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AUSTRIA'S NATIONAL INVENTORY REPORT 2004

Submission under the United Nations Framework Convention on Climate Change

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BE-244

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Date of submission	15.04.2004

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Vienna, 2004

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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 2002.

By taking decision 18/CP.8 (see document FCCC/CP/2002/7/Add.2) the Conference of the Parties (COP) has undertaken to implement the UNFCCC guidelines on reporting and reviewing (FCCC/CP/2002/8). According to this decision Parties shall submit a National Inventory Report (NIR) containing detailed and complete information on their inventories, in order to ensure the transparency of the inventory (see paragraph 38 of FCCC/CP/2002/8). This is the forth version of the National Inventory Report (NIR) submitted by Austria, it is an update of the NIR submitted in 2003[1]. This report is based on the data submitted to the UNFCCC in the common reporting format (CRF submission 2004). 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 2004 and as submitted to the UNFCCC in the data submission 2004 replaces all previous versions of data submissions.

The structure of the NIR follows closely the proposal as included in Appendix A of document FCCC/SBSTA/2002/8. First, there is an Executive Summary that gives an overview on Austria's greenhouse gas inventory. Chapters 1 and 2 provide general information on the inventory preparation process and summarize the overall trends in emissions. Comprehensive information on the methodologies used for estimating emissions of Austria's greenhouse gas inventory is presented in the Sector Analysis Chapters 3 – 8. Chapter 9 gives an overview of actions planned to further improve the inventory and of changes previously made (recalculations), it also describes improvements made in response to the UNFCCC centralized review 2003.

The underlying emission data for the year 2002 as reported in the tables of the common reporting format of the data submission 2004 to the convention are also included as well as abbreviations and references used. Furthermore detailed results from the key source analysis, detailed information on the methodology of emission estimates for the fuel combustion sector, the CO_2 reference approach as well as the National Energy Balance are presented in the Annexes.

The aim of this report is to document the methodology in order to facilitate understanding 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 the preparation of the NIR.

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

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[1] Austria's National Inventory Report 2003 – Submission Under the United Nations Framework Convention of Climate Change. BE-225; Austria's Federal Environment Agency, Vienna.

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

Project leader for the preparation of the NIR 2004 has been Manuela Wieser.

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Chapter 7	Peter Weiss
Chapter 8	Daniela Wappel, Stephan Poupa
Chapter 9	Stephan Poupa, Manuela Wieser
Annexes	Stephan Poupa, Manuela Wieser

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

ES.2 Summary of National Emission and Removal Related Trends

In the year 2002, the most important GHG in Austria was carbon dioxide (CO_2) contributing 82.3% to total national GHG emissions expressed in CO_2 equivalent, followed by CH_4, 8.8% and N_2O, 6.8%. PFCs, HFCs and SF_6 contributed for 2.1% to the overall GHG emissions in the country. The energy sector accounted for 75.4% of the total GHG emissions followed by Industrial Processes 11.9%, Agriculture 8.7% and Waste 3.4%.

Total GHG emissions (excluding land-use change and forestry (LUCF)) amounted to 84 621 Gg CO_2 equivalent and increased by 8.8% from 1990 to 2002 (8.5% if calculated from the base year: 1990 for CO_2, CH_4 and N_2O and 1995 for HFCs, PFCs and SF_6).

Table 1 provides data on emissions by sector and Table 2 by gas from 1990 to 2002.

Table 1: Austria's greenhouse gas emissions by sector

GHG Source and Sink categories		**Total (with net CO_2 emissions/removals)**	**Total (without CO_2 from LUCF)**	1 Energy	2 Industrial Processes	3 Solvent and Other Product Use	4 Agriculture	5 Land-Use Change and Forestry	6 Waste
BY*	[Gg CO_2 equivalent]	**68 783**	**77 998**	54 910	10 032	515	8 444	-9 215	4 097
1990		**68 531**	**77 746**	54 910	9 780	515	8 444	-9 215	4 097
1991		**68 650**	**82 154**	58 924	9 877	469	8 795	-13 504	4 089
1992		**66 479**	**75 135**	54 103	8 895	420	7 710	-8 656	4 007
1993		**66 430**	**75 413**	54 462	8 460	420	8 093	-8 982	3 978
1994		**68 619**	**76 480**	54 544	8 959	404	8 732	-7 862	3 842
1995		**72 102**	**79 356**	57 052	9 881	422	8 298	-7 254	3 702
1996		**77 391**	**82 776**	61 101	9 706	405	7 997	-5 385	3 566
1997		**74 707**	**82 340**	59 917	10 282	423	8 276	-7 633	3 443
1998		**74 367**	**82 000**	60 368	9 906	405	7 975	-7 633	3 346
1999		**72 449**	**80 083**	58 976	9 623	391	7 842	-7 633	3 251
2000		**73 007**	**80 640**	59 116	10 258	414	7 736	-7 633	3 117
2001		**76 765**	**84 398**	63 040	10 171	426	7 764	-7 633	2 998
2002		**76 987**	**84 621**	63 843	10 035	426	7 402	-7 633	2 915

*BY= Base Year: 1990 for CO_2, CH_4 and N_2O and 1995 for HFCs, PFCs and SF_6

Over the period 1990-2002 CO_2 emissions increased by 14.4%, mainly due to increased emissions from transport. Methane emissions decreased during the same period by 20.4% mainly due to lower emissions from *Solid Waste Disposal*; N_2O emissions decreased by 4.0% over the same period due to lower emissions from agricultural soils. Emissions from

HFCs and PFCs increased by 89.2% and 61.0% respectively whereas SF_6 emissions decreased by 42.4% from the base year (1995) to 2002[2].

Table 2: Austria's greenhouse gas emissions by gas

GHG		**Total**	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
BY*	[Gg CO2 equivalent]	**77 998**	60 899	9 374	5 988	546	16	1 175
1990		**77 746**	60 899	9 374	5 988	4	963	518
1991		**82 154**	64 535	9 340	6 616	6	974	683
1992		**75 135**	59 080	9 051	5 694	9	576	725
1993		**75 413**	59 310	9 009	6 211	12	48	823
1994		**76 480**	59 704	8 872	6 801	17	54	1 033
1995		**79 356**	62 474	8 773	6 372	546	16	1 175
1996		**82 776**	66 147	8 604	6 140	625	15	1 246
1997		**82 340**	65 713	8 337	6 406	718	18	1 148
1998		**82 000**	65 808	8 216	6 184	816	21	955
1999		**80 083**	64 336	8 028	6 093	870	25	730
2000		**80 640**	65 064	7 791	6 050	1 033	25	677
2001		**84 398**	69 037	7 656	5 970	1 033	25	677
2002		**84 621**	69 671	7 465	5 750	1 033	25	677

*BY= Base Year: 1990 for CO2, CH4 and N2O and 1995 for HFCs, PFCs and SF6
NOTE: Total without CO_2 from LUCF

[2] Data for fluorinated compounds is only available until 2000, for 2001 and 2002 the values of 2000 was used. However, new data will become available in 2004.

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

In the year 2001, 63 843 Gg CO_2 equivalent, that are 75.4% of national total emissions arose from the sector *Energy*. 99.3% of these emissions arise from fuel combustion activities. The most important subsector of *Fuel Combustion* with 33.4% of total emissions from this sector in 2002 is transport. From 1990 to 2002 emissions from the energy sector increased by 16.3%.

Industrial Processes is the second largest sector in Austria with 11.9% of total GHG emissions in 2002 (10 035 Gg CO_2 equivalent). In the year 2002, 40.6% of these emissions arose from *Metal Production*. From the base year to 2001 emissions from industrial processes increased by 0.03%.

In the year 2002, 0.5% of total GHG emissions in Austria (426 Gg CO_2 equivalent) arose from the sector *Solvent and Other Product Use*. From 1990-2002 emissions from this category decreased by 17.3%.

Emissions from *Agriculture* amounted to 7 402 Gg CO_2 equivalent in the year 2002, that are 8.7% of national total emissions. The most important sub sector is *Enteric Fermentation* with 41.9% of the greenhouse gas emissions from the agricultural sector in 2002, the second important sub source is *Agricultural Soils* with 36.6%. In the year 2002 emissions from that category were 12.3% below the level of the base year.

3.4% of Austria's total greenhouse gas emissions in the year 2002 arose from the IPCC Category *Waste.* Emissions from this category decreased: from 1990 to 2002 emissions by 28.9% from 4 097 Gg CO_2 equivalent to 2 915 Gg.

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 1990-2002

Gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	[Gg]												
NO_X	212.0	217.3	207.4	198.9	193.7	189.4	193.7	190.1	194.0	189.5	190.3	196.4	204.5
CO	1 249	1 253	1 209	1 171	1 118	1 031	1 038	978	938	891	833	837	812
NM-VOC	298.1	286.2	256.9	250.4	232.8	232.5	225.8	213.1	201.1	189.7	190.3	195.5	192.6
SO_2	80.0	77.1	61.4	58.7	53.1	52.0	49.3	45.4	40.5	38.5	35.4	37.6	36.0

Emissions of indirect greenhouse gases decreased from the period from 1990 to 2001: for NMVOCs and CO by 35%, for NO_X by 4% and for SO_2 emissions decreased significantly by 55%.

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

1 INTRODUCTION

1.1 Background Information

Global Warming

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

The average surface temperature of the earth has risen by about 0.6-0.7°C in the past 100 years and, according to the IPCC, will rise by another 1.4-5.8°C in the next 100 years, depending on the emission scenario.

The increase of the average surface temperature of the earth will lead, by increase of the surface temperature of the oceans and the continents, to changes in the hydrologic cycle as well as 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 for 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, in 2003 Austria has launched StartClim and FloodRisk, two research programs.

The Convention, its Kyoto Protocol and the flexible mechanisms there under

In 1992 Austria has 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[3]: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) as well as hydrogenated fluorocarbons (HFCs), perfluorated halocarbons (PFCs) and sulfurhexa flourid (SF_6).

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[3] 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 will entry into force after 55 Parties to the Convention ratify (or approve, accept, or accede to) the Protocol, including Annex I Parties accounting for 55% of that group's carbon dioxide emissions in 1990.

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 1 countries (basically, the industrialised nations) to purchase the rights to emit greenhouse bases (GHG) from other Annex 1 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 for a developing nation to gain a credit (converted to Assigned Amounts) by investing in another country in a project which reduces GHG emissions.
- *Clean Development Mechanism*: Article 12 allows countries (or companies) which fund projects in developing countries to get credits for certified emission reductions providing that "benefits" accrue to 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 2001. 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 means of Quality Assurance due to increased requirements in transparency, consistency, comparability, completeness and accuracy of the national greenhouse gas inventory related to the new standards defined in the KP, the inventories will be annually reviewed by international experts managed by the Climate Change Secretariat in Bonn (expert review team ERT) starting in 2003. To date, Austria's Greenhouse Gas Inventory has been 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 review in 2003. The reports on these reviews can be found on the UNFCCC website[4].

1.2 Institutional Arrangement for Inventory Preparation

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

Regulations under the UNFCCC and the Kyoto Protocol define new standards for national emission inventories. Therefore the present National Inventory System Austria is currently being adapted to meet all the requirements according Article 5.1 of the Kyoto Protocol.

The UMWELTBUNDESAMT is responsible for the preparation of Austrian emission inventories by law (ENVIRONMENTAL CONTROL ACT, 1998)[5]. As Austria has to fulfil various national and international obligations, the UMWELTBUNDESAMT prepares a comprehensive Austrian Air Emission Inventory (Österreichische Luftschadstoff-Inventur, OLI) comprising all air pollutants stipulated in the various national and international obligations. The Austrian Air Emission Inventory and all reporting obligations are the responsibility of the *Department of Air Emissions* which is part of the UMWELTBUNDESAMT.

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 hexachlorbenzene (HCB).
- Austria's annual obligations under the European Council Decision 1993/389/EEC of June 24th 1993 for a Monitoring Mechanism of Community CO_2 and other Greenhouse Gas Emissions as amended by Council Decision 1999/296/EC.
- Austria's obligation under the United Nations Framework Convention on Climate Change. Relevant COP Decisions and Guidelines are:
  - Decision 3/CP.5 Guidelines for the Preparation of National Communications by Parties included in Annex I to the Convention, Part I: UNFCCC Reporting Guidelines on Annual Inventories (referring to Document FCCC/CP/1999/7) revised with Decision 18/CP.8 (referring to Document FCCC/CP/2002/8).
  - Decision 4/CP.5 Guidelines for the Preparation of National Communications by Parties included in Annex I to the Convention, Part II: UNFCCC Reporting Guidelines on National Communications (referring to Document FCCC/CP/1999/7) revised with Decision 19/CP.8 (referring to Document FCCC/CP/2002/8).

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[4] http://unfccc.int/resource/webdocs/iri(2)/2001/aut.pdf, http://unfccc.int/resource/webdocs/iri(3)/2001/aut.pdf and http://unfccc.int/program/mis/ghg/countrep/autrep03.pdf

[5] ENVIRONMENTAL CONTROL ACT, (1998): Environmental Control Act (Umweltkontrollgesetz). Federal Law Gazette 152/1998.

- Document FCCC/CP/1999/7 Review of the Implementation of Commitments and of other Provisions of the Convention – UNFCCC Guidelines on Reporting and Review revised with Document FCCC/CP/2002/8.

- Decision 11/CP.4 National communications from Parties included in Annex I to the Convention.

- Document FCCC/CP/2001/13/Add.3 Report of the Conference of the Parties on its seventh session, held at Marrakech from 29 October to 10 November 2001, Addendum, Part two: Action taken by the Conference of the Parties, Volume III (Decision 20/CP.7: Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol; Decision 21/CP.7: Good practice guidance and adjustments under Article 5, paragraph 2, of the Kyoto Protocol; Decision 22/C.7: Guidance for the preparation of the information required under Article 7 of the Kyoto Protocol; Decision 23/CP.7: Guidelines for review under Article 8 of the Kyoto Protocol).

- Obligation under the Austrian Ambient Air Quality Law[6] comprising 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.
- 1997 a consistent time series for the emission data from 1980 to 1995 was reported for the first time.

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

1.2.3 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 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.

As the Kyoto Protocol is expected to enter into force, Austria is making preparations to meet all requirements it entails. The National Inventory System Austria shall fulfil all the requirements of the Kyoto Protocol and it shall also fulfil all the other obligations Austria has to comply with.

The emission inventory system, which is currently being adapted, will have a structure as illustrated in Figure 1.

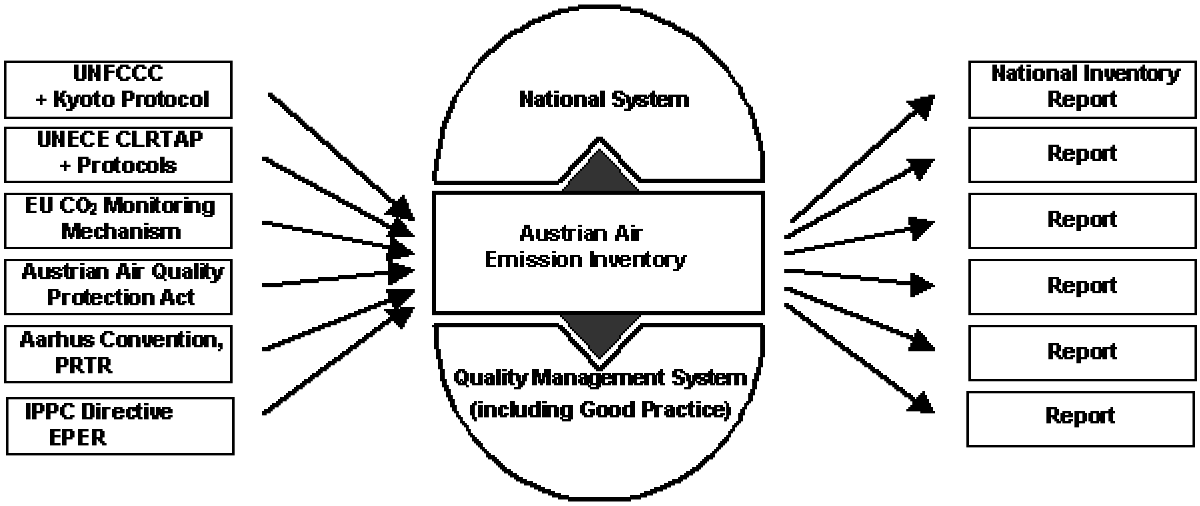

Figure 1: Structure of the future emission inventory system in Austria (NISA)

The Austrian Air Emission Inventory comprising all air pollutants stipulated in the various national and international obligations will be the centre of NISA. The national system and the quality management system are incorporated into NISA as complementary sections.

Austria is taking significant steps to ensure 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 Austrian National Inventory System should be able to take account of any type of flexible mechanism such as international emission trading as defined in the Kyoto Protocol. Details are provided with respect to:

- Adaptation of the national system according to Article 5.1 of the Kyoto Protocol
- Quality management system
- Uncertainty analysis
- Identification of key source categories

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 which shall be included in a national system. The main characteristics are that the national system shall ensure 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 system, to prepare national annual inventories and supplementary information in timely manner and to provide information necessary to meet the reporting requirements. Specific functions in these guidelines are the inventory planning, preparation and management.

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

- Conceptual design for an adaptation of the national system according to Article 5.1 of the Kyoto Protocol
- Development of a quality management system
- Implementation of the quality management system
- First comprehensive uncertainty analysis
- Identification of key source categories

The next steps are:

- Further improvement of the national system according to Article 5.1 of the Kyoto Protocol

It is planned that the national system will be fully operated according to the Monitoring Mechanism Decision[7] by the end of 2005. The system will include all institutions whose data have a significant impact on the emission data and identify their collaboration with the UMWELTBUNDESAMT. Among them are:

- Federal Provinces
- Austrian Federal Economic Chamber
- Statistics Austria
- Federal Ministry of the Environment
- Operators of installations covered by the European IPPC Directive

At the moment the UMWELTBUNDESAMT uses only published information of these institutions. The inventory of the Federal Provinces is prepared by the UMWELTBUNDESAMT using a top down approach.

[7] Decision 280/2004/EC of the European Parliament and of the Council for a Monitoring Mechanism of Community Greenhouse Gas Emissions and the Implementation of the Kyoto Protocol

1.3 Inventory Preparation Process

The present Austrian greenhouse gas inventory for the period 1990 to 2002 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)[8] (version 1.01), the IPCC 1996 Guidelines for National Greenhouse Gas Inventories, which specify the reporting obligations according to Articles 4 and 12 of the UNFCCC [IPCC Guidelines, 1997] as well as the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories [IPCC GPG, 2000].

The preparation of the inventory includes the following three stages:

(i) inventory planning

(ii) inventory preparation and

(iii) inventory management.

In the first stage specific responsibilities are defined and allocated: as mentioned before, the UMWELTBUNDESAMT has the overall responsibility for the national inventory, comprising 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 data base based on the CORINAIR (CORe INventory AIR)/ SNAP (Selected Nomenclature for sources of Air Pollution) systematic. This nomenclature was designed by the ETC/AE (European Topic Centre on Air Emissions) to estimate not only emissions of greenhouse gases but all kind of air pollutants.

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

In 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 are also responsible for methodological choices and for contracting studies, if needed. 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 systematic, 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. Additionally to the actual emission data also 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 is submitted to the UNFCCC.

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

For the inventory management a reliable data management to fulfil the data collecting and reporting requirements is needed. As mentioned above, data collection is performed 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 is stored on a central network server which is backed up daily for the needs of data security. The inventory management also includes quality management (see Chapter 1.6) as well as documentation on QA/QC activities.

1.4 Methodologies and Data Sources Used

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

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

Sector	Data Sources for Activity Data	Emission Calculation
Energy	Energy Balance from STATISTIK AUSTRIA, Steam boiler database;	UMWELTBUNDESAMT, plant operators
Industry	National production statistics, import/export statistics, direct information from industry or associations of industry;	UMWELTBUNDESAMT, plant operators
Waste	Database on landfills	UMWELTBUNDESAMT
LUCF	National forest inventory obtained from the Austrian Federal Office and Research Centre for Forest	UMWELTBUNDESAMT
Solvent	Import/ export statistics, production statistics, consumption statistics;	Contractor: Forschungsinstitut für Energie und Umweltplanung, Wirtschaft und Marktanalysen GmbH and Institut für industrielle Ökologie*
Agriculture	National Studies, national agricultural statistics obtained from STATISTIK AUSTRIA;	Contractors: University of Natural Resources and Applied Life Sciences, Research Center Seibersdorf;

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

A complete list of data sources for activity and emission data or emission factors used by sector can be found on page 267.

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

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

For the preparation of the greenhouse gas inventory, the UMWELTBUNDESAMT prefers emission data that are reported by the operator of the source because these data usually reflect the actual emissions better than data calculated using general emission factors, as the operator has the best information about the actual circumstances. If such data is not available, national emission factors are used or, if there are no national emission factors, international emission factors are used to estimate the emissions.

The main sources for emission factors are:

- National studies for country specific emission factors
- IPCC GPG
- Revised IPCC 1996 Guidelines

- EMEP/CORINAIR Guidebook

Table *Summary 3* of the CRF (Summary Report for Methods and Emission Factors Used) 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 who provides 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 aggregates of the 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 is obtained from STATISTIK AUSTRIA which provides statistics on production data[9]. The methodology of this statistic has changed in 1996, no data is available for that year and there are some product groups that are not reported anymore 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 1998-2001 are calculated on the basis of these data. Activity data needed for the calculation of non energetic emissions are based on several statistics collected by STATISTIK AUSTRIA and national and international studies.

Data from EPER

The European Pollutant Emission Register (EPER) is the first Europe-wide register for emissions from industrial facilities both to air and to water. The legal basis of EPER is Article 15 of the IPPC Directive (EPER Decision 2000/479/EG), the scope is to provide information to the public[10].

It is covering 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 that enabled 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 the year 2001 or 2002. 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 of them reported emissions

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[9] "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 2000.

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

according to the EPER Regulation. The plausibility of the reports were 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 data source for the national inventory. On one hand this is due to the high threshold for emissions reporting, that's why for example only four facilities reported N_2O emissions and no reported fluorinated compounds. On the other hand this is because the EPER report only contains very little information beyond the emission data, the only information included is whether emissions are estimated, measured or calculated, also included is one activity value that is often not useful in the context of emissions.

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

Thus the top-down approach of the national inventory was considered more reliable and data of EPER was not used as point source data for the national inventory.

1.5 Key Source Analysis

In order to prepare for a National System according to Article 5.1 of the Kyoto Protocol each Annex I Party shall identify its key source categories.

The identification of key source categories is described in the IPCC Good Practice Guidance [IPCC-GPG, 2000], Chapter 7. It stipulates that a key source category is one that is prioritised within the National System because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level of emissions, the trend in emissions, or both.

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

The identification includes all reported greenhouse gases CO_2, CH_4, N_2O, HFC, PFC and SF_6. All IPCC source categories are included except the category LUCF as guidelines for this category are not yet available in the IPCC Good Practice Guidance.

The presented key source analysis was performed by UMWELTBUNDESAMT with data for greenhouse gas emissions of the submission 2004 to the UNFCCC and comprises a level assessment for all years between 1990 and 2002 and a trend assessment for the trend of the years 1991 to 2002 with respect to base year emissions (base year for CO_2, CH_4, N_2O is 1990 and 1995 for HFC, PFC and SF_6).

1.5.1 Austria's Key Source Categories

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

The identified key source categories are listed in Table 5. They comprise 81 771.3 Gg CO_2e in the year 2002, which is a share of 96.6% of Austria's total greenhouse gas emissions (without LUCF).

Table 5: Austrian key source categories based on emission data submitted 2004 to the UNFCCC

IPCC Category	Description	Gas	Emissions 2002 [Gg CO_2e]	Share in National Total Emissions 2002
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	4 790.0	5.7%
1 A 1 a liquid	Public Electricity and Heat Production	CO2	835.3	1.0%
1 A 1 a other	Public Electricity and Heat Production	CO2	396.4	0.5%
1 A 1 a solid	Public Electricity and Heat Production	CO2	5 855.3	6.9%
1 A 1 b gaseous	Petroleum refining	CO2	404.6	0.5%
1 A 1 b liquid	Petroleum refining	CO2	2 160.5	2.6%
1 A 1 c liquid	Manuf. of Solid fuels and Other Energy Ind.	CO2	0	-
1 A 1 c gaseous	Manuf. of Solid fuels and Other Energy Ind.	CO2	571.0	0.7%
1 A 2 gaseous	Manufacturing Industries and Construction	CO2	4 269.5	5.0%
1 A 2 mob-liquid	Manufacturing Industries and Construction	CO2	1 100.8	1.3%
1 A 2 solid	Manufacturing Industries and Construction	CO2	5 155.7	6.1%
1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	1 860.5	2.2%
1 A 2 other	Manufacturing Industries and Construction	CO2	117.6	0.1%
1 A 3 b diesel oil	Road Transportation	CO2	13 321.8	15.7%

IPCC Category	Description	Gas	Emissions 2002 [Gg CO_2e]	Share in National Total Emissions 2002
1 A 3 b gasoline	Road Transportation	CO2	6 616.9	7.8%
1 A 3 b gasoline	Road Transportation	N2O	517.4	0.6%
1 A 3 e gaseous	Transportation - Other	CO2	360.5	0.4%
1 A 4 mob-diesel	Other Sectors	CO2	1 655.2	2.0%
1 A 4 biomass	Other Sectors	CH4	248.2	0.3%
1 A 4 gaseous	Other Sectors	CO2	4 161.8	4.9%
1 A 4 stat-liquid	Other Sectors	CO2	6 778.8	8.0%
1 A 4 solid	Other Sectors	CO2	866.7	1.0%
2 A 1	Cement Production	CO2	1 587.6	1.9%
2 A 2	Lime Production	CO2	546.6	0.6%
2 A 3	Limestone and Dolomite Use	CO2	264.7	0.3%
2 A 7 b	Magnesit Sinter Plants	CO2	373.5	0.4%
2 B 1	Ammonia Production	CO2	445.1	0.5%
2 B 2	Nitric Acid Production	N2O	807.2	1.0%
2 C 1	Iron and Steel Production	CO2	4 063.6	4.8%
2 C 4	SF6 used in Al and Mg Foundries	SF6	7.6	0.0%
2 C 3	Aluminium production	PFCs	NO	-
2 C 3	Aluminium production	CO2	NO	-
2 F 6	Semiconductor Manufacture	FCs	350.4	0.4%
2 F 1/2/3	ODS Substitutes	HFCs	1 032.2	1.2%
2 F 8	Other Sources of SF6	SF6	247.6	0.3%
3	Solvent and Other Product Use	CO2	193.6	0.2%
3	Solvent and Other Product Use	N2O	232.5	0.3%
4 A 1	Enteric Fermentation - Cattle	CH4	2 911.0	3.4%
4 B 1	Manure Management - Cattle	N2O	454.5	0.5%
4 B 1	Manure Management - Cattle	CH4	588.8	0.7%
4 B 8	Manure Management - Swine	CH4	403.3	0.5%
4 D	Agricultural Soils	N2O	2 702.1	3.2%
6 A 1	Managed Waste disposal	CH4	2 514.9	3.0%

The most important key source of the Austrian greenhouse gas inventory is Category *1 A 3 b Road Transportation - diesel oil (CO_2)* because of its contribution to total greenhouse gas emissions and also because of its contribution to the trend. It has been identified a key source category both for the level and the trend assessment for all years and has been number one key source in the level assessment of the years 1996-2002 as well as in the trend assessment of the years 1995-2002. In the year 2002 this category contributed 15.7% to national total greenhouse gas emissions. CO_2 Emissions from *Road Transportation - diesel oil (CO_2)* increased from 1990 to 2002 from 4 362 Gg CO_2 to 13 322 Gg, this is an increase of 205%.

Also the second most important source for greenhouse gas emissions is road transportation, namely with gasoline used as fuel. Category *1 A 3 b Road Transportation – gasoline (CO_2)*

was the most important source for greenhouse gas emissions in the years 1990-1995, thus ranking number one in the level assessment of these years. It was also an important source regarding its contribution to the trend of total emissions, only in 1994 it was not rated a key source in the trend assessment, as for the period from the base year to 2002 the trend was similar to the total inventory's trend. In the year 2002 emissions from this category amounted to 7 916 Gg CO_2, it was the third important source category of 2002. From 1990 to 2002 emissions from this category decreased by 16%.

The third most important key source is *1 A 4 stationary-liquid* (commercial and residential plants and plants in agriculture and forestry as well as off road traffic of these sources), it was the second important source for all years. It was also rated a key source in all trend assessments. In the year 2002 it contributed 8.0% to national total greenhouse gas emissions, emissions from this source decreased by 7% from 1990 to 2002.

Another important source is *1 A 1 a Public Electricity and Heat Production (solid fuel)*, both because its contribution to total emissions and to the contribution to the overall trend. In the year 2002 it contributed 6.9% to national total greenhouse gas emissions, ranking number 4 in the level assessment of that year. In the trend assessment of the years 1992-1994 it was the most important and for the years 1995, 1996, 1998, 1999 it was the second important source with respect to the contribution to the overall trend of Austria's greenhouse gas inventory.

Comparison to last year's submission

There is a difference in the identified key source categories compared to the results of last year's analysis, due to recalculations and reallocation of emissions and introduction of new source categories (for further information see Chapter 9 *Recalculations and Improvements*).

Compared to last year's key source analysis, the following sources have additionally been identified as key sources:

- *1 A 1 c liquid* — *Manuf. of Solid fuels and Other Energy Industries* (CO_2)
- *1 A 2 other* — *Manufacturing Industries and Constr.* (CO_2)
- *2 A 3* — *Limestone and Dolomite Use* (CO_2)
- *2 C 3* — *Aluminium Production* (CO_2)
- *3* — *Solvent and Other Product Use (N_2O)*

CH_4 emissions from category *6 D 1 Sludge Spreading (SNAP 091030)* were a key source in last year's assessment. However, for this year's submission emissions have been recalculated and reallocated to the agriculture sector (for explanations see Chapter 6.4.4) thus this category does not exist anymore.

1.5.2 Description of Methodology

The method used to identify key source categories follows closely the Tier 1 method - quantitative approach described in the Good Practice Guidance [IPCC-GPG, 2000], Chapter 7 *Methodological Choice and Recalculation*.

The analysis includes all greenhouse gases reported under UNFCCC: CO_2, CH_4, N_2O, HFC, PFC and SF_6. All IPCC source categories are included (sinks of LUCF are not included).

The identification of key source categories consists of three steps:

Identifying source categories

Level Assessment

Trend Assessment

Level of disaggregation and identification of key source categories

To identify key source categories total emissions have been split into those source categories that have been estimated using the same methodology and the same emission factor. Minor adaptations of the suggested IPCC source categories as presented in the IPCC GPG have been made, but the applied methodology follows the guidance which describes good practice in determining the appropriate level of detail.

Table A1.3 of Annex 1 presents the determined 158 source categories and their greenhouse gas emissions expressed in CO_2 equivalent emissions for the years 1990 to 2002.

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

Level Assessment

For the Level Assessment the contribution of GHG emissions (expressed in CO_2-equivalent emissions) of each source category to national total emissions was calculated. The calculation was performed for the years 1990 to 2002 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 2002, 33 source categories comprised > 95% of the cumulative total and were thus rated as key sources. For the years 1992, 1995 and the base year 35 source categories were identified as key sources in the level assessment, for all other years 34 categories were identified as key sources. The results of each level assessment is presented in Annex 1.

Trend Assessment

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

For the Trend Assessment emissions of the years 1991 to 2002 were compared with base year emissions (1990 for CO_2, CH_4, N_2O and 1995 for HFCs, PFCs and SF_6), resulting in 12 calculations.

The calculation was performed according to Equation 7.2 of the GPG. The results were ranked in descending order of magnitude and a cumulative total was calculated. Those sources that make up > 95% of the total trend were rated key source categories. Between 25 and 30 sources were identified as key source categories for the different trend assessments. Results are presented in Annex 1.

Identification of key source categories

Any source category meeting the 95% threshold in any year of the Level or the Trend Assessment is considered as key source. The key sources are presented in Table 5 in ascending IPCC category order, in Annex 1 they are presented together with their ranking of all assessments where they are within the 95% threshold.

Consequences of key source category selection

Whenever a method used for the estimation of emissions of a key source category is not consistent with the requirements of the IPCC Good Practice Guidance, the method will have to be improved in order to reduce uncertainty. To this end an emission inventory improvement programme (see Chapter 9.4) has been developed as a basis for further improvement of the emission data.

1.6 Quality Assurance and Quality Control (QA/QC)

A quality management system (QMS) has been designed to contribute to the objectives of *good practice guidance*, namely to improve transparency, consistency, comparability, completeness and confidence in national inventories of emissions estimates. After having been fully implemented during the development of the UNFCCC submission 2004, the accreditation of the *Department for Air Emissions* as inspection body is scheduled to take place in 2004.

The QMS contains all relevant features of the European Standard 45004:1995 *General Criteria for the operation of various types of bodies performing inspections*. The QMS ensures that all requirements of a Type A inspection body as stipulated in EN 45004 are met, including strict independence, impartiality and integrity of accredited bodies. The Quality Assurance and Quality Control (QA/QC) procedures within the QMS correspond to the QA/QC system outlined in IPCC-GPG Chapter 8 "Quality Assurance and Quality Control".

Quality Management System (QMS)

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

With the Kyoto Protocol entering into force, pressure upon national GHG emission inventories is assumed to increase, therefore a QMS will be essential to ensure the quality of emission data according to the requirements of the IPCC-GPG as a basis for any kind of international emission trading. The department of air emissions of the UMWELTBUNDESAMT has decided to implement a QMS based on the European Standard EN 45004 *General Criteria for the operation of various types of bodies performing inspections*. The department of air emissions is seeking accreditation as inspection body in 2004. According to EN 45004, *accreditation* is the procedure by which an authorized body (i.e. The Austrian Federal Ministry of Economic Affairs and Labour) formally recognizes that an organisation is competent to perform a given conformity-assessment activity. *Inspection* is the examination of product design, product, service, process or plant, and determination of their conformity with specific requirements, or, on the basis of professional judgement, general requirements. Inspection of processes includes personnel, facilities, technology and methodology.

This European Standard has been drawn up with the objective of promoting confidence in those bodies performing inspections which conform to it. The relevant requirements of the EN/ISO 9000 series of standards applying to the quality systems for inspection bodies are incorporated in EN 45004.

EN 45004 forms part of the following series of standards covering testing, inspection and certification.

- ISO/IEC 17025 (General requirements for the competence of testing and calibration laboratories) replacing EN 45001 (General criteria for the operation of testing laboratories)
- EN 45002 (General criteria for the assessment of testing laboratories)
- EN 45003 (General criteria for the laboratory accreditation bodies)
- EN 45004 (General criteria for the operation of various types of bodies performing inspection)
- EN 45010 (General Criteria for the assessment and accreditation of certification bodies)

- EN 45011 (General criteria for certification bodies operating product certification)
- EN 45012 (General criteria for certification bodies operating quality system certification)
- EN 45013 (General criteria for certification bodies operating certification of personnel)
- EN 45014 (General criteria for supplier's declaration of conformity)
- EN 45020 (General terms and their definitions concerning standardisation and related activities)

As already noted, the department of air emissions of the UMWELTBUNDESAMT is currently implementing a QMS based on the European Standard EN 45004. This system is proces-based as illustrated in
Figure 2.

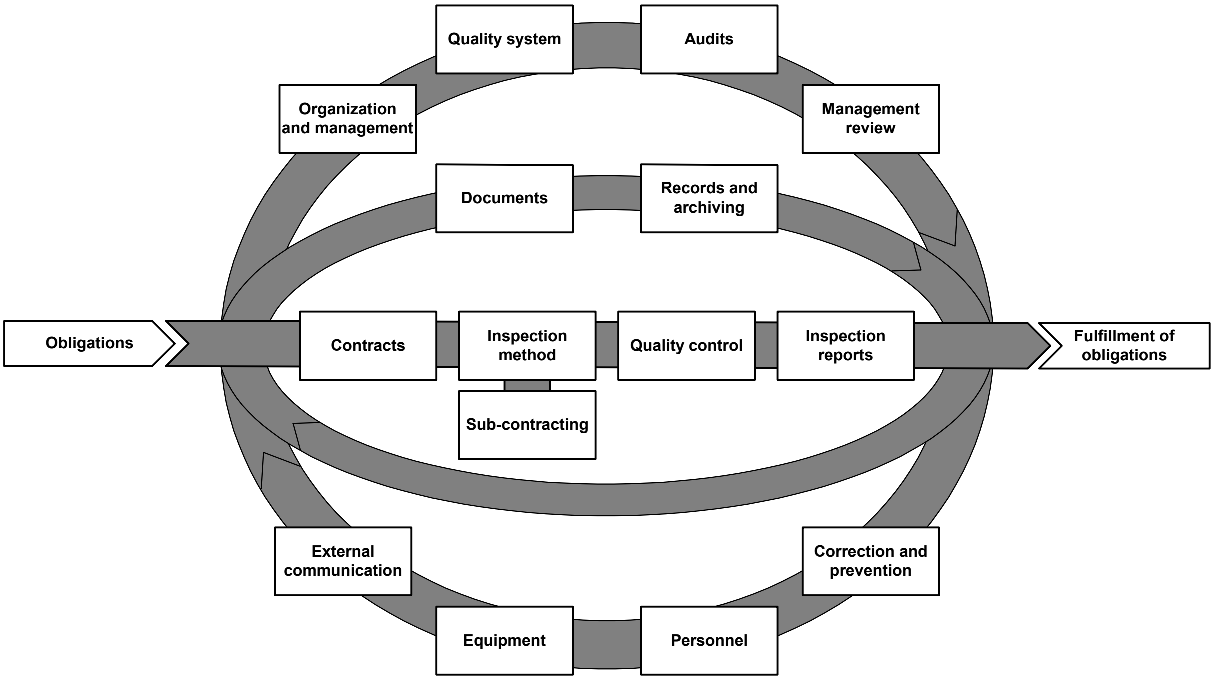


Figure 2: Process-based QMS (the outer circle corresponds to management processes, the straight line to realisation processes and the inner circle to supporting processes)

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

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

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

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

The personnel responsible for inspection has 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.

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

Realisation processes are the department's core competences 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 detailed method, i.e. the method with the lowest uncertainty, is the most appropriate. The inspection process consists of two steps, (i) data collection and (ii) the application of methods to estimate emissions. The UMWELTBUNDESAMT uses IPCC methods, CORINAIR methods and country specific methods. The country-specific methods have to be 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 EN 45004.

2) **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.

The quality management system is in compliance with all relevant requirements addressed in the IPCC-GPG.

Inspection bodies

The European Standard EN 45004 specifies *General criteria for the operation of various types of bodies performing inspection*. This standard covers the functions of bodies whose work may include the examination of materials, products, installations, plants, processes, work procedures or services, and the determination of their conformity with requirements, and the subsequent reporting of results of these activities to clients and, when required, to supervisory authorities. In the case of emissions inventories, inspection concerns the examination of air emissions and covers the collection of emission data or of data which are used to estimate emissions, their compilation and the determination of their conformity with national emission reduction targets in the Kyoto protocol.

For this purpose a quality management system ensuring that all requirements of EN 45004 are met has been implemented. The quality management system takes into account recommendations of European and international documents such as the ISO 9000 series of standards and Guide EA-5/01 (Guidance on the Application of EN 45004, European Co-operation for Accreditation, 2003).

Accreditation Act

The Austrian Accreditation Act ("Akkreditierungsgesetz", Federal Law Gazette 468/1992 as amended by 430/1996) regulates the accreditation of testing, inspection and certification bodies. It designates the Federal Ministry for Economic Affairs and Labour as accreditation body and defines the conditions for granting, maintaining and extending accreditation and the conditions under which accreditation may be suspended or withdrawn, partially or in total for all or part of the testing, inspection or certification body's scope of accreditation. It requires re-assessment in the event of changes affecting the activity and operation of the testing, inspection or certification body, such as changes in personnel or equipment, or if analysis of a complaint or any other information indicates that the testing, inspection or certification body no longer complies with the requirements of the accreditation body.

In Figure 3 the inter-relationship between the Austrian Accreditation Act, the EN 45000 series and the ISO 9000 series is shown.

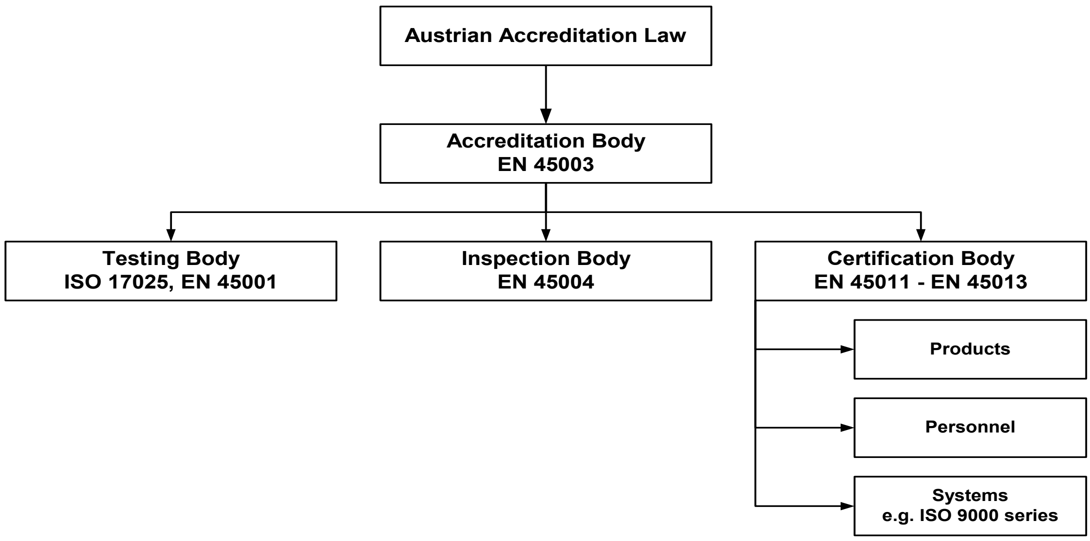


Figure 3: Inter-relationship between the Austrian Accreditation Act, the EN 45000 series and the ISO 9000 series.

The most important difference between EN 45004 and the ISO 9000 series is that accredited bodies under the EN 45004 have to ensure strict independence, impartiality and integrity in their activities. The personnel of the inspection body has to 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 the real emissions as truly as possible.

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

QA/QC Activities

During the year 2003 QA/QC activities were focused on transparent documentation, adaptation of SOPs (Standard Operation Procedures) to be more practical and user friendly. SOPs comply with both IPCC-GPG and EN 45004 requirements. QC procedures follow the recommendations of IPCC-GPG chapter 8 on *Quality Assurance and Quality Control*. Priority is given to key sources. For all sources, fundamental checks such as completeness of estimates, time series consistencies, data transcription and documentation are checked. For key sources, activity data, emission factors, emissions and uncertainty analysis are assessed using the Tier 1 checklist. In addition, where applicable Tier 2 QC procedures are employed.

Special attention is given to documentation, achieving and reporting as outlined in chapter 8.10 of IPCC-GPG.

One of the core activities was the re-design of the key management process "Corrective and Preventive Actions". An efficient process was established to gain transparency when collecting and analyzing findings by UNFCCC reviews experts or any other discrepancies found during inventory compilation. Any findings and discrepancies are documented, responsibilities, resources and a time schedule are attributed to each of these. A periodic review assesses the progress of the inventory improvement process.

Table 6 presents the timetable for the implementation of the quality management system:

Table 6: Timetable for steps

Step	Date
1. Development of a quality management system including quality manual	1999 – 2002
2. Implementation of the quality management system	2003 – 2004
3. Accreditation of the inspection body	2004

Treatment of confidentiality issues

Only one source, the activity of SF_6 (cast aluminium) from aluminium foundries, has to be treated confidential ("C"). One of the aluminium foundries wanted to keep its production volume (its activity) confidential, and as there are less than four such companies in Austria the overall activity for this source category has to be treated as confidential due to an legal regulation on secrecy.

1.7 Uncertainty Assessment

In comparison to last year's submission, there was no change in the uncertainty assessment for the Austrian greenhouse gas emission inventory.

This chapter summarises work on a first comprehensive uncertainty analysis comprising all sectors of the emission inventory. This uncertainty analysis was funded by the UMWELTBUNDESAMT and completed in 2000. It presents the results for three greenhouse gases (CO_2, CH_4 and N_2O) for the years 1990 to 1997. Compilation, prioritisation, uncertainty assessment and Monte Carlo analysis are addressed in greater detail.

