.16**	**165.86**	**161.63**	**159.46**	**151.13**	**143.04**	**135.32**	**128.78**	**123.92**	**118.72**
A. Solid Waste Disposal on Land	160.79	160.48	156.27	154.09	145.77	137.79	130.36	124.17	119.61	114.61
B. Waste-water Handling	4.85	4.84	4.70	4.56	4.39	4.21	3.87	3.53	3.19	2.93
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.52	0.54	0.65	0.82	0.98	1.04	1.09	1.08	1.12	1.18
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**437.19**	**435.82**	**421.87**	**420.57**	**411.37**	**405.81**	**396.90**	**383.80**	**378.02**	**369.74**
Total CH_4 emissions excluding CH_4 from LULUCF	**437.17**	**435.82**	**421.86**	**420.56**	**411.36**	**405.81**	**396.90**	**383.80**	**378.01**	**369.74**
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 EMISSION TRENDS
CH_4
(Part 2 of 2)

Inventory 2005
Submission 2007 v1.2
AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	41.25	42.61	42.79	43.36	44.98	45.95	14.06
A. Fuel Combustion (Sectoral Approach)	14.32	15.29	14.37	14.38	13.89	14.18	-35.45
1. Energy Industries	0.16	0.18	0.20	0.23	0.26	0.22	38.43
2. Manufacturing Industries and Construction	0.46	0.49	0.50	0.54	0.56	0.57	39.07
3. Transport	1.28	1.19	1.13	1.07	0.99	0.92	-68.45
4. Other Sectors	12.42	13.43	12.55	12.52	12.06	12.47	-32.55
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	229.23
B. Fugitive Emissions from Fuels	26.93	27.32	28.42	28.98	31.10	31.77	73.43
1. Solid Fuels	0.27	0.26	0.30	0.25	0.05	IE,NA,NO	-100.00
2. Oil and Natural Gas	26.66	27.07	28.11	28.74	31.05	31.77	78.54
2. Industrial Processes	**0.70**	**0.67**	**0.71**	**0.70**	**0.70**	**0.75**	**6.46**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
B. Chemical Industry	0.70	0.67	0.70	0.69	0.70	0.75	6.27
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	67.75
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	0.00
3. Solvent and Other Product Use							
4. Agriculture	**206.62**	**204.44**	**200.09**	**199.20**	**198.28**	**196.34**	**-14.64**
A. Enteric Fermentation	161.87	159.48	156.59	155.55	155.94	153.95	-14.05
B. Manure Management	44.23	44.46	43.05	43.18	41.89	41.96	-16.90
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	0.00
D. Agricultural Soils	0.45	0.43	0.38	0.41	0.37	0.37	12.92
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	0.00
F. Field Burning of Agricultural Residues	0.06	0.07	0.07	0.06	0.09	0.06	-8.94
G. Other	NA	NA	NA	NA	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**	**-64.94**
A. Forest Land	0.00	0.00	0.01	0.00	0.00	0.00	-64.94
B. Cropland	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
C. Grassland	NO	NO	NO	NO	NO	NO	0.00
D. Wetlands	NO	NO	NO	NO	NO	NO	0.00
E. Settlements	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
G. Other	NA	NA	NA	NA	NA	NA	0.00
6. Waste	**113.58**	**108.81**	**106.71**	**107.84**	**99.94**	**93.00**	**-44.03**
A. Solid Waste Disposal on Land	109.68	105.14	103.24	104.51	96.64	89.50	-44.34
B. Waste-water Handling	2.68	2.42	2.18	1.93	1.95	1.96	-59.55
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	-90.13
D. Other	1.22	1.25	1.28	1.40	1.34	1.54	196.87
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total CH_4 emissions including CH_4 from LULUCF	**362.14**	**356.54**	**350.30**	**351.10**	**343.91**	**336.06**	**-23.13**
Total CH_4 emissions excluding CH_4 from LULUCF	**362.14**	**356.54**	**350.29**	**351.10**	**343.90**	**336.05**	**-23.13**
Memo Items:							
International Bunkers	0.03	0.03	0.03	0.02	0.03	0.03	104.95
Aviation	0.03	0.03	0.03	0.02	0.03	0.03	104.95
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Multilateral Operations	IE	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
N_2O
(Part 1 of 2)

Inventory 2005
Submission 2007 v1.2
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	**2.47**	**2.75**	**2.74**	**2.80**	**2.81**	**2.79**	**2.80**	**2.76**	**2.80**	**2.75**
A. Fuel Combustion (Sectoral Approach)	2.47	2.75	2.74	2.80	2.81	2.79	2.80	2.76	2.80	2.75
1. Energy Industries	0.15	0.18	0.14	0.15	0.15	0.16	0.16	0.15	0.17	0.18
2. Manufacturing Industries and Construction	0.52	0.55	0.54	0.54	0.56	0.55	0.54	0.59	0.57	0.59
3. Transport	0.85	1.07	1.12	1.17	1.17	1.13	1.07	0.99	1.06	0.96
4. Other Sectors	0.94	0.95	0.94	0.95	0.93	0.94	1.03	1.03	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**	**12.87**	**14.35**	**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	10.61	11.43	10.56	9.77	11.26	11.40	10.33	10.47	10.55	10.26
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	**0.43**	**0.43**	**0.44**	**0.46**	**0.53**	**0.55**	**0.61**	**0.65**	**0.68**	**0.74**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	0.35	0.35	0.34	0.34	0.39	0.40	0.46	0.49	0.52	0.57
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.08	0.08	0.10	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**
Total N_2O emissions including N_2O from LULUCF	**20.48**	**21.58**	**20.31**	**19.75**	**21.14**	**21.44**	**20.46**	**20.52**	**20.78**	**20.54**
Total N_2O emissions excluding N_2O from LULUCF	**20.44**	**21.55**	**20.27**	**19.71**	**21.10**	**21.41**	**20.42**	**20.48**	**20.74**	**20.51**
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 EMISSION TRENDS
N_2O
(Part 2 of 2)