The uncertainty estimates are based on emission estimates of the year 1999. Since then, the data was recalculated several times, new data became available and for e.g. agriculture a higher TIER method has been applied. Thus the uncertainty estimate as presented here is no more up to date and it is planned to be recalculated. However, it is assumed that the uncertainty has decreased due to introduction of new, more accurate and more detailed methodologies.

1.7.1 First Comprehensive Uncertainty Analysis

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

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

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

In Table 7 the most important emission sources with respect to uncertainty are listed.

Table 7: Most important emission sources with respect to uncertainty

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

Emission Source	CO_2	CH_4	N_2O
Abandonment of Managed Lands	×		
Solid Waste Disposal		×	

Table 8 shows the estimates for total uncertainty including systematic uncertainty and random uncertainty and Table 9 refers to random uncertainty.

Table 8: Total uncertainty of emission data (emissions given in Tg CO_2 equivalent per year, uncertainties given as a percentage of the mean value)

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

Table 9: Random uncertainty of emission data (emissions given in Tg CO_2 equivalent per year, uncertainties given as a percentage of the mean)

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

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

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

Regarding the individual greenhouse gases, the emissions of CO_2 have a low uncertainty whereas the uncertainty for N_2O is high. The overall relative uncertainty calculated for the year 1990 was 9,8%, for the year 1997 it was 8.9%. The reduction is due to the increase in CO_2 emissions caused by the use of fossil fuels. These CO_2 emissions have a very low uncertainty in comparison to other greenhouse gas emissions and as they dominate the total greenhouse gas emissions their uncertainty dominates the overall uncertainty. The random uncertainty calculated for the year 1990 was 4,5%, for the year 1997 it was 3,8%.

1.7.2 Procedure

The uncertainty was determined in four steps:

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

Step 1: Compilation of emission sources

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

Step 2: Prioritisation and first estimate of uncertainty

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

Step 3: Uncertainty assessment for input parameters

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

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

Step 4: Monte Carlo analysis

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

1.8 Completeness

CRF–Table 9 (Completeness) has been used in order to describe this issue. 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. Austria has no 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, 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).

Allocation to categories may differ from party to party. The main reasons for different allocation to categories are the allocation in national statistics, insufficient information on the national statistics, national methods, and impossibility to disaggregate emission declarations.

- IE (included elsewhere):

"IE" is used 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 the inventory, the CRF completeness table (Table 9) indicates where in the inventory the emissions or removals from the displaced source/sink category have been included. Such deviation from the expected category is explained. It is planned to further improve the level of disaggregation in order to reduce the number of "IE".

- 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 those emissions by sources and removals by sinks of greenhouse gases marked by "NE" there are checkups in progress if they actually are "NO" (not occurring). As a part of the improvement program of the inventory it is planned that those 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 result in emissions or removals of a specific gas. The increase of this number is due to improved completeness of the CRF- tables.

- 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. The only figure that has to be treated confidentially is the activity data for SF_6 from Aluminium Foundries (cast aluminium – sector *2 C*).

Compared to submission 2003, where 90 subcategories were indicated as not estimated, the number of not estimated categories decreased to 75 in submission 2004 (see Table 10). The number of emissions estimates "included elsewhere" decreased from 61 to 48. Subcategories were considered at the most disaggregated level available. Overall transparency increased from 93% to 95%, overall completeness from 93 to 95%. This was accomplished by both advanced completeness of the inventory and the proper use of notation keys.

Table 10: Transparency and completeness in submissions 2003 and 2004.

Sector	Submission 2003		Submission 2003		Submission 2004		Submission 2004	
	IE	NE	Transparency	Completeness	IE	NE	Transparency	Completeness
1 Energy	38	7	88%	98%	25	12	92%	96%
2 Industrial processes	13	59	97%	86%	12	43	97%	91%
3 Solvents	1	1	92%	92%	0	1	100%	95%
4 Agriculture	4	1	92%	98%	6	1	88%	98%
5 LUCF	3	19	94%	61%	3	15	94%	98%
6 Waste	2	3	93%	90%	2	3	93%	89%
Total	**61**	**90**	**93%**	**93%**	**48**	**75**	**95%**	**92%**
total number of estimates (including IE and NE)	**897**				**937**			

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

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

2 TREND IN TOTAL EMISSIONS

According to the Kyoto Protocol, Austria's greenhouse gas emissions have to be 8% below base year emissions during the five-year commitment period from 2008 to 2012. The European Community and its Member States also have a common reduction target of 8%, which they decided to achieve jointly. In April 2002 the Council of the EC has adopted a decision, the so called "burden sharing agreement"[11] 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 (1990 except for fluorinated gases where the base year is 1995).

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

2.1 Emission Trends for Aggregated GHG Emissions

Table 11 presents a summary of Austria's anthropogenic greenhouse gas emissions for the period from 1990 to 2001.

For CO_2, CH_4 and N_2O the base year is 1990. For the F-gases the year 1995 has been selected as base year, since the data are considered to be more reliable than those from 1990.

Table 11: Summary of Austria's anthropogenic greenhouse gas emissions from 1990-2001

	Greenhouse gas emissions [Gg CO2 equivalent]													Trend BY*-2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
Total	**77 998**	**77 746**	**82 154**	**75 135**	**75 413**	**76 480**	**79 356**	**82 776**	**82 340**	**82 000**	**80 083**	**80 640**	**84 398**	**8.5%**
CO_2	60 899	64 535	59 080	59 310	59 704	62 474	66 147	65 713	65 808	64 336	65 064	69 037	69 671	14.4%
CH_4	9 374	9 340	9 051	9 009	8 872	8 773	8 604	8 337	8 216	8 028	7 791	7 656	7 465	-20.4%
N_2O	5 988	6 616	5 694	6 211	6 801	6 372	6 140	6 406	6 184	6 093	6 050	5 970	5 750	-4.0%
HFCs	4	6	9	12	17	546	625	718	816	870	1 033	1 033	1 033	+89.2%
PFCs	963	974	576	48	54	16	15	18	21	25	25	25	25	+61.0%
SF6	518	683	725	823	1 033	1 175	1 246	1 148	955	730	677	677	677	-42.4%

Total emissions and CO_2 are without LUCF
*BY= Base Year: 1990 for CO_2, CH_4 and N_2O and 1995 for HFCs, PFCs and SF_6
Note: Global warming potentials (GWPs) used (100 years time horizon): carbon dioxide (CO_2) = 1; methane (CH_4) = 21; nitrous oxide (N_2O) = 310; sulphur hexafluoride (SF_6) = 23 900; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances

Greenhouse gas emissions in Austria have been fluctuating since 1990, the overall trend has been increasing emissions.

[11] 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

As can be seen in Figure 4, there has been a sharp increase, followed by a sharp decrease of greenhouse gas emissions in Austria at the beginning of the 1990. After that, emissions increased steadily until 1996 and then decreased moderately until 1999. From 2000 to 2001 there was a strong increase in total greenhouse gas emissions in Austria, caused by an increase in CO_2 emissions by 6.1%.

From 2001 to 2002 emissions increased by 0.3%, resulting in total emissions of 84 398 Gg CO_2 equivalent in the year 2002.

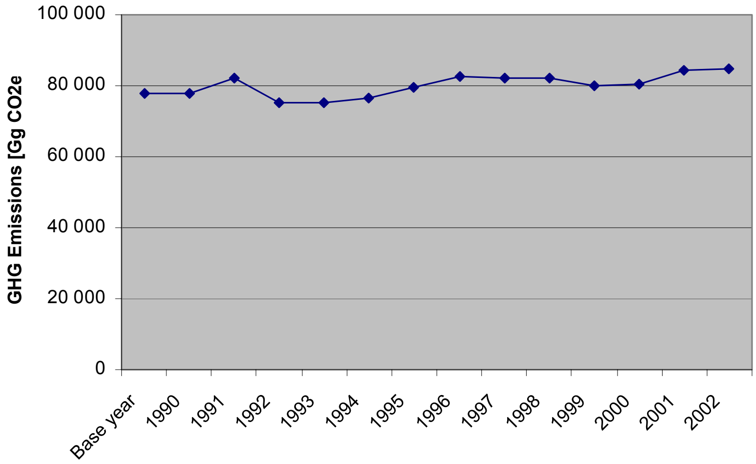


Figure 4: Austria's total greenhouse gas emissions (without LUCF) for the period from 1990-2002

Austria's total greenhouse gas emissions in 2002 were 8.5% above the level of the base year.

2.2 Emission Trends by Gas

Table 12 presents greenhouse gas emissions of the base year and 2002 as well as their share in total greenhouse gas emissions.

Table 12: Austria's greenhouse gas emissions by gas in the base year and in 2001.

GHG	Base year*	2002	Base year*	2002
	CO_2 equivalent [Gg]		[%]	
Total	**77 998**	**84 621**	***100.0%***	***100.0%***
CO_2	60 899	69 671	*78.1%*	*82.3%*
CH_4	9 374	7 465	*12.0%*	*8.8%*
N_2O	5 988	5 750	*7.7%*	*6.8%*
F-Gases	1 736	1 735	*2.2%*	*2.1%*

Total emissions and CO_2 are without LUCF
*1990 for CO_2, CH_4 and N_2O and 1995 for F-Gases

The major greenhouse gas in Austria is CO_2, which represented 82.3% of total greenhouse gas emissions in 2002 compared to 78.1% in the base year, followed by CH_4 (8.8% in 2002 respectively 12.0% in the base year), N_2O (6.8% in 2002 and 7.7% in the base year) and finally fluorinated hydrocarbons (2.1% in 2002 and 2.2% in the base year).

The trend in Austrian greenhouse gas emissions is presented in Figure 5 relative to emissions in the base year (index form: 1990 = 100 for CO_2, CH_4 and N_2O and 1995 = 100 for HFCs, PFCs and SF_6).

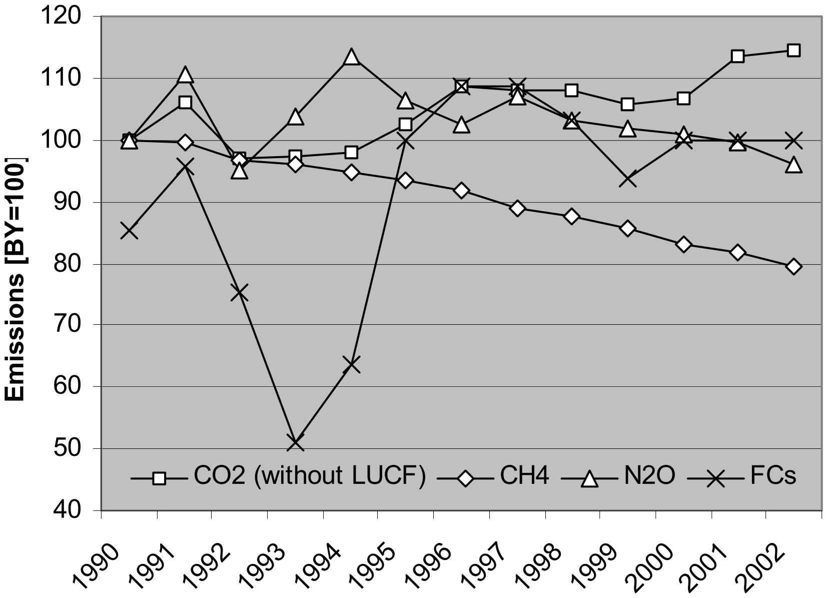


Figure 5: Trend in greenhouse gas emissions 1990-2002 by gas in index form (base year = 100)

CO_2

CO_2 emissions have been fluctuating at the beginning of the decade, after this an upward trend until 1996 could be observed, then emissions were slightly decreasing until the year 1999. A sharp increase in emissions from 2000 to 2001 by 6.1%, followed by a slight increase from 2001 to 2002, resulted in a total increase of 14.4% from 1990 to 2002. Quoting in absolute figures, CO_2 emissions increased from 60 899 to 69 671 Gg (see Table 11) during the period from 1990 to 2002 mainly due to higher emissions from transport.

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 fulfil this goal and the EC was successful doing so.

CH_4

CH_4 emissions decreased steadily during the period from 1990 to 2002, from 9 374 to 7 465 Gg CO_2 equivalent (see Table 11). In 2002 CH_4 emissions were 20.4% below the level of the base year, mainly due lower emissions from solid waste disposal sites.

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

N_2O

N_2O emissions in Austria fluctuated from 1990 to 1997, increasing by 7% over this period. Since then emissions have a moderate decreasing trend, resulting in 5 750 Gg CO_2 equivalent compared to 5 988 in the base year, this is 4% below the level of the base year. The decrease is mainly due lower N_2O emissions from agricultural soils.

The main source of N_2O emissions are agricultural soils with a share of 47% in national total N_2O emissions. Fossil fuel combustion has a share of 22%, nitric acid production which is another important source with regard to national total N_2O emissions had a share of 14%.

HFCs

HFC emissions increased remarkably during the period from 1990 to 2000, from 4 to 1.033 Gg CO_2 equivalent. No update of emission data has been made since 2000; that's why for the years 2001 and 2002 the same values as for 2000 are reported[12]. In 2000 the HFC emissions were 89% above the level of the base year (1995).

The main sources of HFC emissions are refrigeration and air conditioning equipment, foam blowing and XPS/ PU plates.

PFCs

PFC emissions show the inverse trend as HFC emissions. PFC emissions decreased remarkably during the period from 1990 to 2000, from 963 to 25 Gg CO_2 equivalent. No update of emission data has been made since 2000; that's why for the years 2001 and 2002 the same values as for 2000 are reported[12].

In 2000 PFC emissions were 61% above the level of the base year (1995).

The main source of PFC emissions is semiconductor manufacture.

SF_6

SF_6 emissions in 1990 amounted to 518 Gg CO_2 equivalent. They increased steadily until 1996 reaching a maximum of 1 246 Gg CO_2 equivalent. Since then they are deceasing, in 2000 SF_6 emissions amounted to 677 Gg CO_2 equivalent. No update of emission data has been made since 2000; that's why for the years 2001 and 2002 the same values as for 2000 are reported[12].

In 2000 the SF_6 emissions were 42% below the level of the base year (1995).

The main sources of SF_6 emissions are semiconductor manufacture, magnesium production and filling of noise insulate glasses.

2.3 Emission Trends by Source

Table 13 presents a summary of Austria's anthropogenic greenhouse gas emissions by sector for the period from 1990 to 2002:

- Sector 1: Energy

[12] New data will become available in 2004, see Chapter 4.5.3.

- Sector 2: Industrial Processes
- Sector 3: Solvent and Other Product Use
- Sector 4: Agriculture
- Sector 5: Land-Use Change and Forestry
- Sector 6: Waste

Table 13: Summary of Austria's greenhouse gas emissions by sector 1990–2002.

Sector	BY*	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	CO_2 equivalent [Gg]													
Total	**77 998**	**77 746**	**82 154**	**75 135**	**75 413**	**76 480**	**79 356**	**82 776**	**82 340**	**82 000**	**80 083**	**80 640**	**84 398**	**84 621**
1	54 910	54 910	58 924	54 103	54 462	54 544	57 052	61 101	59 917	60 368	58 976	59 116	63 040	63 843
2	10 032	9 780	9 877	8 895	8 460	8 959	9 881	9 706	10 282	9 906	9 623	10 258	10 171	10 035
3	515	515	469	420	420	404	422	405	423	405	391	414	426	426
4	8 444	8 444	8 795	7 710	8 093	8 732	8 298	7 997	8 276	7 975	7 842	7 736	7 764	7 402
5	-9 215	-9 215	-13504	-8 656	-8 982	-7 862	-7 254	-5 385	-7 633	-7 633	-7 633	-7 633	-7 633	-7 633
6	4 097	4 097	4 089	4 007	3 978	3 842	3 702	3 566	3 443	3 346	3 251	3 117	2 998	2 915

Total emissions are without LUCF
*Base Year: 1990 for CO_2, CH_4 and N_2O and 1995 for HFCs, PFCs and SF_6

The dominant sectors are the energy sector, which caused 75% of total greenhouse gas emissions in Austria in 2002 (70% in 1990), followed by the Sector *Industrial Processes*, which caused 12% of greenhouse gas emissions in 2002 (13% in 1990).

The trend of Austria's greenhouse gas emissions by sector is presented in Figure 6 relative to emissions in the base year.

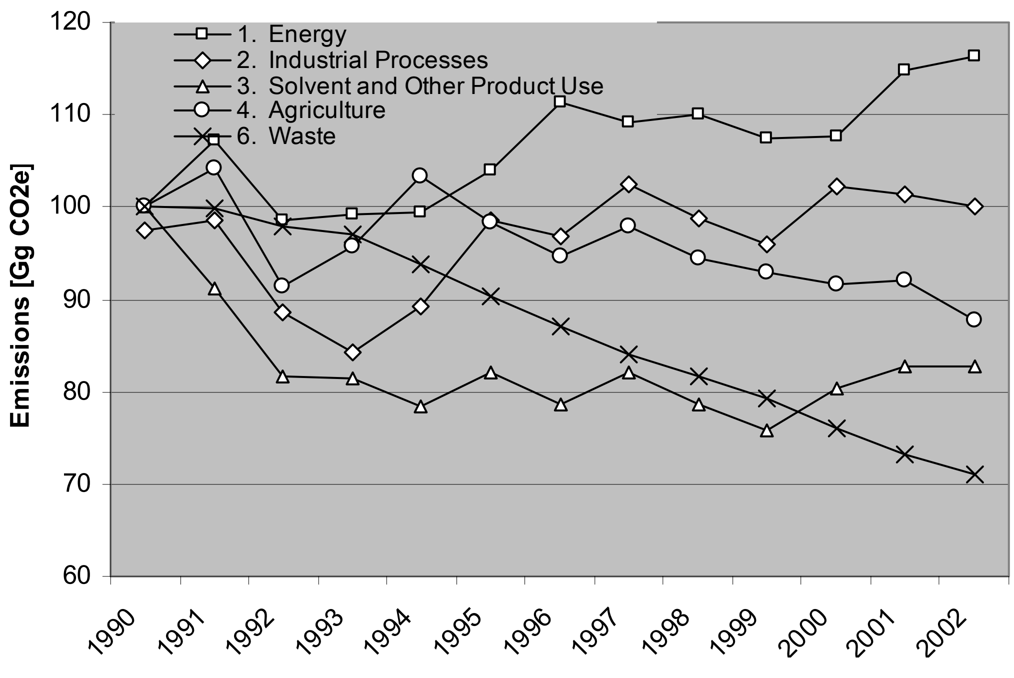


Figure 6: Trend in emissions 1990-2002 by sector in index form (base year = 100)

Table 14: Austria's greenhouse gas emissions by sector in the base year and in 2002 as well as their share and trend.

GHG	Base year*	2002	Trend BY*-2002	Base year*	2002
	Emissions [Gg CO_2e]			Share [%]	
Total	**77 998**	**84 621**	***+9%***	***100%***	***100%***
1 Energy	54 910	63 843	*+16%*	*70%*	*75%*
2 Industry	10 032	10 035	*+0%*	*13%*	*12%*
3 Solvent	515	426	*-17%*	*1%*	*1%*
4 Agriculture	8 444	7 402	*-12%*	*11%*	*9%*
5 LUCF	-9 215	-7 633	*-17%*	*-12%*	*-9%*
6 Waste	4 097	2 915	*-29%*	*5%*	*3%*

Total emissions without LUCF
*1990 for CO_2, CH_4 and N_2O and 1995 for FCs

Energy (IPCC Category 1)

The trend for greenhouse gas emissions from Category *1 Energy* shows increasing emissions. They seemed to have stabilized at the level of 1996, but from 2000 to 2001 emissions increased strongly from 59 116 Gg CO_2 equivalent to 63 040, which corresponds to an increase of 6.6%. From 2001 to 2002 emissions increased again by 1%. The total increase from the base year 1990 to 2002 was 16%. The energy sector is the fastest growing sector, in fact except the industry sector which had an increasing trend of plus 0.03% it is the only sector which's emissions are higher in 2002 than in the base year.

99.3% of emissions from this sector in 2002 originated from fossil fuel combustion.

CO_2 emissions from fossil fuel combustion is the main source of greenhouse gas emissions in Austria. The most important source for greenhouse gas emissions in the year 2002 in Austria was the transport sector with a share of 25% in national total greenhouse gas emissions.

CO_2 contributes 97.1% to total GHG emissions from *Energy*, N_2O 1.9% and CH_4 1.0%.

Industrial Processes (IPCC Category 2)

Greenhouse gas emissions from the industrial processes sector fluctuated during the period, they reached a minimum in 1993. In 2002 they reached the level of the base year again. In 2002 greenhouse gas emissions from Category *2 Industrial Processes* amounted to 10 035 Gg CO_2 equivalent.

The main sources of greenhouse gas emissions in the industrial processes sector are *Metal Production* and *Mineral Products*, which caused 41% respectively 29% of the emissions from this sector in 2002.

The most important GHG of the industry sector was carbon dioxide with 75% of emissions from this category, followed by HFCs with 10%, N_2O with 8%, SF6 with 7%, PFCs with 0.2% and finally CH_4 with 0.1%.

Solvent and Other Product Use (IPCC Category 3)

In the year 2002, 0.5% of total GHG emissions in Austria (426 Gg CO_2 equivalent) arose from the sector *Solvent and Other Product Use*.

Greenhouse gas emissions from Category *3 Solvent and Other Product Use* decreased by almost 20% from 1990 to 2002 and then remained on that level. In 2002 greenhouse gas emissions from *Solvent and Other product Use* were 17% below the level of the base year.

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

Agriculture (IPCC Category 4)

Greenhouse gas emissions from the agricultural sector fluctuated at the beginning of the 90ties, since 1994 they show a steady downward trend: in the year 2002 emissions from that category were 12% below the level of the base year.

Emissions from *Agriculture* amounted to 7 402 Gg CO_2 equivalent in 2002, which corresponds to 9% to national total emissions. The most important sub sector *Enteric Fermentation* contributed 42% to total greenhouse gas emissions from the agricultural sector in 2001, the second largest sub source is *Agricultural Soils* with a share of 37%. *Agriculture* is the largest source for both N_2O and CH_4 emissions: 59% of all N_2O emissions and 54% (191 Gg CH_4) of all CH_4 emissions in Austria in 2002 originated from this sector. N_2O emissions from *Agriculture* amounted to 11 Gg in 2002 (3 404 Gg CO_2 equivalent), which corresponds to 49% of the GHG emissions from this sector, methane contributed 51%.

Waste (IPCC Category 6)

Greenhouse gas emissions from Category *6 Waste* decreased steadily during the period. In 2002 the greenhouse gas emissions from the waste sector amounted to 2 915 Gg CO_2 equivalent. This was 29% below the level of the base year. The decrease in emissions is due to lower emissions from managed waste disposal sites, which is the most important source of this category, as a result of methane recovery systems installed at landfills. The share of emissions from this category in total emissions was 5% in the year 2002.

The main source of greenhouse gas emissions in the waste sector is solid waste disposal on land, which caused 86% of the emissions from this sector in 2002.

97.3% of all greenhouse gas emissions from *Waste* are CH_4 emissions, 2.3% are N_2O and 0.4% CO_2.

2.4 Emission Trends for Indirect Greenhouse Gases and SO_2

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

A detailed description of the methodology used to estimate these emissions will be provided in *Austria's Informative Inventory Report (IIR) 2004, Submission under the UNECE/CLRTAP Convention*, which will be published by the end of 2004.

Table 15 presents a summary of emission estimates for indirect greenhouse gases and SO_2 for the period from 1990 to 2002. 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 15. These reduction targets should be met by 2010 by parties to the UNECE/CLRTAP convention who signed this protocol.

Table 15: Emissions of indirect GHGs and SO_2 1990-2002

Gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	NEC
	[Gg]													
NO_X	212.0	217.3	207.4	198.9	193.7	189.4	193.7	190.1	194.0	189.5	190.3	196.4	204.5	107
CO	1 249	1 253	1 209	1 171	1 118	1 031	1 038	978	938	891	833	837	812	---
NM-VOC	298.1	286.2	256.9	250.4	232.8	232.5	225.8	213.1	201.1	189.7	190.3	195.5	192.6	159
SO_2	80.0	77.1	61.4	58.7	53.1	52.0	49.3	45.4	40.5	38.5	35.4	37.6	36.0	39

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

Emissions of indirect greenhouse gases decreased from the period from 1990 to 2002: for NMVOCs and CO by 35%, NO_X emissions decreased by 4% over this period. SO_2 emissions had a significant negative trend, emissions decreased by 55% compared to 1990 levels.

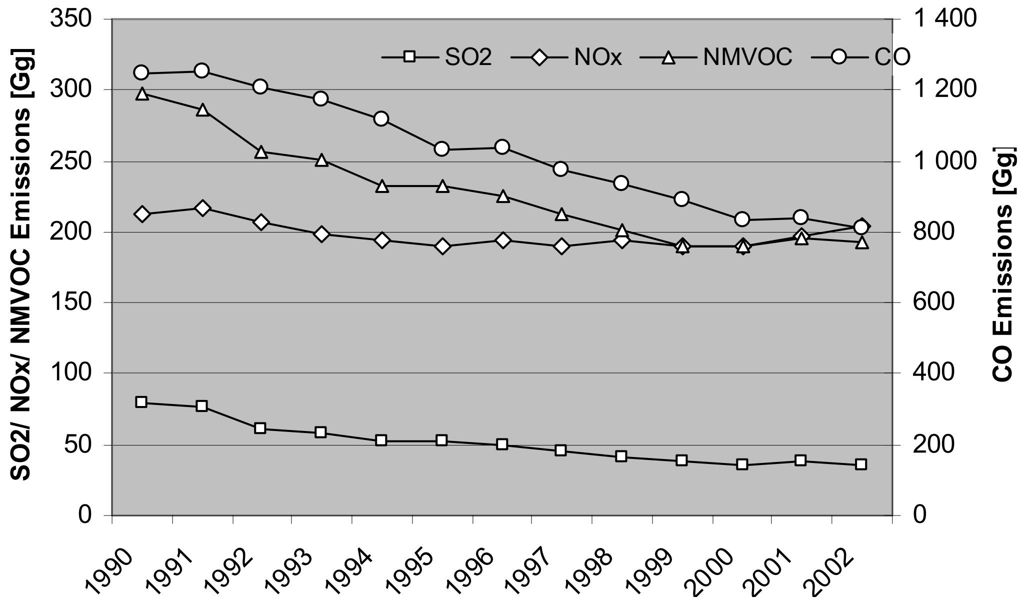


Figure 7: Emissions of indirect GHGs and SO_2 1990-2002

NO_X

NO_X emissions decreased from 212 to 204 Gg during the period from 1990 to 2001. In 2001 the NO_X emissions were 4% below the level of 1990.

Over 90% of NO_X emissions in Austria originate from fossil fuel combustion.

CO

CO emissions decreased from 1 249 to 812 Gg during the period from 1990 to 2002. In 2002 CO emissions were 35% below the level of 1990.

In the year 2002, 92% of total CO emissions in Austria originated from fuel combustion activities.

NMVOC

NMVOC emissions decreased from 298 to 193 during the period from 1990 to 2001. In 2001 NMVOC emissions were 35% below the level of 1990.

The most important emission sources for NMVOC emissions are *Solvent Use* and fossil fuel combustion, both contributed 43% to national total emissions in 2002.

SO_2

SO_2 emissions decreased from 80 to 36 Gg during the period from 1990 to 2002. In 2002 SO_2 emissions were 55% below the level of 1990.

In the year 2002, 89% of total SO_2 emissions in Austria originated from fuel combustion activities. The decrease is mainly due to lower emissions from residential plants and manufacturing industries and construction.

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 2002 about 74.9% of national total GHGs emissions and 88.7% of national total anthropogenic CO_2 emissions from Austria were caused by fossil fuel combustion in road traffic, in the energy and manufacturing industry and in the commercial, agricultural and house holding sector.

3.1.1 Emission Trends

Figure 8 presents the trend for emission from IPCC Sector *1 Energy* in Gg CO_2 equivalent. The trend increased by 16.3% from 54.91 Gg CO_2 equivalent in 1990 to 63.84 Gg CO_2 equivalent in 2002 which is mainly caused by increasing emissions from the transport sector.

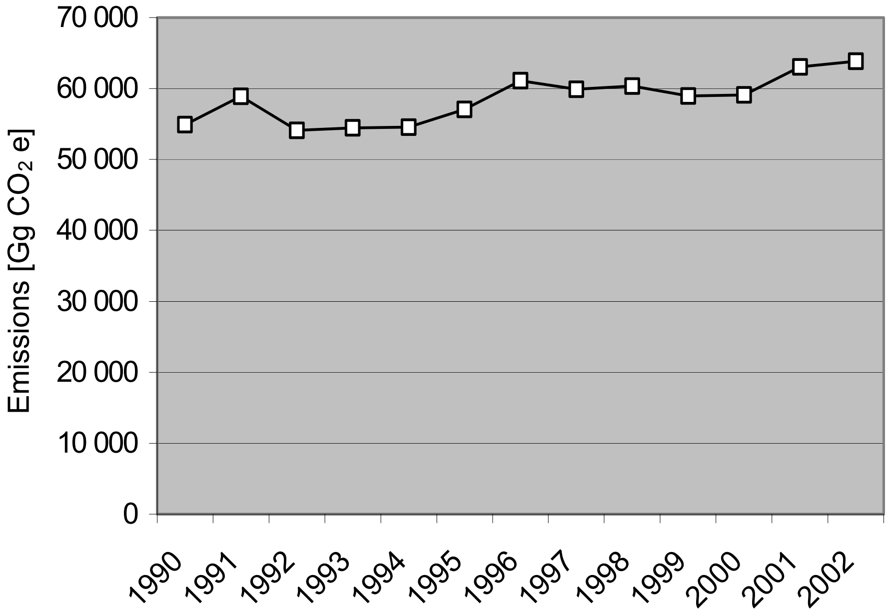


Figure 8: Trend of GHG emissions from 1990-2002 for Sector 1 Energy.

Table 16 presents the emission trend by GHG. The increase of CO_2 and N_2O emissions is mainly caused by the increasing activity in the transport sector. The decrease of CH_4 emissions is mainly caused by the decrease of CH_4 emissions from biomass combustion in category *1 A 4 Other.*

Table 16: Emissions of greenhouse gases and their trend from 1990-2002 from category 1 Energy

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1990	53 219	35.46	3.05
1991	57 000	37.15	3.69
1992	52 144	35.09	3.94
1993	52 422	34.85	4.22
1994	52 499	32.71	4.38
1995	54 993	33.74	4.36
1996	59 024	35.56	4.29
1997	57 984	31.06	4.13
1998	58 414	30.47	4.24
1999	57 098	30.38	4.00
2000	57 306	28.93	3.88
2001	61 189	30.60	3.90
2002	61 982	29.69	3.99
Trend 1990-2002	*16.5%*	*-16.3%*	*30.8%*

Emission trends by sectors

Table 17 presents the emission trend by sub category. Emissions from category *1 A 3 Transport* increased very strong 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 17: Total GHG emissions in [Gg CO_2 equivalent] from 1990–2002 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	54 910	54 530	13 526	13 179	13 305	14 485	36	380	11	369
1991	58 924	58 532	14 324	13 543	14 884	15 743	38	392	9	383
1992	54 103	53 703	11 191	12 552	14 900	15 025	35	400	8	392
1993	54 462	54 063	10 973	13 169	15 102	14 779	40	399	8	392
1994	54 544	54 135	11 328	13 919	15 251	13 594	43	409	6	403
1995	57 052	56 632	12 491	13 970	15 309	14 828	33	420	6	414
1996	61 101	60 717	13 748	13 688	16 911	16 330	40	385	5	380
1997	59 917	59 485	13 726	15 192	15 797	14 732	38	432	5	427
1998	60 368	59 915	12 903	14 341	17 903	14 725	43	453	5	448

	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
1999	58 976	58 490	12 853	13 496	17 282	14 816	43	486	5	481
2000	59 116	58 645	12 557	13 884	18 134	14 023	46	471	6	465
2001	63 040	62 547	14 578	13 097	19 383	15 443	44	493	6	487
2002	63 843	63 372	15 080	12 674	21 333	14 243	42	470	6	465
Trend 1990-2002	*16.3%*	*16.2%*	*11.5%*	*-3.8%*	*60.3%*	*-1.7%*	*16.3%*	*23.9%*	*-49.7%*	*26.1%*

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) for the specific IPCC sub categories.

Additionally to information provided in this chapter, Annex 2 includes further information on the underlying activity data used for estimating emissions. The Annex 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* (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 as well as information on the last revision of the national energy balance is also presented in Annex 2.

For results, methodology and detailed data for the CO_2 reference approach see Annex 3. The source of activity data used for estimating emissions (the national energy balance) is presented in Annex 4.

3.2.1 Source Category Description

In 2002 the most important source for GHGs in this category in Austria was the transport sector (IPCC Category *1 A 3*), with a share of 25.2% in national total GHG emissions. 16.8% of national GHG emissions are released by passenger cars, 2.3% by light duty vehicles, 5.1% by heavy-duty vehicles and 0.2 % 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 land locked country, there is no occurrence of maritime activities. About 0.1% of national GHG arise from domestic air traffic.

The second largest GHG source of the energy sector in Austria in 2002 is category *1 A 1 Energy Industries*, where fossil fuels are combusted to produce electrical power or district heating. In the year 2002, 73.5 % of the overall gross production of 55 222 GWh of public electricity were generated by hydro plants[13]. 14 431 GWh (that are 26.1%) were produced by thermal power plants, 207 GWh by solar and wind plants. Industrial auto producers generated 7 259 GWh of electricity in the year 2002. There are no operating nuclear plants in Austria. Thus, the seasonal water situation in Austria has an important influence on the needs for electric power generation by fossil fuels. Biomass used in this sector 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 (subcategory *1 A 1 b Petroleum refining*).

In the commercial, agricultural and house holding sector (small combustion, Category *1 A 4 Other Sectors*), which is the third largest subcategory, fossil fuels are mainly used for heating purposes. Emissions of this category are very dependant on the climatic circumstances and on the economic trend (for example a "cold winter" combined with an economic up trend may influence emissions from this sector in a strong way). The main share of biomass in Austria is used in the small combustion sector. This sector also includes emissions from off-road activities. In the year 2002 the share in total GHG emissions of category *1 A 4* is 16.8%, of which GHG emissions from tractors and other mobile machines used in the agricultural and forestry sector have a share of 2.2% in the national total.

[13] Source: IEA Questionnaire jan/2003 by STATISTIC AUSTRIA.

3.2.1.1 Key Sources

For the key source analysis liquid fuel consumption of the subcategories *1 A 2 Manufacturing Industries and Construction* and *1 A 4 Other Sectors* was split into mobile and stationary sources. In general, emission sources that are estimated by using the same set of emission factors and source of activity data (which implies a similar range of uncertainty) were aggregated together, resulting in 32 categories for Sector *1 Energy* of which 22 have been identified as key categories.

Due to recalculations, the key categories identified in this submission differ from those identified in last year's analysis:

CO_2 emissions from *1 A 2 Manufacturing Industries and Construction-other fuels* becomes a new key source due to the Level and Trend Assessment.

CO_2 emissions from 1 A 2 c Manufacturing of Solid fuels and Other Energy Industries -other fuels becomes a new key source due to the Trend Assessment.

Table 18 presents the source categories in the level of aggregation for the key source analysis (for the key source analysis see Chapter 3).

Table 18: Key sources of Category 1 Energy

IPCC Category	Source Categories	Key Sources	
		GHG	KS-Assessment
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	LA; TA 1991-1993, 1995-1999, 2001-2002.
1 A 1 a liquid	Public Electricity and Heat Production	CO2	LA; TA 1991-2000, 2002
1 A 1 a other	Public Electricity and Heat Production	CO2	LA 1992,1994-2002. TA 1992-2002
1 A 1 a solid	Public Electricity and Heat Production	CO2	LA; TA
1 A 1 b gaseous	Petroleum refining	CO2	LA; TA 2000
1 A 1 b liquid	Petroleum refining	CO2	LA; TA
1 A 1 c liquid	Manufacturing of Solid fuels and Other Energy Industries	CO2	TA 1992-1995
1 A 1 c gaseous	Manufacturing of Solid fuels and Other Energy Industries	CO2	LA 1990-1995, 2001-2002 TA1996-2002
1 A 2 gaseous	Manufacturing Industries and Construction	CO2	LA; TA
1 A 2 mob-liquid	Manufacturing Industries and Construction-mobile	CO2	LA; TA1992-1995,1997-2002
1 A 2 solid	Manufacturing Industries and Construction	CO2	LA; TA1991-2001
1 A 2 stat-liquid	Manufacturing Industries and Construction-stationary	CO2	LA; TA1991,1993-2000
1 A 2 other	Manufacturing Industries and Construction	CO2	LA 1990, 1991, 1993 TA 1993-1998, 2002
1 A 3 b diesel oil	Road Transportation	CO2	LA; TA
1 A 3 b gasoline	Road Transportation	CO2	LA; TA 1991-1993, 1995-2002.
1 A 3 b gasoline	Road Transportation	N2O	LA; TA
1 A 3 e gaseous	Transport-Other	CO2	LA 1998-2002; TA 1998-2000

IPCC Category	Source Categories	Key Sources	
		GHG	KS-Assessment
1 A 4 mobile-diesel	Fuel Combustion-Other Sectors-mobile-Agriculture and Forestry	CO2	LA; TA1992-2001
1 A 4 stat-biomass	Fuel Combustion-Other Sectors-stationary	CH4	LA 1990-1999, 2001 TA 1997,2000
1 A 4 stat-gaseous	Fuel Combustion-Other Sectors-stationary	CO2	LA; TA
1 A 4 stat-liquid	Fuel Combustion-Other Sectors-stationary	CO2	LA; TA
1 A 4 stat-solid	Fuel Combustion-Other Sectors-stationary	CO2	LA; TA

TA = Trend Assessment 1991-2002
LA = Level Assessment 1990-2002

3.2.1.2 Completeness

Table 19 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 subcategory have been estimated. A "NO" indicates that the Austrian energy balance does not quote an energy consumption for the regarding 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 19: 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

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
1 A 1 c Gaseous Fuels		✓	✓	✓
1 A 1 c Biomass		NO	NO	NO
1 A 1 c Other Fuels		NO	NO	NO
1 A 2 a Iron and Steel	**0301 Comb. In boilers, gas turbines and stationary engines (Iron and Steel Industry) 030301 Sinter and palletising plants 030326 Processes with Contact-Other(Iron and Steel Industry)**			
1 A 2 a Liquid Fuels		✓	✓	✓
1 A 2 a Solid Fuels		✓	✓	✓
1 A 2 a Gaseous Fuels		✓	✓	✓
1 A 2 a Biomass		✓	✓	✓
1 A 2 a Other Fuels		NO	NO	NO
1 A 2 b Non-ferrous Metals	**0301 Comb. In boilers, gas turbines and stationary engines(Non-ferrous Metals Industry)**			
1 A 2 b Liquid Fuels		✓	✓	✓
1 A 2 b Solid Fuels		✓	✓	✓
1 A 2 b Gaseous Fuels		✓	✓	✓
1 A 2 b Biomass		NO	NO	NO
1 A 2 b Other Fuels		NO	NO	NO
1 A 2 c Chemicals	**0301 Comb. in boilers, gas turbines and stationary engines (Chemical Industry)**			
1 A 2 c Liquid Fuels		✓	✓	✓
1 A 2 c Solid Fuels		✓	✓	✓
1 A 2 c Gaseous Fuels		✓	✓	✓
1 A 2 c Biomass		✓	✓	✓
1 A 2 c Other Fuels		✓	✓	✓
1 A 2 d Pulp, Paper and Print	**0301 Comb. in boilers, gas turbines and stationary engines (Pulp, Paper and Print Industry)**			
1 A 2 d Liquid Fuels		✓	✓	✓
1 A 2 d Solid Fuels		✓	✓	✓
1 A 2 d Gaseous Fuels		✓	✓	✓
1 A 2 d Biomass		✓	✓	✓
1 A 2 d Other Fuels		✓	✓	✓
1 A 2 e Food Processing, Beverages and Tobacco	**0301 Comb. in boilers, gas turbines and stationary engines (Food Processing, Beverages and Tobacco Industry)**			
1 A 2 e Liquid Fuels		✓	✓	✓
1 A 2 e Solid Fuels		✓	✓	✓
1 A 2 e Gaseous Fuels		✓	✓	✓

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
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 Industry** **030317 Other Glass** **030319 Bricks and Tiles** **0808 Other Mobile Sources and Machinery-Industry**			
1 A 2 f Liquid Fuels		✓	✓	✓
1 A 2 f Solid Fuels		✓	✓	✓
1 A 2 f Gaseous Fuels		✓	✓	✓
1 A 2 f Biomass		✓	✓	✓
1 A 2 f Other Fuels		✓	✓	✓
1 A 3 a Civil Aviation	**080501 Domestic airport traffic (LTO cycles - <1000 m)** **080503 Domestic cruise traffic (>1000 m)**			
1 A 3 a Aviation Gasoline		✓	✓	✓
1 A 3 a Jet Kerosene		✓	✓	✓
1 A 3 b Road Transportation	**0701 Passenger cars** **0702 Light duty vehicles < 3.5 t** **0703 Heavy duty vehicles > 3.5 t and buses** **0704 Mopeds and Motorcycles < 50 cm3** **0705 Motorcycles > 50 cm3** **0706 Gasoline evaporation from vehicles**			
1 A 3 b Gasoline		✓	✓	✓
1 A 3 b Diesel Oil		✓	✓	✓
1 A 3 b Natural Gas		NO	NO	NO
1 A 3 b Biomass		NO	NO	NO
1 A 3 b Other Fuels		NO	NO	NO
1 A 3 c Railways	**0802 Other Mobile Sources and Machinery-Railways**			
1 A 3 c Solid Fuels		✓	✓	✓
1 A 3 c Liquid Fuels		✓	✓	✓
1 A 3 c Other Fuels		NO	NO	NO
1 A 3 d Navigation	**0803 Other Mobile Sources and Machinery-Inland waterways**			
1 A 3 d Coal		NO	NO	NO
1 A 3 d Residual Oil		NO	NO	NO
1 A 3 d Gas/Diesel oil		✓	✓	✓
1 A 3 d Other Fuels: Gasoline		✓	✓	✓
1 A 3 e Other	**010506 Pipeline Compressors** **0810 Other Mobile Sources and Machinery-Other off-road**			
1 A 3 e Liquid Fuels		NO	NO	NO

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
1 A 3 e Solid Fuels		NO	NO	NO
1 A 3 e Gaseous Fuels		✓	✓	✓
1 A 4 a Commercial/Institutional	**0201 Commercial and institutional plants**			
1 A 4 a Liquid Fuels		✓	✓	✓
1 A 4 a Solid Fuels		✓	✓	✓
1 A 4 a Gaseous Fuels		✓	✓	✓
1 A 4 a Biomass		✓	✓	✓
1 A 4 a Other Fuels		✓	✓	✓
1 A 4 b Residential	**0202 Residential plants** **0809 Other Mobile Sources and Machinery-Household and gardening**			
1 A 4 b Liquid Fuels		✓	✓	✓
1 A 4 b Solid Fuels		✓	✓	✓
1 A 4 b Gaseous Fuels		✓	✓	✓
1 A 4 b Biomass		✓	✓	✓
1 A 4 b Other Fuels		NO	NO	NO
1 A 4 c Agriculture/Forestry/Fisheries	**0203 Plants in agriculture, forestry and aquaculture** **0806 Other Mobile Sources and Machinery-Agriculture** **0807 Other Mobile Sources and Machinery-Forestry**			
1 A 4 c Liquid Fuels		✓	✓	✓
1 A 4 c Solid Fuels		✓	✓	✓
1 A 4 c Gaseous Fuels		✓	✓	✓
1 A 4 c Biomass		✓	✓	✓
1 A 4 c Other Fuels		NO	NO	NO
1 A 5 Other	**0801 Other Mobile Sources and Machinery-Military**			
1 A 5 Liquid Fuels		✓	✓	✓
1 A 5 Solid Fuels		NO	NO	NO
1 A 5 Gaseous Fuels		NO	NO	NO
1 A 5 Biomass		NO	NO	NO
1 A 5 Other Fuels		NO	NO	NO
Marine Bunkers				
Gasoline		NO	NO	NO
Gas/Diesel oil		NO	NO	NO
Residual Fuel Oil		NO	NO	NO
Lubricants		NO	NO	NO
Coal		NO	NO	NO
Other Fuels		NO	NO	NO

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
Aviation Bunkers	**080502 International airport traffic (LTO cycles - <1000 m)** **080504 International cruise traffic (>1000 m)**			
Jet Kerosene		✓	✓	✓
Gasoline		NO	NO	NO
Multilateral Operations		**IE**(2)	**IE**(2)	**IE**(2)

(1) CH_4 emissions from petroleum refining are included in *1 B 2 Fugitive Emissions from Fuels*.
(2) Energy consumption and emissions from Multilateral Operations are included in *1 A 4 a Commercial / Institutional.*

3.2.2 Methodological Issues

In general CORINAIR methodology is applied: the fuel input of each subcategory is multiplied with a fuel and technology dependent emission factor for CO_2, CH_4 and N_2O. Exceptions are CO_2 emissions of categories *1 A 1 b Petroleum Refining*, *1 A 2 a Iron and Steel* and *1 A 2 f Other - Cement* where emission declarations from plant operators were used.