Inventory 2005
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AUSTRIA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	**2.62**	**2.72**	**2.73**	**2.76**	**2.66**	**2.55**	**3.14**
A. Fuel Combustion (Sectoral Approach)	2.62	2.72	2.73	2.76	2.66	2.55	3.14
1. Energy Industries	0.18	0.20	0.20	0.23	0.25	0.20	31.69
2. Manufacturing Industries and Construction	0.57	0.57	0.57	0.54	0.51	0.51	-2.23
3. Transport	0.94	0.94	0.99	1.00	0.94	0.88	3.62
4. Other Sectors	0.93	1.00	0.97	0.98	0.95	0.95	0.50
5. Other	0.00	0.00	0.00	0.01	0.01	0.01	168.11
B. Fugitive Emissions from Fuels	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
1. Solid Fuels	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
2. Oil and Natural Gas	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
2. Industrial Processes	**3.07**	**2.54**	**2.60**	**2.85**	**0.91**	**0.88**	**-69.94**
A. Mineral Products	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	0.00
B. Chemical Industry	3.07	2.54	2.60	2.85	0.91	0.88	-69.94
C. Metal Production	NA	NA	NA	NA	NA	NA	0.00
D. Other Production							
E. Production of Halocarbons and SF_6							
F. Consumption of Halocarbons and SF_6							
G. Other	NA	NA	NA	NA	NA	NA	0.00
3. Solvent and Other Product Use	0.75	0.71	0.67	0.64	0.60	0.56	-25.33
4. Agriculture	**12.88**	**12.82**	**12.75**	**12.32**	**11.91**	**11.94**	**-13.82**
A. Enteric Fermentation							
B. Manure Management	2.98	2.95	2.89	2.87	2.86	2.83	-12.81
C. Rice Cultivation							
D. Agricultural Soils	9.90	9.87	9.86	9.45	9.05	9.11	-14.13
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	0.00
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	0.00	-7.23
G. Other	NA	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**	**0.03**	**-9.49**
A. Forest Land	0.00	0.00	0.00	0.00	0.00	0.00	-66.27
B. Cropland	0.04	0.04	0.03	0.03	0.04	0.03	-9.18
C. Grassland	NO	NO	NO	NO	NO	NO	0.00
D. Wetlands	NO	NO	NO	NO	NO	NO	0.00
E. Settlements	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
F. Other Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
G. Other	NA	NA	NA	NA	NA	NA	0.00
6. Waste	**0.83**	**0.92**	**0.93**	**0.94**	**0.99**	**1.02**	**139.56**
A. Solid Waste Disposal on Land							
B. Waste-water Handling	0.66	0.74	0.74	0.74	0.79	0.80	128.75
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	-74.43
D. Other	0.18	0.18	0.18	0.20	0.19	0.22	189.69
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total N_2O emissions including N_2O from LULUCF	**20.19**	**19.75**	**19.72**	**19.54**	**17.10**	**16.99**	**-17.05**
Total N_2O emissions excluding N_2O from LULUCF	**20.16**	**19.71**	**19.69**	**19.51**	**17.06**	**16.95**	**-17.06**
Memo Items:							
International Bunkers	**0.06**	**0.06**	**0.05**	**0.05**	**0.05**	**0.06**	**96.02**
Aviation	0.06	0.06	0.05	0.05	0.05	0.06	96.02
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Multilateral Operations	IE	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
(Part 1 of 2)

Inventory 2005
Submission 2007 v1.2
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)
Emissions of HFCs[(3)] - (Gg CO_2 equivalent)	**23.03**	**45.21**	**48.68**	**157.34**	**206.83**	**267.34**	**346.84**	**427.42**	**494.89**	**542.20**
HFC-23	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	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00	0.00	0.01	0.01	0.01	0.02
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-134a	0.00	0.00	0.00	0.08	0.11	0.15	0.19	0.23	0.27	0.30
HFC-152a	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.04	0.05	0.06	0.07	0.08	0.09	0.10
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-143a	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	0.00	0.00	0.01	0.01	0.01
HFC-227ea	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00	0.00	0.00	0.00
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed HFCs[(4)] - (Gg CO_2 equivalent)	18.88	38.44	39.58	40.11	40.71	41.64	42.58	43.53	44.71	46.25
Emissions of PFCs[(3)] - (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,NE,NO	NA,NE,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[(4)] - (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[(3)] - (Gg CO_2 equivalent)	**502.58**	**653.36**	**697.85**	**793.71**	**985.70**	**1 139.16**	**1 218.05**	**1 120.15**	**907.99**	**683.96**
SF_6	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.04	0.03

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
HFCs, PFCs and SF_6
(Part 2 of 2)

Inventory 2005
Submission 2007 v1.2
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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
Emissions of HFCs(3) - (Gg CO_2 equivalent)	**596.26**	**695.10**	**782.41**	**864.81**	**899.62**	**911.55**	**3 857.88**
HFC-23	0.00	0.00	0.00	0.00	0.00	0.00	1 264.16
HFC-32	0.00	0.00	0.00	0.00	0.00	0.01	100.00
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-43-10mee	0.00	0.00	0.00	0.00	0.00	0.00	307.13
HFC-125	0.02	0.03	0.03	0.04	0.05	0.05	100.00
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-134a	0.31	0.33	0.35	0.37	0.35	0.33	24 178.57
HFC-152a	0.11	0.24	0.35	0.43	0.53	0.57	100.00
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-143a	0.01	0.02	0.03	0.03	0.04	0.04	100.00
HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	100.00
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Unspecified mix of listed HFCs(4) - (Gg CO_2 equivalent)	47.79	49.91	51.50	52.46	50.04	47.37	150.91
Emissions of PFCs(3) - (Gg CO_2 equivalent)	**72.33**	**82.15**	**86.87**	**102.54**	**114.72**	**117.97**	**-89.07**
CF_4	0.01	0.01	0.01	0.01	0.01	0.01	-95.96
C_2F_6	0.00	0.00	0.00	0.01	0.01	0.01	-56.70
C_3F_8	NA,NO	NA,NO	0.00	0.00	0.00	0.00	100.00
C_4F_{10}	0.00	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	NA,NO	0.00
C_5F_{12}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Unspecified mix of listed PFCs(4) - (Gg CO_2 equivalent)	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
Emissions of SF6(3) - (Gg CO_2 equivalent)	**633.31**	**636.62**	**640.83**	**593.52**	**512.51**	**286.77**	**-42.94**
SF_6	0.03	0.03	0.03	0.02	0.02	0.01	-42.94

Note: All footnotes for this table are given at the end of the table on sheet 5.

TABLE 10 EMISSION TRENDS
SUMMARY
(Part 1 of 2)

Inventory 2005
Submission 2007 v1.2
AUSTRIA

GREENHOUSE GAS EMISSIONS	Base year (1990)	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	50 016.92	47 823.01	47 398.78	43 951.52	45 602.75	48 940.25	57 596.88	48 337.77	49 657.29	43 649.72
CO_2 emissions excluding net CO_2 from LULUCF	61 930.34	65 483.30	60 041.64	60 411.34	60 763.27	63 660.94	67 327.21	67 147.96	66 811.89	65 336.62
CH_4 emissions including CH_4 from LULUCF	9 180.92	9 152.32	8 859.26	8 831.87	8 638.69	8 522.08	8 334.93	8 059.84	7 938.37	7 764.57
CH_4 emissions excluding CH_4 from LULUCF	9 180.67	9 152.25	8 859.08	8 831.72	8 638.61	8 522.03	8 334.90	8 059.81	7 938.25	7 764.56
N_2O emissions including N_2O from LULUCF	6 348.47	6 691.13	6 295.63	6 121.59	6 552.85	6 647.39	6 341.88	6 360.17	6 440.28	6 368.07
N_2O emissions excluding N_2O from LULUCF	6 337.12	6 679.74	6 284.25	6 110.31	6 541.59	6 636.25	6 330.75	6 349.04	6 429.18	6 357.00
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 LULUCF)	**67 151.16**	**65 452.12**	**63 762.86**	**59 908.94**	**62 045.46**	**65 584.96**	**73 904.85**	**64 402.19**	**65 483.58**	**59 073.07**
Total (excluding LULUCF)	**79 052.98**	**83 100.95**	**76 394.16**	**76 357.33**	**77 194.64**	**80 294.47**	**83 624.02**	**83 201.23**	**82 626.96**	**80 748.89**

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	55 654.41	59 541.51	54 620.06	55 101.38	55 118.17	57 823.33	61 856.28	60 982.30	61 031.61	59 726.88
2. Industrial Processes	10 110.82	10 152.82	8 999.19	8 750.66	9 274.86	9 729.28	9 601.28	10 192.60	9 674.44	9 391.20
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	9 123.86	9 297.98	8 813.92	8 583.93	9 049.11	9 134.98	8 718.22	8 687.06	8 690.53	8 503.84
5. Land Use, Land-Use Change and Forestry(5)	-11 901.81	-17 648.83	-12 631.30	-16 448.39	-15 149.18	-14 709.51	-9 719.17	-18 799.04	-17 143.38	-21 675.82
6. Waste	3 648.70	3 639.37	3 540.76	3 501.52	3 348.45	3 184.50	3 042.94	2 916.68	2 825.63	2 736.10
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)(5)	**67 151.16**	**65 452.12**	**63 762.86**	**59 908.94**	**62 045.46**	**65 584.96**	**73 904.85**	**64 402.19**	**65 483.58**	**59 073.07**

(1) The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

(2) Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(3) Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

(4) In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is Gg of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.