Emission factors

Emission factors for combustion plants are expressed as kg/GJ for CO_2 and 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 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.
- 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 technology 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] and [UBAVIE, 2001]. 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.

Activity data

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 as taken from the energy balance as well as information on the last revision of the national energy balance is also presented in Annex 2.

The national energy balance is provided by STATISTIK AUSTRIA [IEA JQ 2003] (it is presented in Annex 4). Also 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).

Only the quantities that are combusted result in CO_2 emissions - and only these are considered in the sectoral approach. This means that the following share of the gross inland fuel consumption is not considered in the sectoral approach: non–energy use, international bunker fuels, transformation and distribution losses and transformations of fuels to other fuels like hard coal to coke oven coke or internal refinery processes which have been added to the transformation sector of the energy balance.

3.2.2.1 1 A 1 a Public Electricity and Heat Production

Key Source: Yes (CO_2: gaseous/ liquid/ solid/ other)

Category *1 A 1 a Public Electricity and Heat Production* enfolds emissions from fuel combustion in public power and heat plants. The share in total GHG emissions from sector *1 A* is 20.4% for the year 1990 and 18.8% for the year 2002.

Table 20: Greenhouse gas emissions from Category 1 A 1 a.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	11 091	0.15	0.14	11 137
1991	11 771	0.16	0.16	11 823
1992	8 631	0.15	0.12	8 673
1993	8 446	0.16	0.13	8 489
1994	8 728	0.15	0.13	8 771
1995	9 918	0.15	0.14	9 966
1996	10 940	0.18	0.14	10 987
1997	10 984	0.19	0.14	11 030
1998	10 043	0.18	0.15	10 093
1999	10 167	0.16	0.15	10 218
2000	9 970	0.16	0.16	10 023
2001	11 263	0.18	0.18	11 324
2002	11 877	0.25	0.19	11 940
Trend 1990-2002	*7.1%*	*70.5%*	*34.8%*	*7.2%*

As can be seen from Table 21 during the last three years solid fossil fuels and natural gas were dominant compared to other fuel types. Since 1998 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 3% in 2002.

Table 21: Share of fuel types on total CO_2 emissions from Category 1 A 1 a.

	Liquid	Solid	Gaseous	Other
1990	12%	56%	30%	1%
1991	14%	58%	27%	2%
1992	17%	46%	33%	3%
1993	24%	37%	36%	3%
1994	22%	38%	37%	3%
1995	16%	46%	36%	3%
1996	14%	43%	40%	3%
1997	17%	46%	34%	3%
1998	22%	35%	40%	3%
1999	20%	37%	40%	3%
2000	12%	50%	35%	3%
2001	14%	53%	30%	3%
2002	7%	49%	40%	3%

Methodology

CORINAIR simple methodology was applied.

Emission factors

National emission factors for CO_2 and CH_4 are taken from [BMWA-EB, 1990], [BMWA-EB, 1996] and [UBAVIE, 2001]. N_2O-emission factors are taken from a national study [STANZEL et al., 1995]. The selected emissions factors for 2002 are listed in the following table.

Table 22: Emission factors of Category 1 A 1 a for 2002.

Fuel	CO_2 [t / TJ]	CH_4 [kg / TJ]	N_2O [kg / TJ]
Light Fuel Oil in plants >= 50 MW_{th}	77.00	1.00	1.00
Light Fuel Oil in plants <= 50 MW_{th}	78.00	0.80	0.60
Medium Fuel Oil	78.00	1.00	1.00
Heavy Fuel Oil in plants >= 50 MW_{th}	80.00	0.60 - 1.00	1.80
Heavy Fuel Oil in plants <= 50 MW_{th}	78.00	2.00	1.00
Gasoil	75.00	1.20	1.00
Diesel	75.00	0.20	0.60
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}	55.00	0.18	0.50
Natural Gas in district heating plants >= 50 MW_{th}	55.00	1.50	1.00
Natural Gas in plants <= 50 MW_{th}	55.00	1.50	0.10
Liquified Petroleum Gas	64.00	1.50	0.10
Fuel Wood	[(1)]100.00	21.00	3.00
Wood Waste	[(1)]110.00	2.00	4.00
Sewage Sludge	[(1)]110.00	12.00	1.40
Biogas, Sewage Sludge Gas, Landfill Gas	[(1)]112.00	1.50	1.00
Municipal Solid Waste	62.00	12.00	1.40
Hazardous Waste	50.00	12.00	1.40
Industrial Waste	10.00	12.00	1.40

(1) Reported as CO2 emissions from biomass.

Activity data

Fuel consumption is taken from [IEA JQ 2003] prepared by STATISTIK AUSTRIA (see Annex 4).

In a first step large point sources are considered. UBAVIE is operating a database to store plant specific data, 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 for the two categories ≥ *300 MW* and ≥ *50 MW to 300 MW* of thermal capacity. Currently 42 plants are considered in this approach.

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

Fuel consumption in the public electricity sector varies strongly over time. The most important reason for this variation is the fact that in Austria up to 70% of the power needed is produced by hydroelectric power plants. If production of electricity by hydropower is low, production from thermal power plants is high and vice versa.

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

Table 23: Public gross electricity and heat production.

	Gross electricity production [GWh]						Heat Production [TJ] by Combustible Fuels
	Total	Hydro	Combustible Fuels	Geothermal	Solar	Wind	
1990	43 404	30 111	13 293	0	0	0	24 420
1991	43 497	30 268	13 229	0	0	0	29 033
1992	42 838	33 530	9 308	0	0	0	27 600
1993	45 063	35 334	9 729	0	1	0	31 823
1994	44 982	34 243	10 738	0	1	0	31 663
1995	47 944	35 794	12 148	0	1	1	35 307
1996	46 011	32 950	13 055	0	1	5	44 438
1997	47 696	34 701	12 972	0	2	20	40 555
1998	48 250	36 058	12 145	0	2	45	43 043
1999	51 608	39 593	11 963	0	2	51	42 860
2000	53 158	41 410	11 677	0	3	67	42 776
2001	53 656	39 681	13 798	0	4	172	46 501
2002	55 222	40 581	14 431	3	4	203	47 318

Source: STATISTIK AUSTRIA.

3.2.2.2 1 A 1 b Petroleum Refining

Key Source: Yes (CO_2: gaseous/ liquid)

Category *1 A 1 b Petroleum Refining* enfolds CO_2 and N_2O emissions from fuel combustion and thermal cracking of the only petroleum refining plant in Austria. CH_4 emissions are included in category *1 B 2 a Fugitive Emissions from Fuels – Oil*.

The share in total GHG emissions from sector *1 A* is 3.7% for the year 1990 and 4.1% for the year 2002. The increase of CO_2 emissions is caused by the increase of crude oil input which was 8 Mio t in 1990 and 9 Mio t in 2002.

Table 24: Greenhouse gas emissions from Category 1 A 1 b.

	CO_2 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	2 019	0.01	2 023
1991	2 138	0.01	2 142
1992	2 237	0.01	2 241
1993	2 187	0.02	2 192
1994	2 262	0.02	2 267
1995	2 203	0.01	2 208
1996	2 590	0.02	2 595
1997	2 487	0.02	2 492
1998	2 640	0.02	2 645
1999	2 464	0.01	2 468
2000	2 384	0.01	2 388
2001	2 482	0.01	2 486
2002	2 565	0.01	2 569
Trend 1990-2002	*27.1%*	*-13.4%*	*27.0%*

Table 25 presents the share of CO_2 emissions on the different fuel types. Natural gas combustion became less important whereas the combustion of liquid fossil fuels increased.

Table 25: Share of fuel types on total CO_2 emissions from Category 1 A 1 b.

	Liquid	Gaseous
1990	78%	22%
1991	79%	21%
1992	82%	18%
1993	80%	20%
1994	83%	17%
1995	81%	19%
1996	82%	18%
1997	83%	17%
1998	85%	15%
1999	84%	16%
2000	85%	15%
2001	84%	16%
2002	84%	16%

Methodology

CO_2 emissions are reported by the *Association of the Austrian Petroleum Industry.* CO_2 emissions are divided to the fuel categories as the following: for liquid fossil fuels (residual fuel oil, gas oil, diesel, petroleum, jet gasoline, other oil products and LPG) and natural gas default emission factors are used for calculating CO_2 emissions. The remaining CO_2 emissions are assumed to result from combustion of refinery gas.

N_2O emissions are calculated by multiplying fuel consumption with the emission factors presented below.

CH_4 emissions are reported under Category *1 B 2 a Fugitive Emissions from Fuels – Oil*.

For crude oil input data see Table 89 in Chapter 3.5.

Emission factors

N_2O emission factors are taken from a national study [BMUJF, 1994]. CO_2 emission factors are taken from [BMWA-EB, 1990], [BMWA-EB, 1996].

Emission factors for CO_2 and N_2O are presented in Table 26.

Table 26: Emission factors of Category 1 A 1 b for 2002.

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	0.10
Refinery Gas	(1) 69.85	0.10
Natural Gas	55.00	0.10

(1) Implied emission factor of remaining CO2 emissions including those from thermal cracking.

Activity data

Fuel consumption is taken from [IEA JQ 2003] as presented in Annex 4.

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

Key Source: Yes (CO_2: gaseous, liquid)

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. The share in sector *1 A* overall GHG emissions is 0.7% for the year 1990 and 0.9% for the year 2002.

Table 27: Greenhouse gas emissions from Category 1 A 1 c.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	366	0.008	0.0011	366
1991	359	0.008	0.0010	359
1992	277	0.008	0.0005	277
1993	292	0.008	0.0005	292
1994	290	0.008	0.0005	290
1995	317	0.009	0.0006	317
1996	166	0.005	0.0003	166
1997	204	0.006	0.0004	204
1998	164	0.004	0.0003	165
1999	166	0.005	0.0003	166
2000	147	0.004	0.0003	147
2001	767	0.021	0.0014	768
2002	571	0.016	0.0010	572
Trend 1990-2002	*56.2%*	*90.1%*	*-4.6%*	*56.1%*

Table 28 shows that in 2002 all emissions of category *1 A 1 c* originated from natural gas combustion.

Table 28: Share of fuel types on total CO_2 emissions from Category 1 A 1 c.

	Liquid	Gaseous
1990	20%	80%
1991	17%	83%
1992	0%	100%
1993	1%	99%
1994	1%	99%
1995	0%	100%
1996	0%	100%
1997	0%	100%
1998	0%	100%
1999	0%	100%
2000	0%	100%
2001	0%	100%
2002	0%	100%

Methodology

CORINAIR simple methodology is applied.

Emission factors

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

The N_2O emission factor is taken from a national study [BMUJF, 1994].

The emission factors are presented in Table 29.

Table 29: Emission factors of Category 1 A 1 c.

Fuel	CO_2 [t / TJ]	CH_4 [kg / TJ]	N_2O [kg / TJ]
Natural Gas	55.00	1.50	0.10
Other Oil Products	78.00	0.20	0.60

Activity data

Fuel consumption is taken from [IEA JQ 2003] as presented in Annex 4.

3.2.2.4 1 A 2 a Iron and Steel

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

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 9.8% for the year 2002.

Table 30: Greenhouse gas emissions from Category 1 A 2 a.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	4 877	0.022	0.0412	4 890
1991	4 408	0.019	0.0403	4 421
1992	3 767	0.016	0.0339	3 778
1993	4 057	0.019	0.0362	4 068
1994	4 328	0.023	0.0396	4 341
1995	4 573	0.021	0.0442	4 587
1996	4 380	0.022	0.0405	4 393
1997	5 225	0.031	0.0519	5 242
1998	4 654	0.030	0.0493	4 670
1999	4 588	0.024	0.0466	4 603
2000	4 976	0.031	0.0541	4 994
2001	4 990	0.033	0.0562	5 008

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
2002	6 220	0.041	0.0537	6 237
Trend 1990-2002	*27.5%*	*83.7%*	*30.3%*	*27.6%*

As can be seen from Table 31, CO_2 emissions from category *1 A 2 a* are mainly arising from solid fossil fuels.

Table 31: Share of fuel types in total CO_2 emissions from Category 1 A 2 a.

	Liquid	Solid	Gaseous	Other
1990	6%	82%	12%	0%
1991	7%	81%	12%	0%
1992	8%	78%	14%	0%
1993	9%	78%	13%	0%
1994	10%	77%	13%	0%
1995	10%	77%	13%	0%
1996	9%	76%	15%	0%
1997	18%	67%	15%	0%
1998	18%	65%	17%	0%
1999	14%	70%	16%	0%
2000	17%	68%	15%	0%
2001	17%	66%	17%	0%
2002	16%	71%	13%	0%

Methodology

The two main iron and steel production sites (the only ones operating blast furnaces in Austria) are considered as point sources. CO_2 emissions and fuel consumption from these two plants are 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 2003]. The complex carbon fluxes in iron and steel plants can not be well modelled within the energy balance. Thus the resulting implied CO_2 emission factors for solid fuels in CRF-table 1.A(a) for category *1 A 2 a* vary strongly over time and are not reliable.

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 2002 this ratio is 90/291; the plant reported 90 t NMVOC and by applying the ratio obtained from the CORINAIR simple methodology total CH_4 emissions were estimated to be 28 t. In a last step CH_4 emissions were allocated to the different fuel types.

Emissions

The following table lists the results of the two approaches.

Table 32: 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	75	0.002	0.0005	4 802	0.021	0.0408
1991	72	0.002	0.0005	4 336	0.017	0.0398
1992	68	0.002	0.0004	3 699	0.015	0.0334
1993	102	0.002	0.0009	3 955	0.016	0.0353
1994	115	0.003	0.0010	4 213	0.020	0.0386
1995	89	0.002	0.0007	4 484	0.019	0.0436
1996	122	0.003	0.0010	4 258	0.019	0.0395
1997	364	0.009	0.0035	4 861	0.022	0.0484
1998	327	0.008	0.0032	4 326	0.022	0.0461
1999	77	0.002	0.0008	4 511	0.022	0.0458
2000	174	0.004	0.0011	4 803	0.027	0.0530
2001	235	0.006	0.0012	4 754	0.027	0.0550
2002	532	0.013	0.0058	5 687	0.028	0.0479

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 the national study [BMUJF, 1994].

The selected and calculated emission factors for 2002 are presented in Table 33 and Table 34.

Table 33: Emission factors of Category 1 A 2 a for 2002, 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	0.10
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	55.00	1.50	0.10
Wood Waste	(1) 110.00	2.00	4.00

(1) Reported as CO2 emissions from biomass.

Table 34: Emission factors of Category 1 A 2 a for 2002, point sources

Fuel	CO_2 [t / TJ]	CH_4 [kg / TJ]	N_2O [kg / TJ]
Heavy Fuel Oil	78.00	0.62	1.00
Coke	104.00	0.62	1.40
Coke Oven Gas	(1) 154.04	0.00	0.00
Natural Gas	55.00	0.46	0.10

(1) Implied emission factor of remaining CO2 emissions.

Activity data

Fuel consumption is taken from [IEA JQ 2003] as presented in Annex 4.

An inconsistency in coke oven coke consumption in [IEA JQ 2003] has been identified, this is planned to be corrected by the statistical office in 2004. This causes an implied CO_2 emission factor for 2002 which is out of the range of IPCC default emission factors for coal. The inconsistency is also reflected in the comparison of the sectoral and reference approach as described in Chapter 3.3 and ANNEX 3.

3.2.2.5 1 A 2 b Non-Ferrous Metals

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

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 0.2% for the year 2002.

Table 35: Greenhouse gas emissions from Category 1 A 2 b.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	113	0.003	0.0003	113
1991	118	0.003	0.0005	119
1992	146	0.003	0.0007	146
1993	150	0.004	0.0006	151
1994	174	0.004	0.0008	174
1995	165	0.004	0.0006	165
1996	164	0.004	0.0006	164
1997	201	0.004	0.0009	201
1998	195	0.004	0.0008	195
1999	204	0.005	0.0009	204
2000	198	0.005	0.0008	198
2001	220	0.005	0.0011	221
2002	158	0.004	0.0007	158
Trend 1990-2002	*39.8%*	*43.8%*	*104.8%*	*39.9%*

As can be seen from Table 36, CO_2 emissions from combustion of liquid fossil fuels became less important whereas the combustion of solid fossil fuels increased.

Table 36: Share of fuel types in total CO_2 emissions from Category 1 A 2 b

	Liquid	Solid	Gaseous	Other
1990	31%	4%	66%	0%
1991	28%	16%	56%	0%
1992	21%	19%	59%	0%
1993	20%	10%	69%	0%
1994	22%	14%	64%	0%
1995	23%	6%	71%	0%
1996	26%	8%	66%	0%
1997	27%	10%	63%	0%
1998	27%	8%	65%	0%
1999	31%	10%	59%	0%
2000	22%	12%	66%	0%
2001	17%	19%	64%	0%
2002	25%	10%	65%	0%

Methodology

CORINAIR simple methodology is applied. Fuel consumption is taken from [IEA JQ 2003] as described in Annex 4.

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].

The emission factors for 2001 are presented in Table 37.

Table 37: Emission factors of Category 1 A 2 b for 2001.

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	0.10
Hard Coal	94.00	5.00	1.40
Coke	104.00	2.00	1.40
Natural Gas	55.00	1.50	0.10

Activity data

Fuel consumption is taken from [IEA JQ 2003] as presented in Annex 4.

3.2.2.6 1 A 2 c Chemicals

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

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% for the year 1990 and 0.9% for the year 2002.

Table 38: Greenhouse gas emissions from Category 1 A 2 c.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	544	0.052	0.0173	551
1991	544	0.050	0.0175	551
1992	603	0.051	0.0193	610
1993	631	0.041	0.0142	636
1994	675	0.043	0.0135	680
1995	679	0.046	0.0131	684
1996	691	0.042	0.0141	696
1997	888	0.056	0.0177	894
1998	864	0.055	0.0142	869

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1999	821	0.056	0.0107	825
2000	776	0.058	0.0103	780
2001	630	0.066	0.0173	636
2002	542	0.048	0.0176	548
Trend 1990-2002	*-0.4%*	*-8.9%*	*2.1%*	*-0.4%*

As can be seen in Table 39, natural gas is still the main source of CO_2 emissions from category *1 A 2 c*. CO_2 emissions from solid fossil fuel combustion increased whereas liquid fossil and industrial waste got less important.

Table 39: Share of fuel types in total CO_2 emissions from Category 1 A 2 c

	Liquid	Solid	Gaseous	Other
1990	13%	4%	77%	5%
1991	14%	10%	71%	5%
1992	9%	20%	67%	4%
1993	10%	22%	65%	2%
1994	12%	24%	62%	2%
1995	11%	20%	66%	3%
1996	11%	22%	65%	2%
1997	11%	26%	61%	2%
1998	10%	25%	63%	3%
1999	8%	27%	63%	3%
2000	6%	19%	72%	4%
2001	3%	26%	65%	5%
2002	2%	21%	74%	3%

Methodology

CORINAIR simple methodology is applied.

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].

Emission factors for 2002 are presented in Table 40.

Table 40: Emission factors of Category 1 A 2 c for 2002.

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	0.10
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	55.00	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
Industrial Waste	10.00	12.00	1.40

(1) Reported as CO2 emissions from biomass

Activity data

Fuel consumption is taken from [IEA JQ 2003] as described in Annex 4.

3.2.2.7 1 A 2 d Pulp, Paper and Print

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

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 2.5% for the year 1990 and 1.6% for the year 2002.

Table 41: Greenhouse gas emissions from Category 1 A 2 d.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	1 323	0.078	0.0417	1 338
1991	1 410	0.082	0.0421	1 424
1992	1 249	0.073	0.0414	1 263
1993	1 289	0.076	0.0450	1 304
1994	1 221	0.072	0.0400	1 235
1995	1 093	0.071	0.0411	1 108
1996	1 035	0.062	0.0337	1 046
1997	1 580	0.084	0.0403	1 594
1998	1 532	0.086	0.0499	1 549
1999	1 303	0.080	0.0443	1 319

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
2000	1 412	0.089	0.0465	1 428
2001	1 374	0.087	0.0481	1 391
2002	1 010	0.076	0.0429	1 025
Trend 1990-2002	-23.7%	-1.5%	2.7%	-23.4%

As can be seen in Table 42, natural gas combustion is the main source of CO_2 emissions from category *1 A 2 d*. The share of CO_2 emissions from liquid fossil fuel combustion decreased since 1990 whereas the share of solid fossil fuels varies only slightly.

Table 42: Share of fuel types in total CO_2 emissions from Category 1 A 2 d.

	Liquid	Solid	Gaseous	Other
1990	30%	17%	53%	0%
1991	30%	23%	47%	0%
1992	30%	16%	54%	0%
1993	37%	21%	43%	0%
1994	37%	23%	40%	0%
1995	28%	23%	49%	0%
1996	24%	20%	57%	0%
1997	20%	22%	57%	0%
1998	19%	22%	59%	0%
1999	14%	20%	66%	0%
2000	12%	23%	66%	0%
2001	10%	21%	69%	0%
2002	9%	24%	68%	0%

Methodology

The CORINAIR simple methodology is applied.

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].

Emission factors for 2002 are presented in Table 43.

Table 43: Emission factors of Category 1 A 2 d for 2002.

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 Bri-quettes	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
LPG	64.00	1.50	0.10
Natural Gas	55.00	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
Industrial Waste	10.00	12.00	1.40

(1) Reported as CO2 emissions from biomass

(2) Including sewage sludge from paper mills

Activity data

Fuel consumption is taken from [IEA JQ 2003] as presented in Annex 4.

3.2.2.8 1 A 2 e Food Processing, Beverages and Tobacco

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

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 1.4% for the year 1990 and 1% for the year 2002.

Table 44: Greenhouse gas emissions from Category 1 A 2 e.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	746	0.017	0.0039	748
1991	787	0.018	0.0045	789
1992	743	0.017	0.0041	745
1993	749	0.015	0.0044	751
1994	786	0.019	0.0047	788
1995	777	0.017	0.0039	779
1996	683	0.015	0.0027	685
1997	735	0.016	0.0029	736
1998	713	0.016	0.0027	714
1999	620	0.015	0.0022	621
2000	873	0.021	0.0029	875
2001	841	0.022	0.0028	842
2002	613	0.016	0.0021	614
Trend 1990-2002	*-17.9%*	*-3.3%*	*-46.1%*	*-17.9%*

As can be seen in Table 45, natural gas combustion is increasing and is the main source of CO_2 emissions from category *1 A 2 e*. The share of liquid fossil fuel combustion on CO_2 emissions decreased since 1990.

Table 45: Share of fuel types in total CO_2 emissions from Category 1 A 2 e.

	Liquid	Solid	Gaseous	Other
1990	34%	1%	65%	0%
1991	36%	3%	61%	0%
1992	35%	4%	61%	0%
1993	41%	2%	57%	0%
1994	35%	4%	61%	0%
1995	33%	1%	66%	0%
1996	26%	1%	72%	0%
1997	28%	2%	71%	0%
1998	26%	2%	72%	0%
1999	19%	1%	79%	0%
2000	15%	5%	81%	0%
2001	13%	4%	84%	0%
2002	15%	2%	83%	0%

Methodology

CORINAIR simple methodology is applied.

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].

Emission factors for 2002 are presented in Table 46.

Table 46: Emission factors of Category 1 A 2 e for 2002.

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	0.10
Hard Coal	94.00	5.00	1.40
Lignite and brown coal	97.00	7.00	1.40
Brown Coal Bri-quettes	97.00	7.00	1.40
Coke	104.00	2.00	1.40
Natural Gas	55.00	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	10.00	12.00	1.40

(1) Reported as CO2 emissions from biomass

Activity data

Fuel consumption is taken from [IEA JQ 2003] as presented in Annex 4.

3.2.2.9 1 A 2 f Manufacturing Industries and Construction – Other

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

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 all industrial auto producer plants as well as emissions from mobile sources (off road machinery of total industry). For the stationary sources cement is considered separately.

The share in total GHG emissions from sector *1 A* is 10.2% for the year 1990 and only 6.5% for the year 2002. The increase of N_2O emissions is caused by off road activity.

Table 47: Greenhouse gas emissions from Category 1 A 2 f.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	5 429	0.233	0.3403	5 540
1991	6 120	0.258	0.3652	6 239
1992	5 889	0.260	0.3719	6 010
1993	6 136	0.253	0.3759	6 258
1994	6 571	0.276	0.4050	6 702
1995	6 518	0.272	0.4003	6 648
1996	6 572	0.293	0.4052	6 704
1997	6 383	0.284	0.4346	6 524
1998	6 205	0.254	0.4315	6 344
1999	5 783	0.279	0.4376	5 924
2000	5 472	0.240	0.4267	5 609
2001	4 866	0.221	0.4169	4 999
2002	3 962	0.186	0.4055	4 091
Trend 1990-2002	*-27.0%*	*-20.4%*	*19.2%*	*-26.1%*

As can be seen from Table 48, 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 48: Share of fuel types in total CO_2 emissions from Category 1 A 2 f.

	Liquid	Solid	Gaseous	Other
1990	42%	11%	43%	4%
1991	42%	12%	42%	4%
1992	37%	15%	45%	3%
1993	39%	11%	48%	2%
1994	35%	8%	54%	2%
1995	34%	9%	54%	2%
1996	32%	11%	54%	3%
1997	36%	11%	50%	2%
1998	37%	11%	51%	1%
1999	33%	9%	54%	4%
2000	34%	12%	51%	3%
2001	35%	11%	49%	4%
2002	44%	8%	45%	3%

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 8.5% for the year 1990 and 4.5% for the year 2002.

Table 49: 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	4 607	0.17	0.05	4 627
1991	5 247	0.19	0.06	5 270
1992	4 988	0.19	0.06	5 010
1993	5 246	0.19	0.07	5 271
1994	5 638	0.21	0.07	5 664
1995	5 588	0.20	0.07	5 613
1996	5 647	0.23	0.07	5 674
1997	5 423	0.22	0.08	5 451
1998	5 208	0.19	0.06	5 230
1999	4 757	0.22	0.07	4 784
2000	4 410	0.18	0.06	4 433
2001	3 785	0.16	0.06	3 806
2002	2 861	0.13	0.05	2 880
Trend 1990-2002	*-37.9%*	*-24.5%*	*-2.8%*	*-37.8%*

As can be seen in Table 50, natural gas and liquid fossil fuel combustion is the main stationary source of CO_2 emissions from category *1 A 2 f*. The share of natural gas combustion in total CO_2 emissions increased and liquid fossil fuel combustion got less important.

Table 50: Share of fuel types on total CO_2 emissions from Category 1 A 2 f stationary sources.

	Liquid	Solid	Gaseous	Other
1990	32%	13%	50%	5%
1991	33%	14%	49%	5%
1992	26%	17%	54%	4%
1993	28%	12%	57%	2%
1994	25%	9%	64%	3%
1995	24%	11%	63%	3%
1996	21%	13%	63%	3%
1997	25%	13%	59%	3%
1998	25%	13%	61%	1%
1999	19%	11%	66%	4%

	Liquid	Solid	Gaseous	Other
2000	18%	15%	63%	4%
2001	17%	14%	63%	6%
2002	22%	12%	63%	4%

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

This category enfolds emissions from fuel combustion in cement clinker kilns. The capacity of the 9 Austrian plants is about 4 mio t cement clinker / year. Yearly clinker production is about 80% of total capacity. Further information about yearly clinker production is provided in the methodology chapter of category *2 A 1 cement production*.

Methodology

Information about CO_2 emissions due to fuel combustion for cement production is taken from three studies of the Austrian cement industry [HACKL, MAUSCHITZ, 1995, 1997 and 2001]. 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 1999.

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

Emissions for the yeas 1990 to 1999 are taken from [HACKL, MAUSCHITZ, 1995, 1997 and 2001]. For the years 2000 and 2001 the value of 1999 was used.

For solid, liquid and gaseous fuels CO_2 emissions are calculated by multiplying activity data with national default emission factors (for sources of emission factors see relating chapter). The remaining CO_2 emissions are allocated to industrial waste, which does not always lead to an reliable implied emission factor. Rationales are given in the following chapter *Activity data.*

For the year 2002 CO_2 emissions from coal, fuel oil and natural gas are calculated by multiplying activity data with national default emission factors, whereas for industrial waste the implied emission factor of the year 2001 is used.

CH_4 and N_2O emissions

Are calculated with the simple CORINAIR methodology.

Emissions

The following table present greenhouse gas emissions from fuel combustion for cement clinker production.

Table 51: Greenhouse gas emissions from Category 1 A 2 f - cement clinker production.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]
1990	1 020	0.03	0.01
1991	1 035	0.03	0.01
1992	991	0.04	0.01
1993	1 044	0.04	0.01
1994	1 089	0.04	0.01
1995	867	0.04	0.01
1996	861	0.04	0.01
1997	882	0.04	0.01
1998	802	0.04	0.01
1999	793	0.03	0.01
2000	793	0.04	0.01
2001	793	0.04	0.01
2002	644	0.03	0.01

Activity data

Hard Coal, Brown Coal, Petrol Coke and Industrial Waste

In [IEA JQ 2003] 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 used in cement industry. It has to be noted that [IEA JQ 2003] uses heat calorific values that are only one third of the heat calorific values used in [HACKL, MAUSCHITZ, 1995, 1997 and 2001], this is the reason for the high implied emission factor.

Natural Gas

For the period 1990 to 1999 natural gas consumption is taken from [HACKL, MAUSCHITZ, 1995, 1997 and 2001] and converted into the unit TJ by applying the calorific values reported in [IEA JQ 2003].

For the period 2000 to 2002 the natural gas consumption of 1999 is used.

Fuel Oil

For the period 1990 to 1999 fuel oil consumption is taken from [HACKL, MAUSCHITZ, 1995, 1997 and 2001] and converted into the unit TJ by applying the calorific values reported in [IEA JQ 2003].

For the period 2000 to 2002 the fuel oil consumption is selected so that ratio of the total fuel consumption to the cement clinker production is about 2.8 TJ/ t cement clinker but not greater than total fuel oil consumption of NACE Division 26 as reported in [IEA JQ 2003].

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].

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 and from total autoproducers except those reported in *1 A 2 a iron an steel* and *1 A 1 b petroleum refining*.

Methodology

CORINAIR simple methodology is applied.

Activity data

Fuel consumption is taken from [IEA JQ 2003] as presented in Annex 4, fuel consumption of cement industry is subtracted as it is considered separately (see above).

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].

The emission factors for 2002 are presented in Table 46.

Table 52: Emission factors of Category 1 A 2 f stationary sources for 2002.

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	0.10
Petrol Coke(3)	104.00	2.00	1.40
Natural Gas	55.00	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	10.00	12.00	1.40

Industrial Waste-Cement industry	(2)156.30	12.00	1.40

(1) Reported as CO2 emissions from biomass

(2) Implied emission factor as cited in chapter *methodology,* see Page 75

(3) In [IEA JQ 2003] reported as 'Other Petroleum Products'.

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 1.7% for the year 1990 and 1.9% for the year 2002. All GHGs emissions originate from liquid fossil fuel combustion.

Table 53: Greenhouse gas emissions from Category 1 A 2 f mobile sources.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	822	0.06	0.29	913
1991	873	0.07	0.30	969
1992	901	0.07	0.31	1 000
1993	890	0.07	0.31	988
1994	933	0.07	0.33	1 038
1995	930	0.07	0.33	1 035
1996	924	0.07	0.34	1 030
1997	961	0.07	0.36	1 073
1998	996	0.07	0.38	1 114
1999	1 025	0.06	0.37	1 140
2000	1 062	0.06	0.37	1 176
2001	1 081	0.06	0.36	1 193
2002	1 101	0.06	0.35	1 212
Trend 1990-2002	*33.9%*	*-9.0%*	*23.3%*	*32.8%*

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

Methodology

In 2001 a study on off road emissions in Austria was finished [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 b Military Activities
- 1 A 3 c Railways
- 1 A 3 d Navigation
- 1 A 4 b Household and Gardening
- 1 A 4 c Agriculture and Forestry

Depending on the fuel consumption of the engine the ratio power of the engine was calculated, emissions were calculated by multiplying ratio power and 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

Due to the high fuel consumption of the off road sector the ratio of fuel consumption between the on- and off road transport sector has been recalculated.

The used methodology conforms to the requirements of the IPCC very detailed 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 54 to Table 57. The emission factors present fuel consumption and emissions according to the engine power output. Total emissions are calculated by multiplying emission factors with 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 54: Emission Factors for diesel engines > 80 kW [g/kWh]

Year	Fuel	CO_2	CH_4	N_2O
	[g/kWh]			
1993	282	890	0.05	0.32
1997	273	861	0.04	0.35
2000	265	834	0.03	0.22

Table 55: Emission Factors for diesel engines < 80 kW [g/kWh]

Year	Fuel	CO_2	CH_4	N_2O
	[g/kWh]			
1993	296	935	0.10	0.32
1997	287	904	0.07	0.35
2000	278	876	0.06	0.22

Table 56: Emission Factors for 4-stroke-petrol engines [g/kWh]

Year	Fuel	CO_2	CH_4	N_2O
	[g/kWh]			
1993	550	1 734	2.16	0.04
1997	520	1 640	1.92	0.04
2000	500	1 577	1.78	0.04

Table 57: Emission Factors for 2-stroke-petrol engines [g/kWh]

Year	Fuel	CO_2	CH_4	N_2O
	[g/kWh]			
1993	700	2 207	3.00	0.01
1997	675	2 128	2.70	0.01
2000	655	2 065	2.40	0.01

Activity data

Activity data, vehicle stock and specific fuel consumption for vehicles and machinery 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 kWh) are presented in the following table.

Table 58: Implied emission factors and activities for industrial off-road traffic 1990–2002

Year	Activity [GWh]	CO_2 [kg/kWh]	CH_4 [g/kWh]	N_2O [g/kWh]
1990	3 086	0.27	0.020	0.093
1991	3 276	0.27	0.020	0.093
1992	3 380	0.27	0.020	0.093
1993	3 341	0.27	0.020	0.093
1994	3 501	0.27	0.019	0.095
1995	3 499	0.27	0.019	0.095
1996	3 478	0.27	0.019	0.096
1997	3 614	0.27	0.018	0.099
1998	3 748	0.27	0.018	0.100
1999	3 866	0.27	0.016	0.095

2000	4 003	0.27	0.015	0.091
2001	4 074	0.27	0.014	0.088
2002	4 151	0.27	0.014	0.085

Recalculation

An error regarding CH_4 emissions reported in the last submission was identified, it was corrected in this year's submission (emissions reported this year are the same as reported in the submission 2002).

3.2.2.10 1 A 3 a Civil Aviation

Key Source: No

Greenhouse gas emissions from aviation are low in comparison to emissions from the transport sector but show a strong increase from 1990 to 2002. However, the trend for the different GHGs varies due to different methodologies of emission estimation.

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

Table 59: CO_2 and N_2O emissions from 1 A 3 a Civil Aviation by subcategories 1990-2002

Year	CO_2			N_2O		CH_4
	nat. LTO	VFR	nat. cruise	nat. LTO	nat. cruise	nat. LTO
	[Gg]	[Gg]	[Gg]	[Gg]	[Gg]	[Gg]
1990	10.0	7.8	14.2	0.0006	0.0005	0.0022
1991	10.8	8.1	18.7	0.0007	0.0006	0.0021
1992	11.6	8.3	23.2	0.0007	0.0007	0.0021
1993	12.4	8.6	27.6	0.0008	0.0009	0.0020
1994	13.2	8.8	32.1	0.0008	0.0010	0.0019
1995	14.0	7.1	36.6	0.0009	0.0012	0.0018
1996	16.2	6.8	40.6	0.0010	0.0013	0.0029
1997	18.4	7.6	44.5	0.0011	0.0014	0.0039
1998	20.6	8.2	48.5	0.0012	0.0015	0.0050
1999	21.1	8.7	51.3	0.0012	0.0016	0.0052
2000	21.6	6.4	54.1	0.0014	0.0017	0.0054
2001	20.9	6.4	52.1	0.0013	0.0017	0.0052
2002	19.5	6.4	48.8	0.0013	0.0015	0.0049

Methodological Issues

A country-specific methodology was applied.

The calculations are based on a study commissioned by the Umweltbundesamt finished in 2002 [KALIVODA et. al, 2002].

For the air transport class IFR (Instrument Flight Rules) the very detailed methodology from the CORINAIR guidebook in an advanced version (based on the [MEET, 1999] model) has been used. It is based on air traffic movement data[14] (flight distance and destination per aircraft type), aircraft/ engine performance data and emission factors.

Activity Data

Fuel consumptions for the different transport modes IFR national LTO, IFR international LTO, IFR national cruise and IFR international cruise as obtained from the MEET model were summed up to a total fuel consumption figure. This value was compared by the Umweltbundesamt with the total amount of kerosene sold in Austria of the national energy balance: a difference was observed (lower fuel consumption in the energy balance). Therefore the fuel consumption of IFR international cruise was adjusted so that the total fuel consumption of the calculations according to the MEET model is consistent with national fuel sales figures from the energy balance. The reason for choosing IFR international cruise for this adjustment is that this mode is assumed to have the highest uncertainty.

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

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

The study only delivers values until 2000, for the years 2001 and 2002 the fuel allocation was based on the values and shares for 2000.

Fuel consumption in [t] was transformed into [GJ] using the heating values as presented in Annex 4.

Table 60: Number of national LTO cycles and fuel consumptions as obtained from the MEET model 1990-2002

Year	Activity			national LTO
	nat. LTO	VFR	nat. cruise	
	Kerosene	Gasoline	Kerosene	
	[Mg]	[Mg]	[Mg]	[-]
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

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

1999	6 697	2 771	16 279	12 210
2000	6 868	2 039	17 161	13 551
2001	6 621	2 039	16 544	13 045
2002	6 201	2 039	15 494	13 084

CO_2

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

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

N_2O

CORINAIR simple methodology was used.

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

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

CH_4

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

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

Recalculations

Military aviation that was reported under this category for last year's submission is now reported under *1 A 5 Other.*

Following the simple methodology of the CORINAIR Guidebook, CH_4 emissions for national and international cruise that have been reported in last year's submission are now assumed to be Zero.

3.2.2.11 1 A 3 b Road Transport

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

Emissions from road transportation and from military activity are covered in this category. However, for confidentiality reason emission estimates for emissions from military activities present only rough estimations [PISCHINGER, 2000].

Methodology

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

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* except emissions from military activities are based on the GLOBEMI study [HAUSBERGER, 1998].

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

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 54; for these vehicles an power of 300kW was assumed). The yearly road performance for such vehicles was estimated to be 30 h / year (as a lot of vehicles are old and many are assumed not to be in actual use anymore).

Emission factors

Implied emission factors for road transport except military activities are listed in Table 61 for the base year and Table 62 for the last year of the inventory. The IEFs change over time due to new technologies and changes in the fleet composition.

Table 61: Implied Emission Factors of Road Transport and activities for the year 1990

Emission Source	CO_2	CH_4	N_2O	Activity
	kg/kWh	g/kWh	g/kWh	GWh
Passenger Cars	0.267	0.066	0.039	34 786
Light Duty Vehicles	0.266	0.015	0.012	2 172
Heavy Duty Vehicles and Buses	0.265	0.009	0.015	8 754
Mopeds	0.267	2.103	0.002	182
Motorcycles	0.267	0.236	0.003	187

Table 62: Implied Emission Factors of Road Transport and activities for the year 2002

Emission Source	CO_2	CH_4	N_2O	Activity
	kg/kWh	g/kWh	g/kWh	GWh
Passenger Cars	0.266	0.021	0.037	51 147
Light Duty Vehicles	0.265	0.004	0.012	7 221
Heavy Duty Vehicles and Buses	0.265	0.005	0.013	15 914

Mopeds	0.267	2.021	0.005	130
Motorcycles	0.267	0.137	0.004	588

Implied emission factors and activity data for military activities are presented in the following table.

Table 63: Emission factors and activity data for military activities 1990–2002

Year	Activity	CO_2	CH_4	N_2O
	GWh	kg/kWh	g/kWh	g/kWh
1990	8.0	0.27	0.015	0.095
1991	8.0	0.27	0.015	0.095
1992	8.0	0.27	0.015	0.095
1993	8.0	0.27	0.015	0.095
1994	8.0	0.27	0.014	0.095
1995	8.0	0.27	0.014	0.096
1996	8.0	0.27	0.014	0.098
1997	7.9	0.27	0.014	0.100
1998	7.9	0.27	0.013	0.101
1999	7.9	0.27	0.013	0.098
2000	7.8	0.27	0.012	0.095
2001	7.8	0.27	0.012	0.091
2002	7.7	0.27	0.012	0.083

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: due to uncertainties of the bottom up method the values differ by about 5% for gasoline and about 20% for diesel (fuel consumption of the bottom up approach is lower). 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.

Activities used for estimating emissions from military activities are presented in Table 63.

Uncertainties

As already mentioned above, the result of the bottom-up approach (calculated total fuel consumption) is compared with national fuel sales of the national energy balance: due to uncertainties of the bottom up method and tank tourism (in Austria fuel prices are below the prices in the neighbour countries), which is not considered in the calculation, the values differ by about 5% for gasoline and up to 20% for diesel. A study to quantify tank tourism will be finished in 2004.

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

Furthermore the carbon content of different fuel categories may vary over time.

Recalculation

Emission factors for road traffic have been updated based on new measures within the different vehicle groups. These updated emission factors will be published in 2004 [HAUSBERGER, 2004].

An error regarding CH_4 emissions reported in the last submission was identified, it was corrected in this year's submission (emissions reported this year are the same as reported in the submission 2002).

Planned Improvements

For the category *1 A 3 b* the following improvements are planned:

- additional improvement and widening of the underlying data sources for emission factors
- further validation of the database with emission factors based on real driving cycles

3.2.2.12 1 A 3 c Railways

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). Activities used for estimating the emissions and the implied emission factors are presented in the following table.

Table 64: Emission factors and activity data for railway 1990–2002

	Activity	CO_2	CH_4	N_2O
	[GWh]	[kg/kWh]	[g/kWh]	[g/kWh]
1990	647	0.27	0.011	0.033
1991	671	0.27	0.011	0.034
1992	670	0.27	0.011	0.033
1993	653	0.27	0.011	0.033

1994	659	0.27	0.010	0.032
1995	616	0.27	0.010	0.032
1996	557	0.27	0.010	0.031
1997	555	0.27	0.010	0.031
1998	547	0.27	0.009	0.030
1999	676	0.27	0.009	0.030
2000	674	0.27	0.009	0.029
2001	636	0.27	0.009	0.029
2002	629	0.27	0.008	0.028

Recalculation

An error regarding CH_4 emissions reported in the last submission was identified, it was corrected in this year's submission (emissions reported this year are the same as reported in the submission 2002).

3.2.2.13 1 A 3 d Navigation

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). Activities used for estimating the emissions and the implied emission factors are presented in the following table.

Table 65: Emission factors and activity data for the sector Navigation 1990–2002

Year	Activity	CO_2	CH_4	N_2O
	GWh	kg/kWh	g/kWh	g/kWh
1990	194.6	0.27	0.066	0.064
1991	176.6	0.27	0.072	0.063
1992	172.9	0.27	0.074	0.062
1993	175.0	0.27	0.073	0.061
1994	208.4	0.27	0.062	0.062
1995	202.6	0.27	0.063	0.061
1996	202.9	0.27	0.062	0.060
1997	232.3	0.27	0.055	0.060
1998	234.7	0.27	0.054	0.059
1999	236.9	0.27	0.053	0.058
2000	238.6	0.27	0.051	0.058
2001	240.3	0.27	0.051	0.057
2002	242.0	0.27	0.050	0.056

Recalculation

An error regarding CH_4 emissions reported in the last submission was identified, it was corrected in this year's submission (emissions reported this year are the same as reported in the submission 2002).

3.2.2.14 1 A 3 e Other Transportation

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 0.6% for the year 2002.

Table 66: Greenhouse gas emissions from Category 1 A 3 e.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	223	0.01	0.00	223
1991	224	0.01	0.00	224
1992	218	0.01	0.00	219
1993	213	0.01	0.00	213
1994	208	0.01	0.00	208
1995	225	0.01	0.00	225
1996	232	0.01	0.00	232
1997	231	0.01	0.00	231
1998	349	0.01	0.00	349
1999	526	0.01	0.00	527
2000	531	0.01	0.00	531
2001	500	0.01	0.00	501
2002	361	0.01	0.00	361
Trend 1990-2002	*-37.9%*	*-24.5%*	*-2.8%*	*-37.8%*

Combustion of natural gas is the only source of CO_2 emissions from category *1 A 2 e*.

Methodology

The CORINAIR simple methodology is applied.

Activity data (fuel consumption) is taken from [IEA JQ 2003] as presented in Annex 4.

CO_2 and CH_4 emission factors are taken from studies [BMWA-EB, 1996].

N_2O emission factors are taken from a national study [BMUJF, 1994].

Emission factors for 2002 are presented in Table 67.

Table 67: Emission factors of Category 1 A 2 e for 2002.

Fuel	CO_2 [t / TJ]	CH_4 [kg / TJ]	N_2O [kg / TJ]
Natural Gas	55.00	1.50	0.10

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 26.6% for the year 1990 and 25.5% for the year 2002.

Table 68: Greenhouse gas emissions from Category 1 A 4.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	13 815	18.82	0.89	14 485
1991	15 025	20.19	0.95	15 743
1992	14 350	18.43	0.93	15 025
1993	14 109	17.98	0.94	14 779
1994	12 969	16.19	0.92	13 594
1995	14 171	16.89	0.97	14 828
1996	15 630	17.93	1.04	16 330
1997	14 126	13.65	1.03	14 732
1998	14 127	13.12	1.04	14 725
1999	14 219	13.00	1.05	14 816
2000	13 452	12.11	1.02	14 023
2001	14 825	13.65	1.07	15 443
2002	13 651	13.04	1.03	14 243
Trend 1990-2002	*-1.2%*	*-30.7%*	*16.0%*	*-1.7%*

As can be seen from Table 69, liquid fossil fuels are the main source of CO_2 emissions from category *1 A 4* with a quite constant share over the total time series. Since 1990 solid fossil fuels became less important whereas CO_2 emissions from natural gas combustion increased.

Table 69: Share of fuel types on total CO_2 emissions from Category 1 A 4.

	Liquid	Solid	Gaseous	Other
1990	62%	21%	16%	0%
1991	61%	20%	19%	0%
1992	60%	18%	22%	0%

	Liquid	Solid	Gaseous	Other
1993	61%	15%	24%	0%
1994	61%	14%	24%	0%
1995	61%	13%	26%	0%
1996	63%	11%	26%	0%
1997	62%	10%	28%	0%
1998	63%	9%	28%	0%
1999	63%	8%	29%	0%
2000	61%	7%	32%	0%
2001	62%	7%	30%	0%
2002	63%	6%	30%	0%

1 A 4 Other sectors - stationary sources

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

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

The share in total GHG emissions from sector *1 A* is 23.8% for the year 1990 and 19.3% for the year 2001.

Table 70: Greenhouse gas emissions from Category 1 A 4 stationary sources.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	12 470	18.54	0.47	13 004
1991	13 651	19.91	0.52	14 230
1992	12 930	18.14	0.49	13 462
1993	12 651	17.69	0.49	13 174
1994	11 472	15.90	0.45	11 945
1995	12 639	16.60	0.48	13 137
1996	14 038	17.64	0.53	14 572
1997	12 475	13.36	0.49	12 906
1998	12 421	12.82	0.47	12 837
1999	12 460	12.72	0.47	12 874
2000	11 646	11.84	0.44	12 033
2001	12 998	13.39	0.50	13 435
2002	11 811	12.79	0.47	12 226
Trend 1990-2002	*-5.3%*	*-31.0%*	*0.7%*	*-6.0%*

As can be seen in Table 71, liquid fossil fuels are the main stationary source of CO_2 emissions from category *1 A 4* with quite constant share over the total time series. Since 1990 solid fossil fuels became less important whereas CO_2 emissions from natural gas combustion increased.

Table 71: Share of fuel types in total CO_2 emissions from Category 1 A 4 stationary sources.

	Liquid	Solid	Gaseous	Other
1990	58%	24%	18%	0.02%
1991	57%	22%	21%	0.05%
1992	56%	20%	24%	0.08%
1993	56%	17%	27%	0.06%
1994	56%	16%	27%	0.08%
1995	56%	14%	29%	0.05%
1996	58%	12%	29%	0.03%
1997	57%	11%	32%	0.04%
1998	58%	10%	32%	0.05%
1999	58%	9%	33%	0.05%
2000	55%	8%	37%	0.06%
2001	57%	8%	35%	0.07%
2002	57%	7%	35%	0.04%

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 2003] 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]. 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 72. The split follows closely [STANZEL et. al, 1995].

Table 72: 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 2002 are presented in Table 73.

Table 73: Emission factors of Category 1 A 4 for the year 2002.

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	-
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	-
Natural Gas	55.00	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	5.00
Landfill Gas	(1)112.00	1.50	-	1.00	-
Industrial Waste	10.00	12.00	-	1.40	-

(1) Reported as CO2 emissions from biomass.

Activity data

Fuel consumption is taken from [IEA JQ 2003] as presented in Annex 4.

1 A 4 Other sectors - mobile sources

1 A 4 b Household and Gardening

Key Source: No

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

Table 74: Emission factors and activity data for the sector Household and Gardening 1990–2001

	Activity	CO_2	CH_4	N_2O
	GWh	kg/kWh	g/kWh	g/kWh
1990	525.3	0.27	0.200	0.045
1991	526.9	0.27	0.200	0.045
1992	532.1	0.27	0.199	0.045
1993	541.7	0.27	0.196	0.045
1994	537.8	0.27	0.197	0.047
1995	541.3	0.27	0.193	0.048
1996	537.7	0.27	0.192	0.048
1997	533.9	0.27	0.191	0.048
1998	530.6	0.27	0.190	0.048
1999	528.2	0.27	0.184	0.043
2000	527.5	0.27	0.167	0.042
2001	527.5	0.27	0.150	0.042
2002	527.6	0.27	0.134	0.041

1 A 4 c Agriculture and Forestry

Key Source: Yes (CO_2: mobile-diesel)

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

Table 75: Emission factors and activity data for the sector Agriculture 1990–2001

	Activity	CO_2	CH_4	N_2O
	GWh	kg/kWh	g/kWh	g/kWh
1990	3 078.4	0.27	0.038	0.087
1991	3 152.0	0.27	0.038	0.087
1992	3 260.6	0.27	0.037	0.088
1993	3 360.4	0.27	0.037	0.088
1994	3 453.5	0.27	0.036	0.088
1995	3 551.1	0.27	0.036	0.089
1996	3 712.5	0.27	0.035	0.090

1997	3 879.6	0.27	0.034	0.091
1998	4 034.9	0.27	0.032	0.091
1999	4 189.7	0.27	0.031	0.089
2000	4 323.8	0.27	0.029	0.088
2001	4 391.3	0.27	0.028	0.085
2002	4 429.8	0.27	0.026	0.082

Table 76: Emission factors and activity data for the sector Forestry 1990–2001

	Activity	CO_2	CH_4	N_2O
	GWh	kg/kWh	g/kWh	g/kWh
1990	1 433.5	0.27	0.039	0.087
1991	1 469.0	0.27	0.039	0.087
1992	1 524.9	0.27	0.039	0.087
1993	1 569.7	0.27	0.037	0.088
1994	1 624.4	0.27	0.038	0.088
1995	1 670.6	0.27	0.037	0.089
1996	1 735.2	0.27	0.037	0.090
1997	1 795.4	0.27	0.036	0.091
1998	1 851.1	0.27	0.034	0.092
1999	1 910.3	0.27	0.033	0.091
2000	1 956.7	0.27	0.031	0.090
2001	1 965.5	0.27	0.029	0.088
2002	1 974.9	0.27	0.028	0.087

Recalculation

An error regarding CH_4 emissions reported in the last submission was identified, it was corrected in this year's submission (emissions reported this year are the same as reported in the submission 2002).

3.2.2.16 1 A 5 Other

In this category emissions of military aviation are reported.

Table 77: Greenhouse gas emissions from Military Aviation

Year	CO_2	N_2O	CH_4	Activity
	[Gg]	[Gg]	[Gg]	[Mg]
1990	32.9	0.0021	0.0011	10 439
1991	35.0	0.0022	0.0011	11 102
1992	31.6	0.0020	0.0010	10 019

1993	37.3	0.0024	0.0012	11 840
1994	39.5	0.0025	0.0013	12 527
1995	30.5	0.0019	0.0010	9 672
1996	36.8	0.0023	0.0012	11 689
1997	35.0	0.0021	0.0011	11 119
1998	40.3	0.0024	0.0013	12 809
1999	39.5	0.0023	0.0013	12 551
2000	42.9	0.0027	0.0014	13 613
2001	41.3	0.0026	0.0014	13 124
2002	38.7	0.0026	0.0013	12 290

Methodological Issues

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

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

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

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

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 78: Emissions from International Aviation 1990-2002

Year	CO_2		N_2O		CH_4		Activity	
	int. LTO [Gg]	int. cruise [Gg]	int. LTO [Gg]	int. cruise [Gg]	int. LTO [Gg]	int. cruise [Gg]	int. LTO [Mg]	int. cruise [Mg]
1990	90.3	795.7	0.006	0.025	0.015	0	28 651	252 610
1991	103.0	890.8	0.006	0.028	0.016	0	32 712	282 805
1992	115.8	961.6	0.007	0.031	0.017	0	36 773	305 271
1993	128.6	1 011.4	0.008	0.032	0.018	0	40 834	321 065
1994	141.4	1 044.2	0.009	0.033	0.019	0	44 895	331 502
1995	154.2	1 173.2	0.010	0.037	0.020	0	48 957	372 447
1996	164.8	1 301.6	0.010	0.041	0.023	0	52 315	413 214
1997	175.4	1 350.2	0.011	0.043	0.027	0	55 673	428 634
1998	186.0	1 392.3	0.011	0.044	0.030	0	59 032	441 988
1999	190.1	1 351.6	0.011	0.043	0.029	0	60 336	429 082

2000	194.2	1 480.8	0.012	0.047	0.029	0	61 641	470 082
2001	187.2	1 427.6	0.012	0.045	0.028	0	59 426	453 194
2002	175.3	1 336.9	0.012	0.042	0.026	0	55 653	424 422

Methodological Issues

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

3.2.3 Quality Assurance and Quality Control and Verification

For general QA/QC see Chapter 1.6.

For estimating emissions from road transport a bottom up- approach based on road performance per vehicle was used. To be consistent with the national energy balance total fuel consumption as obtained from this approach [GLOBEMI] was compared with and adjusted to total fuel consumption of [IEA JQ 2003]. Fuel consumption of the bottom up approach is about 5% lower for gasoline and up to 20% lower for diesel, one reason for this deviation is tank tourism due to lower fuel prices in Austria compared to the fuel prices in neighbouring countries.

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

- BGBl II 1997/ 331 Feuerungsanlagen-Verordnung
- BGBl 1989/ 19 Luftreinhalteverordnung für Kesselanlagen
- BGBl 1988/ 380 Luftreinhaltegesetz für Kesselanlagen

Extracts of the relevant paragraphs are provided in Annex 6.

3.2.4 Recalculations

The revision of the national energy statistics for the time series 1990-2001 by STATISTIC AUSTRIA results changes for category *1 A* for all GHGs from 1990 onwards (for details see Annex 2).

For information on recalculations of categories *1 A 3 a*, *1 A 3 b* and memo item *International Bunkers* see the corresponding subchapters of Chapters 3.2.2.10, 3.2.2.11 and 3.2.2.17.

Some description of reasons for recalculation for each GHG is given below together with tables showing the recalculation difference of emissions from Sector *1 A Fuel Combustion* and its sub categories with respect to the previous submission.

CO_2 emissions

1 A 2: In the previous submission total CO_2 emissions from iron and steel plants and cement plants were reported in the industrial processes sector. Following recommendations by the ERT, CO_2 emissions due to combustion are now reported in category *1 A 2 a* and *1 A 2 f*, respectively. A quantification of this shift is provided in chapter 3.2.2.4.

1 A 1, 1 A 2, 1 A 4: Additionally recalculations for categories are caused by the revision of the energy balance

1 A 5: Enfolds emissions from military (military aviation and military road transport) which were allocated under categories *1 A 3 a* and *1 A 3 b* in the previous submission.

Table 79 shows the recalculations of CO_2 emissions for the subcategories of sector *1 Energy.*

Table 79: 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	6 588.28	250.35	6 105.70	20.50	176.71	35.02
1991	6 256.33	173.97	5 922.35	5.20	117.69	37.11
1992	5 394.27	178.63	5 015.89	-11.59	177.65	33.70
1993	4 963.20	15.40	4 914.30	-39.31	33.39	39.43
1994	5 240.78	17.20	5 187.97	-41.80	35.81	41.60
1995	5 136.99	11.15	5 075.37	-32.36	50.24	32.59
1996	4 656.60	-4.54	4 565.04	-38.87	96.05	38.94
1997	5 214.37	-6.05	5 196.16	-37.60	24.72	37.13
1998	4 582.06	-3.95	4 560.84	-42.28	25.01	42.45
1999	4 622.79	-102.21	4 546.52	54.77	82.09	41.62
2000	4 996.11	264.83	4 645.32	-43.51	84.51	44.95
2001	5 333.61	136.94	5 167.72	-181.26	166.81	43.40

CH_4 emissions

1 A 1: CH_4 emissions changed due to the revision of activity data (also see Annex 2).

1 A 3: CH_4 emissions changed due to the revision of activity data (also see Annex 2). Additionally CH_4 emissions from off road transport were recalculated (an error in the last submission was identified and corrected, now the reported emissions are again the same as in the submission 2002, apart from revised energy data).

1 A 2: CH_4 emissions of cement production and iron and steel industry - both allocated in category *1 A 2* - which were not estimated in the previous submission are now estimated. Additionally CH_4 emissions from off road transport were recalculated (see explanation for *1 A 3*). The sum of recalculations leads to smaller CH_4 emissions for category *1 A 2* for the whole period compared to the data in submission 2003.

1 A 4: The emission factors for coal and fuel wood taken from national studies actually referred to TOC (total organic carbon) emissions and not to VOC emissions. For this submission the factors were transformed to VOC factors by multiplication with a factor of 1.3 (see Chapter 3.2.2.15).

Table 80 shows the recalculations of CH_4 emissions for the subcategories of sector *1 A Fuel Combustion.*

Table 80: 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	0.28	0.00	-0.14	-0.01	0.43	0.00
1991	0.15	0.00	-0.14	-0.01	0.30	0.00
1992	0.38	0.01	-0.16	-0.01	0.55	0.00
1993	-0.07	0.00	-0.15	-0.02	0.09	0.00
1994	-0.11	0.00	-0.16	-0.02	0.05	0.00
1995	-0.12	0.00	-0.17	-0.01	0.06	0.00
1996	-0.17	0.00	-0.17	-0.02	0.03	0.00
1997	2.79	0.00	-0.17	-0.01	2.96	0.00
1998	2.65	0.00	-0.19	-0.01	2.84	0.00
1999	2.54	-0.03	-0.18	0.00	2.75	0.00
2000	2.20	-0.05	-0.21	-0.02	2.48	0.00
2001	3.00	-0.11	-0.17	-0.03	3.31	0.00

N_2O emissions

1 A 1, 1 A 3, 1 A 4: CH_4 emissions changed due to the revision of activity data (also see Annex 2).

1 A 2: CH_4 emissions of cement production and iron and steel industry - both allocated in category *1 A 2* - which were not estimated in the previous submission are now estimated.

Table 81 shows the recalculations of N_2O emissions for the subcategories of sector *1 A Fuel Combustion.*

Table 81: 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	0.07	0.01	0.06	0.00	0.00	0.00
1991	0.07	0.01	0.06	0.00	0.00	0.00
1992	0.06	0.01	0.05	0.00	0.00	0.00
1993	0.05	0.00	0.05	0.00	0.00	0.00
1994	-0.09	0.00	0.05	-0.15	0.00	0.00
1995	-0.25	0.00	0.05	-0.31	0.00	0.00
1996	-0.33	0.00	0.05	-0.38	0.00	0.00
1997	-0.38	0.00	0.06	-0.45	0.00	0.00
1998	-0.46	0.00	0.08	-0.56	0.01	0.00
1999	-0.50	0.01	0.07	-0.59	0.01	0.00
2000	-0.52	0.02	0.08	-0.63	0.01	0.00
2001	-0.51	0.02	0.12	-0.67	0.02	0.00

Emissions in Gg CO_2 equivalent

Table 82 shows the recalculations in [Gg CO_2 equivalent] for the subcategories of sector *1 A Fuel Combustion.*

Table 82: 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	6 616.58	253.39	6 119.91	20.18	187.19	35.02
1991	6 282.60	177.33	5 937.64	4.53	125.07	37.11
1992	5 420.79	180.44	5 027.65	-12.53	190.64	33.70
1993	4 978.32	16.20	4 926.33	-40.61	35.96	39.43
1994	5 209.50	18.08	5 201.37	-90.09	37.51	41.60
1995	5 055.56	11.91	5 088.29	-130.15	52.05	32.59
1996	4 551.46	-3.44	4 575.34	-157.87	97.50	38.94
1997	5 154.50	-4.82	5 210.47	-177.57	88.37	37.13
1998	4 494.82	-2.85	4 581.44	-215.32	88.10	42.45
1999	4 522.64	-99.81	4 565.02	-127.98	142.81	41.62
2000	4 880.19	270.08	4 664.63	-239.63	139.05	44.95
2001	5 238.12	142.31	5 201.35	-391.16	241.16	43.40

3.2.5 Planned Improvements

Energy Balance

In 2003 the Umweltbundesamt performed an industry inquiry which will be the basis of allocating emission permits to installations according the *EC CO_2 trading directive*. The results of this bottom up approach will upon release by the ministry of environment be used to improve the sectoral breakdown of [IEA JQ 2003] from 1998 to 2001 and will provide an improved basis to split emissions of industrial electricity and heat auto producers between *1 A 2 a* to *1 A 2 f*.

Consistency check with EPER

Cross-check the emission declarations of the EPER reporting obligation with the national inventory.

1 A 1 b Petroleum refining and 1 A 2 a Iron and Steel

Inquire plant operators for historical fuel consumption data to avoid double counting of emissions.

1 A 2 Manufacturing Industries and Construction

Shift fuel consumption and emissions of industrial electricity and heat auto producers which are now reported in category *1 A 2 f* into categories *1 A a* to *1 A e*.

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 83 compares the results of the two approaches.

Table 83: 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	28 106	13 509	11 405	53 020	27 555	14 056	11 088	417	53 117
1991	30 513	14 328	12 047	56 889	30 168	14 582	11 686	453	56 889
1992	29 544	10 707	12 106	52 357	29 044	10 761	11 749	470	52 024
1993	30 518	9 358	12 562	52 437	30 022	9 576	12 296	416	52 310
1994	29 652	9 315	13 222	52 190	29 504	9 491	12 930	446	52 371
1995	30 179	10 646	14 461	55 287	29 586	10 830	13 993	456	54 866
1996	32 752	11 036	15 415	59 203	32 374	10 904	15 149	525	58 953
1997	32 084	11 491	14 841	58 416	31 475	11 251	14 611	526	57 863
1998	34 470	9 734	15 259	59 463	33 853	9 043	14 937	439	58 272
1999	32 521	9 849	15 531	57 901	32 045	9 192	15 166	525	56 928
2000	31 548	11 130	14 802	57 480	31 464	10 576	14 596	506	57 142
2001	34 300	12 195	15 804	62 298	34 028	11 405	14 976	598	61 006
2002	34 735	11 318	15 031	61 083	34 859	11 880	14 557	518	61 815

Table 84 presents the differences in percent of the two approaches.

Table 84: Difference of CO_2 emissions of the two approaches.

Year	Liquid	Solid	Gaseous	Total
1990	2.00%	-3.90%	2.86%	-0.18%
1991	1.14%	-1.74%	3.09%	0.00%
1992	1.72%	-0.50%	3.04%	0.64%
1993	1.65%	-2.28%	2.16%	0.24%
1994	0.50%	-1.85%	2.26%	-0.35%
1995	2.00%	-1.70%	3.34%	0.77%
1996	1.16%	1.21%	1.75%	0.42%
1997	1.93%	2.13%	1.58%	0.95%
1998	1.82%	7.64%	2.15%	2.04%
1999	1.49%	7.15%	2.41%	1.71%
2000	0.26%	5.24%	1.41%	0.59%
2001	0.80%	6.93%	5.53%	2.12%
2002	-0.36%	-4.73%	3.25%	-1.18%

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

Reasons for deviation of CO_2 emissions:

- In the reference approach the IPCC default net calorific values are used. In the sectoral approach country specific net calorific values are taken to calculate the energy consumption.
- The selected emission factors (carbon content) of the two approaches are different.
- *Liquid Fuels:* Energy balance is mass balanced but not carbon balanced. Fuel category *Other Oil* is an aggregation of several fuel types and therefore it is difficult to quantify a reliable carbon emission factor for the reference approach.
- *Solid Fuels:* an inconsistency in coke oven coke consumption reported in [IEA JQ 2003] has been identified, this is planned to be corrected by the statistical office in 2004.
- *Gaseous Fuels:* In the reference approach the distribution losses and statistical differences are not considered.
- *Other Fuels:* In the sectoral approach emissions from fuel waste are reported as emissions from "other fuels". In the reference approach the emissions from fuel waste are not estimated.

3.3.2 Comparison of energy consumption

Table 85 compares the energy consumption of the two approaches.

Table 85: 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	432 688	168 733	219 239	820 661	380 405	140 870	201 600	8 226	731 101
1991	466 806	177 293	231 794	875 894	412 672	149 226	212 477	9 026	783 401
1992	457 228	137 560	227 610	822 398	396 748	112 098	213 616	10 353	732 815
1993	465 501	123 581	240 044	829 126	414 975	98 406	223 567	8 085	745 033
1994	455 593	125 300	246 908	827 802	409 040	97 893	235 084	8 786	750 803
1995	459 320	142 538	269 583	871 441	409 506	112 695	254 421	8 885	785 508
1996	500 916	145 218	286 941	933 075	445 916	114 122	275 442	10 721	846 202
1997	499 983	153 817	276 551	930 351	434 255	119 424	265 653	11 264	830 596
1998	529 839	134 744	283 920	948 503	463 035	101 399	271 590	9 831	845 856
1999	502 556	134 936	288 876	926 368	436 107	99 838	275 740	12 249	823 934
2000	489 364	151 108	275 682	916 154	428 097	114 647	265 385	10 909	819 038
2001	530 520	163 023	293 067	986 610	462 159	124 626	272 287	12 282	871 354
2002	536 389	151 851	279 606	967 847	468 977	114 601	264 678	12 465	860 722

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 caused by transformation losses of coking coal to coke oven coke and coke oven coke into 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 a value of 1.0 is applied for all fuels. For next submission it is planned to use the IPCC default values for carbon stored. Efforts are still ongoing to ensure completeness, to avoid double counting in the national inventory and to ensure consistency with the national energy balance.

Lubricants:

manufacture: emissions are assumed to be included in total emissions from category *1 A 1 b* petroleum refinery.

use: emissions from the use of motor oil are included in CO_2 emissions from transport. VOC emissions from lubricants used in rolling mills are considered in category *2 C 1*. It is assumed that other uses of lubricants do not result in VOC or CO_2 emissions due to the low vapour pressure of lubricants.

disposal: emissions from incineration of lubricants (waste oil) are either included in categories *1 A 1 a* and *1 A 2* if waste oil is used as fuels or in category *6 C* respectively if energy is not recovered.

Bitumen:

manufacture: emissions from the production of bitumen are assumed to be included in total emissions of category *1 A 1 b* petroleum refinery.

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

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

Natural Gas:

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

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

Coke oven coke:

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

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

disposal: not applicable.

Other bituminous coal:

In [IEA JQ 2003] 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 2002 0.6% of national total emissions arose from IPCC Category *1 B Fugitive Emissions*. No key sources have been identified within this category.

3.5.1.1 Emission Trends

The following table presents GHG emissions arising from this category, their share and trend from 1990 to 2002.

Table 86: Greenhouse gas emissions from Category 1 B Fugitive Emissions

Sector/ Gas	GHG emissions [Gg CO_2 equivalent]													Share 2002	Trend 1990-2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002		
TOTAL	**379.72**	**392.49**	**399.68**	**399.17**	**409.37**	**420.23**	**384.55**	**431.91**	**452.90**	**485.99**	**471.08**	**492.92**	**470.49**	***100%***	***+24%***
CO_2	102.03	111.03	120.03	112.03	127.53	127.03	71.03	120.51	141.83	170.53	164.53	182.73	167.03	*36%*	*+64%*
CH_4	277.69	281.47	279.65	287.14	281.84	293.20	313.52	311.40	311.07	315.46	306.55	310.19	303.46	*64%*	*+9%*

3.5.1.2 Completeness

Table 87 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 subcategory have been estimated.

Table 87: Overview of subcategories of Category 1 B Fugitive Emissions: transformation into SNAP Codes and status of estimation

IPCC Category	SNAP	Status	
		CO_2	CH_4
1 B 1 a Coal Mining and Handling			
i Underground Mines	050102 Underground mining	NO	NO
ii Surface Mines	050101 Open cast mining	NA	✓
1 B 1 b Solid Fuel Transformation		IE(1)	IE(1)
1 B 2 a Oil			
i Exploration ii Production	0502 Extraction, 1st treatment and loading of liquid fossil fuels	IE(2)	IE(2)
iii Transport	050502 Transports and Depots	NE	NE
vi Refining/ Storage	0401 Processes in Petroleum Industries	NA(3)	✓
v Distribution of oil products	0504 Liquid fuel distribution (Except Petrol distribution) 0505 Petrol distribution	NA	NA(4)
1 B 2 b Natural Gas			

IPCC Category	SNAP	Status	
		CO_2	CH_4
Exploration	0503 Extraction, 1st treatment and loading of gaseous fossil fuels	✓(2)	IE(2)
i Production/Processing			
ii Transmission	050601 Pipelines	✓	✓
Distribution	050602 Distribution Networks	✓	✓
iii Other Leakage		NE	NE
1 B 2 c Venting/Flaring		IE(5)	IE(5)

(1) included in *1 A 2 a Iron and Steel*
(2) *1 B 2 a i, 1 B 2 b Exploration* and *1 B 2 b I*, 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*

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 decreased by 50% from 1990 to 2002 due to lower mining activities (see Table 88).

Emissions are calculated by multiplying the amount of brown coal produced (= activity data) with the CORINAIR default emission factor of 214 g CH_4/ Mg coal (Emission Factor Data Base #11378[15]). Activity data are taken from the national energy balance, for 2002 no up-to-date activity data was available, that's why the value of 2001 was also used for 2002.

Table 88: Activity data (brown coal produced) and CH_4 emissions for Fugitive Emissions from Fuels-Coal Mining 1990-2002

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

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

Year	Coal Mined [Mg]	CH_4 emissions [Gg]
2000	1 254 605	0.24
2001	1 230 000	0.27
2002	1 230 000	0.26

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 addressed. CO_2 emissions from the refinery are included in *1 A 1 b Petroleum Refining*.

For transport, distribution and storage only NMVOC emissions from gasoline were estimated, as fugitive emissions from diesel, heating oil or other oil products are assumed to be negligible. The CH_4 content of the NMVOC emissions from gasoline was also assumed to be negligible.

CH_4 emissions from this category fluctuated over the period from 1990 to 2002, with an overall decreasing trend: in 2002 emissions were 8% lower than in 1990.

CO_2 emissions from this category had an increasing trend, according to increased gas production in Austria.

Refining

Methane emissions from refining are calculated using IPCC Tier 1 methodology (reference manual chapter 1.8).

Emissions are calculated by multiplying the amount of crude oil input (= activity data) with an emission factor. Activity data are reported by the *Association of the Austrian Petroleum Industry* (see Table 89).

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) with 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 89). Methane emissions for the years 1992 to 2002 from combined oil and gas production was also reported by the *Association of the Austrian Petroleum Industry*, according to the association 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“. As can be seen from the table, the implied emission factor decreased by about 40% from the period from 1990 to 2002.

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 is CO_2 that has been separated from the raw gas).

Table 89: Activity data (Crude Oil Refined and Gas Produced, respectively) and CH_4 emissions for Fugitive Emissions from Fuels- Oil Refining and Production 1990-2002

	Refining		Production				
Year	Crude Oil Refined [Gg]	CH_4 emissions [Gg]	Gas Produced [Mio m³]	CH_4 emissions [Mg]	IEF CH_4 [g/1000 m³]	CO_2 emissions [Gg]	IEF CO_2 [kg/1000 m³]
1990	7 993	0.253	1 288	4 560	3 540	43	33.39
1991	8 463	0.268	1 326	4 560	3 439	43	32.43
1992	8 856	0.280	1 437	4 560	3 173	40	27.84
1993	8 659	0.274	1 488	4 541	3 052	37	24.87
1994	8 957	0.284	1 355	4 495	3 317	48	35.06
1995	8 721	0.276	1 482	4 408	2 974	38	25.64
1996	9 100	0.288	1 492	4 470	2 996	41	27.48
1997	9 656	0.306	1 428	4 548	3 185	31	21.76
1998	9 707	0.307	1 568	4 386	2 797	61	38.90
1999	9 123	0.289	1 741	4 146	2 381	90	51.69
2000	8 720	0.276	1 805	4 033	2 234	72	39.89
2001	8 855	0.280	1 954	4 098	2 097	88	45.04
2002	9 020	0.286	2 014	4 182	2 076	84	41.71

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

In this category CO_2 and CH_4 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.

CO2 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, in 1990 as well as in 2002 it contributed only 0.04% to total CO2 emissions from category 1 B 2 b.

56% of CH4 emissions from this category in 2002 arise from natural gas distribution, another 41% arise from gas transmission in pipelines and 3% from gas storage. Total CH4 emissions increased by 23%. As emissions were calculated using a constant emission factor, the increase is due to increased gas transmission (pipelines length) and increasing natural gas consumption.

Methodological Issues

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 90) and were calculated from sour gas composition.

Distribution

Emissions from natural gas distribution are calculated by multiplying the gross inland consumption with a constant emission factor.

Activity data for natural gas distribution corresponds to the gross inland consumption of the energy balance. Activity data for natural gas production are reported by the *Association of the Austrian Petroleum Industry* (see Table 90).

Emission factors from natural gas distribution are calculated by means of net losses for the year 1990: 697.90 kg CH_4 / Mm^3 Gas distributed; 2 950 kg CO_2 / Mm^3 Gas distributed.

Transmission, Storage

Pipeline lengths and natural gas stored were taken from annual reports of the *Association of the Austrian Petroleum Industry*. Emission factors were taken from the IPCC GPG Table 2.16 (for transmission sum of lower values for venting and fugitives).

Table 90: Activity data and emissions for Fugitive Emissions from Fuels – Natural Gas Distribution and Sour Gas Processing 1990-2002

Year	Natural Gas Distribution		Sour Gas Processing	
	Natural Gas Consumption [Mm³]	CH_4 Emissions [Mg]	Natural Gas Production [1000m³]	CO_2 Emissions [Gg]
1990	6 090	4 250	248 090	59
1991	6 439	4 493	285 901	68
1992	6 323	4 412	357 135	80
1993	6 668	4 653	321 653	75
1994	6 859	4 786	363 582	80
1995	7 488	5 226	405 638	89
1996	7 971	5 562	136 737	30
1997	7 682	5 361	406 177	89
1998	7 887	5 504	367 195	81
1999	8 058	5 623	352 318	81
2000	7 690	5 367	358 357	93
2001	8 175	5 705	393 492	95
2002	7 799	5 443	347 513	83

Table 91: Activity data and emissions for Fugitive Emissions from Fuels – Natural Gas Transmission and Storage 1990-2002

Year	Natural Gas Transmission (Pipelines Fugitive & Venting)			Natural Gas Storage	
	Pipelines [km]	CH_4 Emissions [Mg]	CO_2 Emissions [Gg]	Natural Gas Stored [Mm³]	CH_4 Emissions [Mg]
1990	1 032	2 992	0.025	1 500	645
1991	1 032	2 992	0.025	1 500	645
1992	1 032	2 992	0.025	1 625	699
1993	1 032	2 992	0.025	1 980	851
1994	1 032	2 992	0.025	1 329	571
1995	1 032	2 992	0.025	1 820	783

Year	Natural Gas Transmission (Pipelines Fugitive & Venting)			Natural Gas Storage	
	Pipelines [km]	CH_4 Emissions [Mg]	CO_2 Emissions [Gg]	Natural Gas Stored [Mm³]	CH_4 Emissions [Mg]
1996	1 238	3 589	0.030	1 820	783
1997	1 238	3 589	0.030	1 820	783
1998	1 238	3 589	0.030	1 820	783
1999	1 358	3 937	0.033	1 820	783
2000	1 358	3 937	0.033	1 665	716
2001	1 358	3 937	0.033	1 132	487
2002	1 358	3 937	0.033	789	339

3.5.3 Recalculations

Natural gas transmission and natural gas storage have been added as new sources and CH_4 emissions from combined oil and gas production have been reported for the first time.

Previously CO_2 emissions from oil and gas production and from sour gas processing have been reported under IPCC Category *1 B 2 b i*, in this submission only CO_2 emissions from sour gas processing are reported in this category, whereas other emissions from oil and gas production are reported under *1 B 2 a ii*.

CO_2 emissions from gas distribution that have been previously reported are not reported in this submission anymore as the IPCC GPG default emission factor for CO_2 emissions from gas distribution is zero (see Table 2.16 of the GPG).

In response to the comments of the ERT, now a default EF for coal mining is used. Previously a country-specific emission factor, that was substantially lower was used (7.11 g / Mg coal vs. 214 g / Mg coal). Additionally activity data of 2001 was updated.

The following table presents the resulting difference for CO_2 and CH_4 emissions.

Table 92: Recalculation difference of CO_2 emissions in [Gg] for Category 1 B Fugitive Emissions with respect to the previous submission.

	CO_2	CH_4
1990	-17.94	8.70
1991	-18.97	8.63
1992	-18.63	8.61
1993	-19.65	8.73
1994	-20.21	8.34
1995	-22.07	8.45
1996	-23.48	9.07
1997	-22.63	9.15
1998	-23.24	8.99
1999	-23.74	9.10
2000	-22.95	8.88
2001	-24.16	8.76

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 of activity data and emission factors reported under IPCC Category *2 Industrial Processes* for the period from 1990 to 2002 in the Common Reporting Format.

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 100.

4.1.1 Emission Trends

In the year 2002 11.9% of national total greenhouse gas emissions (without LULUCF) originated from industrial processes, compared to 12.9% in the base year (for CO_2, CH_4 and N_2O the base year is 1990; for HFCs, PFCs and SF_6 the year 1995 has been selected as base year, since the data are considered to be more reliable than those of 1990).

Greenhouse gas emissions from the industrial processes sector fluctuated during the period, they reached a minimum in 1993 which was mainly due to termination of primary aluminium production in Austria in 1992 which was an important source for PFC emissions. Since then emissions are increasing again, mainly due to increasing emissions from consumption of fluorinated compounds.

In 2002 greenhouse gas emissions from Category *2 Industrial Processes* amounted to 10 035 Gg CO_2 equivalent compared to 10 032 Gg in the base year. Figure 9 shows the trend of GHG emissions from this category for 1990-2002.

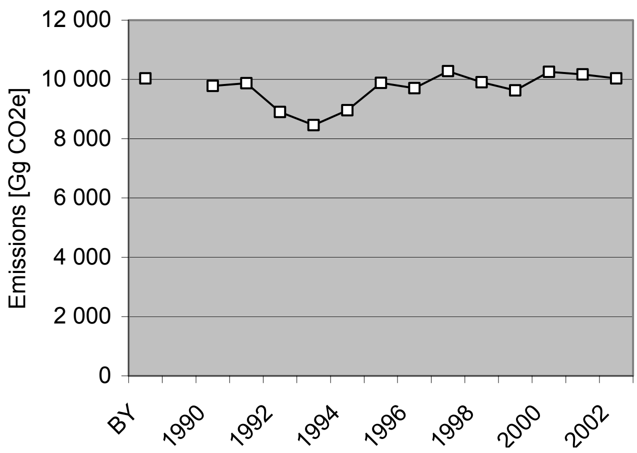


Figure 9: GHG emissions from IPCC Sector 2 Industrial Processes 1990-2002

Emission trends by gas

Table 93 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 2002.

Table 93: Greenhouse gas emissions from 2 Industrial Processes by gas in the base year and in 2001.

GHG	Base year*	2001	Base year*	2001
	CO_2 equivalent [Gg CO_2e]		[%]	
Total	**10 033**	**10 035**	***100.00%***	***100.00%***
CO_2	7 377	7 484	*73.5%*	*74.6%*
CH_4	6.9	8.3	*0.1%*	*0.1%*
N_2O	912	807	*9.1%*	*8.0%*
HFCs	546	1 033	*5.4%*	*10.3%*
PFCs	16	25	*0.2%*	*0.2%*
SF_6	1 175	677	*11.7%*	*6.7%*

*1990 for CO_2, CH_4 and N_2O and 1995 for F-Gases

The major GHG of the industrial processes sector is carbon dioxide with 74.6% of emissions from this category in 2002, followed by HFCs with 10.3%, N_2O with 8.0%, SF6 with 6.7%, PFCs with 0.2% and finally CH_4 with 0.1%. Emissions by gas and their trends are presented in Table 94.

Table 94: Emissions from IPCC Category 2 Industrial Processes by gas from 1990-2001 and their trend

Gas	GHG emissions [Gg CO_2e]													Trend BY*-2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
Total	**9 780**	**9 877**	**8 895**	**8 460**	**8 959**	**9 881**	**9 706**	**10 282**	**9 906**	**9 623**	**10 258**	**10 171**	**10 035**	*+0%*
CO_2	7 377	7 280	6 741	6 691	7 023	7 281	6 940	7 529	7 211	7 068	7 565	7 644	7 484	*+1%*
CH_4	6.9	6.6	6.2	6.7	6.7	5.9	5.9	6.3	6.8	5.6	5.6	5.3	8.3	*+20%*
N_2O	912	927	837	879	825	857	874	863	897	923	952	786	807	*-11%*
HFCs	546	4	6	9	12	17	546	625	718	816	870	1 033	1 033	*+89%*
PFCs	16	963	974	576	48	54	16	15	18	21	25	25	25	*+61%*
SF_6	1 175	518	683	725	823	1 033	1 175	1 246	1 148	955	730	677	677	*–42%*

* BY: 1990 for CO_2, CH_4 and N_2O and 1995 for F-Gases

CO_2 emissions

As can be seen in Figure 10, CO_2 emissions from the industrial processes sector fluctuated during the period from 1990 to 2002, showing no clear trend. In 2002 CO_2 emissions from Industrial Processes amounted to 7 484 Gg CO_2 equivalent, which corresponds to an increase of 1% compared to base year emissions (7 377 Gg).

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

CH_4 emissions

As can be seen in Figure 10, CH_4 emissions from Industrial Processes fluctuated over the period from 1990 to 2001 with an overall decreasing trend: in 2001 emissions were 23% lower than in 1990 mainly due to lower emissions from fertilizer production (*2 B 5 Other*). From 2001 to 2002 emissions decreased remarkably, this can be explained by an inconsistency in the time series of CH_4 emissions from urea production (see 4.3.4.4).

CH_4 emissions from this sector mainly arise from *Chemical Industry (Ammonia Production and Production of Urea and Fertilizers)* but also from *Mineral Products (Asphalt Roofing),* a minor source for CH_4 emissions is *Metal Production (Electric Furnace Steel Plants, Rolling Mills)*.

N_2O emissions

As can be seen in Figure 10, N_2O emissions from the industrial processes sector fluctuated during the period from 1990 to 2001, from 1992 to 2000 emissions increased steadily, from 2000 to 2001 emissions decreased. In 2002 N_2O emissions from Industrial Processes amounted to 807 Gg CO_2 equivalent. This was 11% below the level of the base year.

N_2O emissions from this sector arise from *Nitric Acid Production (Chemical Industry)*.

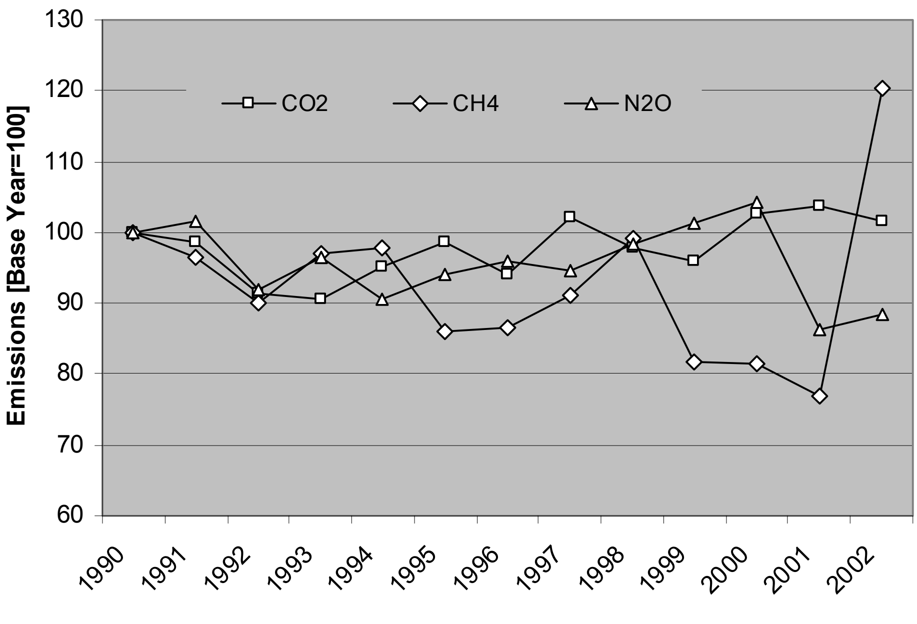


Figure 10: CO_2, CH_4 and N_2O emissions from Industrial Processes 1990-2002 in index form (base year = 100)

HFC emissions

As can be seen in Figure 11, HFC emissions increased remarkably during the period from 1990 to 2000. In 2000 HFC emissions amounted to 1 033 Gg CO_2 equivalent. This was 89.2% above the level of the base year (1995). For the years 2001 and 2002 there was no update in activity data, therefore emissions are assumed to be constant on the level of 2000.

HFC emissions arise from *Refrigeration and Air Conditioning Equipment*, *Foam Blowing* and *XPS/ PU plates*.

PFC emissions

As can be seen in Figure 11, PFC emissions decreased remarkably during the period from 1990 to 2000. In 1990 PFC emissions amounted to 963 Gg CO_2 equivalent, they decreased until 1993 to around 50 Gg CO_2 equivalent due to the termination of primary aluminium production in 1993 which was the major source for PFC emissions. Then PFC emissions decreased further and reached a minimum in 1996. In the year 2000 they amounted to 26 Gg CO_2 equivalent, this was 61.0% above the level of the base year (1995). For the years 2001 and 2002 there was no update in activity data, therefore emissions are assumed to be constant on the level of 2000.

PFC emissions arise from semiconductor manufacture.

SF_6 emissions

As can be seen in Figure 11, SF_6 emissions increased at the beginning of the period and reached a maximum in 1996, since then SF_6 emissions are decreasing again. In 2000 SF_6 emissions amounted to 677 Gg CO_2 equivalent. This was 42.4% below the level of the base year (1995). For the years 2001 and 2002 there was no update in activity data, therefore emissions are assumed to be constant on the level of 2000.

SF_6 emissions arise mainly from semiconductor manufacture, magnesium production and filling of noise insulate glasses.

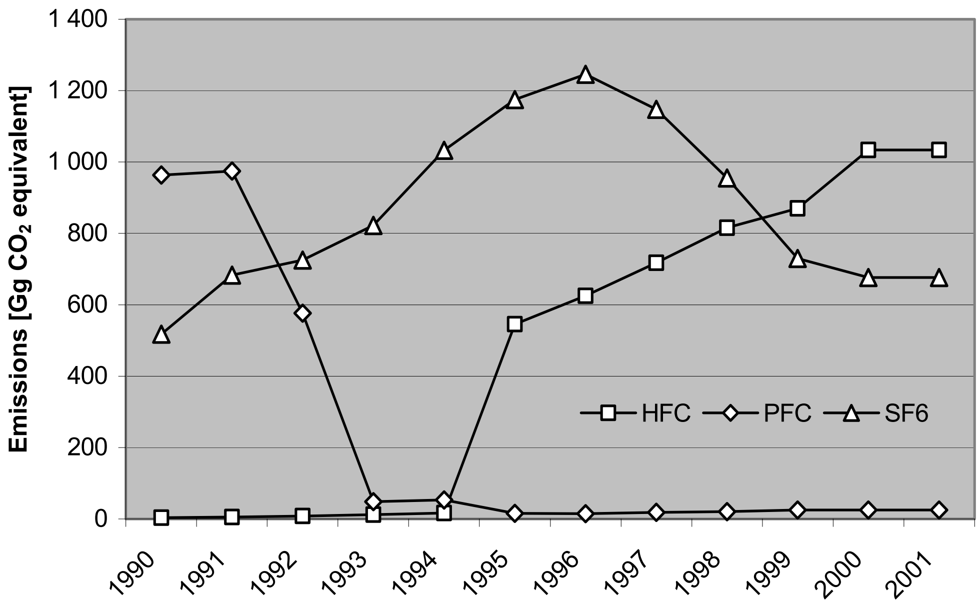


Figure 11: HFC, PFC and SF_6 emissions from Industrial Processes 1990-2001

Emission trends by sources

The main sources of greenhouse gas emissions in the industrial processes sector are *Metal Production* and *Mineral Products*, which caused 41% respectively 29% of the emissions from this sector in 2002 (see Table 95).