(5) Includes net CO_2, CH_4 and N_2O from LULUCF.

TABLE 10 EMISSION TRENDS
SUMMARY
(Part 2 of 2)

Inventory 2005
Submission 2007 v1.2
AUSTRIA

GREENHOUSE GAS EMISSIONS	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	49 605.05	50 922.31	56 234.96	61 027.61	60 166.28	62 613.44	25.18
CO_2 emissions excluding net CO_2 from LULUCF	65 960.13	70 044.56	71 709.42	77 972.46	77 139.93	79 650.36	28.61
CH_4 emissions including CH_4 from LULUCF	7 605.04	7 487.35	7 356.37	7 373.16	7 222.06	7 057.18	-23.13
CH_4 emissions excluding CH_4 from LULUCF	7 604.98	7 487.32	7 356.12	7 373.07	7 221.97	7 057.09	-23.13
N_2O emissions including N_2O from LULUCF	6 259.71	6 123.62	6 114.70	6 056.39	5 300.13	5 266.09	-17.05
N_2O emissions excluding N_2O from LULUCF	6 248.71	6 110.55	6 104.10	6 047.04	5 288.51	5 255.81	-17.06
HFCs	596.26	695.10	782.41	864.81	899.62	911.55	3 857.88
PFCs	72.33	82.15	86.87	102.54	114.72	117.97	-89.07
SF_6	633.31	636.62	640.83	593.52	512.51	286.77	-42.94
Total (including LULUCF)	**64 771.70**	**65 947.14**	**71 216.16**	**76 018.03**	**74 215.33**	**76 252.98**	**13.55**
Total (excluding LULUCF)	**81 115.72**	**85 056.29**	**86 679.76**	**92 953.45**	**91 177.27**	**93 279.54**	**18.00**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	59 679.15	63 882.63	64 993.08	71 334.29	70 562.22	72 527.89	30.32
2. Industrial Processes	10 034.30	9 908.19	10 592.72	10 664.20	9 976.20	10 294.78	1.82
3. Solvent and Other Product Use	413.52	414.32	398.57	382.82	367.07	351.00	-31.87
4. Agriculture	8 332.69	8 268.92	8 155.34	8 002.32	7 855.33	7 823.37	-14.25
5. Land Use, Land-Use Change and Forestry(5)	-16 344.02	-19 109.15	-15 463.60	-16 935.41	-16 961.95	-17 026.56	43.06
6. Waste	2 656.06	2 582.23	2 540.06	2 569.82	2 416.45	2 282.49	-37.44
7. Other	NA	NA	NA	NA	NA	NA	0.00
Total (including LULUCF)(5)	**64 771.70**	**65 947.14**	**71 216.16**	**76 018.03**	**74 215.33**	**76 252.98**	**13.55**

(1) The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.

(2) Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(3) Enter actual emissions estimates. If only potential emissions estimates are available, these should be reported in this table and an indication for this be provided in the documentation box. Only in these rows are the emissions expressed as CO_2 equivalent emissions.

(4) In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is Gg of CO_2 equivalent and that appropriate notation keys should be entered in the cells for the individual chemicals.
(5) Includes net CO_2, CH_4 and N_2O from LULUCF.

Documentation box:
• Parties should provide detailed explanations on emissions trends in Chapter 2: Trends in Greenhouse Gas Emissions and, as appropriate in the corresponding Chapters 3 - 9 of the NIR. Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.
• Use the documentation box to provide explanations if potential emissions are reported.

ANNEX 8: EXTRACTS FROM AUSTRIAN LEGISLATION

Extracts from Austrian legislation, which regulate monitoring, reporting and verification of emissions at plant level

Cement production

BGBI 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.