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 1.5.1 Austria's Key Source Categories).

Table 95: Greenhouse gas emissions from IPCC Category 2 Industrial Processes by sector, their share and trend for the base year and 2002.

	Emissions [Gg CO2e]		Share [%]		Trend BY - 2002
	BY*	2002	BY*	2002	
2 Industrial Processes	**10 032**	**10 035**	***100%***	***100%***	***+0%***
A Mineral Products	3 243	2 911	*32%*	*29%*	*-10%*
B Chemical Industry	1 379	1 325	*14%*	*13%*	*-4%*
C Metal Production	4 116	4 071	*41%*	*41%*	*-1%*
F Consumption of Halocarbons and SF_6	1 293	1 728	*13%*	*17%*	*+34%*

*1990 for CO_2, CH_4 and N_2O and 1995 for F-Gases

Figure 12 and Table 96 present greenhouse gas emissions from IPCC Category *2 Industrial Processes* by sub category for the years 1990 to 2002.

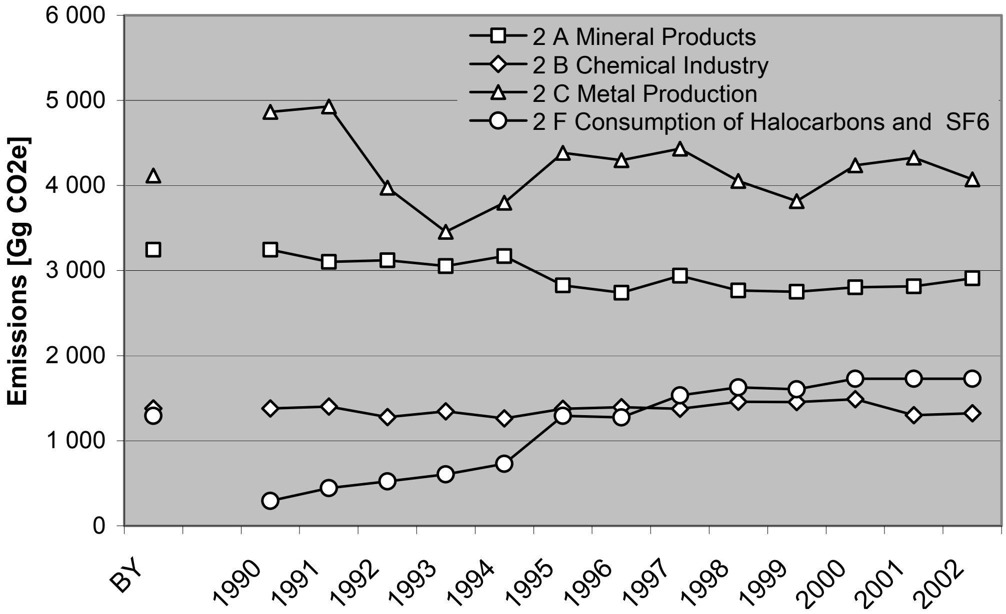


Figure 12: Emissions from IPCC Category 2 Industrial Processes per sub sector 1990-2002

GHG emissions from *2 F Consumption of Halocarbons and SF_6* increased by 34% from the base year to 2002, compensating the decrease in greenhouse gas emissions from the other sub categories of this sector.

The strongest overall declining trend can be found in sub category *2 A Mineral Products*; in 2002 emissions were 10% lower than in the base year. Emissions from *Chemical Industry* and *2 C Metal Production* decreased by 4% and 1% respectively from the base year to 2002. Compared to emissions of 1990 emissions from *2 C Metal Production* decreased by 17% mainly due to termination of primary aluminium production.

Table 96: Total greenhouse gas emissions from 1990–2002 by subcategories of Category 2 Industrial Processes

	GHG emissions [Gg CO_2 equivalent]													
	BY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
2	**10 032**	**9 780**	**9 877**	**8 895**	**8 460**	**8 959**	**9 881**	**9 706**	**10 282**	**9 906**	**9 623**	**10 258**	**10 171**	**10 035**
2 A	3 243	3 243	3 101	3 119	3 054	3 168	2 827	2 739	2 939	2 766	2 751	2 805	2 815	2 911
2 B	1 379	1 379	1 402	1 279	1 345	1 262	1 377	1 396	1 376	1 458	1 453	1 489	1 300	1 325
2 C	4 116	4 863	4 928	3 975	3 455	3 798	4 384	4 295	4 432	4 054	3 815	4 236	4 328	4 071
2 F	1 293	294	445	521	606	730	1 293	1 275	1 535	1 627	1 603	1 728	1 728	1 728

*1990 for CO_2, CH_4 and N_2O and 1995 for F-Gases

2 A Mineral Products

For the source *Mineral Products* greenhouse gas emissions decreased by 10% from 1990 to 2002. This was mainly due to decreasing CO_2 emissions from cement production due to a decrease in cement production.

2 B Chemical Industry

For the source *Chemical Industry* greenhouse gas emissions decreased by 4% from 1990 to 2001. This was mainly due to decreasing N_2O emissions from nitric acid production because a new catalyst to reduce N_2O was introduced.

2 C Metal Production

Greenhouse gas emissions from *Metal Production* fluctuated over the period, which is mainly a result of a drop in PFC emissions from primary aluminium production which was terminated in 1993 and an increase in CO_2 emissions from *Iron and Steel Production.* The overall trend is a decrease of 16% compared to emissions of the year 1990.

Related to emissions of the base year, emissions were stable (plus 1%) because the increase in CO_2 emissions from *Iron and Steel Production* was compensated by a strong decrease in emissions from *SF_6 Used in Aluminium and Magnesium Foundries*.

2 F Consumption of Halocarbons and SF_6

For the source *Consumption of Halocarbons and SF_6* greenhouse gas emissions increased by 34% compared to base year emissions (1995 for PFCs, HFCs and SF_6). In 2000 emissions were almost six times higher than in 1990. This was mainly due to strongly increasing emissions from the use of HFCs as substitutes for ozone depleting substances (*ODS Substitutes*). For 2001 and 2002 there was no update in activity data.

4.1.2 Key Sources

The key source analysis is presented in Chapter 1.5, this chapter presents the 13 key sources in the IPCC Sector *2 Industrial Processes* (see Table 97.

Compared to last year's key source analysis, two more key categories have been identified: CO_2 emissions from *Limestone and Dolomite Use* and from *Aluminium Production*. These two emissions sources have been newly added to the inventory for this submission.

Table 97: 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, TA91
2 A 3	Limestone and Dolomite Use	CO_2	LA00
2 A 7 b	Magnesia Sinter Plants	CO_2	All
2 B 1	Ammonia Production	CO_2	All LA, TA95
2 B 2	Nitric Acid Production	N_2O	All LA, TA91, TA94-97, TA00-02
2 C 1	Iron and Steel Production	CO_2	All except TA94 and TA96
2 C 3	Aluminium production	PFCs	LA90-92, TA91, TA92
2 C 3	Aluminium production	CO_2	TA92
2 C 4	SF6 used in Aluminium and Magnesium Foundries	SF_6	LA90-97, TA91-94, TA96-02
2 F 6	Semiconductor Manufacture	FCs	LABY, LA92-02, TA91-93, TA96, TA00-02
2 F 1/2/3	ODS Substitutes	PFCs	LABY, LA95-02, TA91-94, TA97-02
2 F 8	Other Sources of SF6	SF_6	LA95-00, TA91-92

LA90 = Level Assessment 1990
LA00 = Level Assessment 2000
TA91 = Trend Assessment BY-1991
TA00 = Trend Assessment BY-2000

In the base year, 12.5% of total greenhouse gas emissions in Austria originated from the 13 key sources of the industrial processes sector compared to 11.5% in 2002. The most important key source is *Iron and Steel Production* which had a share of 4.8% in total emissions in 2002. The second important is *Cement Production*: 1.9% of total emissions 2002 originated from this category. Another 1.2% of total emissions originated 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 2002 (see Table 98).

Table 98: Level Assessment for the base year and 2002 for the key sources of Category 2 Industrial Processes

IPCC Category	Source Categories	GHG	Level Assessment	
			BY	2002
2 A 1	Cement Production	CO_2	2.61%	1.88%
2 A 2	Lime Production	CO_2	0.51%	0.65%
2 A 3	Limestone and Dolomite Use	CO_2	0.26%*	0.31%*
2 A 7 b	Magnesia Sinter Plants	CO_2	0.62%	0.44%
2 B 1	Ammonia Production	CO_2	0.51%	0.53%

IPCC Category	Source Categories	GHG	Level Assessment	
			BY	2002
2 B 2	Nitric Acid Production	N_2O	1.17%	0.95%
2 C 1	Iron and Steel Production	CO_2	4.51%	4.80%
2 C 3	Aluminium production	PFCs	0.00%*	NO
2 C 3	Aluminium production	CO_2	0.20%*	NO
2 C 4	SF_6 used in Aluminium and Magnesium Foundries	SF_6	0.57%	0.01%*
2 F 6	Semiconductor Manufacture	FCs	0.57%	1.22%
2 F 1/2/3	ODS Substitutes	PFCs	0.70%	0.41%
2 F 8	Other Sources of SF_6	SF_6	0.31%*	0.29%*

*Level Assessment does not meet the 95% threshold of that year

4.1.3 Methodology

The general method for estimating emissions for the industrial processes sector, as recommended by the IPCC, involves multiplying production data for each process by an emission factor per unit of production.

In some categories emission and production data were reported directly by industry or associations of industries and thus represent plant specific data. For IPCC key source categories, methodologies for industry reporting are described in more detail.

4.1.4 Uncertainty Assessment

In this year's submissions uncertainty estimates based on the IPCC GPG or on expert judgement by Umweltbundesamt for most key sources is provided (see respective subchapters). It is planned to provide quantitative uncertainty estimates for all key sources of Sector *2 Industrial Processes* for the next submission.

4.1.5 Quality Assurance and Quality Control (QA/ QC)

For the Austrian Inventory an internal quality management system has been established, for further information see Chapter 1.6.

Concerning measurement and documentation of emission data there are also specific regulations in the Austrian legislation as presented in Table 99. This legislation also addresses verification. Some plants that are reporting emission data have quality management systems according to the ISO 9000–series or according similar systems.

Table 99: Austrian legislation with specific regulations concerning measurement and documentation of emission data

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

Extracts of the applicable paragraphs are provided in Annex 6.

4.1.6 Recalculations

Compared to last year's inventory several sources have been added, one source has been removed and there have been reallocations of emissions as well as updates of data. However, the greatest implication on the level of emissions from IPCC Category *2 Industrial Processes* had the reallocation of combustion related CO_2 emissions from the categories *2 A 1 Cement Production* and *2 C 1 Iron and Steel* to the energy sector.

- *Addition of source categories:*

  CO_2 emissions from *2 A 3 Limestone and Dolomite Use*

  CO_2 emissions from *2 A 4 Soda Ash Use*

  CO_2 emissions from *2 B 4 Calcium Carbide Production*

  CO_2 emissions from *2 A 7 Other* - bricks production

  CO_2 emissions from *2 C 3 Aluminium Production*

  CO_2 emissions from electric arc furnaces (category *2 C 1 Iron and Steel*)

  CH_4 emissions from *2 B 5 Other* - production of fertilizers

- *Removal of source categories:*

  In response to the issue raised by the ERT, CO_2 emissions *2 D 2 Food and Drink Production* are now reported as biogenic emissions.

- *Reallocation of emissions*

  Process specific CO_2 emissions from glass production (decarbonising) have been recalculated based on information from industry, they have been split into the categories *Limestone and Dolomite Use* and *Soda Ash Use*. All other emissions have been allocated to the energy sector (*1 A 2 f Other)*, as they are mainly emissions due to combustion and difficult to separate.

  There was also a reallocation of emissions in the categories *2 A 1 Cement Production* and *2 C 1 Iron and Steel*: in response to the issues raised by the ERT, combustion related emissions have been reallocated to the energy sector (*1 A 2 f Other* for combustion related emissions from cement production and *1 A 2 a Iron and Steel* for combustion related emissions from iron and steel production).

- *Update of data*

  In the following categories data has been updated, for further information see the recalculation section of the respective subchapters of this chapter.

  2 A 7 Other - Magnesite Sinter Plants

  2 A 2 Lime Production

  2 A 5 Asphalt Roofing

  2 B 2 Nitric Acid Production

For further information see the recalculation sections of the respective subchapters of this chapter and the tables presented in Chapter 9 Recalculations and Improvements.

4.1.7 Completeness

Table 100 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 subcategory have been estimated, the grey shaded cells are those also shaded in the CRF.

Table 100: Overview of subcategories of Category 2 Industrial Processes: transformation into SNAP Codes and status of estimation

	IPCC Category		SNAP	Status		
				CO_2	CH_4	N_2O
2 A	**MINERAL PRODUCTS**					
2 A 1	Cement Production	040612	Cement (decarbonising)	✓		
2 A 2	Lime Production	040614	Lime (decarbonising)	✓		
2 A 3	Limestone and Dolomite Use	040618	Limestone and Dolomite Use	✓		
2 A 4	Soda Ash Production and Use	040619	Soda Ash Production and Use	✓		
2 A 5	Asphalt Roofing	040610	Roof covering with asphalt materials	NE	✓	
2 A 6	Road Paving with Asphalt	040611	Road paving with asphalt	NE(1)		
2 A 7	*Other*					
2 A 7 a		040613	Bricks (decarbonising)	✓		
2 A 7 b		040617	Other - Magnesia Sinter Plants	✓		
2 B	**CHEMICAL INDUSTRY**					
2 B 1	Ammonia Production	040403	Ammonia	✓	✓	
2 B 2	Nitric Acid Production	040402	Nitric acid	✓		✓
2 B 3	Adipic Acid Production	040521	Adipic acid			NO(2)
2 B 4	Carbide Production	040412	Calcium carbide production	✓	NE	
2 B 5	Other	040407 040408	NPK fertilisers Urea	✓	✓	

	IPCC Category	SNAP		Status		
				CO_2	CH_4	N_2O
2 C	**METAL PRODUCTION**					
2 C 1	Iron and Steel Production[(3)]	040202 040206 040207 040208	Blast furnace charging Basic oxygen furnace steel plant Electric furnace steel plant Rolling mills	✓	✓	
2 C 2	Ferroalloys Production	040302	Ferro alloys	NE	NE	
2 C 3	Aluminium Production	040301	Aluminium production (electrolysis) – except SF_6	✓ / NO[(3)]	✓ / NO[(3)]	
2 C 4	SF_6 Used in Aluminium and Magnesium Foundries	030310 040301 040304	Secondary Aluminium Production Aluminium Production – SF_6 only Magnesium Production – SF_6 only	SF_6 ✓		
2 C 5	*Other*					
2 D	**OTHER PRODUCTION**					
2 D 1	*Pulp and Paper*					
2 D 1	*Food and Drink*			NA[(4)]		
				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)]					
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	Semiconductor Manufacture			✓		
2 F 7	Electrical Equipment			✓		
2 F 8	*Other*			✓		

(1) Direct greenhouse gas emissions from this IPCC-category are not estimated. Only NMVOC emissions from this category have been estimated (for further information see Austria's Informative Inventory Report 2003, Submission under the UNECE/CLRTAP Convention)
(2) There is no adipic acid production in Austria.
(3) Primary aluminium production was terminated in 1992.
(4) CO_2 emissions from this source are of biogenic origin.
(5) There is no production of halocarbons or SF_6 in Austria.
(6) No corresponding SNAP category is presented here as the actual estimation is based on IPCC Categories.

4.1.8 Planned Improvements

For emissions of fluorinated gases a study to update emissions is planned for 2004/2005.

It is planned to provide uncertainty estimates for all key sources of Sector *2 Industrial Processes* for the next submission.

4.2 Mineral Products (CRF Source Category 2 A)

4.2.1 Cement Production (2 A 1)

4.2.1.1 Source Category Description

Key Source: Yes (CO_2)

CO_2 emissions from production of cement are a key source because of the contribution both to the level of all years of the greenhouse gas inventory and to the trend from the base year to all years. In 2002 CO_2 emissions from cement production contributed 1.9% to total greenhouse gas emissions in Austria (see Table 98).

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 101 presents process-related CO_2 emissions from the production of cement for the period from 1990 to 2001.

Table 101: CO_2 emissions from cement production in total and split into combustion- and process related emissions 1990–2001

Year	Process specific CO_2 emissions [Gg]	Clinker [t/a]	IEF [g/t_{Cl}]
1990	2 067.58	3 693 539	559 783
1991	2 007.49	3 635 462	552 198
1992	2 221.22	3 820 397	581 410
1993	2 026.41	3 678 293	550 911
1994	2 102.26	3 791 131	554 519
1995	1 631.33	2 929 973	556 772
1996	1 634.25	2 915 956	560 450
1997	1 760.92	3 103 312	567 432
1998	1 579.62	2 832 262	557 723
1999	1 587.56	2 853 437	556 367
2000	1 587.56	2 853 437	556 367
2001	1 587.56	2 853 437	556 367
2002	1 587.56	2 853 437	556 367

CO_2 emissions (see Table 101) have been quite constant from 1990 to 1994, then dropped by 21.7% compared to the previous year, due to a drop in cement production of almost 20%. Since then emissions as well as production of cement remained on this lower level with only minor fluctuations. The overall trend from 1990 to 1999 was minus 23%. For the years after the value was assumed to be constant, as cement production remained stable from 1999 to 2001[16].

4.2.1.2 Methodological Issues

Emissions were estimated using 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 and 2001]. The studies cover the years 1988 to 1999. As data for 2000-2002 was not available in time, the value of 1999 was assumed to be constant because cement production remained stable from 1999 to 2001[16] (for 2002 no data was available from national production statistics).

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

CO_2 emissions from the raw meal calcination were calculated as follows:

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

Whereas:

m	mass stream [kg/a]
x	mass portion
k	for the k^{th} cement plant

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

Table 101 presents activity data and implied emission factors for process-specific CO_2 emissions from cement production as reported in the studies [HACKL, MAUSCHITZ, 1995, 1997 and 2001].

4.2.1.3 Uncertainty Assessment

According to the IPCC GPG Table 3.2, the uncertainty for emissions using Tier 2 methodology (based on clinker production data) is 5-10%. As the applied methodology is based on plant specific data, the uncertainty of the resulting emission data is assumed to be 5% at most.

4.2.1.4 Recalculation

Emissions due to combustion that have been reported together with process-specific emissions in this category until last submission are now reported in category *1 A 2 f*.

[16] The comparison of cement production data, which is available for 2000 and 2001 from official statistics, shows that cement production remained stable: the value for 2001 was only 0.2% higher than the value for 1999 (3 611 Gg in 1999, 3 617 Gg in 2001).

4.2.1.5 Planned Improvements

Activity and emission data for 2000, 2001 and 2002 will be updated, data will become available in 2004.

4.2.2 Lime Production (2 A 2)

4.2.2.1 Source Category Description

Key Source: Yes (CO_2)

CO_2 emissions from lime production was 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 1991. In the year 2002 emissions from this category contributed 0.65% to the total amount of greenhouse gas emissions in Austria (see Table 98).

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 102 presents activity data for this category (lime produced) as well as CO_2 emissions from lime production for the period from 1990 to 2002.

Table 102: Activity data and CO_2 emissions for Lime production 1990–2001

Year	Lime Produced [t/a]	CO_2 emissions [Gg]	CO_2 IEF [kg/Mg]
1990	512 610	396	772.84
1991	477 135	361	757.16
1992	462 392	355	768.00
1993	479 883	365	760.96
1994	518 544	390	753.06
1995	522 934	395	754.60
1996	505 189	383	757.59
1997	549 952	412	749.99
1998	594 695	454	763.03
1999	595 978	453	760.34
2000	654 437	498	760.26
2001	666 633	507	759.97
2002	719 246	547	759.97

The overall trend for CO_2 emissions from this category was increasing emissions, in the year 2002 emissions were 38% higher than 1990 (see Table 102).

4.2.2.2 Methodological Issues

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

Activity data and emission values were reported by the *Association of the Stone & Ceramic Industry*, except the emission value for 2002, which was calculated using the IEF of 2001.

The reported CO_2 emission data is based data of each lime production plant in Austria, considering the CaO and MgO content of limestone used at the different plants and calculating CO2 emissions from the stoichiometric ratios (using IPCC default emission factors).

Activity data for lime production for the period from 1990 to 2001 is presented in Table 102.

4.2.2.3 Uncertainty Assessment

According to the IPCC GPG, the uncertainty of EF is only dependent on the composition of lime and is estimated to be 2% for lime other than hydraulic lime.

Uncertainties for activity data are considered to be low as it is based on plant specific data of all Austrian plants and is therefore considered the same as for cement production (5%).

4.2.2.4 Recalculation

Previously activity data was taken from statistical data. However, not all lime production was considered as there are different lime categories in the national production statistics and not all lime is actually calcined in Austria (a part of the lime is only imported and grinded). Furthermore there was an inconsistency in the time series as some companies changed the reporting category when reporting their lime production. Now plant specific data from all lime production plants in Austria were used, reported by the *Association of the Stone & Ceramic Industry*, resulting in higher production figures.

Furthermore previously the IPCC default ratio of high calcium to dolomitic lime was used, whereas now the CaO and MgO content of limestone used at the different plants is considered.

The following table presents the implication of the recalculation on the level of CO_2 emissions from this category.

Table 103: Recalculation Difference with respect to last year's submission for CO_2 emissions from Lime Production

Year	CO_2 Emissions Difference [Gg]
1990	79
1991	62
1992	69
1993	74
1994	103
1995	91
1996	79
1997	109
1998	150
1999	158
2000	202
2001	211

4.2.3 Limestone and Dolomite Use (2 A 3)

4.2.3.1 Source Category Description

Key Source: Yes

In this category CO_2 emissions from decarbonising of limestone and dolomite in the glass industry and in the iron and steel industry is considered. This category is a key source because of its contribution to the total inventory level in 2000. In 2002 emissions from this category contributed 0.31% to national total emissions.

Emissions from this category increased by 32% mainly due to increased limestone use in iron and steel industries.

Table 104: Activity data and CO_2 emissions for Limestone and Dolomite Use 1990–2002

Year	Limestone Used [t/a]	Dolomite Used [t/a]	CO_2 emissions [Gg]
1990	430 729	24 020	200
1991	433 122	27 646	203
1992	386 650	24 463	181
1993	386 186	24 485	181
1994	417 440	26 212	195
1995	485 610	26 225	225
1996	430 890	26 225	201
1997	494 406	24 457	228
1998	516 957	24 457	238
1999	476 446	26 826	222
2000	545 077	22 624	250
2001	530 453	26 573	245
2002	577 853	23 477	265

4.2.3.2 Methodological Issues

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

Activity data for limestone and dolomite used in glass industry were reported by the *Association of Glass Industry* for the year 2002, 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 activity data was estimated using the average ratio of limestone used per ton of pig iron produced of the years 1998-2002.

For calculation of CO_2 emissions the IPCC default emission factors of 440 kg CO_2/ t limestone and 447 kg CO_2/ t dolomite were used.

4.2.3.3 Uncertainty Assessment

As for lime production, the uncertainty of the EF is considered 2% (taken from the IPCC GPG).

For activity data, a systematic uncertainty might occur as there might be other uses of limestone and dolomite not considered in the inventory. Random uncertainty is assumed to be negligible compared to systematic uncertainty as data is based on plant specific data.

Based on these assumptions the uncertainty of emission estimates for dolomite use is estimated to be –5% and +100%, for limestone use it is estimated to be –5% and +20%, as in the case of limestone the use of limestone for iron production is the main use in Austria and the contribution of other uses is assumed to be low.

4.2.4 Soda Ash Use (2 A 4)

4.2.4.1 Source Category Description

Key Source: No

In this category CO_2 emissions from decarbonising of soda used in glass industry is considered. In 2002 emissions from this category contributed 0.02% to total emissions in Austria. The following table presents CO_2 emissions from this category.

Table 105: Activity data and CO_2 emissions for Soda Use 1990–2002

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

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 year 2002, for the years before activity data was estimated using a constant ratio of soda used per ton of glass produced (glass production was reported by the *Association of Glass Industry* for all years). Activity data is presented in Table 105.

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

4.2.5 Asphalt Roofing (2 A 5)

4.2.5.1 Source Category Description

Key Source: No

In this category CH_4 emissions from the production and laying of asphalt roofing are considered. CO_2 emissions have not been estimated as they are assumed to be negligible.

CH_4 emissions from this source reached a maximum in 1994. In 2002 emissions from this category were 3% below the level of the base year. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of roofing paper.

4.2.5.2 Methodological Issues

No IPCC methodology is available for CH_4 emissions from this source.

Estimation of CH_4 emissions from asphalt roofing was carried out applying an emission factor expressed as g of m² produced asphalt roofing (CORINAIR simple methodology).

$$\text{Emission [Mg]} = (\text{Emission factor } [g_{CH4}/m^2_{\text{asphalt roofing}}] \times \text{Activity } [m^2])/1000000$$

Emission factor

An emission factor of 1.3 g CH_4 /m² of produced asphalt roofing was applied [BUWAL, 1995]. The consumption of bitumen was assumed to be 1.2 kg/m² of asphalt roofing.

Activity data

Activity data were taken from national statistics (STATISTIK AUSTRIA). For 1996 and 2002 no activity value was available from these statistics, that's why the value of the year before was used for these years.

Table 106 presents activity data for asphalt roofing as well as emissions from this category for the period from 1990 to 2002.

Table 106: Activity data (Roofing Paper produced) and CH_4 emissions for Asphalt Roofing 1990-2002

Year	Roofing Paper [m²]	CH_4 emissions [Gg]
1990	27 945 000	0.036
1991	28 007 000	0.036
1992	29 311 000	0.038
1993	30 731 000	0.040
1994	31 745 000	0.041
1995	31 229 000	0.041
1996	31 229 000	0.041
1997	29 976 436	0.039

Year	Roofing Paper [m²]	CH_4 emissions [Gg]
1998	27 060 715	0.035
1999	26 616 092	0.035
2000	26 020 734	0.034
2001	28 645 036	0.037
2002	28 645 036	0.037

4.2.5.3 Recalculation

Activity data for 2001 was updated.

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

Emission: *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 107 presents CO_2 emissions from bricks production for the period from 1990 to 2002. CO_2 emissions from bricks production had a maximum in 1995/1996, following brick production. In 2002 emissions from this category were 6% above the level of 1990.

Methodological Issues

No IPCC methodology is available for this source.

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

Activity data for the production of bricks was taken from national statistics (STATISTIK AUSTRIA), for 1996 the value of 1995 was used due to lack of data. From the IEF for 1998 emissions of the years before 1998 were calculated. For 2002 the value of 2001 was used.

Table 107 presents activity data for production of bricks and CO_2 emissions for this category for the period from 1990 to 2002.

Table 107: Activity data and CO_2 emissions for Bricks Production 1990-2002

Year	Bricks [t/a]	CO_2 emissions [Gg]	CO_2 IEF
1990	2 230 000	112	50.35
1991	2 333 852	118	50.35
1992	2 412 902	121	50.35
1993	2 593 236	131	50.35
1994	2 675 473	135	50.35
1995	2 848 716	143	50.35
1996	2 848 716	143	50.35
1997	2 625 046	132	50.35
1998	2 557 448	129	50.35
1999	2 184 773	117	53.43
2000	1 954 855	112	57.16
2001	1 959 395	119	60.88
2002	1 959 395	119	60.88

4.2.6.3 Magnesia Sinter Production

Key Source: Yes (CO_2)

This category includes CO_2 emissions from the production of magnesia sinter. CO_2 emission from magnesia sinter production is a key source both due to the contribution to total emissions of all inventory years and also with regard to all trend assessments. In 2002 it contributed 0.44% to the total amount of greenhouse gas emissions in Austria (see Table 98).

During production of magnesia sinter CO_2 is generated during the calcination step, when magnesia ($MgCO_3$) is roasted at high temperatures in a kiln to produce MgO. Magnesia sinter is processed in the refractory industry.

Table 108 presents CO_2 emissions from production of magnesia sinter for the period from 1990 to 2000.

CO_2 emissions from magnesia sinter plants varied over the period from 1990 to 2002 with an overall decreasing trend. In 2002 emissions were 22% less than in 1990.

Methodological Issues

No IPCC methodology is available for this source.

Emission values were directly reported by the only company in Austria sintering magnesia. Emissions have been calculated based on the carbonate content of the raw material.

Table 108 presents CO_2 emissions from this category for the period from 1990 to 2002.

Table 108: CO_2 emissions from Magnesia Sinter Production 1990-2002

Year	CO2 Emissions [Gg]
1990	481
1991	392
1992	336
1993	325
1994	323
1995	410
1996	355
1997	384
1998	345
1999	350
2000	339
2001	334
2002	374

Uncertainty Assessment

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

Based on these assumptions the uncertainty of emission estimates is assumed to be 5%.

Recalculations

As recommended by the ERT and as indicated in last year's NIR, data have been updated according to plant specific information. Previously activity data have been taken from national statistics where only data up to 1995 was available, and an emission factor of 1 100 kg CO_2/t magnesia has been used. Now plant specific data for all years has been collected, resulting in a small difference in emission values.

Table 109: Recalculation Difference with respect to last year's submission for CO_2 emissions from Magnesit Sinter Production

Year	CO_2 Emissions Difference [Gg]
1990	-4.1
1991	-7.9
1992	20.5
1993	42.3
1994	29.0
1995	71.4
1996	16.8

1997	45.7
1998	6.9
1999	11.5
2000	0.7
2001	-4.6

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 2002. It is also rated a key category with respect to its contribution to the total inventories trend from the base year to 1995. In 2002 it contributed 0.53% to the total amount of greenhouse gas emissions in Austria (see Table 98).

Ammonia (NH_3) is produced by catalytic steam reforming of natural gas or other light hydrocarbons (e.g. liquefied petroleum gas, naphtha). 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 110 presents CO_2 and CH_4 emissions from ammonia production as well as production of ammonia for the period from 1990 to 2002.

Emissions varied during the period and followed closely the trend in ammonia production. From 1990 to 1994 emissions remained quite stable and then increased and reached a maximum in 1998. Since then emissions were decreasing again. In 2002 CO_2 emissions increased by 12%, CH_4 emissions by 11%. The implied emission factors vary depending on the plant utilization and on how often the production process was interrupted, e.g. because of change of the catalyst.

4.3.1.2 Methodological Issues

Following the IPCC Guidelines plant specific measurement data was collected.

Activity data since 1990 and emission data from 1994 onwards were reported directly to the UMWELTBUNDESAMT by the only ammonia producer in Austria and thus represent plant specific data. From emission and activity data an implied emission factor was calculated (see Table 110). The implied emission factor 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.

Emissions are measured regularly at the only ammonia producer in Austria, using spot sampling and extrapolation to annual loads. The measurements are performed 2 to 12 times per year for both CO_2 and CH_4.

CO_2 and 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.

Table 110: Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from ammonia production 1990–2002

Year	Ammonia Produced [t]	CO_2 Emissions [Gg]	CH_4 Emissions [Gg]	IEF CO2 [kg/t]	IEF CH4 [g/t]
1990	461 000	396	0.062	859.00	135.00
1991	475 000	408	0.064	859.00	135.00
1992	432 000	371	0.058	859.00	135.00
1993	469 000	403	0.063	859.00	135.00
1994	444 000	381	0.060	859.00	135.00
1995	473 000	468	0.061	990.11	129.39
1996	484 772	465	0.059	959.90	121.91
1997	479 698	457	0.081	952.90	169.06
1998	484 449	501	0.102	1 034.66	210.55
1999	490 493	472	0.055	962.54	111.72
2000	482 333	463	0.060	959.92	124.40
2001	448 176	442	0.051	986.22	113.79
2002	464 028	445	0.069	959.25	148.27

4.3.1.3 Uncertainty assessment

As data was obtained from the only ammonia plant in Austria the quality of emission estimates was rated as "high".

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)

Nitric acid (HNO_3) is manufactured via the reaction of ammonia (NH_3) whereas 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 contain a small amount of methane, which is solved in the ammonia and is a byproduct. 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 a CO_2 emission in the tail gas.

In Austria there is only one producer of HNO_3.

Table 111 presents N_2O and CO_2 emissions from production of nitric acid for the period from

1990 to 2001.

N_2O emissions fluctuated during the period from 1990 to 2002, they increased from 1993 to 2000 and decreased by 15% from 2000 to 2002. This drop in emissions in the last year of the inventory was due to efforts made by the company to reduce their N_2O emissions. In the year 2001 N_2O emissions were 11% lower than in 1990.

CO_2 emissions also varied over the period from 1990-2002 following the trend of nitric acid production closely until 1999. Specific emissions decreased since 2000 due to efforts made by the plant owner to reduce greenhouse gas emissions (also see implied emission factors in Table 111). In 2002 emissions were 11% lower than in 1990.

4.3.2.2 Methodological Issues

Following the IPCC Guidelines plant specific measurement data was collected.

Activity and emission data of N_2O emissions was obtained directly from the plant operator. Since 1998, emissions are measured continuously. Based on the analysed emission data of 1998 and due to the fact that the production technology has not changed between 1990 and 1998 emission factors per ton of product were calculated for the used technologies (nitric acid is produced at one site in up to five plants with different technologies; some of the plants where closed since 1990, two are still in operation). With these (conservative) estimate of emission factors and the production volume of the individual plants the total emission of N_2O per year was calculated.

Activity and emission data of CO_2 emissions from the years 1994 onwards have been reported directly to the UMWELTBUNDESAMT by the plant operator and thus represent plant specific data. The implied emission factor that was calculated from activity and CO_2 emission data from 1994 was applied to calculate CO_2 emissions of the years 1990 to 1993 as no CO_2 emission data was available for these years.

Table 111: Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from Nitric Acid Production 1990-2002

Year	Nitric Acid Produced [t]	CO_2 Emissions [Gg]	N_2O Emissions [Gg]	IEF CO_2 [kg/t]	IEF N_2O [kg/t]
1990	529 998	0.413	2 942	0.78	5.55
1991	534 910	0.417	2 991	0.78	5.59
1992	484 731	0.378	2 702	0.78	5.57
1993	513 224	0.400	2 835	0.78	5.52
1994	467 391	0.365	2 662	0.78	5.70
1995	484 016	0.368	2 765	0.76	5.71
1996	495 738	0.376	2 820	0.76	5.69
1997	489 376	0.358	2 783	0.73	5.69
1998	504 977	0.381	2 893	0.75	5.73
1999	512 797	0.398	2 979	0.78	5.81
2000	533 715	0.370	3 070	0.69	5.75
2001	510 800	0.362	2 537	0.71	4.97
2002	522 410	0.366	2 604	0.70	4.98

4.3.2.3 Uncertainty assessment

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

4.3.2.4 Recalculation

As indicated in last year's NIR, the presented emission values of some years did not cover the whole production of nitric acid, this was corrected.

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 2002, emissions from this source contributed 0.05% to national total emissions.

4.3.3.2 Methodological Issues

Emissions were estimated using a country specific methodology.

Activity data was 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 112: Activity data and emissions for CO_2 emissions from Calcium Carbide Production 1990-2002

Year	Calcium Carbid [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

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 emissions from the production of urea (CO_2 emissions are negligible) and CH_4 and CO_2 emissions 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.

CO_2 emissions from the production of fertilizers varied over the period following closely the trend of fertilizer production. They first decreased, reaching a minimum in 1998 and since then increased again. In 2002 emissions from this category were 13% lower than in 1990 (see Table 113).

4.3.4.2 Methodological Issues

No IPCC methodology is available for these sources.

Data for urea production were directly reported by the Austrian producer of urea and thus represent plant-specific data.

Data for fertilizer production for 1990 to 1994 were taken from national statistics (STATISTIK AUSTRIA), for 1995 to 2002 production data were reported directly by the main producer of fertilizers in Austria.

Emission data for CH_4 emissions from the production of urea and CO_2 emissions from the production of fertilizers for 1994 to 2002 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 year 2002, this data became available due to a measurement program for CH_4 at the plant starting in 2002. For the years before no data is available, that's why the implied emission factor for the year 2002 was used for all years.

Table 113 presents activity data, emissions and implied emission factors for CH_4 and CO_2 emissions from *Fertilizer Production* and CH_4 emissions from *Urea Production* for the period from 1990 to 2002.

Table 113: Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from NPK-fertilizer Production and CH_4 emissions from Urea Production 1990-2002

Year	Urea Production			Fertilizer Production			
	Urea produced [t]	CH_4 emissions [Gg]	IEF CH_4 [g/t]	Fertilizers produced [t]	CO_2 emissions [Gg]	IEF CO_2 [kg/t]	CH_4 emissions [Gg]
1990	282 000	0.040	140.71	1 388 621	27.14	19.55	0.184
1991	295 000	0.042	140.71	1 273 467	24.89	19.55	0.168
1992	259 000	0.036	140.71	1 182 595	23.12	19.55	0.156
1993	305 000	0.043	140.71	1 250 804	24.45	19.55	0.165
1994	360 000	0.051	140.71	1 222 578	23.90	19.55	0.162
1995	393 000	0.055	140.71	916 265	19.55	21.34	0.121
1996	417 705	0.056	134.54	940 313	18.07	19.22	0.124
1997	392 017	0.053	134.43	924 856	17.22	18.62	0.122
1998	395 288	0.055	137.87	977 212	18.68	19.12	0.129
1999	408 386	0.044	107.01	988 662	19.65	19.88	0.131
2000	390 185	0.033	85.60	1 022 983	20.59	20.13	0.135
2001	367 218	0.033	89.86	959 698	19.75	20.58	0.127
2002	389 574	0.150	384.27	1 013 767	23.61	23.29	0.134

4.3.4.3 Recalculation

The time series for CH_4 emissions from fertilizer production was added, as data from a measurement program for CH_4 at the plant starting in 2002 became available.

4.3.4.4 Time Series Consistency / Planned Improvements

The time series for CH_4 emissions from urea production is not consistent due to different methodologies used: for the years 1995-2001 data obtained from industry was based on single measurements (about four per year) of CH_4 in the waste gas flow – such single measurements are subject to fluctuations. Thus in 2002 a measurement program for CH_4 content of the ammonia used for urea production was done. The emission estimate reported for 2002 is based on these measurements (with the assumption that all CH_4 introduced in the process is emitted) and is assumed to be more accurate than data obtained with the old methodology. The resulting inconsistency will be corrected for the next submission.

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 2002 reflect only the production of the largest Austrian producer. It is planned to prepare a consistent time series.

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, producing about 10% of total steel production in Austria.

In this category process specific CO_2 emissions resulting 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 CO_2 emissions from steel production resulting from the lowering of 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 seven to nine) and because of its contribution to the trend of most years.

In the year 2002 CO_2 emissions from production of iron and steel contributed 4.8% to total greenhouse gas emissions in Austria (see Chapter 1.5.1).

CH_4 emissions from this category are negligible, the contribution to national total emissions in 2002 was 0.0001%.

Table 115 presents total CO_2 and CH_4 emissions from the production of iron and steel for the period from 1990 to 2002. CO_2 emissions from *Iron and Steel Production* decreased from 1990 to 1993 and then increased steadily following the trend of steel production. In 2002 emissions were 16% above the level of 1990.

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. They are calculated by applying a very detailed mass balance approach for carbon. Process specific emissions[17] 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 drawbacks 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 fur-

[17] 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.

naces 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).

CO_2 emissions from pig iron production

CO_2 emissions were calculated following closely the IPCC GPG guidelines Tier 2 approach, applying the default emission factor of table 3.6 of the IPCC GPG:

*CO_2 Emissions = Mass of reducing agent * 3.1 t CO_2/ t reducing agent + (Mass of Carbon in the Ore – Mass of Carbon in the Crude Iron) * 44/12*

The mass of reducing agent (coke) was taken from the national energy balance (see Annex 4). According to a national study [Hiebler/Gamsjäger/God] 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. 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[18]. 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 onwards the mass of ore was directly reported by industry.

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 it was directly reported by industry.

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 114.

Table 114: Activity data, emissions and implied emission factors for CO_2 emissions from pig iron production 1990–2002

Year	Coke [kt]	Ore [kt]	Pig Iron [kt]	CO_2 [Gg]	IEF CO_2 [t/t Pig Iron]
1990	857	2 225	3 444	2 994	869
1991	887	2 092	3 442	3 039	883
1992	803	1 629	3 074	2 656	864
1993	819	1 627	3 070	2 707	882
1994	891	1 695	3 320	2 917	879
1995	1 011	2 071	3 888	3 350	862
1996	930	2 071	3 432	3 164	922

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

Year	Coke [kt]	Ore [kt]	Pig Iron [kt]	CO_2 [Gg]	IEF CO_2 [t/t Pig Iron]
1997	1 057	2 071	3 972	3 480	876
1998	1 025	1 810	4 032	3 274	812
1999	1 004	1 734	3 912	3 196	817
2000	1 126	1 879	4 320	3 570	826
2001	1 156	1 875	4 380	3 653	834
2002	1 068	1 925	4 712	3 349	711

CO_2 emissions from steel production

CO_2 emissions from steel production (which corresponds to steel production at the two integrated sites operating blast furnaces) were calculated following the IPCC GPG guidelines Tier 2 approach:

*CO_2 Emissions = (Mass of Carbon in the Crude Iron used for Crude Steel – Mass of Carbon in the Crude Steel) * 44/12*

For the years 1990 to 2001 activity data for electric steel production was subtracted from total steel production in Austria taken from national statistics (statistical yearbook of STATISTIK AUSTRIA) to obtain steel production of the two integrated sites operating blast furnaces. For 2002 steel production of the two integrated sites operating blast furnaces was directly reported by industry.

The average carbon content of 0.15% was obtained from the operator of the two integrated sites.

CO_2 and CH_4 emissions from electric steel production

Emissions were estimated using a country specific methodology.

For calculating CO_2 emissions an emission factor of 100 kg CO_2 / t electric steel taken from [BUWAL, 1995] was applied.

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, for 2002 the value of 2001 was used.

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 115 presents pig iron, 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 115: Activity data, emissions and implied emission factors for CO_2 and CH_4 emissions from Iron and Steel Production 1990–2002

Year	Steel Production				Electric Steel Production			**Total CH_4 [Gg]**	**Total(*) CO_2 [Gg]**
	Steel [t]	CO_2 [Gg]	IEF CO_2 [t/t Steel]	CH_4 [Gg]	Electric Steel [t]	CO_2 [t/t Steel]	CH_4 [Gg]		
1990	3 921 341	484	123	0.00039	370 107	37	0.0019	**0.00229**	**3 514**
1991	3 896 418	483	124	0.00039	290 324	29	0.0015	**0.00189**	**3 552**
1992	3 592 487	431	120	0.00036	360 620	36	0.0018	**0.00216**	**3 123**
1993	3 738 096	430	115	0.00037	410 769	41	0.0021	**0.00247**	**3 178**
1994	3 967 938	465	117	0.00040	430 949	43	0.0022	**0.00260**	**3 425**
1995	4 538 355	545	120	0.00045	453 645	45	0.0023	**0.00275**	**3 941**
1996	4 031 800	481	119	0.00040	396 200	40	0.0020	**0.00240**	**3 685**
1997	4 718 422	557	118	0.00047	465 578	47	0.0023	**0.00277**	**4 083**
1998	4 801 087	565	118	0.00048	502 913	50	0.0025	**0.00298**	**3 889**
1999	4 722 071	548	116	0.00047	485 929	49	0.0024	**0.00287**	**3 793**
2000	5 183 461	605	117	0.00052	540 539	54	0.0027	**0.00322**	**4 229**
2001	5 346 305	613	115	0.00053	545 695	55	0.0027	**0.00323**	**4 321**
2002	5 647 282	660	117	0.00056	545 695	55	0.0027	**0.00326**	**4 064**

(*) Total CO_2 emissions from the IPCC Category Iron and Steel Production (thus also including emissions from pig iron production as presented in Table 114)

4.4.1.3 Uncertainty Assessment

According to the IPCC GPG the uncertainty of the CO_2 emission factor for coke and the carbon content of iron and steel is 5%. The uncertainty of the EF for electric steel production is assumed to be high (50%) as no information on applicability of the emission factor is available.