Anlage 2

(§ 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

BGBl 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, BGBl Nr 468/ 1992) heranzuziehen.

(3) Die Messwerte für die im § 3 angeführten Stoffe sowie der während der Messung herrschenden Betriebszustände sind zusammen mit den Kriterien, nach denen der Zeitraum für die Messung, der stärksten Emission festgelegt worden ist, in einem Messbericht festzuhalten. Im Messbericht sind auch die verwendeten Messverfahren zu beschreiben. Der Messbericht und sonstige zum Nachweis der Einhaltung der im § 3 festgelegten Emissionsgrenzwerte dienende Unterlagen sind bis zur nächsten Messung in der Betriebsanlage derart aufzubewahren, dass sie den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden können.

Iron and steel production

BGBl 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.

<u>Anlage</u>

(§ 6)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für alle im § 3 Abs. 1 und 3 und im § 4 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90% zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 6 Abs. 5 angeführten Personenkreis zu kalibrieren.

c) Jährlich ist eine Funktionskontrolle des registrierenden Messgerätes durch einen Sachverständigen aus dem im § 6 Abs. 5 angeführten Personenkreis vorzunehmen.

Sinter plants

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.

Anlage

(§ 5)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für die im § 3 Abs. 1 Z 2 lit. a und b und Z 3 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 5 Abs. 3 angeführten Personenkreis zu kalibrieren. Die Kalibrierung hat nach den Regeln der Technik zu erfolgen.

c) Jährlich ist eine Funktionskontrolle des registrierenden Messgerätes durch einen Sachverständigen aus dem im § 5 Abs. 3 angeführten Personenkreis vorzunehmen.

Combustion plants

<u>BGBl II 1997/ 331 Feuerungsanlagen-Verordnung</u>

Emissionsmessungen

§ 4 (1) Der Betriebsanlageninhaber hat Emissionsmessungen sowie die Bestimmung des Abgasverlustes entsprechend der Anlage 1 zu dieser Verordnung durchzuführen bzw. durchführen zu lassen.

(2) Zur Durchführung der Emissionseinzelmessungen sowie zur Bestimmung des Abgasverlustes ist ein Sachverständiger aus dem im § 2 Abs. 2 zweiter Satz genannten Personenkreis heranzuziehen.

§ 5 (1) Der Betriebsanlageninhaber hat, sofern in dieser Verordnung nicht anderes bestimmt ist,

1. kontinuierliche Messungen der Emissionskonzentrationen, abhängig von der jeweiligen Brennstoffwärmeleistung und dem eingesetzten Brennstoff, entsprechende der folgenden Tabelle durchzuführen

Brennstoff	Staub	CO	SO_2	NO_x	
fest	> 10	> 10	> 30	> 30	MW
flüssig	> 10	> 10	> 50	> 30	MW
gasförmig	-	> 10	-	> 30	MW

Prüfungen

Erstmalige Prüfung

§ 23 (1) Feuerungsanlagen sind anlässlich ihrer Inbetriebnahme einer erstmaligen Prüfung zu unterziehen.

(2) Die erstmalige Prüfung hat in der Erbringung des Nachweises zu bestehen, dass die Feuerungsanlage den Anforderungen dieser Verordnung entspricht.

Wiederkehrende Prüfungen

§ 25 (1) Feuerungsanlagen sind jährlich zu prüfen. Bei dieser jährlichen Prüfung sind die Feuerungsanlagen hinsichtlich jener Anlagenteile, die für die Emissionen oder deren Begrenzung von Bedeutung sind, zu besichtigen und auf etwaige Mängel zu kontrollieren... Weiters sind jährlich die Ergebnisse der gemäß § 5 durchgeführten kontinuierlichen Messungen zu beurteilen.