The uncertainty of activity data is assumed to be low (5%) because there are only five production sites with two sites strongly 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[19], uncertainties of emission estimates for process emissions from solid raw materials is 5%.

4.4.1.4 Recalculation

In last year's submission total CO_2 emissions (thus also including CO_2 emissions due to combustion) of the two integrated iron and steel production sites in Austria were reported in

[19] 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

this category and emissions of electric furnaces and rolling mills were reported separately under category *2 C 5 Other*. In this year's submission only process-specific CO_2 emissions of the two main iron and steel production site were considered, combustion related emissions are now reported in *1 A 2 a Iron and Steel*. Emissions of electric arc furnaces and rolling mills are now also reported in *2 C 1 Iron and Steel*, CO_2 emissions of electric arc furnaces are reported for the first time.

4.4.2 Aluminium Production (2 C 3)

4.4.2.1 Source Category Description

Key Source: Yes (PFCs and 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 because of its contribution to the trend from the base year to 1991 and 1992. In the trend assessment for the base year to 1992 also this source was also identified a key category with respect to CO_2 emissions.

Table 116 presents PFC and CO_2 emissions from primary aluminium production for the period from 1990 to 1992.

Table 116: PFC emissions from primary aluminium production from 1990 to 1992

	1990	1991	1992
PFC emission [Gg CO_2-equivalent]	937	941	535
CO_2 emissions [Gg]	158	158	63

4.4.2.2 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 1b 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, 1996], [TABERAUX, 1996]:

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

Where:

AE/pot/day	=	frequency of occurrence of the anode effect (dependent on type of oxide supply (1,2 / day)
t_{Al}	=	effective production capacity per year [t]
AE_{min}	=	anode effect duration in minutes (5 min)
F	=	fraction of CF_4 in the anode gas (13%)
CE	=	current efficiency (85%)

1,7 = constant resulting from Faraday's law

In Austria so called "Søderberg" anodes were used. The frequency of the anode effect (AE/pot/day) was about 1.2 per day. The duration of the anode effect (AE_{min}) was in the range of 4 to 6 minutes. The average fraction of CF_4 formed in percent of the anode gas (F) can be determined as a function of the duration of the anode effect. International values are about 10% after two minutes, 12% after three minutes and after that there is only a marginal increase. Therefore for Austrian aluminium production a CF_4 fraction in the anode gas of 13% was assumed.

Because C_2F_6 is formed only during the first minute of the anode effect, the rate of C_2F_6 is the higher the shorter the duration of the anode effect is. For the aluminium production in Austria the rate of C_2F_6 is about 8% and the current efficiency (CE) about 85.4%.

Activity data were taken from national statistics (88 021 t for 1990 – value was also used for 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.

4.4.2.3 Recalculation

CO_2 emissions from primary aluminium production have been added to the inventory for this submission.

4.4.3 SF_6 Used in Aluminium and Magnesium Foundries (2 C 4)

4.4.3.1 Source Category Description

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 1994 to 1997 and to the trend of emissions in the trend assessment of the years 1991, 1992 and 1996 to 2001.

In 2001 SF_6 emission from aluminium and magnesium foundries contributed 0.01% to the total amount of greenhouse gas emissions in Austria compared to 0.57% in the base year (1995 for SF_6; see Table 98).

Table 117 presents SF_6 emissions from magnesium and aluminium foundries for the period from 1990 to 2001.

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%. For the years 2001 and 2002 the value of 2000 was used due to lack of more up to date emission data.

Table 117: SF_6 emissions from magnesium and aluminium foundries 1990–2001

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
SF_6 emission [Gg]	0.0106	0.0116	0.0106	0.0116	0.0156	0.0185	0.0256	0.0146	0.0069	0.0009	0.0003	0.0003

4.4.3.2 Methodological Issues

Emissions were estimated using a country specific methodology.

SF_6 used in aluminium foundries

Information about the amount of SF_6 used in aluminium foundries was obtained directly from the aluminium producers in Austria and thus represent plant-specific data. Actual emissions of SF_6 correspond to the annual consumption of SF_6 in aluminium foundries.

SF_6 used in magnesium foundries

Estimation of actual SF_6 emissions from magnesium foundries was carried out by applying an emission factor of 4 kg SF_6 per ton of magnesia die cast (no potential emissions occur):

$$\text{Emission [Mg]} = (\text{Emission factor } [g_{SF6}/Mg_{activity}] \times \text{Activity [Mg]})/1\,000\,000$$

This emission factor was derived from a worldwide survey of 20 producers of magnesia die cast [LEISEWITZ, 1996].

4.5 Consumption of Halocarbons and SF_6 (CRF Source Category 2 F)

4.5.1 Source Category Description

***NOTE:* As no new data on emissions of F-gases was available, that's why the values of 2000 were also used for 2001 and 2002. However, a mistake in reporting of potential emissions has been identified and corrected for the submission 2004.**

This category includes the following emission sources: refrigeration and air conditioning equipment, foam blowing, fire extinguishers, aerosols/metered dose inhalers, semiconductor manufacture, electrical equipment and other sources (noise insulation windows, tyres and research; heat pumps).

Potential emissions are only 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 increased by 33.59% compared to base year emissions (1995 for PFCs, HFCs and SF_6). In 2001 emissions were almost six times higher than in 1990. This was mainly due to strongly increasing emissions from the use of HFCs as substitutes for ozone depleting substance (*ODS Substitutes*). Emissions by subsector and gas are presented in Table 118.

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 ODS (Ozone Depleting Substances) Substitutes* (HFCs),
- *2 F 6 Semiconductor Manufacture* (HFCs, PFCs and SF_6),
- *2 F 4 Electrical Equipment* (SF_6) and
- *2 F 8 Other Sources of SF_6*.

Emissions of heat pumps are included in *ODS Substitutes*.

Three of these sources have been identified as key sources: *2 F 1/2/3 ODS (Ozone Depleting Substances) Substitutes* (HFCs), *2 F 6 Semiconductor Manufacture* (HFCs, PFCs and SF_6) and *2 F 8 Other Sources of SF_6* (for further information on key sources see Chapter 1.5.1).

4.5.2 Methodological Issues

Emissions were estimated using a country specific methodology.

The basic 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

Table 118: Emissions of IPCC Category 2 F by subsector 1990-2001

CRF-Sector	Description	Unit	GHG	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	GWP
2 F 6	Semiconductor Manufacture	t	HFC-23	0.17	0.26	0.38	0.50	0.61	0.04	0.16	0.08	0.08	0.09	0.09	0.09	*11 700*
		t	CF4	3.33	3.82	4.31	4.80	5.01	0.78	0.66	0.90	0.90	1.50	1.47	1.47	*6 500*
		t	C2F6	0.50	0.96	1.40	1.84	2.29	1.15	1.14	1.35	1.63	1.69	1.70	1.70	*9 200*
		t	SF6	4.17	7.23	9.88	12.54	15.19	17.84	13.66	20.37	17.97	16.03	13.56	13.56	*23 900*
2 F 6	**Semiconductor Manufacture**	**Gg**	**CO2 equivale**	**127.87**	**209.55**	**281.50**	**353.53**	**423.78**	**442.49**	**343.06**	**506.03**	**451.27**	**409.40**	**350.38**	**350.38**	
2 F 8	Other / Heat Pumps	t	HFC-134a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*1300*
2 F 1	Refrigeration and Air Conditioning Equipment	t	HFC-32	0.00	0.00	0.00	0.00	0.02	0.07	0.17	0.35	0.60	0.91	1.75	1.75	*650*
		t	HFC-125	0.00	0.00	0.00	0.00	0.03	1.44	5.70	11.05	14.79	16.19	21.90	21.90	*2 800*
		t	HFC-134a	1.35	2.13	3.15	4.60	6.73	23.33	41.30	62.68	90.25	103.90	134.30	134.30	*1 300*
		t	HFC-152a	0.00	0.00	0.00	0.00	0.00	0.06	0.33	0.57	0.76	0.69	0.79	0.79	*140*
		t	HFC-143a	0.00	0.00	0.00	0.00	0.00	0.38	2.51	5.62	8.14	9.47	13.57	13.57	*3 800*
2 F 2	Foam Blowing	t	HFC-134a	0.00	0.00	0.00	0.00	0.00	391.00	416.50	446.25	477.42	498.10	518.76	518.76	*1 300*
		t	HFC-152a	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	451.44	451.44	*140*
2 F 3	Fire Extinguishers	t	HFC-23	0.00	0.00	0.00	0.03	0.07	0.12	0.18	0.24	0.31	0.39	0.46	0.46	*11 700*
		t	HFC-227ea	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.07	0.11	0.17	0.17	*2 900*
2 F 1/2/3	**ODS Substitutes**	**Gg**	**CO2 equivale**	**1.76**	**2.77**	**4.10**	**6.33**	**9.70**	**545.56**	**622.92**	**717.12**	**814.66**	**869.43**	**1 032.18**	**1 032.18**	
2 F 7	Electrical Equipment	t	SF6	1.57	2.22	2.25	2.32	3.13	2.65	2.39	2.32	3.16	3.55	4.08	4.08	*23 900*
3 F 7	**Electrical Equipment**	**Gg**	**CO2 equivale**	**37.56**	**53.11**	**53.74**	**55.53**	**74.73**	**63.42**	**57.22**	**55.33**	**75.57**	**84.87**	**97.59**	**97.59**	
2 F 8	Other / Research	t	SF6	5.32	7.52	7.62	7.97	9.30	10.12	10.54	10.74	11.95	10.03	10.36	10.36	*23 900*
2 F 8	**Other Sources of SF6**	**Gg**	**CO2 equivale**	**127.15**	**179.73**	**182.12**	**190.48**	**222.27**	**241.87**	**251.91**	**256.69**	**285.68**	**239.76**	**247.56**	**247.56**	
2 F	**Consumption of Halocarbons and SF6**	**Gg**	**CO2 equivale**	**294.34**	**445.16**	**521.45**	**605.88**	**730.48**	**1 293.33**	**1 275.11**	**1 535.17**	**1 627.17**	**1 603.46**	**1 727.71**	**1 727.71**	

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 volume of stocks of household, industrial and commercial refrigerators, heat pumps, cold storage warehouses, automobiles with mobile air condition and imported mobile refrigeration systems were obtained from Associations of Industry.

HFC-125, HFC-143a and HFC-32 were not in use as individual gases but are parts of the blends used for stationary refrigeration where actual emissions normally agree with the respective equipment installation stock.

4.5.2.2 2 F 2 Foam Blowing and XPS/PU Plates

Production data and information about the used blowing agent were obtained from Associations of Industry (construction industry).

The actual emissions were calculated from the total consumption of XPS/PU plates in Austria - about 75% of the XPS/ PU plates are imported. Based on expert judgement it was assumed that for plates of common thickness (40 to 60 mm) about 5 kg blowing agent per m³ plate are used. About 30% of that amount (that are 1,5 kg) is emitted during production and storage at the place of production. The rest - about 3,5 kg per m³ XPS/ PU plate - is emitted gradually by diffusion. These diffusion losses were calculated using the half-life-time with the following formula:

$$T_{1/2} \approx 0{,}8 \times 10^{-6} \times d^2/D$$

Where: d = thickness of the plates [cm]

D = Diffusion coefficient [cm²/s]

$T_{1/2}$ = half-life-time [days]

For HFC R134a a diffusion coefficient of $2{,}9\times10^{-9}$ cm²/s and for HFC R152a a diffusion coefficient of $0{,}21\times10^{-6}$ cm²/s was assumed.

The consumption per capita of XPS/ PU plates in Austria is higher than in all other European countries.

4.5.2.3 2 F 3 Fire Extinguishers

From 1992 to 1995 1.000 t of R 3110 for the use in fire extinguishers in Austria was sold. It was assumed that actual emissions are 1% of potential emissions.

HFC-23 and HFC-227ea in fire extinguishers were first introduced to the Austrian market in 1995. It was assumed that the actual emissions correspond to 1,5% of the annual potential emissions. Potential emissions correspond to the sum of consumption data of all years before.

Consumption data were obtained directly from the producers of fire extinguishers.

4.5.2.4 2 F 4 Aerosols/Metered Dose Inhalers

NO

There was no consumption of Halocarbons and SF_6 under this category in Austria.

4.5.2.5 2 F 5 Solvents concerning Halocarbons

NO

There was no consumption of halocarbons and SF_6 as solvents in Austria.

4.5.2.6 2 F 6 Semiconductor Manufacture (HFCs, PFCs, SF_6)

SF_6 is used for etching in semiconductor manufacture and for insulation purposes for high frequency measurements.

All consumption data and data about actual emissions of SF_6 from semiconductor manufacture were based on direct information from industry.

All consumption data and data about emissions of PFCs and HFCs from semiconductor manufacture were based on direct information from industry.

The actual emissions correspond to approximately 8% (CF_4), respectively 1% (C_2F_6) of the total consumption. For HFCs it was assumed that about 90% of total consumption is emitted. Potential emissions were not relevant.

4.5.2.7 2 F 7 Electrical Equipment (SF_6)

Based on information from energy supplier and industry it was estimated that in 1998 about 100 tons SF_6 were used for electrical transmission and distribution purposes. From these 100 tons about 97% can be assigned to the high voltage sector and about 3% can be assigned to the middle voltage sector.

With the following assumptions the SF_6 emissions were calculated:

- Consumption of SF_6 means first filling of equipment installations and covering of losses.
- There are no emissions during first filling on site. When equipment installation is opened for servicing or if there is leakage, emissions are below 1% of total filled SF_6 (expert judgement).
- The potential emissions correspond to the respective equipment installation stock.

4.5.2.8 2 F 8 Other Sources of SF_6 (noise insulate glass, tyres and research)

Activity data were based upon direct information from industry. The average consumption of SF_6 was calculated by multiplying the area of SF_6 filled insulate glass produced with 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 with a density of 6.18 g/litre.

The actual emissions were the annual congestion losses based on annual production data plus the leakage's losses (1%) of the total stock of insulate glasses filled with SF_6. The potential emissions correspond to the total SF_6 included in insulate glasses (about 50 g SF_6/m^2), minus the amount of SF_6 which escaped before by diffusion.

For estimation of actual emissions from SF_6 filled tyres it was assumed that the total amount of gas contained in a tyre is emitted within three years (1/3 of total amount each year).

Also SF_6 emissions from electron microscopes and shoes were considered in this category.

4.5.3 Planned Improvements

New data on emissions of F-gases will become available in the year 2004 because the new order which regulates the use of F-gases also includes a reporting obligation of companies dealing with those substances. This data is planned to be included in the submission 2005.

5 SOLVENT AND OTHER PRODUCT USE (CRF SECTOR 3)

5.1 Sector Overview

This chapter describes the methodology used for calculating greenhouse gas emissions from solvent use in Austria. Solvents are chemical compounds, which are used to dissolve substances as paint, glues, ink, rubber, plastic, pesticides or for cleaning purposes (degreasing). After application of these substances or other procedures of solvent use most of the solvent is released into air. Because solvents consist mainly of NMVOC, solvent use is a major source for anthropogenic NMVOC emissions in Austria. Once released into the atmosphere NMVOCs react with reactive molecules (mainly HO-radicals) or high energetic light to finally form CO_2.

Estimations for N_2O emissions from other product use (anaesthesia and aerosol cans) are also addressed in this chapter.

5.1.1 Emission Trends

In the year 2002 this category had a contribution of 0.5% to total greenhouse gas emissions (not considering CO_2 from LUCF). There has been a decrease of 17% in greenhouse gas emissions from 1990 to 2002 (see Table 119) due to the positive impact of the enforced laws and regulations in Austria[20] (regulations and directives on solvents, VOC-directive). In emission intensive activity areas such as coating, printing and in the pharmaceutical industry the number of waste air purification plants has grown during the period from 1990 to 1995. From 1995 to 1998 the quantities of solvents varied heavily due to the economic development, especially in the last years (1999-2002) an increase was observed.

Table 119: Trend in greenhouse gas emissions of Category 3 Solvent and Other Product Use 1990 – 2002

GHG [Gg CO_2 equivalent]	CO_2	N_2O	Total
1990	282.67	232.50	515.17
1991	236.77	232.50	469.27
1992	187.74	232.50	420.24
1993	187.35	232.50	419.85
1994	171.54	232.50	404.04
1995	189.88	232.50	422.38
1996	172.81	232.50	405.31
1997	190.09	232.50	422.59
1998	172.24	232.50	404.74
1999	158.37	232.50	390.87

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

2000	181.02	232.50	413.52
2001	193.60	232.50	426.10
2002	193.60	232.50	426.10
Trend 1990 – 2002	*-31,51%*	*0.00%*	*-17.29%*

Table 120: Total greenhouse gas emissions and trend from 1990 – 2002 by subcategories of Category 3 Solvent and Other Product Use

CO2 equivalent (Gg)	3 A	3 B	3 C	3 D	Total
1990	119.69	36.11	42.25	317.13	515.17
1991	97.02	29.53	35.02	307.69	469.27
1992	74.37	22.85	27.48	295.54	420.24
1993	71.67	22.23	27.13	298.82	419.85
1994	63.28	19.84	24.58	296.35	404.04
1995	67.46	21.38	26.91	306.62	422.38
1996	59.76	20.15	24.21	301.20	405.31
1997	63.93	22.91	26.31	309.43	422.59
1998	56.29	21.45	23.56	303.45	404.74
1999	50.26	20.34	21.40	298.87	390.87
2000	55.73	23.97	24.16	309.66	413.52
2001	59.60	25.64	25.84	315.02	426.10
2002	59.60	25.64	25.84	315.02	426.10
Trend 1990 – 2002	*-50.20%*	*-29.00%*	*-38.84%*	*-0.66%*	*-17.29%*

5.1.2 Key Sources

The key source analysis is presented in Chapter 1.5. This chapter includes information about the key sources in the IPCC Sector *3 Solvents*. Both subcategories of this source have been identified as key categories.

Table 121: Key sources of category Solvent and Other Product Use

IPCC Category	Source Categories	Key Sources*	
		GHG	KS-Assessment
3	Solvent and Other Product Use	CO_2	LA 90, 91 TA 91-99, 01
		N_2O	LA 92-94

LA02 = Level Assessment 2002
TA02= Trend Assessment Base year-2002

5.1.3 Completeness

Table 139 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 subcategory have been estimated.

Table 122: Overview of subcategories of Category Agriculture: transformation into SNAP Codes and status of estimation

IPCC Category	**SNAP**		**CO_2**	**N_2O**
3A Paint application	0601	Paint application	✓	NA
3B Degreasing and Dry Cleaning	0602	Degreasing, dry cleaning and electronics	✓	NA
3C Chemical Products, Manufacture and Processing	0603	Chemical products manufacturing and processing	✓	NA
3D Other	0604	Other use of solvents and related activities	✓	NA
	0605	Use of HFC, N2O, NH3, PFC and SF6	NA	✓

5.2 CO_2 Emissions from Solvent and Other Product Use

5.2.1 Methodology Overview

CO_2 emissions from solvent use were calculated from NMVOC emissions of this sector. So as a first step the quantity of solvents used and the solvent emissions were calculated.

To determine the quantity of solvents used in Austria in the various applications, a bottom up and a top down approach were combined. Figure 13 presents 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.

A study [FIEU&IIÖ, 2002b] 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 used as solvents are used as feed stock in chemical, pharmaceutical or petrochemical industry (e.g. production of MTBE, formaldehyde, polyester, biodiesel, pharmaceuticals etc.)

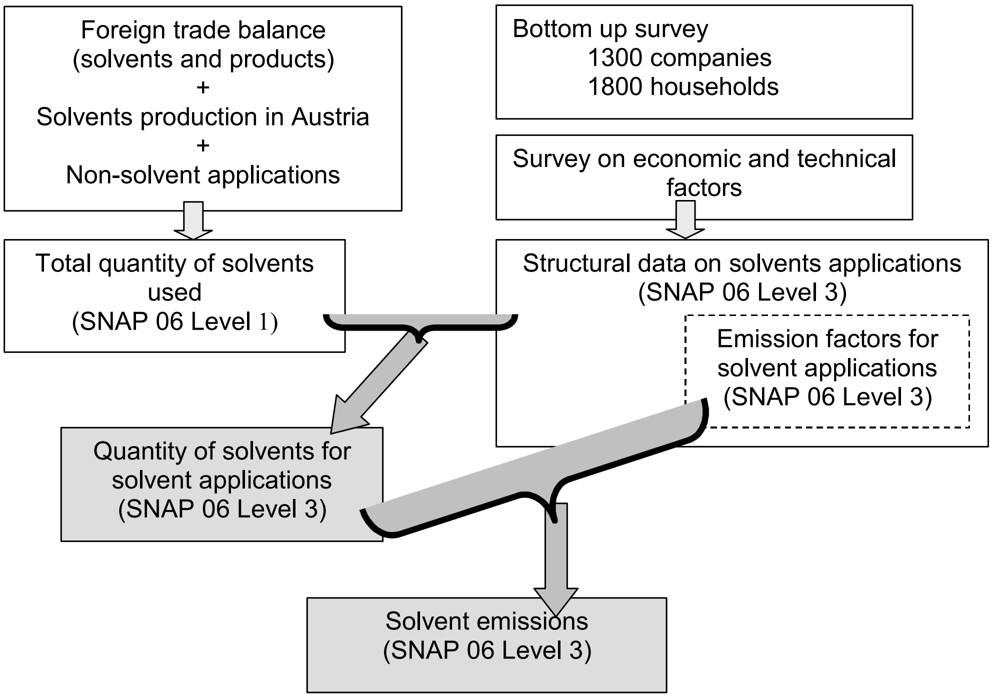
and where therefore no emissions from "solvent use" arise. However, there might be emissions from the use of the produced products, such as MTBE which is used as fuel additive and finally combusted, these emissions for example are considered in the transport sector.

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, de-icing agents of aeroplanes, tourism, cement- respectively pulp industry, which were not considered in the top-down approach.

Figure 13: Overview of the methodology for solvent emissions

Top-down approach
Total census: 1980-1981, 1984-1985, 1988-2001
Interpolation: 1982, 1983, 1986, 1987

Bottom up approach
Pillar years:1980, 1990, 1995, 2000
Interpolation for the years in between



5.2.2 Top down Approach

The top-down approach is based on

1. import-export statistics
2. production statistics on solvents in Austria
3. a survey on non-solvent-applications in companies [IIÖ&FIEU, 2004]
4. a survey on the solvent content in products and preparations at producers and retailers [FIEU&IIÖ, 2002 b]

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 [FIEU&IIÖ, 2002b] 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 [FIEU&IIÖ, 2002 a]. In this survey data about the solvent content of paints, cleaning agents etc. and on solvents used (both substances and substance categories) like acetone or alcohols were collected.

Information about the type of application of the solvents was gathered, divided into the three categories "final application", "cleaner" and "product preparation" as well as the actual type of waste gas treatment, which was divided into the categories "open application", "waste gas collection" and "waste gas treatment".

For every category of application and waste gas treatment an emission factor was estimated to calculate solvent emissions in the year 2000 (see Table 123).

Table 123: Emission factors for NMVOC emissions from Solvent Use

Category	Factor
final application	1.00
cleaner	0.85
product preparation	0.05
open application	1.00
waste gas collection	1.00
waste gas treatment	0.20

In a second step a survey in 1 800 households was made [FIEU&IIÖ, 2002 b] 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 quantities of solvents used for each application in the year 2000 (at SNAP level 3) [FIEU&IIÖ, 2002 b].

To archive a time series the development of the economic and technical situation in relation to the year 2000 was considered. It was distinguished between "general aspects" and "specific aspects" (see tables below). The information about these defined aspects were collected for three pillar years (1980, 1990, 1995) and were taken from several studies [SCHMIDT et al. 1998] [BARNERT 1998] and expert judgements from associations of industries (chemical industry, printing industry, paper industry) and other stakeholders. On the basis of this information calculation factors were estimated. With these factors and the data for solvent use and emission of 2000 data for the three pillar years was estimated. For the years in between data was linearly interpolated.

Table 124: General aspects and their development

General aspects	1980	1990	1995	2000
efficiency factor solvent cleaning	250 %	150 %	130 %	100 %
efficiency factor application	150 %	110 %	105 %	100 %
solvent content of water-based paints	15 %	12 %	10 %	8 %
solvent content of solvent-based paints	60 %	58 %	55 %	55 %
efficiency of waste gas purification	70 %	75 %	78 %	80 %

Table 125: Specific aspects and their development: distribution of the used paints (water based-paints - solvent-based paints) and part of waste gas purification (application - purification)

SNAP category	description	year	Distribution of used paints		Part of waste gas treatment	
			Solvent based paints	Water based paints	application	purification
060101	manufacture of automobiles	**2000**	**73%**	**27%**	**10%**	**0%**
		1995	80%	20%	8%	0%
		1990	90%	10%	5%	0%
		1980	100%	0%	0%	0%
060102	car repairing	**2000**	**51%**	**49%**	**62%**	**1%**
		1995	55%	45%	60%	0%
		1990	75%	25%	10%	0%
		1980	85%	15%	5%	0%
060107	wood coating	**2000**	**46%**	**54%**	**46%**	**3%**
		1995	60%	40%	45%	2%

		1990	85%	15%	10%	0%
		1980	100%	0%	0%	0%
060108	Other industrial paint application	***2000***	**97%**	**3%**	**90%**	**46%**
		1995	99%	1%	87%	45%
		1990	100%	0%	26%	20%
		1980	100%	0%	0%	0%
060201	Metal degreasing	***2000***	**92%**	**8%**	**75%**	**0%**
		1995	95%	5%	65%	0%
		1990	100%	0%	10%	0%
		1980	100%	0%	0%	0%
060403	Printing industry	***2000***			**44%**	**17%**
		1995			29%	10%
		1990			10%	5%
		1980			0%	0%
060405	Application of glues and adhesives	***2000***			**58%**	**0%**
		1995			53%	0%
		1990			15%	0%
		1980			0%	0%
060103	Paint application : construction and buildings	***2000***	**91%**	**9%**	**19%**	**4%**
		1995	93%	7%	15%	2%
		1990	100%	0%	5%	0%
		1980	100%	0%	0%	0%
060105	Paint application : coil coating	***2000***	**100%**	**0%**	**63%**	**0%**
		1995	100%	0%	60%	0%
		1990	100%	0%	25%	0%
		1980	100%	0%	0%	0%
060406	Preservation of wood	***2000***	**83%**	**17%**	**0%**	**0%**
		1995	85%	15%	0%	0%
		1990	95%	5%	0%	0%
		1980	100%	0%	0%	0%
060412	Other (preservation of seeds,…)	***2000***	**100%**	**0%**	**90%**	**0%**
		1995	100%	0%	80%	0%
		1990	100%	0%	10%	0%
		1980	100%	0%	0%	0%

Table 126: Specific aspects and their development: changes in the number of employees compared to the year 2000

SNAP97		Changes in the number of employees compared to the year 2000 [%]			
		1980	1990	1995	2000
0601	**Paint application**				
060101	manufacture of automobiles	88%	82%	72%	100%
060102	car repairing	94%	98%	96%	100%
060103	construction and buildings	96%	90%	102%	100%
060104	domestic use	separate analysed			
060105	coil coating	99%	113%	107%	100%
060107	wood coating	107%	109%	112%	100%
060108	industrial paint application	122%	112%	106%	100%
0602	**Degreasing, dry cleaning and electronics**				
060201	Metal degreasing	151%	113%	83%	100%
060202	Dry cleaning	63%	75%	88%	100%
060203	Electronic components manufacturing	143%	122%	104%	100%
060204	Other industrial cleaning	33%	77%	56%	100%
0603	**Chemical products manufacturing and processing**				
060305	Rubber processing	110%	101%	102%	100%
060306	Pharmaceutical products manufacturing	118%	112%	97%	100%
060307	Paints manufacturing	118%	112%	97%	100%
060308	Inks manufacturing	118%	112%	97%	100%
060309	Glues manufacturing	118%	112%	98%	100%
060310	Asphalt blowing	124%	120%	120%	100%
060311	Adhesive, magnetic tapes, films and photographs	33%	57%	76%	100%
060312	Textile finishing	241%	171%	132%	100%
060314	Other	117%	112%	98%	100%
0604	**Other use of solvents and related activities**				
060403	Printing industry	129%	125%	111%	100%
060404	Fat, edible and non edible oil extraction	129%	116%	112%	100%
060405	Application of glues and adhesives	239%	156%	104%	100%
060406	Preservation of wood	108%	105%	100%	100%
060407	Under seal treatment and conservation of vehicles	97%	102%	103%	100%
060408	Domestic solvent use (other than paint application	separate analysed			
060411	Domestic use of pharmaceutical products (k)				
060412	Other (preservation of seeds,…)	108%	105%	101%	100%

5.2.4 Combination Top down – Bottom up approach

To verify and adjust the data the solvents given in the top down approach and the results of the bottom up approach were differentiated by 15 defined categories of solvent groups (see below Table 127). The differences between the quantities of solvents from the top down approach and bottom up approach respectively are lower than 10%. Table 127 shows the range of the differences in the considered pillar years broken down to the 15 substance categories.

Table 127: Differences between the results of the bottom up and the top down approach

	Acetone	Methanol	Propanol	Solvent naphta	Paraffins	Alcohols	Glycols	Ester	Aromates	Ether	org. acids	Ketones	Aldehydes	Amines	cycl. Hydrocarb.	Others	ences [kt/a]
2000																	**-14**
1995																	**-2**
1990																	**14**
1980																	**-18**

	Difference less than 2 kt/a
	Difference 2 -10 kt/a
	Difference greater than 10 kt/a

As the data of the top down approach were obtained from national statistics, they are assumed to be more reliable than the data of the bottom up approach. That's why the annual quantities of solvents used were taken from the top down approach while the share of the solvents for the different applications (on SNAP level 3) and the solvent emission factors have been calculated on the basis of the bottom up approach.

The following tables present activity data and implied emission factors (Table 128 and Table 129)

Table 128: Activity data of Category 3 Solvent and other product use [Mg]

SNAP		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
0601	**Paint application**													
060101	manufacture of automobiles	1.8	1.5	1.2	1.3	1.2	1.3	1.3	1.5	1.4	1.4	1.7	1.7	1.7
060102	car repairing	1.0	0.9	0.8	0.8	0.8	1.0	0.9	1.0	0.9	0.8	0.9	1.0	1.0
060103	construction and buildings	3.9	3.6	3.2	3.5	3.6	4.3	4.1	4.4	3.9	3.6	4.0	4.4	4.4
060104	domestic use	4.6	3.6	2.7	2.4	1.9	1.7	1.7	1.8	1.7	1.6	1.8	2.0	2.0
060105	coil coating	5.7	5.1	4.4	4.8	4.8	5.6	5.2	5.5	4.8	4.3	4.7	5.3	5.3
060107	wood coating	7.1	6.2	5.2	5.5	5.4	6.1	5.5	5.7	4.9	4.3	4.6	5.3	5.3
060108	Other industrial paint application	31.3	28.5	24.7	27.1	27.4	32.3	30.6	32.8	29.5	26.9	30.3	33.4	33.4
0602	**Degreasing, dry cleaning and electronics**													
060201	Metal degreasing	9.4	8.0	6.4	6.6	6.2	6.7	6.6	7.4	6.9	6.6	7.8	8.2	8.2
060202	Dry cleaning	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5	0.5	0.5
060203	Electronic components manufacturing	2.5	2.2	1.7	1.8	1.7	1.8	1.7	1.8	1.6	1.5	1.6	1.8	1.8
060204	Other industrial cleaning	4.1	3.9	3.5	4.0	4.2	5.1	5.3	6.1	5.9	5.8	7.0	7.2	7.2
0603	**Chemical products manufacturing AND processing**													
060305	Rubber processing	1.0	0.9	0.7	0.8	0.7	0.8	0.8	0.8	0.7	0.6	0.6	0.7	0.7
060306	Pharmaceutical products manufacturing	8.4	7.0	5.5	5.5	5.0	5.2	5.6	6.7	6.7	6.8	8.4	8.4	8.4
060307	Paints manufacturing	60.0	55.0	50.0	45.0	40.0	35.0	34.5	33.9	33.4	32.8	32.2	34.9	34.9
060308	Inks manufacturing	7.2	6.9	6.7	6.4	6.2	6.0	5.8	5.6	5.5	5.3	5.1	5.6	5.6
060309	Glues manufacturing	4.2	4.2	4.1	4.1	4.1	4.0	4.1	4.2	4.3	4.4	4.5	4.9	4.9
060310	Asphalt blowing	1.3	1.2	1.0	1.0	1.0	1.1	1.0	1.0	0.8	0.7	0.7	0.8	0.8
060311	Adhesive, magnetic tapes, films and photographs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
060312	Textile finishing	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
060314	Other	41.5	40.7	39.8	39.0	38.1	37.3	37.6	37.9	38.2	38.5	38.8	42.0	42.0
0604	**Other use of solvents and related activities**													
060403	Printing industry	14.9	13.2	11.2	11.9	11.8	13.5	12.6	13.2	11.6	10.4	11.4	12.8	12.8
060404	Fat, edible and non edible oil extraction	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
060405	Application of glues and adhesives	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6
060406	Preservation of wood	0.7	0.6	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6
060407	Under seal treatment and conservation of vehicles	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
060408	Domestic solvent use (other than paint application)	14.0	13.5	12.3	14.1	14.9	18.2	18.3	20.6	19.6	18.9	22.4	23.4	23.4
060411	Domestic use of pharmaceutical products (k)	5.1	4.6	4.1	4.5	4.6	5.4	5.3	5.8	5.3	5.0	5.8	6.2	6.2
060412	Other (preservation of seeds,…)	7.6	6.8	5.8	6.3	6.3	7.3	7.0	7.6	6.9	6.4	7.3	8.0	8.0

Table 129: Implied NMVOC emission factors for Solvent Use 1990-2002 [in %]

SNAP		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
0601	Paint application													
060101	manufacture of automobiles	94	88	82	76	70	64	63	62	60	59	57	56	56
060102	car repairing	98	97	97	97	96	96	95	93	92	91	89	88	88
060103	construction and buildings	92	90	89	87	86	84	85	86	86	87	88	89	89
060104	domestic use	88	89	89	89	89	89	89	89	89	89	89	89	89
060105	coil coating	84	79	74	69	63	58	57	56	55	54	53	52	52
060107	wood coating	94	89	85	80	76	71	71	70	69	68	67	66	66
060108	Other industrial paint application	78	70	62	54	46	37	36	35	33	32	30	29	29
0602	Degreasing, dry cleaning and electronics													
060201	Metal degreasing	93	86	78	71	63	56	54	51	49	47	45	43	43
060202	Dry cleaning	95	94	92	91	89	88	87	87	86	86	85	84	84
060203	Electronic components manufacturing	68	64	61	57	53	49	48	47	46	45	44	43	43
060204	Other industrial cleaning	72	72	71	71	70	70	69	69	69	68	68	68	68
0603	Chemical products manufacturing AND processing													
060305	Rubber processing	99	98	98	97	97	96	96	95	95	94	94	93	93
060306	Pharmaceutical products manufacturing	46	42	38	34	29	25	25	25	26	26	26	26	26
060307	Paints manufacturing	5	5	5	5	5	5	5	4	4	4	4	3	3
060308	Inks manufacturing	5	5	5	5	5	5	5	5	5	5	5	5	5
060309	Glues manufacturing	20	20	20	20	20	20	20	20	20	20	20	20	20
060310	Asphalt blowing	1	1	1	1	1	1	1	1	1	1	1	1	1
060311	Adhesive, magnetic tapes, films and photographs	100	100	67	100	100	75	75	100	100	100	80	100	100
060312	Textile finishing	89	88	89	89	89	88	89	89	87	89	89	89	89
060314	Other	22	22	21	21	20	20	19	18	18	17	16	15	15
0604	Other use of solvents and related activities													
060403	Printing industry	86	82	79	76	72	69	68	68	67	66	66	65	65
060404	Fat, edible and non edible oil extraction	19	19	19	20	20	20	20	20	20	20	20	20	20
060405	Application of glues and adhesives	86	83	79	76	72	69	68	67	66	65	64	63	63
060406	Preservation of wood	99	99	99	99	99	99	99	99	99	99	99	99	99
060407	Under seal treatment and conservation of vehicles	85	85	85	85	85	85	85	85	85	85	85	85	85
060408	Domestic solvent use (other than paint application)	84	84	84	84	84	84	84	84	84	84	84	84	84
060411	Domestic use of pharmaceutical products (k)	94	94	94	94	94	94	94	94	94	94	94	94	94
060412	Other (preservation of seeds,…)	92	82	72	62	53	43	41	40	38	36	35	33	33

5.2.5 Calculation of CO_2 emissions from Solvent Emissions

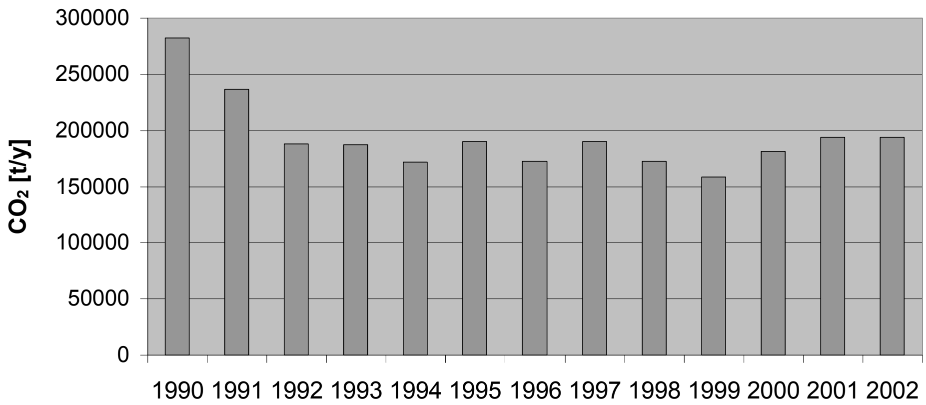
The basis for the calculation of the carbon dioxide emissions were the quantities of solvent emissions differentiated by the 15 groups of substances (acetone, methanol, propanol, solvent naphtha, paraffins, alcohols, glycols, ester, aromates, ketones, aldehydes, amines, organic acids, cyclic hydrocarbons, and others). Substance specific carbon dioxide factors for these 15 substance groups have been created (see Table 130) on the basis of the carbon content and the stoichiometrically formed CO_2.

Table 130: Substance specific carbon dioxide emission factors

Substances	CO_2 factor [kg CO_2/kg substance]
Acetone	2.28
Aldehydes	2.44
Alcohols	1.91
Alcohols / Propanols	2.20
Aromates	3.33
Cydic Hydrocarbons	3.14
Ester	2.16
Ether	2.38
Glycols	1.82
Ketones	2.45
Methanol	1.38
Paraffins	3.14
Residuals	0.92
Solvent naphta	3.14

The amount of carbon dioxide emissions was disaggregated to SNAP level 3 according to the share of solvents used and solvent emissions respectively, that were calculated in the context of the bottom up approach.

Figure 14: Carbon dioxide emission of Category 3 Solvent and Other Producte Use 1990-2002 [t/a]



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) [IIÖ&FIEU, 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

Uncertainty in Activities	Data source	1990 [%]	1995 [%]	2000 [%]	Uncertainty source
Substances	National statistics STAT.A, foreign trade balance	+2,5 to – 2,5 %	+1,5 to –1,5 %	+0,5 to –0,5 %	Expert judgement [IIÖ&FIEU, 2004]
Products	National statistics STAT.A, foreign trade balance	+10 to –10 %	+5 to –5 %	+2,5 to –2,5 %	Expert judgement [IIÖ&FIEU, 2004]
Solvent Production	National production statistics STAT.A,	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 [IIÖ&FIEU, 2004]

Table 132 presents the uncertainties of the emission factors that were obtained by expert judgement. A sensitivity analysis [FIEU&IIÖ, 2002a] showed a variation of 5% of the emission factors of solvent application in the year 2000.

Table 132: Uncertainties of Bottom- up approach

Uncertainty emissions factors	1990 [%]	1995 [%]	2000 [%]	Data and uncertainty source
Emissions factor	86%	63%	58%	[IIÖ&FIEU, 2004]
Uncertainty – emissions factor	+10 to –10%	+7 to –7%	+5 to 5%	Expert judgement [IIÖ&FIEU, 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%	[IIÖ&FIEU, 2004]

5.2.7 Recalculations

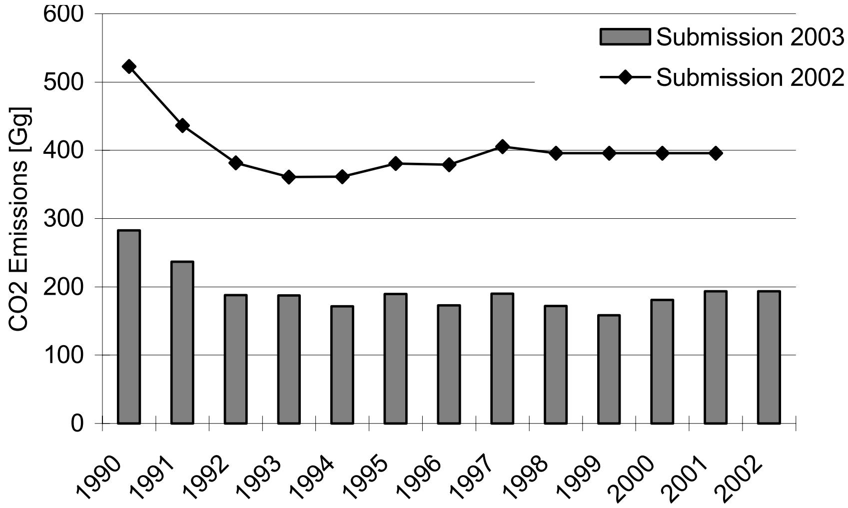
Data was recalculated and updated according to new national studies. The top down method is improved by combining it with a bottom up approach which is based on several surveys in industry and public.

In this submission the NMVOC content of solvents is estimated for each SNAP category separately (Level 3), the resulting average implied emission factor is 38% for the year 2000 and 49% for the year 1990 compared to 85% previously used for all years.

In the last submission the carbon content of NMVOC was assumed to be on average of 85% for all solvents. For this submission substance specific carbon dioxide factors were used.

The overall reduction is caused mainly by the high amount of solvents that are used as "non solvent application", that were identified by of the comparison of top down and bottom up approach.

Figure 15: Recalculations of Category 3 Solvent and Other Product Use



5.3 N_2O Emissions from Solvent and Other Product Use

Anaesthesia

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

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

Fire Extinguishers

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

Aerosol Cans

100% of N_2O used for aerosol cans is released into atmosphere, that's why the emission factor used is 1.00. It is assumed that the use of N_2O for aerosol cans is constant at 400 tons per year. This estimate is based on expert judgement and industry inquiries.

6 AGRICULTURE (CRF SECTOR 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 E., Strebl F., Orthofer R., (2002): Greenhouse Gas Emissions from Enteric Fermentation in Austria; ARC Seibersdorf research, July 2002*
- *Amon B., Hopfner- Sixt K., Amon T. (2002): Emission Inventory for the Agricultural Sector in Austria - Manure Management, Institute of Agricultural, Environmental and Energy Engineering (BOKU - University of Agriculture, Vienna), July 2002*
- *Strebl F., Gebetsroither E., Orthofer R., (2002): Greenhouse Gas Emissions from Agricultural Soils in Austria; ARC Seibersdorf research, revised version, Nov. 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 1999 Farm Structure Survey – full survey) [BMLFUW, 2003]:

Agriculture in Austria is small- structured: about 217 500 farms are managed, 41% of these farms manage less than 10 ha cultivated area. More than 85 000 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 3.4 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:

41% arable land

27% grassland (meadows mown several times and seeded grassland)

30% 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 2002 the sector *Agriculture* contributed 8.7% to the total of Austria's greenhouse gas emissions (not considering CO_2 emissions from LUCF). The trend of GHG emissions from 1990 to 2002 shows a decrease of 12.3% for this sector (see Figure 16 and Table 135) due to a decrease in activity data.