Prüfbescheinigung

§ 27 Das Ergebnis jeder Prüfung muss in einer Prüfbescheinigung festgehalten sein, die insbesondere festgestellte Mängel sowie Vorschläge zu deren Behebung zu enthalten hat. Die Prüfbescheinigung ist im Original in der Betriebsanlage zumindest fünf Jahre so aufzubewahren, dass sie den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

<u>Anlage 1</u>

(§§ 4 und 25)

Emissionsmessungen

1. Die Messungen sind

1.3 für gasförmige Emissionen nach den Regeln der Technik, oder nach einem diesen Verfahren gleichwertigen Verfahren durchzuführen.

2. Die Messstellen sind so festzulegen, dass eine repräsentative und messtechnisch einwandfreie Emissionsmessung gewährleistet ist.

3. Einzelmessungen

3.2 Die Einzelmessungen sind an einer repräsentativen Entnahmestelle im Kanalquerschnitt vorzunehmen. Es sind innerhalb eines Zeitraumes von drei Stunden drei messwerte als Halbstundenmittelwerte zu bilden.

4. Kontinuierliche Messungen

4.1 Die Datenaufzeichnung hat durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat. Die Messergebnisse müssen mit dem einzuhaltenden Grenzwert vergleichbar sein.

4.2 Registrierende Emissionsmessgeräte sind im Abnahmeversuch und mindestens alle drei Jahre durch einen Sachverständigen aus dem im § 2 Abs. 2 zweiter Satz angeführten Personenkreis zu kalibrieren. Die Kalibrierung hat nach den Regeln der Technik (z.B. nach den vom Verein Deutscher Ingenieure herausgegebenen und beim Österreichischen Normungsinstitut, Heinestraße 38, 1021 Wien, erhältlichen Richtlinien VDI 2066, Blatt 4 und Blatt 6, und VDI 3950, Blatt 1E) zu erfolgen.

4.3 Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige aus dem im § 2 Abs. 2 zweiter Satz angeführten Personenkreis vorzunehmen.

Non-ferrous metal production

BGBl II 1998/ 1 Verordnung zur Erzeugung von Nichteisenmetallen

§ 6 (1) Der Betriebsanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 und im § 4 angeführten Stoffe entsprechend der Z 1 lit. a bis c der Anlage zu dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen durchführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebsanlageninhaber hat kontinuierliche Messungen ... entsprechend der Z 2 der Anlage zu dieser Verordnung reingasseitig (im Kamin) durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992), Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 7 Die Ergebnisse der Messungen gemäß § 6 sind in einem Messbericht festzuhalten, der zu enthalten hat:

1. bei Messungen gemäß § 6 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff, Rohmaterial und Zuschlagstoffen),

2. bei Messungen gemäß § 6 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes und die gemäß § 5 Abs. 2 zu führenden Aufzeichnungen über Grenzwertüberschreitungen.

Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 6 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage

(§ 6)

Emissionsmessungen

1. Einzelmessungen

a) Einzelmessungen sind für alle im § 3 Abs. 1 und 4 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 6 Abs. 3 angeführten Personenkreis zu kalibrieren.

c) Die Wartung des registrierende Messgerätes ist durch einen Sachverständigen aus dem im § 6 Abs. 3 angeführten Personenkreis mindestens einmal jährlich vornehmen zu lassen.

Steam boilers

BGBl 1988/ 380 idF (BGBl 1993/ 185, BGBl I 1997/ 115, BGBl I 1998/ 158) Luftreinhaltegesetz für Kesselanlagen

Überwachung

§ 7 (1) Die in Betrieb befindlichen Dampfkesselanlagen ... sind einmal jährlich durch einen befugten Sachverständigen auf die Einhaltung der Bestimmungen dieses Bundesgesetzes zu überprüfen. Die Überprüfung umfasst die Besichtigung der Anlage und deren Komponenten, soweit sie für die Emissionen oder deren Begrenzung von Bedeutung sind, verbunden mit der Kontrolle vorhandener Messergebnisse oder Messregistrierungen.