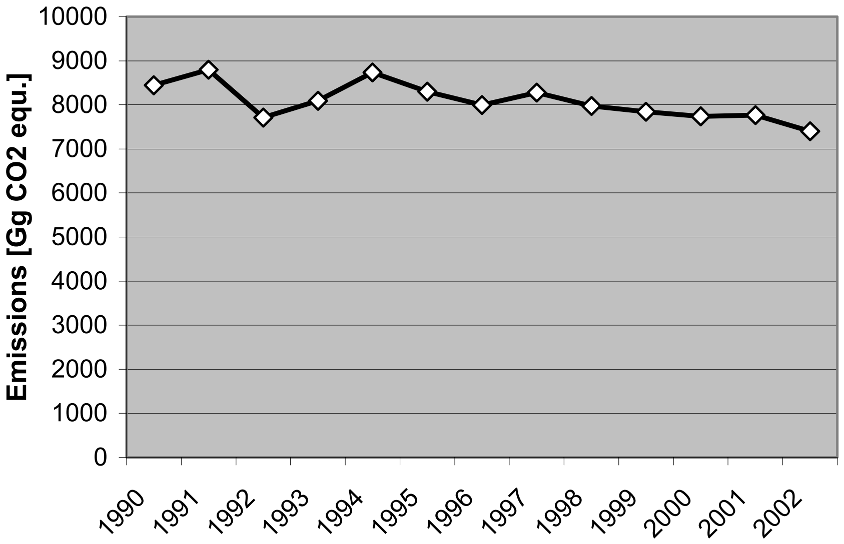


Figure 16: Trend of total GHG emissions from Agriculture

The fluctuations in the time series shown in Figure 16 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 12.9% since the base year mainly due to lower emissions from *Enteric Fermentation*. N_2O emissions decreased by 11.6% mainly due to lower emissions from *Agricultural Soils (direct and indirect emissions)*. The trend is presented in Table 134.

Table 134: Emissions of greenhouse gases and their trend from 1990-2002 from Category 4 Agriculture

Gas	GHG emissions [Gg]													Trend
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	90-02
CH_4	218.67	215.69	207.67	207.66	210.15	211.28	207.96	205.48	204.94	200.69	197.13	194.76	190.35	-12.9%
N_2O	12.42	13.76	10.80	12.04	13.93	12.46	11.71	12.78	11.84	11.70	11.60	11.85	10.98	-11.6%

Emission trends per sector

Table 135 presents total GHG emissions and trend 1990-2002 from *Agriculture* by subcategories as well as the contribution to the overall inventory emissions. Important sub- sectors are *4 A Enteric Fermentation* (3.7%) and *4 D Agricultural Soils* (3.2%) followed by *4 B Manure Management* (1.9%).

Table 135: Total GHG emissions (CO2 equivalent) and trend 1990 - 2002 by subcategories of Agriculture

Year	GHG emissions [Gg CO_2 equivalent] by sub categories				
	4	4 A	4 B	4 D	4 F
1990	**8443.72**	3563.22	1806.71	3071.05	2.74
1991	**8443.72**	3563.22	1806.71	3071.05	2.74
1992	**8794.67**	3514.79	1783.34	3493.80	2.74
1993	**7710.33**	3361.26	1740.23	2606.10	2.74
1994	**8092.87**	3361.66	1742.61	2985.86	2.73
1995	**8731.55**	3407.36	1759.56	3561.91	2.73
1996	**8298.04**	3433.77	1765.87	3095.68	2.72
1997	**7997.19**	3383.16	1733.49	2877.83	2.72
1998	**8275.98**	3330.78	1726.99	3215.53	2.69
1999	**7975.18**	3308.82	1735.70	2927.97	2.69
2000	**7842.11**	3271.34	1670.26	2897.83	2.68
2001	**7735.56**	3224.43	1628.38	2880.08	2.68
2002	**7764.41**	3167.49	1628.76	2965.48	2.68
Share in Austrian Total 2002	***8.7%***	*3.7%*	*1.9%*	*3.2%*	*0.0%*
Trend 1990-2002	***-12.3%***	*-12.9%*	*-12.4%*	*-11.7%*	*-2.3%*

As can be seen in Figure 17 and Table 135 the trend concerning emissions from all categories is decreasing. The reason for the nearly linear decrease of emissions from categories *4 A Enteric Fermentation* and *4 B Manure Management* is due to a decrease in livestock numbers (cattle and swine). Fluctuations of emissions from *4 D Agricultural Soils* are mainly due to varying underlying activity data (sales numbers of mineral fertilizers).

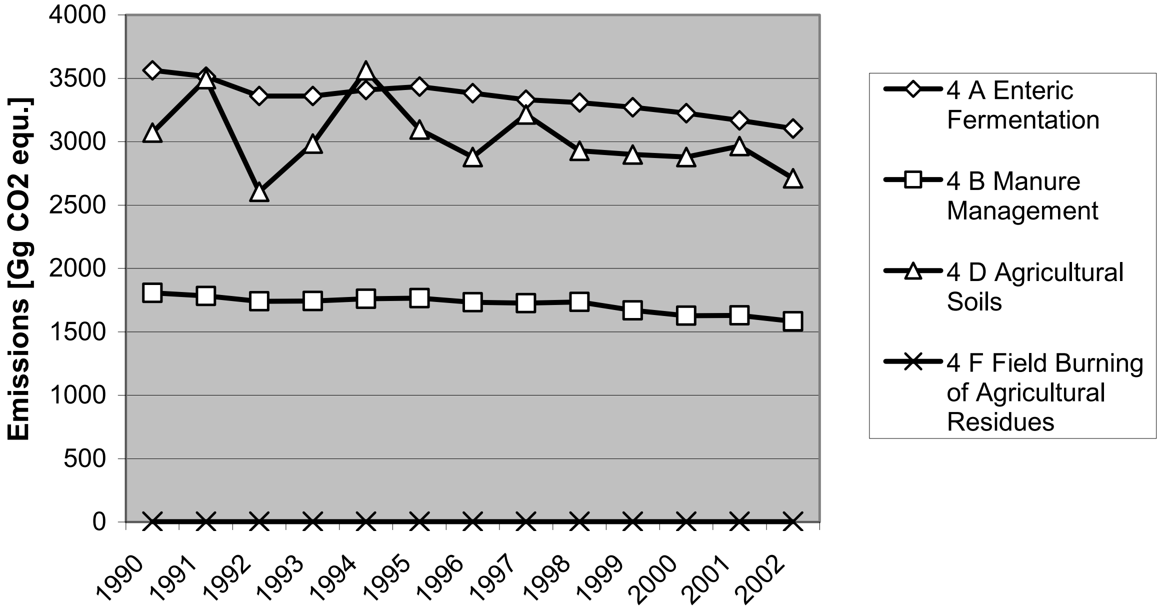


Figure 17: Emission trends of sub- sectors of Agriculture

As can be seen in Table 136, within the agricultural sector the subcategories *4 A* and *4 D* both contribute around 40% to total emissions, category *4 B* contributes another 20%. Sub category *2 F Field Burning of Agricultural Wastes* contributes only a negligible part (0.04% in 2002).

Table 136: Total greenhouse gas emissions and share of subcategories of Agriculture, 1990 and 2002

Year	GHG emissions [%] by sub categories				
	4	4 A	4 B	4 D	4 F
1990	100.0%	42.2%	21.4%	36.4%	0.0%
2002	100.0%	41.9%	21.4%	36.6%	0.0%

6.1.2 Key Sources

The key source analysis is presented in Chapter 1.5. This chapter includes information about the key sources in the IPCC Sector *4 Agriculture*. Key sources within this category are presented in Table 137.

Table 137: Key sources of Category 4 Agriculture

IPCC Category	Source Categories	Key Sources	
		GHG	KS-Assessment*
4 A 1	Cattle	CH_4	all
4 B 1	Cattle	N_2O	all LA, TA 91, 01, 02
4 B 1	Cattle	CH_4	all LA, TA 91, 99 - 02
4 B 8	Swine	CH_4	Al LA
4 D	Agricultural Soils	N_2O	all LA, TA 91, 92, 94, 96, 98, 99, 01, 02

* LA 90 = Level Assessment 1990
LA 90 - 01 = Level Assessments for all years between 1990 and 2001
TA 00 = Trend Assessment BY-2000

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 estimating emissions of category *4 F Field Burning of Agricultural Wastes* CORINAIR simple methodology was used.

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 138 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 138: 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]	--
4B1a	Dairy Cattle			+/- 65%[1]	- 50% to + 100%[2]

Categories		CH_4 Emissions	N_2O Emissions	EF CH_4	EF N_2O
4B1b	Non-dairy Cattle			+/- 75%[1]	- 50% to + 100%[2]
4B8	Swine	+/- 90%.		+/- 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	--	+/- 24 %	--	(see Table 179)
Activity Data					
	animal population	+/- 10%[4]			
	agricultural used land	+/- 5%[4]			

(1) Expert judgement by Dr. Barbara Amon, University of Agriculture Vienna (see also below under "Recalculation")

(2) IPCC

(3) Calculation by expert (Monte Carlo Analysis), DI Gebetsroither (see also below under "Recalculation")
(4) [WINIWARTER & RYPDAL, 2001]

6.1.6 Recalculations

4 A 1 a, 4 B 1 a, 4 D:

The time series of annual milk yields was revised by STATISTIK AUSTRIA. Background for this revision is the consideration of a new data source:

1990-1994: data are based on livestock counts held in December each year

1995-2002: a new data source was used: AMA-Rinderdatenbank (Bovine Database, agricultural marketing association AMA)

As the methodology for emissions from manure production of dairy cattle is based on milk yield data, this revision resulted in higher emissions.

4 B 8:

As recommended in the centralised review (October 2003), the age class split for swine categories for the years 1990–1992 was adjusted because there is an inconsistency in the time series in the statistical data set resulting from a changing methodology of the statistical survey in 1992/1993. The time series has been adjusted using the split from 1993, resulting in higher emissions for the years 1990-1992.

6.1.7 Completeness

Table 139 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 subcategory have been estimated.

Table 139: 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 100410	Laying hens Other poultry (ducks, gooses, etc.)	NE	NA
4 A 10	Other	100411 100415	Fur Animals Other animals	NE	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 100509	Laying hens Other poultry (ducks, gooses,…)	✓	✓
4 B 10	Anaerobic	100901	Anaerobic	NO	NO
4 B 11	Liquid Systems	100902	Liquid Systems	NO	✓
4 B 12	Solid Storage and Dry Lot	100903	Solid Storage and Dry Lot	NO	IE(3)
4 B 13	Other	100904	Other management	NO	IE(3)
4 B 13	Other	100510	Fur animals	NO	IE(3)
4 B 13	Other	100915	Other animals	NO	IE(3)

IPCC Category		SNAP		CH_4	N_2O
4 C	**RICE CULTIVATION**	100103 100103	Rice Field (with fertilizers) Rice Field (without fertilizers)	**NO**	**NO**
4 D	**AGRICULTURAL SOILS**	**1001** **1002**	**CULTURES WITH FERTILIZERS** **CULTURES WITHOUT FERTILIZERS**	**NO**	✓
4 D 1	Direct Soil Emissions	100205 100206	Grassland Fallows	NO	✓
4 D 2	Animal Production	--	--	NO	✓
4 D 3	Indirect Emissions	--	--	NO	✓
4 D 4	Other	--	--	NO	NO
4 E	**PRESCRIBED BURNING OF SAVANNAS**	**--**	**--**	**NO**	**NO**
4 F	**FIELD BURNING OF AGRICULTURAL WASTE**	**1003**	**ON- FIELD BURNING OF STUBBLE, STRAW, …**	✓	✓
4 F 1	Cereals	100301	Cereals	✓	✓
4 F 2	Pulse	100302	Pulse	NO	NO
4 F 3	Tuber and Root	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) included in categories *4 B 1 – 4 B 9*

Emissions from *4 A 9 Poultry* and *4 A 10 Other* were not estimated because no default emission factors are provided in the IPCC Guidelines.

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 2002 78% of the agricultural CH_4 emissions arose from this source category.

6.2.1 Source Category Description

CH_4 emissions amounted to 169.7 Gg in the "Kyoto" base year and have decreased by 12.9% to 147.8 Gg in 2002. Almost all emissions (94% in 2002) are caused by cattle farming. The contribution of *Dairy Cattle* to total emissions from cattle decreased from 50% in 1990 to 44% in 2002.

Table 140: Greenhouse gas emissions from Enteric Fermentation by sub categories 1990-2002

Year	CH_4 emissions [Gg] Livestock Category						
	4 A Total	4 A 1 a Dairy	4 A 1 b Non Diary	4 A 3 Sheep	4 A 4 Goats	4 A 6 Horses	4 A 8 Swine
1990	169.68	80.16	80.43	2.48	0.19	0.89	5.53
1991	167.37	77.94	80.12	2.61	0.20	1.04	5.46
1992	160.06	75.19	75.49	2.50	0.20	1.11	5.58
1993	160.08	74.27	76.00	2.67	0.24	1.17	5.73
1994	162.26	75.62	76.85	2.74	0.25	1.20	5.59
1995	163.51	68.55	84.90	2.92	0.27	1.30	5.56
1996	161.10	68.32	82.65	3.05	0.27	1.32	5.50
1997	158.61	71.22	77.17	3.07	0.29	1.34	5.52
1998	157.56	72.71	74.62	2.89	0.27	1.36	5.72
1999	155.78	70.28	75.77	2.82	0.29	1.47	5.15
2000	153.54	63.10	80.93	2.71	0.28	1.49	5.02
2001	150.83	61.31	79.97	2.56	0.30	1.53	5.16
2002	147.83	60.93	77.69	2.43	0.29	1.53	4.96
Share 2002	*100%*	*41.2%*	*52.6%*	*1.6%*	*0.2%*	*1.0%*	*3.4%*
Trend 1990-2002	*-12.9%*	*-24.0%*	*-3.4%*	*-1.8%*	*54.9%*	*72.8%*	*-10.4%*

The overall reduction is caused mainly by a decrease in the 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). CH_4 Emissions from the subcategory *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 Animals*. Emissions from these categories were not estimated.

Activity data

The Austrian official statistics [STATISTIK AUSTRIA, 2002] provides national data of annual livestock numbers on a very detailed level. These data are based on livestock counts held in December each year. The activity data used is presented in the following table. The inherent uncertainty is estimated to be about 5% [FREIBAUER & KALTSCHMITT, 2001].

Table 141: Domestic livestock population and its trend 1990-2002 (I)

Year	Population size [heads] * Livestock Category							
	Dairy	Non Dairy	Mother Cows (suckling cows >2yr)	Young Cattle <1yr	Young Cattle 1-2yr	Cattle > 2yr	Sheep	Goats
1990	904 617	1 679 297	47 020	925 162	560 803	146 312	309 912	37 343
1991	876 000	1 658 088	57 333	894 111	555 432	151 212	326 100	40 923
1992	841 716	1 559 009	60 481	831 612	521 078	145 838	312 000	39 400
1993	828 147	1 420 872	61 845	668 926	544 994	145 107	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
Trend	*-34.9%*	*-12.0%*	*421.0%*	*-30.8%*	*-19.8%*	*-2.2%*	*-1.8%*	*54.9%*

Table 142: Domestic livestock population and its trend 1990-2002 (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	0
1991	57 803	3 637 980	1 290 785*	377 152*	1 970 044*	14 397 143	13 478 820	918 323	0
1992	61 400	3 719 600	1 319 744*	385 613*	2 014 243*	13 683 900	12 872 100	811 800	0
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	83 000	3 347 931	1 211 988	334 278	1 801 665	11 786 670	11 077 343	709 327	38 475
2001	85 000	3 440 405	1 264 253	350 197	1 825 955	12 571 528	11 905 111	666 417	38 475
2002	85 000	3 304 650	1 187 908	341 042	1 775 700	12 571 528	11 905 111	666 417	38 475
Trend	*72.8%*	*-10.4%*	*-9.2%*	*-10.8%*	*-11.1%*	*-9.0%*	*-9.4%*	*-2.0%*	*3.7%*

*…..adjusted age class split for swine as recommended in the centralized review (October 2003)

The statistical data as presented above generally provides consistent time series. However, there have been minor inconsistencies for the categories cattle, poultry, horses and other. The explanations for these inconsistencies are presented below:

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 [STAT. ZENTRALAMT, 1991].

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 (October 2003), the age class split for swine categories of the years 1990-1992 was adjusted using the split from 1993.

1993: For the first time there was a collection of wild animals in enclosures.

The increase of the "*mother and suckling cows"* population and a concurrent decrease of the "*dairy cattle*" population in 1993 and again in 1995 and 2000 is a result of the increased financial support for "*mother and suckling cows"* [STAT. ZENTRALAMT, 1993 and 1995].

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.

Information about the extent of organic farming in Austria was provided in the Austrian INVEKOS[21] database [KIRNER & SCHNEEBERGER, 1999], which was established to ac-

[21] INVEKOS (**In**tegriertes **Ve**rwaltungs- und **Ko**ntrollsystem*, 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.

count 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 1980-1996) 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, mother cows, calves etc.). Table 143 shows the results of the shares of organic farming in the relevant livestock categories for 1997-2000.

For the years 1990-1996, a trend extrapolation using surrogate data was made, namely the number of farms that apply organic farming practices [BMLFUW, 2002]. 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.

Table 143: Share of animal population under organic farming systems (average 1997-2000, calculations by ARCS, based on INVEKOS data)

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

6.2.2.1 Cattle (4 A 1)

Key Source: Yes

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 2002 emissions from *Enteric Fermentation - Cattle* contributed 3.44% 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 141 and Table 142.

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)

The use of country specific values for the Gross Energy Intake results in a more precise estimation of CH_4 emissions from enteric fermentation than when applying IPCC default values.

The Gross Energy Intake for dairy cows was taken from a study by the animal nutrition experts [GRUBER & STEINWIDDER, 1996] who carried out intensive model calculations on nitrogen and phosphorus excretion of livestock. They modeled dairy cow diets typically fed in Austria, taking into account milk yields from 3 000 to 8 000 kg per cow and year and calculated the corresponding Gross Energy Intake (see Table 144).

Table 144: Energy intake for diary cattle in Austria in dependency of annual milk yield (after GRUBER & STEINWIDDER 1996)

Milk yield	3 500	4 000	4 500	5 000
Gross energy intake [MJ GE day^{-1}]	214.96	227.63	240.22	252.75

For calculation of the average gross energy intake of Austrian dairy cattle the average milk yield of Austrian cows was converted like presented in the study mentioned above. The time series of average milk yields of the cattle was taken from national statistics and are presented in Table 146. For dairy cattle there was a ~17% increase of GE intake between 1990 and 2002 due to the increase of the milk yield per dairy cow in this time.

GE Gross energy intake of Non-Dairy Cattle (1 A 1 b)

Gross energy intake for *Non-Dairy Cattle* was calculated from typical Austrian diets of these livestock categories. Animal nutrition expert Dr. Andreas Steinwidder[22] worked out animal diets as shown in Table 145. There are distinct differences in organic and conventional diets for *Non-Dairy Cattle*. 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]. As no major changes in diets of *Non-Dairy Cattle* occurred in the period from 1980-2001, methane emissions from enteric fermentation of *Non-Dairy Cattle* are calculated with a constant gross energy intake for the whole time series.

Table 145: Typical Austrian diets and gross energy intake of Non-Dairy Cattle, conventional and organic production system.

		Suckling cows	cattle < 1 year	cattle 1-2 years	non dairy cattle > 2 years
CONVENTIONAL	live weight	600 kg	210 kg	530 kg	600 kg
	animal diet	50 % green feeding 20 % hay 30 % grass silage	15 % green feeding 20 % hay 30 % grass silage 35 % maize silage	20 % green feeding 15 % hay 30 % grass silage 35 % maize silage	40 % green feeding 20 % hay 30 % grass silage 10 % maize silage
	Gross Energy Intake [(MJ GE (kg dry matter)$^{-1}$]	191.56	84.36	166.96	163.44
		Suckling cows	cattle < 1 year	cattle 1-2 years	non dairy cattle > 2 years
ORGANIC	live weight	600 kg	190 kg	480 kg	580 kg
	animal diet	50 % green feeding 20 % hay 30 % grass silage	35 % green feeding 20 % hay 45 % grass silage	40 % green feeding 15 % hay 45 % grass silage	40 % green feeding 15 % hay 45 % grass silage
	Gross Energy Intake [(MJ GE (kg dry matter)$^{-1}$]	191.56	72.06	151.14	159.93

The resulting emission factors are presented in the following tables:

Table 146: Annual milk yield, Gross Energy Intake and Emission Factors of Dairy Cattle 1990-2002

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Milk Yield [kg/cow*yr]	3791	3862	3934	4005	4076	4619	4670	4787	4924	5062	5210	5394	5487
Gross Energy Intake [MJ GE/head*day]	225	226	227	228	237	247	249	251	254	256	258	261	263
Emission Factor [kg CH4/head*yr]	89	89	89	90	93	97	98	99	100	101	102	103	103

[22] Dr. Andreas Steinwidder, head of department animal production of the Federal Research Institute for Agriculture in Alpine Regions (BAL Gumpenstein)

Table 147: Emission Factors and Gross Energy Intake of Non- Dairy Cattle 1990-2002

IPCC Category	Farming type	Gross Energy Intake [MJ/head.day]	Calculated Emission Factor [kg CH_4/head.yr]
Mother cows suckling > 2 yr	conventional	192	75
Mother cows suckling > 2 yr	organic	192	75
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) and Swine (4 A 8)

Key Source: No

As presented in Table 140, CH_4 emissions from *Sheep, Goats, Horses* and *Swine* are only minor emission sources of category *4 A Enteric Fermentation*. Together they contributed 6.2% to total emissions from this category in 2002. The most important sub source is *Swine*, with a contribution of 3.4%, followed by *Sheep* (1.6%), *Horses* (1.0%) and finally *Goats* with 0.2% (figures are also presented in Table 140).

Emissions from this category were estimated using the IPCC Tier 1 methodology. Default emission factors were taken from the IPCC Guidelines and are presented in the following table:

Table 148: 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	8	4 A 6 Horses	18
4 A 4 Goats	5	4 A 8 Swine	1.5

* Source: IPCC Reference Manual p.4.10

Activity data were obtained from national statistics and are presented in Table 141 and Table 142. For all swine categories an emission factor of 1.5 kg/head*yr was used.

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: (Source: 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 149: 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
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

IPCC Category	Farming Type	Standard deviation (σ) in %
Swine for breeding > 50 kg	Conventional	30
Swine for breeding > 50 kg	Organic	32
Swine for breeding > 50 kg	Total	30
YOUNG SWINE		
Young Swine < 50 kg	Conventional	31
Young Swine < 50 kg	Organic	32
Young Swine < 50 kg	Total	31
SHEEPS	Conventional	31
SHEEPS	Organic	32
SHEEPS	Total	31
GOATS	Conventional	31
GOATS	Organic	32
GOATS	Total	31
POULTRY	Total	Not estimated
SOLIPEDS	Total	5
Horses	Conventional	5
Other Solipeds	Conventional	Not estimated
OTHER ANIMAL	Conventional	Not estimated
Total		**4**

Table 149 presents the standard deviations for CH_4 emissions from animal categories. The uncertainty is defined as +/- 2 σ.

6.2.4 Recalculations

As indicated in the last year's NIR, in this submission the revised milk yield data compiled by STATISTIK AUSTRIA was used (also see Chapter 6.1.6).

The estimation of CH_4 emissions from enteric fermentation / diary cattle is based on gross energy intake depending on milk yield data. Thus, reversed higher milk yield data led to higher emissions.

Table 150: Difference to last year's submission of CH_4 emissions from subcategories of Category 4 A

Year	CH_4 emissions [Gg]	
	4 A Total	4 A 1 a Dairy
1990	0.40	0.40
1991	0.39	0.39
1992	0.37	0.37
1993	0.37	0.37
1994	3.06	3.06

1995	4.07	4.07
1996	3.51	3.51
1997	3.12	3.12
1998	2.61	2.61
1999	1.99	1.99
2000	1.33	1.33
2001	0.84	0.84

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 2002 22% of the agricultural CH_4 emissions and 21% of the agricultural N_2O emissions were caused by this source category.

6.3.1 Source Category Description

From 1990 to 2002 CH_4 emissions from *Manure Management* decreased by 13.5% to 42.02 Gg. This is mainly due a the decrease of the livestock categories cattle and swine.

Table 151: CH_4 Emissions from Manure Management 1990-2002

	CH_4 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 13
1990	**48.59**	15.80	10.27	0.06	0.00	0.07	21.32	1.08	0.00
1991	**47.92**	15.33	10.29	0.06	0.00	0.08	21.03	1.12	0.00
1992	**47.22**	14.76	9.74	0.06	0.00	0.09	21.50	1.07	0.00
1993	**47.04**	14.56	9.11	0.06	0.01	0.09	22.08	1.13	0.01
1994	**47.42**	14.63	9.75	0.07	0.01	0.09	21.77	1.11	0.01
1995	**47.25**	13.10	11.05	0.07	0.01	0.10	21.83	1.09	0.01
1996	**46.34**	12.98	10.85	0.07	0.01	0.10	21.31	1.01	0.01
1997	**46.35**	13.45	10.21	0.07	0.01	0.10	21.35	1.15	0.01
1998	**46.86**	13.65	9.88	0.07	0.01	0.10	22.02	1.12	0.01
1999	**44.39**	13.12	10.11	0.07	0.01	0.11	19.84	1.13	0.01
2000	**43.07**	11.72	10.98	0.06	0.01	0.12	19.25	0.92	0.01
2001	**43.42**	11.32	10.80	0.06	0.01	0.12	20.12	0.98	0.01
2002	**42.02**	11.19	10.45	0.06	0.01	0.12	19.20	0.98	0.01
Share 2002	***100%***	*26.6%*	*24.9%*	*0.1%*	*0.0%*	*0.3%*	*45.7%*	*2.3%*	*0.0%*
Trend 1990-2002	***-13.5%***	*-29.1%*	*1.8%*	*-1.8%*	*54.9%*	*72.8%*	*-9.9%*	*-9.0%*	*0.0%*

From 1990 to 2002 the N_2O emissions from *Manure Management* decreased by 10.8% to 2.26 Gg. Emissions of cattle dominate the trend. The reduction of diary cows is partly counterbalanced by an increase in emissions per animal (because of the increasing gross energy intake, milk production and N excretion of diary cattle since 1990).

Table 152: N_2O Emissions from Manure Management 1990-2002

	N_2O 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 13 Other
1990	**2.54**	1.13	1.01	0.009	0.0002	0.001	0.304	0.085	1.13
1991	**2.51**	1.10	1.01	0.010	0.0003	0.001	0.300	0.090	1.10
1992	**2.41**	1.06	0.95	0.009	0.0002	0.001	0.306	0.085	1.06
1993	**2.43**	1.04	0.97	0.010	0.0003	0.001	0.315	0.090	1.04
1994	**2.46**	1.07	0.99	0.010	0.0003	0.001	0.310	0.089	1.07
1995	**2.50**	0.97	1.12	0.011	0.0003	0.001	0.310	0.086	0.97
1996	**2.45**	0.96	1.09	0.011	0.0003	0.001	0.302	0.080	0.96
1997	**2.43**	1.01	1.02	0.011	0.0004	0.001	0.302	0.091	1.01
1998	**2.42**	1.03	0.98	0.011	0.0003	0.001	0.315	0.088	1.03
1999	**2.38**	0.99	1.00	0.011	0.0004	0.001	0.284	0.089	0.99
2000	**2.34**	0.89	1.08	0.010	0.0004	0.001	0.276	0.073	0.89
2001	**2.31**	0.87	1.07	0.010	0.0004	0.001	0.288	0.077	0.87
2002	**2.26**	0.86	1.04	0.009	0.0004	0.001	0.274	0.077	0.86
Share 2002	***100%***	*38.1%*	*45.8%*	*0.4%*	*0.0%*	*0.1%*	*12.1%*	*3.4%*	*0.0%*
Trend 1990-2002	***-10.8***	*-23.8%*	*3.1%*	*-1.8%*	*54.9%*	*72.8%*	*-9.8%*	*-8.6%*	*0.0%*

6.3.2 Methodological Issues

The IPPC-Tier 2 methodology is applied to estimate CH_4 emissions from manure management of cattle and swine as these are key sources. This method requires detailed information on animal characteristics and the manner in which manure is managed. Sheep, goats, horses and other soliped, chicken, other poultry and other animals are of minor importance in Austria, therefore the CH_4 emissions of these livestock categories are estimated with the Tier 1 approach.

For the estimation of N_2O emissions a Tier 1 methodology is used. N_2O emissions are calculated on the basis of N excretion per animal and waste management system.

Data of Austria's manure management system distribution were taken from [KONRAD, 1995].

Activity data

[STATISTIK AUSTRIA, 2002] provides national data of annual livestock numbers on a very detailed level (see Table 141 and Table 142).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

6.3.2.1.1 Cattle (4 B 1)

Key Source: Yes (CH_4 level 0.54%, N_2O level 0.70%)

B0i Values

IPCC default values were used (Appendix B, IPCC Guidelines, Reference Manual)

MCF Values

Due to the lack of sufficiently detailed information about manure systems in Austria, the default MCF values for "cool climate regions" presented in the IPCC Guidelines' Reference Manual (table 4-8) were used. For liquid systems the revised GPG default value of 39% was used.

Manure Management Systems

In Austria national statistics on manure management systems are not available. Up to now, only one comprehensive survey has been carried out [KONRAD, 1995] (Table 153). This manure management system distribution was used for the whole period from 1990-2002.

Table 153: Manure Management System distribution in Austria: Cattle

Livestock category	Liquid/Slurry [%]	Solid Storage [%]	Pasture/range/paddock [%]
dairy cattle summer	16.7[1]	62.0[1]	21.3[1]
dairy cattle winter	21.2[1]	78.8[1]	---
Dairy cattle winter/summer	18.95[1]	70.4[1]	10.65[1]
suckling cows summer	16.7[1]	62.0[1]	21.3[1]
suckling cows winter	21.2[1]	78.8[1]	---
suckling cows winter/summer	18.95[1]	70.4[1]	10.65[1]
cattle 1 –2 years summer	7.7[1]	39.9[1]	52.4[1]
cattle 1 –2 years winter	16.2[1]	83.8[1]	---
cattle 1 –2 years winter/summer	11.95[2]	61.85[2]	26.2[2]

Livestock category	Liquid/Slurry [%]	Solid Storage [%]	Pasture/range/paddock [%]
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 153). During the summer months, a part of the manure from these livestock categories is managed in "pasture/range/paddock". The value for "pasture/range/paddock" is estimated as follows: During summer, 14.1% of Austrian dairy cows and suckling cows are on alpine pastures 24 hours a day. 43.6 % are on pasture for 4 hours a day and 42.3 % stay in the housing for the whole year [KONRAD 1995]. "Alpine pasture" and "pasture" are counted together as MMS "pasture/range/paddock". As "pasture" only lasts for about 4 hours a day, only 1/6 of the dairy cow pasture-% (43.6%) is added to the total number. This results in 21.3% "pasture/range/paddock" during summer. In winter, "pasture/range/paddock" does not occur in Austria. Summer and winter both last for six months.

VS Values

Values for VS excretion of *Diary Cattle* specific for Austria have been calculated with the country specific data given in [SCHECHTNER, 1991] and [GRUBER & STEINWIDDER 1996]:

Table 154: VS excretion after [GRUBER & STEINWIDDER 1996]

	VS excretion after [GRUBER & STEINWIDDER 1996].			
Milk Yield [kg/cow*yr]	3500	4000	4500	5000
VS	3.53	3.65	3.75	3.86

[GRUBER & STEINWIDDER 1996] calculated manure production of *Diary Cattle* in dependency on annual milk yields. Using this information, a time series of manure production was calculated:

Table 155:VS excretion of Austrian diary cows for the period 1990-2002

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Milk Yield [kg/cow*yr]	3791	3862	3934	4005	4076	4619	4670	4787	4924	5062	5210	5394	5487
VS	3.63	3.64	3.64	3.65	3.75	3.85	3.87	3.88	3.89	3.91	3.92	3.93	3.95

Austrian specific values on VS excretion of *Non-Dairy Cattle* were calculated from feed intake (gross energy intake, feed digestibility, ash content). This approach has been chosen as it allows to differentiate between organic and conventional production systems. Nutrition expert Dr. Steinwidder worked out country-specific feed rations under organic and conventional management (see Table 145). As no major changes in diets of *Non-Dairy Cattle* occurred in the period from 1990-2002, methane emissions from manure management of *Non-Dairy Cat-*

tle 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:

$$VS\ [kg\ dm\ day^{-1}] = Intake\ [MJ\ day^{-1}] * (1kg\ (18.45\ MJ)^{-1}) * (1 - DE\%/100) * (1 - ASH\%/100)$$

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 156 presents data for the calculation of VS excretion of the livestock categories *Non-Dairy Cattle*.

Table 156: Austrian VS excretion rates of Non-Dairy Cattle, conventional and organic production system

	Suckling cows		cattle < 1 year		cattle 1-2 years		non dairy cattle > 2 years	
	Conv.	Org.	Conv.	Org.	Conv.	Org.	Conv.	Org.
feed digestibility [%]	64	64	76	75	73	73	73	73
ash content [%]	11.5	11.5	12.0	12.0	11.5	11.5	11.0	11.0
Gross energy intake [MJ GE (kg dry matter)$^{-1}$]	191.56	191.56	84.36	72.06	166.96	151.14	163.44	159.93
VS excretion [kg head^{-1} day^{-1}]	3.31	3.31	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%.

6.3.2.1.2 Swine (4 B 8)

Key Source: Yes (CH_4, level assessment for 2002 0.48%)

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 157: 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]	---
nursery and growing pigs	81.38[1]	18.62[1]	---

[1]. "Die Rinder-, Schweine- und Legehennenhaltung in Österreich aus ethologischer Sicht" [KONRAD, 1995]
[2]..Estimation of Dipl.-Ing. Alfred Pöllinger (Federal Research Institute, Gumpenstein) following [KONRAD, 1995]

VS excretion

VS excretion of *Swine* was estimated from country-specific data on VS content in the manure [SCHECHTNER, 1991]. Changes in animal performance of *Swine* are not reported for Austria. Thus, VS excretion rates of *Swine* were kept constant for the whole time series. As already mentioned above, 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].

Table 158. 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

6.3.2.1.3 Sheep (4 B 3), Goats (4 B 4), Horses (4 B 6), Poultry (4 B 9) and Other Animals (4 B 13)

CH_4 emissions from *Manure Management* for *Sheep, Goats, Horses, Poultry* and *Other Animals* are estimated with the Tier 1 approach. A differentiation between organic and conventional management is not possible due to lack of data.

Default emission factors were taken from the IPCC guidelines (Table 4-5 of the reference manual). Default emission factors are multiplied with annual livestock populations in Austria to estimate CH_4 emissions from these sources.

Table 159: CH_4 emissions from manure management systems for Sheep, Goats, Horses and Other Soliped, Chicken, Other Poultry and Other Animals 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 Animals	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* (1.39 kg CH_4 per head per year).

6.3.2.2 Estimation of N_2O Emissions

All emissions of N_2O taking place before the manure is added to soils are to be 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).

<u>N excretion per animal waste management system:</u>

$$Nex_{(AWMS)} = \sum_{(T)}[N_{(T)} \times Nex_{(T)} \times AWMS_{(T)}]$$

$Nex_{(AWMS)}$	=	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

<u>N_2O emission per animal waste management system:</u>

$$N_2O_{(AWMS)} = \sum[Nex_{(AWMS)} \times EF_{3(AWMS)}]$$

$N_2O_{(AWMS)}$	=	N_2O emissions from all animal waste management systems in the country [kg N yr^{-1}]
$Nex_{(AWMS)}$	=	N excretion per animal waste management system [kg yr^{-1}]
$EF_{3(AWMS)}$	=	N_2O emissions factor for an AWMS [kg N_2O-N per kg of Nex in AWMS]

AWMS

The animal waste management system distribution data used to estimate N_2O emissions from *Manure Management* are the same as those that were used to estimate CH_4 emissions from *Manure Management* (see Table 153 and Table 157).

N excretion

For *Goats, Sheep, Horses, Chicken, Other Poultry* and *Other Animal* default values for N excretion were used, whereas for *Cattle* and *Swine* country specific emission factors as presented below were applied.

N excretion from Austrian *Dairy Cattle* was calculated after [GRUBER & STEINWIDDER, 1996], who intensively reviewed research on N excretion in dependency on the annual milk yield (Table 160).

Table 160: N excretion of Austrian dairy cows for the period 1990-2002

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	54.33	1996	4 670	61.64
1990	3 791	55.82	1997	4 787	62.25
1991	3 862	55.97	1998	4 924	62.86
1992	3 934	56.12	1999	5 062	63.48
1993	4 005	56.27	2000	5 210	64.09
1994	4 076	58.64	2001	5 394	64.71
1995	4 619	61.02	2002	5 487	65.32

N excretion rates for the livestock categories of *Non-Dairy Cattle* were derived from different sources (Table 161). The milk production of *Suckling Cows* is about 3 000 kg, thus the value of N excretion of *Dairy Cattle* with that annual milk production taken from [GRUBER & STEINWIDDER, 1996] was used for this livestock category. N excretion of *Cattle 1-2 years* were taken from this study as well. However, [GRUBER & STEINWIDDER, 1996] do not give data on N excretion of *Cattle <1 year* and *Cattle >2 years.* As there is no significant difference in husbandry of these livestock categories, N excretion of *Cattle <1 year* was taken from the revised German inventory on ammonia emissions and for N excretion of *Cattle >2 years* the value of the Swiss inventory was used.

Austrian specific N excretion values for *Swine* were also taken from [GRUBER & STEINWIDDER, 1996] (Table 161).

Table 161: N excretion values used for calculation of N_2O emissions from manure management

Livestock category	Nitrogen excretion [kg per animal per yr]
suckling cows[1]	51.9[2]
cattle 1 – 2 years	42.2[2]
cattle < 1 year	16.0[3]
cattle > 2 years	60.0[4]
breeding sows[5]	26.9[2]
fattening pigs	15.0[4]
Sheep	20.0[6]
Goats	20.0[6]
Horses	50.0[7]
Chicken	0.8[6]
Other Poultry	2.0[7]
Other Animals	20.0[6]

(1) annual milk yield: 3 000 kg
(2) GRUBER & STEINWIDDER 1996
(3) DÖHLER ET AL. 2001
(4) Eidgenössische Forschungsanstalt für Agrarökologie und Landbau Zürich-Reckenholz 1997
(5) 2.1 litters per year
(6) IPCC DEFAULT
(7) CORINAIR

Livestock numbers per category can be found in Table 141 and Table 142, manure management system distribution for cattle and swine can be found in Table 153 and Table 157. For the other categories it is presented in the following table (Table 162).

Table 162: Distribution of manure management systems in Austria: Sheep, Goats, Horses, Poultry and Other Animals

Livestock category	Liquid/Slurry [%]	Solid Storage [%]	Pasture/ range/paddoc k [%]	Other Management System [%]
Sheep	2	0	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 163. 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 138.

6.3.4 Recalculations

4 B 1 a:

The revised time series of annual milk yields [BMLFUW, 2003] resulted in higher emissions from diary cattle.

4 B 8:

As recommended in the centralised review (October 2003), the age class split for swine categories for the years 1990–1992 was adjusted because there is an inconsistency in the time series in the statistical data set resulting from a changing methodology of the statistical survey in 1992/1993. The time series has been adjusted using the split from 1993, resulting in higher emissions for the years 1990-1992.

Table 164: Difference to last submission of CH_4 emissions from subcategories of Category 4 B

IPCC Categories	[Gg CH_4]											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
4B MANURE MANAGEMENT	7.30	7.29	7.28	0.05	0.40	0.58	0.49	0.45	0.36	0.29	0.18	0.11
4B1 Cattle	0.03	0.07	0.06	0.04	0.39	0.57	0.48	0.44	0.35	0.28	0.17	0.10
4B1a Dairy	0.03	0.07	0.06	0.05	0.40	0.58	0.49	0.45	0.36	0.29	0.18	0.10
4B8 Swine	7.27	7.22	7.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 165: Difference to last submission of N_2O emissions from subcategories of Category 4 B

IPCC Categories	[Gg N_2O]											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
4B MANURE MANAGEMENT	0.12	0.12	0.12	0.00	0.04	0.06	0.05	0.05	0.04	0.03	0.02	0.03
4B1 Cattle	0.00	0.00	0.00	0.00	0.04	0.06	0.05	0.04	0.04	0.03	0.02	0.03
4B1a Dairy	0.00	0.00	0.00	0.00	0.04	0.06	0.05	0.05	0.04	0.03	0.02	0.03
4B8 Swine	0.12	0.12	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

6.3.5 Planned Improvements

A survey on Austria's distribution of manure management systems is planned to be started this year.

6.4 Agricultural Soils (CRF Source Category 4 D)

6.4.1 Source Category Description

N_2O emissions from category *4 D Agricultural Soils* are a key source (see Table 137).

In 2002 79% of total N_2O emissions from *Agriculture* (47% 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 3.2% (2711.18 Gg CO_2 equivalents) to Austria's total greenhouse gas emissions in the year 2002. This is 37% of total GHG emissions of the sector *Agriculture*.

The trend of N_2O emissions from this category is decreasing: in 2002 emissions were 11.8% below 1990 levels.

Table 166 presents N_2O emissions of *Agricultural Soils* by subcategory as well as their trends and their share in total N_2O emissions.

Table 166: N_2O emissions from Category 4 D, 1990-2002

Year	N2O emissions [Gg] IPCC Categories										
	4 D total	**4 D 1** Direct Soil Emissions	Synthetic Fertilisers	Organic Fertiliser	Crop Residue	N-fixing Crops	Sewage Sludge	**4 D 2** Animal Production	**4 D 3** Indir. Soil Emissions	Nitrogen Leaching	Athm. Deposition
1990	**13.66**	**5.46**	2.68	2.00	0.43	0.33	0.02	**0.64**	**3.78**	3.37	0.41
1991	**15.52**	**6.32**	3.45	2.00	0.48	0.36	0.02	**0.66**	**4.27**	3.85	0.42
1992	**11.51**	**4.62**	1.74	1.94	0.46	0.46	0.02	**0.64**	**3.12**	2.74	0.38
1993	**13.19**	**5.31**	2.36	1.99	0.47	0.45	0.03	**0.71**	**3.59**	3.19	0.40
1994	**15.72**	**6.48**	3.39	2.00	0.61	0.45	0.03	**0.72**	**4.26**	3.84	0.42
1995	**13.65**	**5.51**	2.44	2.03	0.69	0.32	0.03	**0.75**	**3.69**	3.29	0.41
1996	**12.73**	**5.03**	2.15	2.00	0.51	0.34	0.03	**0.75**	**3.48**	3.08	0.39
1997	**14.21**	**5.72**	2.74	2.00	0.53	0.40	0.03	**0.76**	**3.87**	3.46	0.41
1998	**12.90**	**5.20**	2.16	2.00	0.58	0.43	0.03	**0.73**	**3.48**	3.09	0.40
1999	**12.76**	**5.15**	2.16	1.95	0.61	0.39	0.03	**0.73**	**3.44**	3.05	0.39
2000	**12.72**	**5.09**	2.30	1.89	0.48	0.37	0.03	**0.71**	**3.46**	3.09	0.38
2001	**13.09**	**5.28**	2.47	1.88	0.53	0.36	0.03	**0.70**	**3.55**	3.18	0.38
2002	**11.95**	**4.80**	2.02	1.84	0.54	0.38	0.03	**0.69**	**3.23**	2.86	0.37
Share 2002	***100%***	***55.1%***	*23.2%*	*21.1%*	*6.2%*	*4.3%*	*0.4%*	***7.9%***	***37.0%***	*32.9%*	*4.2%*
Trend 90-02	***-11.8%***	***-12.1%***	*-24.8%*	*-7.9%*	*25.6%*	*13.8%*	*26.3%*	***6.4%***	***-14.5%***	*-15.0%*	*-10.3%*

CH_4 emissions from Agricultural Soils originate from sewage sludge spreading on agricultural soils. Emissions from this category contribute only a negligible part of Austria's total greenhouse gas emissions (0.01% or 6.88 Gg CO_2 equivalents 2002). This is 0.12% of total GHG emissions of the sector *Agriculture*.

Table 167:CH_4 emissions from Category 4 D, 1990-2002

Year	CH_4 emissions [Gg] IPCC Category	
	4 D total	**4 D 1** Direct Soil 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	0.43	0.43
Share 2002	*100.0%*	*100.0%*
Trend 90-02	*32.0%*	*32.0%*

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
Direct Soil Emissions		
Synthetic Fertilizers (mineral fert.)	0.0125	IPCC
Animal Waste applied to soils		
N- fixing Crops		
Crop Residue		
Sewage Sludge		
Animal Production Grazing animals	0.02/ t N_{exGRAZ}	IPCC
Indirect Soil Emissions		
Athmospheric Deposition	0.01/ t of volatized nitrogen	IPCC
Nitrogen Leaching (and Run- off)	0.0025/ t N- loss by leaching	IPCC

For sewage sludge also CH_4 emissions were estimated.