§ 8 (1) Die Behörde hat im Genehmigungsbescheid festzulegen, ob und in welchem Umfange Abnahmemessungen sowie wiederkehrende Emissionsmessungen an der Dampfkesselanlage durchzuführen sind. Emissionsmessungen sind ferner durchzuführen, wenn der befugte Sachverständige anlässlich einer Überprüfung gemäß § 7 Grund zur Annahme hat, dass die einzuhaltenden Emissionsgrenzwerte im Betrieb überschritten werden.

Pflichten des Betreibers

§ 10 (3) Der Betreiber hat der Behörde oder dem hierzu beauftragten Sachverständigen während der Betriebszeit den Zutritt zu der Anlage zu gestatten und Einsicht in alle die

Emissionen der Dampfkesselanlage betreffenden Aufzeichnungen zu gewähren, die in einem Dampfkesselanlagenbuch zusammenzufassen sind.

BGBl 1989/ 19 idF (BGBl 1990/ 134, BGBl 1994/ 785, BGBl II 1997/ 324) Luftreinhalteverordnung für Kesselanlagen

Emissionseinzelmessungen

§ 2 a (1) Die Durchführung der Emissionsmessungen hat nach den Regeln der Technik zu erfolgen.

(2) Die in Anlage 7 wiedergegebene ÖNORM M 9415-1, Ausgabe Mai 1991, und die in Anlage 8 wiedergegebene ÖNORM 9415-3, Ausgabe Mai 1991, sind verbindlich anzuwenden.

§ 3 (1) Emissionseinzelmessungen sind für jede Schadstoffkomponente bei jenem feuerungstechnisch stationären Betriebzustand durchzuführen, bei dem nachweislich die Anlage vorwiegend betrieben wird.

(2) Für die Durchführung der Emissionseinzelmessungen ist die in Anlage 9 wiedergegebene ÖNORM M 9415-2, Ausgabe Mai 1991, verbindlich anzuwenden.

Kontinuierliche Emissionsmessungen

§ 4 (3) Kontinuierliche Emissionsmessungen der Massekonzentration einer Emission (§ 8 Abs. 1 LRG-K) haben i der Regel in Halbstundenmittelwerten zu erfolgen.

(5) Die Messstellen sind auf Grund des Gutachtens eines befugten Sachverständigen (§ 7 Abs. 2 LRG-K) von der Behörde derart festzulegen, dass eine repräsentative und messtechnisch einwandfreie Emissionsmessung gewährleistet ist.

§ 5. Für kontinuierliche Emissionsmessungen hat die Datenaufzeichnung zu erfolgen:

1. Durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

3. Die Auswertung der Messdaten aus registrierenden Messgeräten hat mittels Auswertegeräten zu erfolgen, die dafür geeignet sind und die dem Stand der Technik entsprechen.

5. Registrierende Emissionsmessgeräte und Auswertegeräte sind im Abnahmeversuch und danach alle drei Jahre durch einen Sachverständigen zu kalibrieren. Die Kalibrierung hat nach den geltenden einschlägigen technischen Regelwerken zu erfolgen.

6. Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige vorzunehmen.

§ 7 (1) Der Betreiber hat während des Betriebes der Anlage an den Messgeräten mindestens einmal wöchentlich zu kontrollieren, ob der Nullpunkt einjustiert ist und die erforderliche Messfunktion gegeben ist.

(2) Die Messgeräte und alle dazuhörenden Komponenten sind mindestens alle drei Monate zu warten. Hierüber hat der Betreiber Aufzeichnungen zu führen.

(3) Der Sachverständige hat im Rahmen der Überwachung die Aufzeichnungen gemäß Abs. 2 zu kontrollieren und in begründeten Fällen die Richtigkeit der Anzeige der Messgeräte zu überprüfen.