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
Direct Soil Emissions	
Synthetic Fertilizers (mineral fert.)	fertilizer consumption: Grüner Bericht 2002 [BMLFUW, 2003] (1) ; urea application in Austria: Sales data RWA, 2003 (2)
Animal Waste applied to soils	calculations and expert judgement by Dr. Barbara Amon following [GRUBER & STEINWIDDER, 1996]
N- fixing Crops	Cropped area legume production: [BMLFUW, 2003], (1)
Crop Residue	Harvested amount of different agricultural crops: [BMLFUW, 2003], (1)
Sewage Sludge	Water Quality Report 2000 [PHILIPPITSCH ET AL., 2001], Report on sewage sludge [SCHARF ET AL., 1997], Gewäserschutzbericht 2002 [BMLFUW 2002]
Animal Production Grazing animals	calculations and expert judgement by Dr. Barbara Amon following [GRUBER & STEINWIDDER, 1996]
Indirect Soil Emissions	
Athmospheric Deposition	calculations and expert judgement by Dr. Barbara Amon following [GRUBER & STEINWIDDER, 1996]
Nitrogen Leaching (and Run- off)	see above (synthetic fertilizers, animal waste, sewage sludge)

[1] http://www.awi.bmlf.gv.at (Bundesanstalt für Agrarwirtschaft des BMLFUF)

[2] RWA: Raiffeisen Ware Austria

Detailed data about the use of different kinds of fertilizer are available until 1994, because until then, a fertilizer tax („Düngemittelabgabe") had been collected. Data about the total synthetic fertilizer consumption are available for amounts (but not for fertilizer types) from the statistical office (STATISTIK AUSTRIA) and from an agricultural marketing association (Agrarmarkt Austria, AMA). Annual sales figures about urea are available for the years 1994 onwards from a leading fertilizer trading firm (RWA). These sources were used to get a time series of annual fertilizer application distinguishing urea fertilizers and other fertilizers ("mineral fertilizers").

The time series for fertilizer consumption is presented in Table 170. From the different synthetic nitrogen or combined fertilizers applied in Austria, only between 2 and 6% are urea fertilizers.

Table 170: Mineral fertiliser N consumption in Austria 1990-2001

Year	Nutrient Consumption [t N/yr]	of which Urea	Fraction Urea from total N fertiliser consumption [%]	Data Source
1990	140 379	3 965	2.8	estimated, GB[1]
1991	180 388	3 965	2.2	GB[1]
1992	91 154	3 886	4.3	GB[1]
1993	123 634	3 478	2.8	GB[3], RWA[2]
1994	177 266	4 917	2.9	GB[3], RWA[2]
1995	127 963	5 198	4.1	GB[3], RWA[2]
1996	112 641	4 600	4.1	GB[3], RWA[2]
1997	143 818	6 440	4.5	GB[3], RWA[2]
1998	113 301	6 440	5.7	GB[3], RWA[2]
1999	113 409	6 808	6.0	GB[3], RWA[2]
2000	120 541	3 848	3.2	GB[3], RWA[2]
2001	129 100	3 329	2.6	GB[3], RWA[2]
2002	105 899	5 297	5.0	GB[3], RWA[2]

1 [GRÜNER BERICHT, 1999]
2 Raiffeisen Ware Austria, sales company
3 [GRÜNER BERICHT, 2002]

The yearly numbers of the legume cropping areas were taken from official statistics [BMLFUW, 2003].

Table 171: Cropped area legume production, 1990-2002

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

Harvest data were taken from [BMLFUW, 2003], partly adopted from [JONAS & NIELSEN, 2002] and are presented in Table 172.

Table 172: Harvest Data I, 1990-2002

Harvest [1000 t]									
	corn	wheat	rye	barley	oats	maize (corn)	potato	sugar beet	fodder beet
1990	5 290	1 404	396	1 521	244	1 620	794	2 494	171
1991	5 045	1 375	350	1 427	226	1 571	790	2 522	173
1992	4 323	1 325	278	1 342	185	1 118	738	2 605	119
1993	4 206	1 018	292	1 100	191	1 524	886	2 994	129
1994	4 436	1 255	319	1 184	172	1 421	594	2 561	103
1995	4 452	1 301	314	1 065	162	1 474	724	2 886	85
1996	4 493	1 240	156	1 083	153	1 736	769	3 131	62
1997	5 009	1 352	207	1 258	197	1 842	677	3 012	59
1998	4 771	1 342	236	1 212	164	1 646	647	3 314	72
1999	4 806	1 416	218	1 153	152	1 700	712	3 217	70
2000	4 490	1 313	183	855	118	1 852	695	2 634	47
2001	4 827	1 508	214	1 012	128	1 771	695	2 773	43
2002	4 745	1 434	171	861	117	1 956	684	3 043	40

Table 173: Harvest Data II, 1990-2002

Harvest [1000 t]									
Year	silo-green maize	clover-hey	rape	sunflower	soja bean	horse-/fodder bean	peas	vege-tables	oil pumkin
1990	4 289	717	102	57	18	41	145	273	3
1991	4 252	797	128	72	37	37	133	277	4
1992	3 523	587	126	79	81	31	137	227	4
1993	4 220	628	125	104	103	29	107	230	3
1994	4 152	743	217	92	105	27	134	246	3
1995	3 996	823	268	61	31	17	60	302	5
1996	3 918	858	121	44	27	10	93	297	8
1997	3 940	962	129	44	34	6	162	349	8
1998	3 865	1 014	128	57	51	5	178	313	11
1999	3 729	1 025	193	64	50	6	140	399	6
2000	3 531	1440	125	55	33	7	97	361	6
2001	3 035	1349	147	51	34	7	112	391	7
2002	3 285	1395	129	58	35	9	96	406	9

Data about the annual amount of sewage sludge produced and agriculturally applied were taken from [PHILIPPITSCH ET AL., 2001], [SCHARF ET AL., 1997] and [BMLFUW, 2002].

Data were reported for 1991, 1993, 1995 and 1998; for the years 1992 and 1994 interpolated values were used, whereas for the years 1996, 1997, 1999 and 2000 the value of the year before or for 1990 the value of the year after was used. For the year 2001 data were taken from [BMLFUW, 2002].

Table 174: Amount of sewage sludge (dry matter) produced in Austria, 1990-2002

Year	produced [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	10.0
2002	398 800	41 600	10.0

6.4.2.1 Direct Soil Emissions (4 D 1)

Direct Soil Emissions is the most important subcategory of *4 D Agricultural Soils*. 55.1% (4.80 Gg in 2002) of N_2O emissions from *Agricultural Soils* arise from this subcategory (see Table 166).

Calculation of direct N_2O emissions from soils is based on the assumption that 1.25% of the nitrogen input to agricultural soils is emitted in the form of N_2O (expressed as N). In this method, the nitrogen input is corrected for gaseous losses through volatilization of NH_3 and NO_X.

N_2O emissions from following sub- sources were estimated:

- Synthetic fertilizers (mineral fertilizers and urea)
- Animal waste (manure collected in stables and applied to soils)
- Biological nitrogen fixation through legumes
- Crop residues remaining on the field after harvest
- Application of sewage sludge on agricultural soils.

Nitrogen input from all sources was added and the direct N_2O emissions from agricultural soils 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 of nitrogen input from these sources are 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.

CH_4 emissions from agricultural soils only for sewage sludge application were estimated. In the previous submission CH_4 emissions from sludge spreading were reported under category 6 D. Now they are reported under 4 D 1

6.4.2.1.1 Nitrogen input through application of mineral fertilizers

The method applied for calculation of the emissions is IPCC Tier 1a (GPG, Equation 4.22), but with specific consideration of nitrogen that is lost during application ($Frac_{GASF}$).

$$F_{SN} = N_{FERT} * (1- Frac_{GASF})$$

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.

6.4.2.1.2 Nitrogen input through application of animal manure

The method applied for calculation of the emissions is IPCC Tier 1b, but with country-specific data and with specific consideration of nitrogen that is lost during application ($Frac_{GASF}$). 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.

$$F_{AW} = N_{exLFS} * (1 – Frac_{GASM})$$

F_{AW} = Nitrogen from animal waste that is left for spreading on agricultural soils annually [t N], corrected for losses occurring during manure management and NH_3/NO_x volatilisation lost during spreading of manure onto soils

N_{exLFS} = Annual amount of nitrogen in animal excreta left for spreading on agricultural soils, corrected for losses during manure management (This value was adopted from the calculations of the category *Manure Management*. It does not include nitrogen from grazing animals) [t N]

$Frac_{GASM}$ = Fraction of nitrogen in excreted animal waste that is volatilised as NH_3 and NO_x during application to agricultural soils (=spreading) [t/t]

$Frac_{GASM}$

For $Frac_{GASM}$ the IPCC default value was not used (0.2). Instead, NH_3 volatilisation losses occurring during application of animal waste to agricultural soils were calculated following the CORINAIR- EMEP methodology. For comparison reasons an equivalent loss fraction, derived as quotient between volatilisation losses (NH_3) and the nitrogen left for spreading, for 1990 yielded a value of 0.18. Adding 0.01 to account for NO_x losses, a similar figure (0.19) as recommended by IPCC methodology (0.20) was estimated for volatilisation losses during spreading of animal waste on agricultural lands. This confirms that consistency of calculations was not disturbed by the application of a more refined emission calculation method.

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. In Table 175 the nitrogen left for spreading for the years 1990-2002 per animal type is presented.

Table 175: Animal manure left for spreading on agricultural soils per livestock category 1990-2002

year	Nitrogen left for spreading [tons 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 / solipeds	oth. animals
1990	**123787**	41060	1852	18366	12559	7442	8277	15875	8083	1054	6137	739	2342	0
1991	**123701**	39868	2258	18190	12137	7691	8165	15660	8292	1420	6458	810	2752	0
1992	**119977**	38410	2382	17065	11289	7418	8347	16010	7919	1255	6178	780	2923	0
1993	**123086**	37891	2729	18763	9578	8035	8570	16366	8360	1422	6611	936	3091	735
1994	**123884**	38625	3544	18771	9592	7568	8547	15978	8161	1412	6775	985	3178	747
1995	**125425**	35057	8288	18482	9386	7785	8689	15848	8094	1240	7233	1074	3451	798
1996	**123362**	34960	8376	17599	9101	7829	8627	15244	7515	1182	7542	1079	3487	822
1997	**123980**	36465	6715	16849	8564	8224	8608	15323	8582	1254	7597	1155	3531	1114
1998	**123487**	37251	6075	16249	8621	8007	8360	16605	8330	1186	7145	1074	3587	997
1999	**120536**	36024	6957	15991	8560	8106	7441	15104	8488	1083	6976	1148	3884	774
2000	**116944**	32364	9954	15277	8896	8128	7234	14636	6815	1097	6718	1111	3952	762
2001	**116546**	31463	10149	14924	8945	7533	7579	15267	7324	1030	6346	1177	4047	762
2002	**113689**	31283	9646	14735	8689	7275	7381	14345	7324	1030	6027	1145	4047	762

6.4.2.1.3 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:

$$F_{BN} = LCA * B_{Fix} / 1000$$

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 1990-2002 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 publication made by the Umweltbundesamt [GÖTZ, 1998]; these values are constant over the time series.

6.4.2.1.4 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 with 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] , source: [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] [OLI, 2000], [OZONBERICHT, 1997]

Harvest data were taken from [BMLFUW, 2003], partly adopted from [JONAS, 2002] 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	0.0063
Rye	0.86	1.4	0.005	0.7	0.0063
Barley	0.86	1.1	0.005	0.7	0.0063
Oats	0.86	1.5	0.005	0.7	0.0063
Maize (corn)	0.50	1.4	0.005	0.0	0
Potato	0.30	0.3	0.005	0.0	0.0063
Sugarbeet	0.45	0.8	0.005	0.0	0
Fodderbeet	0.20	3.0	0.005	1.0	0
Maize (silo)	0.30	0.0	0.005	1.0	0
Clover-hay	0.86	0.0	0.005	1.0	0

Rape	0.86	21	0.005	0.0	0
Sunflower	0.86	2.5	0.015	0.0	0
Sojabean	0.40	15.0	0.015	0.0	0
Fodderbean	0.40	1.5	0.015	0.0	0
Peas	0.40	1.0	0.015	0.0	0
Vegetables	0.20	0.8	0.005	0.0	0
Oil pumpkin	0.80	72.0	0.015	0.0	0

6.4.2.1.5 Nitrogen input through use of sewage sludge

In Austria fertilisation by sewage sludge is very small. In 2002 N_2O emissions from sewage sludge contributed only 0.35% of N_2O emissions from category 4 D Agricultural Soils.

The estimation of annually applied sewage sludge is based on the figures reported in the Austrian water protection report [PHILIPPITSCH et al., 2001] and [BMLFUW, 2002] which provide data for selected years. A mean value of 3.9% N in dry matter based on a large set of measurements [SCHARF et al., 1997] was taken to calculate the nitrogen content. The amount of agriculturally applied sewage sludge can be calculated through:

$$F_{SSlu} = SSlu_N * SSlu_{agric}$$

F_{SSlu} = Annual nitrogen input to soils by agriculturally applied sewage sludge [t N]

SsluN = Nitrogen content in dry matter [%] – 3.9%

$SSlu_{agric}$ = Annual amount of sewage sludge agriculturally applied [t/t] - see Table 174

CH_4 emissions from sewage sludge application

According to the Institute for Applied Ecology and a study [SCHÄFER, 2002] the average carbon content of sewage sludge amounts to about 300 kg carbon per ton sewage sludge. While 48% of the carbon remain in the soil, 52% are emitted to air. 5% of this emitted carbon is emitted as CH_4. Consequential about 10.4 kg methane are emitted per ton sewage sludge.

6.4.2.2 Animal Production (4 D 2)

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}) in Austria, 1990-2002

Nitrogen excreted during grazing [t N]												
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
20520	21140	20472	22454	22953	23860	23880	24071	23341	23224	22676	22311	21843

6.4.2.3 Indirect Soil Emissions (4 D 3)

According to IPCC definition, indirect N_2O emissions are caused by atmospheric deposition of nitrogen and by nitrogen leaching from soils. The calculation is based on the recommendations of the IPCC guidelines.

6.4.2.3.1 N_2O emissions through atmospheric nitrogen deposition

The calculation of the emissions according to IPCC guidelines was slightly adapted to the available input values. Instead of deriving the animal waste volatilisation losses from N_{ex} (total nitrogen produced in animal waste management systems), the sum of gaseous losses (NH_3 and NO_x emissions) derived from N_{lfs} (nitrogen left for spreading produced in all animal waste management systems except "pasture range & paddock") was used.

Thus the original formula from the IPCC guidebook:

$$F_{AD} = [(N_{FERT} * Frac_{GASF}) + (N_{ex} * Frac_{GASM})] * EF_{AD}$$

is adapted to:

$$F_{AD} = [(N_{FERT} * Frac_{GASF}) + (NH_3 + NO_x \text{ from spreaded manure})] * EF_{AD}$$

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 applications 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] , see Table 160, Table 161
$Frac_{GASM}$	=	Fraction of animal manure that is volatized as NH_3 or NO_x [t/t]
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]

Ammonia emissions from animal waste application for Cattle and Swine were calculated using the CORINAIR detailed methodology [EMEP/CORINAIR, 1999], for the other categories the CORINAIR simple methodology was used. NO_X emissions were estimated according to the assumption from [FREIBAUER & KALTSCHMITT, 2001], that 1% of the manure nitrogen left for spreading N_{LFS} (see Table 175) is emitted as NO_X- N.

6.4.2.3.2 N_2O emissions through nitrogen leaching losses

The method applied for calculation of the emissions is IPCC Tier 1b. Following IPCC recommended values, leaching losses from nitrogen fertilizers are estimated to be about 30% of the nitrogen inputs from synthetic fertilizer use, livestock excretion, and sewage sludge application. N_2O emissions are then estimated as 2,5% of the leaching losses, as suggested by the IPCC.

The calculation is:

$$E\text{-}N_2O_{LL} = (F_{FERT} + N_{exLFS} + N_{exGRAZ} + F_{SSlu}) * Frac_{LEACH} * EF\text{-}N_2O_{LL}$$

$E\text{-}N_2O_{LL}$	=	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] [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] [IPCC Guidelines, 1997], workbook table 4-18

Annual nitrogen input from sewage sludge applied on agricultural soils as presented in Table 178 was calculated according to the formula presented in the subsection *Nitrogen input through the use of sewage sludge.*

Table 178: Annual nitrogen input from sewage sludge applied on agricultural soils (F_{SSlu}) in Austria, 1990-2002

Annual nitrogen input from sewage sludge applied on agricultural soils [t N]												
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1232	1232	1170	1755	1502	1654	1675	1675	1686	1686	1686	1555	1555

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
Direct soil emissions	
Mineral fertilizer application	+/- 27%
Animal waste application	+/- 25%
Crop residues	+/- 25%
Biological N fixation	+/- 50%
Sewage sludge application	+/- 25%
Animal production	
Emissions from animal production (grazing)	+/- 58%
Indirect emissions	
Leaching	+/- 25%
Atmospheric deposition	+/- 57%
Total	**+/- 24%**

6.4.4 Recalculations

N_2O:

In response to the issue raised by the expert review team at the centralised review 2003 the age class split of swine for the years 1990-1992 was adjusted. The shift from young swine to fattening pigs led to more organic waste spread on agricultural soils and accordingly to higher emissions in these years.

Updated data of synthetic fertilizer use 2001 led to significant higher emissions in this year.

Higher values of the whole time series are effected by the revised milk yield data (also see Chapter 6.1.6), which led to more organic waste from diary cattle.

CH_4:

In the previous submission CH_4 emissions from sludge spreading were reported under category *6 D*. Now they are reported under *4 D 1*.

While in the last submission the spread sludge was assumed to be constant throughout the period, the activity data are updated now according to several national studies.

The CH_4 emission factor has been revised as well. In the last submission an emission factor for land filled sludge instead for spread sludge was used. This error was identified and corrected in this submission.

Table 180: Difference to submission 2002 of CH_4 and N_2O emissions from Category 4 D Agricultural Soils

IPCC Category 4D AGRICULTURAL SOILS												
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
[Gg CH_4]	0.33	0.33	0.31	0.47	0.40	0.44	0.45	0.45	0.45	0.45	0.45	0.43
[Gg N_2O]	0.30	0.30	0.30	0.01	0.06	0.08	0.07	0.06	0.05	0.04	0.03	0.40

6.5 Field Burning of Agricultural Waste (CRF Source Category 4 F)

6.5.1 Source Category Description

Key Source: No

Emissions: CH_4, N_2O

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, which explains the strong reduction. Therefore the contribution of emissions from the category *Field Burning of Agricultural Waste* to the total emissions is very low.

In the year 2002 total emissions from this category amounted to 2.7 Gg CO_2 equivalent, this is a share of 0.04% in total GHG emissions from agriculture. CH_4 and N_2O emissions for the years from 1990 to 2002 are presented in Table 181.

Table 181: Greenhouse gas emissions and their trend from 1990-2002 from Category 4 F Field Burning of Agricultural Waste 1990-2002

	CH4	N2O
1990	0.075	0.004
1991	0.075	0.004
1992	0.075	0.004
1993	0.074	0.004
1994	0.074	0.004
1995	0.074	0.004
1996	0.074	0.004
1997	0.072	0.004
1998	0.072	0.004
1999	0.072	0.004
2000	0.072	0.004
2001	0.072	0.004
2002	0.072	0.004
Trend	-3.47%	-0.71%
Share on AT Total	0.02%	0.02%

6.5.2 Methodological Issues

A simple method (Emission = Activity x Emission Factor) using country specific emission factors was used.

6.5.2.1 Cereals/ Wheat (4 F 1 a)

N_2O emissions 4 F 1 a Cereals/ Wheat are estimated to be constant over the period from 1990 to 2002 and to amount to 0.0038 Gg. CH_4 emissions from the same category are also estimated to be constant and to amount to 0.05 Gg.

The applied emission factors (8.9 kg CH_4 /ha and 0.595 kg N_2O/ha) are based upon expert judgement (Umweltbundesamt) and correspond to burning wood with a caloric value of 7.1 MJ/kg in poor operation furnace systems.

According to an expert judgement from Dr. Johannes Schima from the *Presidential Conference of Austrian Agricultural Chambers*, about 6 000 ha of straw fields are burnt every year. This value was held constant for all years.

6.5.2.2 Other (4 F 5)

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 used.

Activity data (viniculture area) are taken from the Statistical Yearbooks 1992-2002 [STATISTIK AUSTRIA]. According to an expert judgement from the *Federal Association of Viniculture* (Bundesweinbauverband Österreich) the amount of residual wood per hectare viniculture is 1.5 to 2.5 t residual wood and the part of it that is burnt is estimated to be 1 to 3%. For the calculations the upper limits (3% of 2.5 t/ha) have been used resulting in a factor of 0.075 t burnt residual wood per hectare viniculture area.

Table 182: Activity data for 4 F Field Burning of Agricultural Waste 1990–2002

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

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 [JOANNEUM RESEARCH, 1995] with a calorific value of 7.1 MJ/kg burnt wood which corresponds to burning wood logs in poor operation furnace systems.

6.5.3 Planned Improvements

It is planned to use IPCC default emission factors for *4 F 1 a Cereals/ Wheat* in the next submission.

7 LAND USE CHANGE AND FORESTRY (CRF SECTOR 5)

NOTE: As there have been no changes in methodology for this chapter, and because the emissions/removals reported for 2001 and 2002 equal the values for 2000, this chapter is identical to the corresponding one in the NIR 2003. An update is planned for the submission 2005, as the data of a new forest inventory will become available in 2004.

7.1 Source Category Description

3,9 Mio ha (46%) of Austria are forest land [FBVA, 1997]. 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].

Table 183 shows the IPCC categories and the corresponding SNAP categories for which the actual calculations are made.

Table 183: IPCC categories and the corresponding SNAP categories for IPCC Category 5

IPCC-Category	SNAP / SPLIT-Category	Description
5 A 2		**Temperate Forests**
5 A 2	112102 Deciduous	Temperate forests
5 A 2	112102 Evergreen	Temperate forests

Other IPCC categories are IE, NE or NO. The quantitatively most relevant sub-categories of *5 B Forest and Grassland Conversion* and *5 C Abandonment of Managed Lands* are included in the figures for category *5 A Changes in Forest and Other Woody Biomass Stocks* (see chapter 4.5.2).

Emission trends

In the period 1961 to 1996 changes in the Austrian forest biomass (*IPCC Category 5 A*) led to a mean annual net carbon sink of 2.527 kt carbon (from 1.014 kt C to 3.689 kt C with an uncertainty of ±748 kt C). Between 1980 and 1996 the net carbon sink of this category equals to about 15% of the gross CO_2 equivalent emissions of the GHGs CO_2, CH_4 and N_2O in this period [Weiss et al., 2000]. Between 1990 and 1996 a decrease in the net sink of category *5 A* was detected (mean: 2.371 kt C; range: 1.469 to 3.683 kt C), and so the offset of category *5 A* to the total GHG emissions in the individual years of this period was between 6,7 and 16,6% (mean value: 11,2%).

The time series of accurate and measured values for individual years ends with the year 1996. For the years after 1996 the means for the last period (1992 to 1996) of the National Forest Inventory (NFI) have been reported (the rationale in behind this procedure is given in chapter 4.5.2). Therefore, the reported annual data for category *5 A* are constant after 1996. A revision of the data for these years will be carried out when the results of the follow-up NFI will be available, which will be in 2003.

Details on the methodology, uncertainty assessment, quality assurance, quality control and verification are given in chapter 4.5.2

7.2 Changes in Forest and Other Woody Biomass Stocks (5 A)

7.2.1 Methodological Issues

A national method is applied which follows to some extent the IPCC methodology. However, it gives more accurate and appropriate figures for the Austrian forests.

The main basis of the estimates are measured data on forest area, volume increment of the growing stock and harvest (for both stem wood over bark with a diameter at breast height > 5 cm) according to the Austrian NFI [SCHIELER et al., 1995], [FBVA, 1997], [WINKLER, 1997]. The NFI was carried out in the periods 1961-70, 1971-80, 1981-85, 1986-90, 1992-96. Recently, the follow-up NFI is running – the new data will be available in 2003. 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 1964-1998]. These statistics are not based on measured data. Therefore, it is assumed that the NFI provides more accurate figures on the harvest 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 harvest data:

The NFI increment data include all possible reasons for biomass increments in the forests. Therefore, the figures for "Total biomass increment in Commercial Harvest" include also the biomass increments due to abandonment of managed land and regrowth by forests. The NFI harvest data include also all possible reasons for biomass losses in the forests. This means, that the figures for "Total biomass removed in Commercial Harvest" include in addition: e.g. traditional (non-commercial) fuel wood consumption, biomass losses by forest conversion, forest fires[23] and losses due to other damages. Therefore, to provide accurate and representative figures for the entire commercial forests of Austria and to avoid double accounting as well as further conflicting matters with the categories *5 B Forest and Grassland Conversion* and *5 C Abandonment of Managed Lands*, these figures are reported as a total in category *5 A Changes in Forest and Other Woody Biomass Stocks*.

The NFI provides means of annual increment and harvest for the individual periods. Instead of using these means or interpolated values for single years, these NFI means are converted with indices[24] to obtain annual data of increment and harvest. For harvest these relative indices are derived from further national statistics on harvest which are the annually reported records of wood felled and the wood balance [BITTERMANN and GERHOLD 1995], [BMLF 1964-1998]. For increment a representative Austrian set of tree ring cores [HASENAUER et al. 1999a, b] is used to calculate the relative indices. The means of these estimated annual

[23] In the 90-ies the annual maximum area affected by forest fires in Austria was 135 ha, but usually this annually affected area is much lower. Hence, biomass losses and emissions of other GHGs by forest fires are negligible in Austria.

[24] Values for the relative variation in the individual years of the time series

data on increment and harvest for a certain inventory period are equal to the measured periodic means provided by the NFI. This method allows more accurate estimates of the figures for individual years for the category *5 A*. 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 are used to convert the measured m^3 stem wood over bark to t carbon increment and t carbon harvest of the whole trees (including also below ground biomass). These conversion factors are not based on default values given by the IPCC (1997) but on estimates, which give more accurate figures for the Austrian forests. These estimates of the used conversion factors are based on the species and age class composition of increment and harvest according to NFI and literature values for the wood densities for all individual tree species (compiled in [KOLLMANN, 1982], [LOHMANN, 1987]), literature values on the dry mass relations of stem wood to the other tree compartments for the main tree species in Austria and for individual age classes (compiled in [KÖRNER et al., 1993]) and literature values on C contents for individual tree compartments and species (Table 184). The conversion factors are calculated for each inventory period and separately for increment and harvest respectively.

Further details on the approach and methodology are given in [WEISS et al., 2000].

Table 184: Conversion factors for the Austrian forests [WEISS et al. 2000]

Conversion factors	Coniferous	Deciduous
m^3 o.b. → t dm (stemwood)	0,39	0,53
t dm stemwood → t dm whole tree (incl. also below ground biomass)		
increment	1,45	1,46
harvest	1,54	1,50
t dm whole tree → t C whole tree	0,49	0,48

The time series of accurate and measured values for individual years ends with the year 1996. For the years after 1996 the means for the last inventory period (1992/96) and therefore constant values have been reported. An extrapolation of trends for increment and harvest from the 2nd but last inventory period (1986/90) to the 90ies led to figures which had to be strongly revised downwards after the last inventory (1992/96). One of the main reasons was that increment did not increase as in the years before. A use of means 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 which are rather uncertain. This is particularly true for increment which strongly depends on weather conditions, but also for harvest, when - for instance – storm fellings are taken into consideration. A revision of these means and constant figures for the years after 1996 will be carried out when the results of the follow-up forest inventory will be available, which will be in 2003[25].

Other sub-categories under *5 A* were not estimated or are not occurring. The area of temperate forest plantations (category *5 A 2 c*) is very small in Austria (< 2.000 ha). Therefore, the C stock changes at these plantations are negligible. There are not sufficient data to estimate accurately the emissions and removals from other wooded land like vineyards, or-

[25] The last recalculation was carried out for the year-2000-submission for the period 1990 to 1998. The rationale was the inclusion of the results of the latest NFI (1992/96) and a development of a more detailed approach compared to the estimates before.

chards, parks, forest nurseries and Christmas tree cultures. This is also the case for the emissions and removals from grasslands. However, it is assumed that figures for this category are also of minor relevance for the Austrian GHG balance. Estimates on the subcategory *5 A 2 d Harvested Wood* will be made in the near future.

7.2.2 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* is embedded in the overall QA/QC-system of the Austrian GHG inventory (see chapter 1.4):

The calculation of the uncertainty of the reported data for category *5 A* 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[26]
- and the uncertainty of each conversion and expansion factor.

The estimates of the uncertainty includes a consistency approach with other national statistics. Because of the differing quality of the data classic statistical approaches were not always adequate. For instance, the uncertainties of the conversion factors were estimated in a pragmatic as well as conservative way (Table 185, details are described in [WEISS et al., 2000]). Such an approach takes into account that the conversion factors were not measured by a systematic inventory (like NFI) but derived from a few local ecosystem studies (expansion factors) and literature data on wood densities and C contents. Therefore, the uncertainty related to these conversion factors is comparably higher than the one of the systematically measured stem wood volume of increment and harvest. Error propagation was used to calculate the overall uncertainty.

The absolute uncertainty of the Austrian annual net carbon balance of category *5 A* is ±748 kt C. This corresponds to varying relative uncertainties between ±20% and ±74% (mean ±30%) for the individual years of the time period 1960 to 1996 depending on the individual annual net C sequestration of category *5 A*.

In the near future a further estimate on the uncertainties of the carbon figures of category *5 A* which uses Monte Carlo simulations will be available.

[26] 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

Table 185: Relative uncertainties of the used data for the calculations [WEISS et al. 2000]

	Relative uncertainties in %				
	Forest inventory	Uncertainty related to the calculation of annual data and to the necessary consistency of different statistics	Conversion factor „m^3 o.b. → t dm“	Conversion factor „t dm stemwood → t dm whole tree“	Conversion factor „t dm → t C“
Increment	2,0	3,2	11,1	6,5	2,0
Harvest	3,5	12,2			

7.3 Forest and Grassland Conversion (5 B), Abandonment of Managed Lands (5 C)

Categories *5 B* and *5 C* are indirectly included in the figures of category *5 A* as far as changes of tree biomass of the Austrian forests are concerned (afforestation, reforestation in the sense of IPCC, abandonment of managed lands and regrowth of forests and deforestation; see also above). Under Austrian ecological conditions abandonment of managed lands is usually followed by regrowth of forests. Therefore, the quantitatively more important activities under the categories 5B and 5C and their impact on the biomass C stock changes are covered by the figures of sector 5A. Grassland conversions (category *5 B 4*) as well as abandonment of managed land and regrowth by grasslands (category *5 C 4*) also occur in Austria, but data which would allow to estimate accurately the emissions/removals from these sub-categories are lacking. It is assumed that activities under these two sub-categories are of minor relevance for the Austrian GHG balance and mainly lead to changes in the soil carbon pools, whereas the related changes in the biomass carbon pools are assumed to be much less significant. Changes of soil carbon pools related to all activities of the categories *5 B* and *5 C* would be included in category *5 D* if these data were already available (see below).

Hence, the non-reporting of specific figures for the categories *5 B* and *5 C* does not represent a data gap but avoids double-accounting. In addition, the relative uncertainty of these specific figures for the categories *5 B* and *5 C* would be considerably higher than those of category *5 A* because the Austrian NFI (as most forest inventories) is designed to provide accurate figures on a nation-wide basis. Each estimate of respective figures for a sub-category, e.g. previous and new forest areas (afforestation, reforestation, deforestation), is related with much higher relative uncertainties or would even need a completely different approach to obtain accurate figures. This is very much a question of costs and resources for measurement and of weighing up the necessary efforts against the gain of information (particularly as figures for these categories are already included in other categories). However, it should be noted that in the future measurement, calculation and reporting of figures for specific parts of the categories 5B and 5C might be necessary under the Kyoto-Protocol (Article 3.3). Such preliminary Austrian estimates for Article 3.3 were given in a supporting submission for the Kyoto-negotiations (UNFCCC 2000).

7.4 CO_2 Emissions and Removals from Soil (5 D)

As given in the introduction, Weiss et al. (2000) estimated the carbon-stock of the Austrian forest soils by using data of the Austrian forest soil survey (humus layers and mineral soil layers 0-50 cm were sampled at the grid points of an 8,7 x 8,7 km grid across all Austria in the period 1987 to 1989; FBVA 1992). Similar carbon stock estimates are also available for the Austrian agricultural soils (see UNFCCC submission 2000).

CO_2 emissions or removals from soils are not reported at the moment. The changes in the carbon content of the soils are very small and slow and no reassessments of the Austrian soil inventories have taken place that would allow estimates for the carbon stock changes of the soils. 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. 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. It is planned to carry out such a reassessment of the forest soil inventory in the near future. This will allow to provide measured figures for the carbon stock changes in this category.

8 WASTE (CRF SECTOR 6)

8.1 Sector Overview

This chapter includes information on and descriptions of methods for estimating greenhouse gas emissions as well as references of activity data and emission factors concerning waste management and treatment activities reported under IPCC Category *6 Waste*.

The emissions addressed in this chapter include emissions from the IPCC categories *6 A Solid Waste Disposal on Land*, *6 B Wastewater Handling*, *6 C Waste Incineration* and *6 D Other* Waste (*Compost Production*).

Waste management and treatment activities are sources of methane (CH_4), carbon dioxide (CO_2) and nitrous oxide (N_2O) emissions.

8.1.1 Emission Trends

Table 186 presents greenhouse gas emissions for the period from 1990 to 2002 for the IPCC Category *6 Waste*.

Overall greenhouse gas emissions from waste management and treatment activities during the year 2002 amounted to 2 915.1 Gg CO_2 equivalent. This are about 3.4% of total greenhouse gas emissions in Austria in 2002 and 5.3% in the base year respectively.

The trend for the years 1990 to 2002 concerning greenhouse gas emissions from the waste sector was decreasing (Table 186). In 2002 the greenhouse gas emissions from the waste sector were 28.9% below the level of the base year.

Table 186: Emissions of greenhouse gases and their trend from 1990-2002 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	20.7	4 030.6	45.9	4 097.2
1991	18.5	4 023.1	47.4	4 089.0
1992	7.5	3 947.0	52.5	4 007.0
1993	8.5	3 910.0	59.7	3 978.1
1994	9.8	3 765.6	66.8	3 842.1
1995	10.1	3 622.1	69.8	3 701.9
1996	10.4	3 483.6	72.2	3 566.2
1997	10.7	3 363.4	68.5	3 442.6
1998	11.0	3 265.9	69.6	3 346.4
1999	11.3	3 169.5	70.2	3 251.0
2000	11.3	3 037.7	68.5	3 117.5
2001	11.2	2 918.0	68.3	2 997.5
2002	11.2	2 835.6	68.3	2 915.1
Trend 1990-2002	*-45.7%*	*-29.6%*	*48.7%*	*-28.9%*

Emission trends by greenhouse gas

Table 187 presents greenhouse gas emissions from the sector *Waste* for the base year (1990) and for 2002 as well as their share in greenhouse gas emissions from this sector.

Table 187: Greenhouse gas emissions from the Waste sector in the base year and in 2002.

Greenhouse gas emissions	Base year*	2002	Base year	2002
	CO_2 equivalent [Gg]		[%]	
Total	**4 097.2**	**2 915.1**	***100%***	***100%***
CO_2	20.7	11.2	*0.5%*	*0.4%*
CH_4	4 030.6	2 835.6	*98.4%*	*97.3%*
N_2O	45.9	68.3	*1.1%*	*2.3%*

*1990 for CO_2, CH_4 and N_2O

The major greenhouse gas emissions from this sector are CH_4 emissions, which represent 97.3% of all emissions from this sector in 2002 compared with 98.4% in 1990, followed by N_2O (2.3% 2002 and 1.1% 1990 respectively) and CO_2 (0.4% 2002 and 0.5% 1990 respectively).

CH_4 emissions

CH_4 emissions from the sector *Waste* have decreased by 29.6% since 1990 (see Table 186) as a result of waste management policies: the amount of land filled waste has decreased and in addition the implemented methane recovery systems have increased during the period.

CH_4 emissions originate from most subcategories within the sector but the largest source is *Solid Waste Disposal on Land*.

N_2O emissions

N_2O emissions from the waste sector have increased over the considered period (see Table 186). In 2002 the N_2O emissions from the Waste sector amounted to 68.3 Gg CO_2 equivalent. This was 48.7% above the level of the base year.

N_2O emissions come mainly from the category Other Waste (Compost production) but also from *Wastewater Handling* (*Domestic and Commercial Wastewater* and *Industrial Wastewater*). *Waste Incineration* (*Municipal Solid Waste* and *Waste Oil*) is a minor source of N_2O emissions.

CO_2 emissions

CO_2 emissions of the sector Waste decreased remarkably (see Table 186). In 2002, CO_2 emissions from this sector amounted to 11.2 Gg CO_2 equivalent, this was 45.7% below the level of the base year.

CO_2 emissions originate from *Waste Incineration* (*Municipal Solid Waste, Waste Oil and Incineration of Corpses*). The only plant incinerating municipal waste without energy recovery was shut down in 1991, which resulted in a drop of CO_2 emissions from 1991-1992.

Emission trends by sources

Table 188 presents the greenhouse gas emissions for the period from 1990 to 2002 from the different subcategories within the IPCC *Category 6 Waste*.

Table 188: Total greenhouse gas emissions and trend from 1990–2002 by subcategories of Category 6 Waste

CO2 equivalent (Gg)	6 A	6 B	6 C	6 D	Total
1990	3 731.40	310.13	20.85	34.78	4 097.17
1991	3 720.29	313.67	18.60	36.43	4 088.99
1992	3 638.18	317.92	7.56	43.39	4 007.05
1993	3 594.72	320.71	8.52	54.17	3 978.12
1994	3 445.51	322.50	9.77	64.37	3 842.15
1995	3 300.10	323.51	10.11	68.22	3 701.94
1996	3 160.07	324.38	10.42	71.38	3 566.25
1997	3 041.05	324.72	10.72	66.06	3 442.55
1998	2 943.15	325.66	11.02	66.62	3 346.44
1999	2 845.72	325.59	11.34	68.34	3 250.98
2000	2 714.14	326.32	11.31	65.73	3 117.49
2001	2 597.29	323.21	11.26	65.73	2 997.50
2002	2 514.85	323.21	11.26	65.73	2 915.06
Trend 1990 -2002	*-32.60%*	*4.22%*	*-45.97%*	*88.96%*	*-28.85%*

The dominant subcategory in the sector *6 Waste* is *6 A Solid Waste Disposal on Land*. In 2002 *Solid Waste Disposal on Land* contributed 86.3% to total greenhouse gas emissions from the sector *Waste*. However, the contribution decreased over the period: in 1990 91.1% of the greenhouse gas emissions originated from this subcategory.

6 A Solid Waste Disposal on Land

For *Solid Waste Disposal on Land* greenhouse gas emissions decreased by 32.6% from 1990 to 2002. The main greenhouse gas which originates from this subcategory is CH_4.

The decreasing amount of land filled waste and the increasing recovery rate of landfill gas causes a decreasing trend in emissions.

6 B Wastewater Handling

For *Wastewater Handling* the greenhouse gas emissions increased by 4.2% from 1990 to 2002. This was mainly due to increasing CH_4 emissions from handling of industrial and domestic/commercial wastewater.

6 C Waste Incineration

For *Waste Incineration* greenhouse gas emissions decreased by 45.9% from 1990 to 2002. This was mainly due to the shut down of the only plant incinerating municipal waste without energy recovery in 1991, which resulted in a drop of CO_2 emissions from 1991-1992.

6 D Other Waste

This category addresses *Compost Production*. Greenhouse gas emissions from this sub-category increased by 89% due to the increasing amount of composted waste.

8.1.2 Key Sources

Key source analysis is presented in chapter 1.5. This chapter includes information about the key sources in the IPCC Sector *6 Waste*. Table 189 presents the source categories in the level of aggregation as used for the key source analysis.

The only key source of category 6 is *6 A 1 Managed Waste disposal on Land*. 2002 it contributed 2.97% to national total greenhouse gas emissions.

Table 189: Key sources of Category 6 Waste

IPCC Category	Source Categories	Key Sources	
		GHG	KS-Assessment
6 A 1	Managed Waste disposal on Land	CH_4	LA: all TA: all except TA92, TA93

LA00= Level Assessment 2000
TA00= Trend Assessment BY-2001

8.1.3 Methodology

Detailed information on the country specific methodology can be found in the corresponding subchapters, where it was applied.

8.1.4 Recalculations

Recalculations have been made for the subcategories *6 A 1 Managed Waste Disposal on Land (*see Table 196), and 6 D Other Waste (see Table 208). For further information please refer to the respective subchapters.

8.1.5 Completeness

Table 190 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 subcategory have been estimated, the grey shaded cells are those also shaded in the CRF.

Table 190: Overview of subcategories of Category Waste: transformation into SNAP Codes and status of estimation

IPCC Category	SNAP	CO_2	CH_4	N_2O
6 A SOLID WASTE DISPOSAL ON LAND				
6 A 1 Managed Waste Disposal	090401 Solid Waste Disposal on Land	NO	✓	
6 A 2 Unmanaged Waste Disposal	090402 Unmanaged Waste Disposal			
6 B WASTEWATER HANDLING				
6 B 1 Industrial Wastewater	091001 Waste water treatment in industry		✓	✓
6 B 2 Domestic and Commercial Wastewater	091002 Waste water treatment in residential/commercial sect.		✓	✓
6 C WASTE INCINERATION	090901 Incineration of corpses 090201 Incineration of municipal waste 090208 Incineration of waste oil	✓ ✓ ✓	NO ✓ NA	NO ✓ ✓
6 D OTHER WASTE	091003 Sludge spreading 091005 Compost production	IE NO	IE ✓	IE NO

In Austria all waste disposal sites are managed sites (also see Chapter 8.2.1.1).
Sludge spreading is included in category *4 D 1*.

8.2 Waste Disposal on Land (CRF Source Category 6 A)

8.2.1 Managed Waste Disposal on Land (CRF Source Category 6 A 1)

8.2.1.1 Source Category Description

Key Source: Yes

Emissions: CH_4

In Austria all waste disposal sites are managed sites (landfills). Emissions from illegal deposition of waste was assumed to be negligible because it was assumed that illegal deposited waste mainly consists of construction waste and other waste with no or very low biodegradable content.

In the year 2002 CH_4 emissions from managed waste disposal on land (landfills) contributed 3.0% to total greenhouse gas emissions in Austria.

Managed waste disposal on land accounts for the largest contribution to CH_4 emissions in the IPCC Category *6 Waste*.

The anaerobic degradation of land filled organic substances results in the formation of landfill gas. About 55% of this landfill gas is CH_4. Most active landfills in Austria have gas collection systems. According to a recent study [ROLLAND, OLIVA; 2004] the amount of the collected and burnt landfill gas increased over the time period (see Figure 18). While for example the amount of the collected landfill gas was about 2% in 1990, this amount reached 13% in the year 2002.

Figure 18: Amount of collected landfill gas 1990 to 2002 [ROLLAND, OLIVA; 2004]

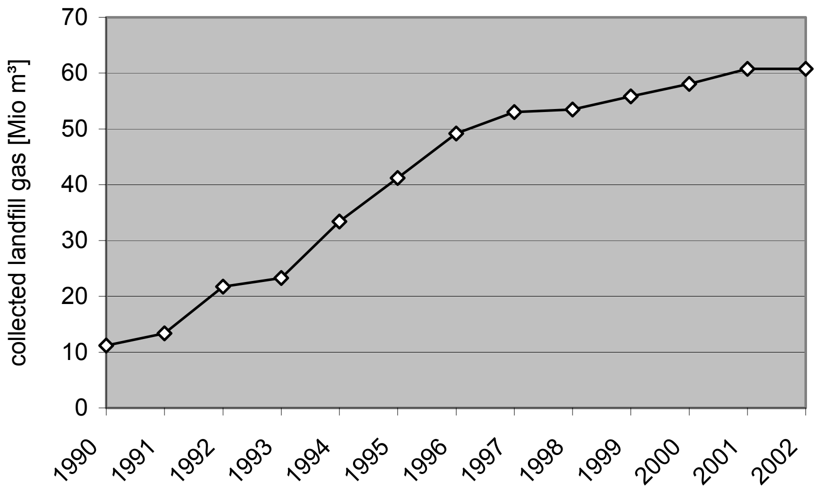


Table 191 presents CH_4 emissions from managed waste disposal on land for the period from 1990 to 2002.

As can be seen in the table, the trend of CH_4 emissions during the period was decreasing. From 1990 to 2002 CH_4 emissions decreased by 22% according to decreasing amounts of land filled waste and increasing amounts of the collected landfill-gas.

Table 191: Greenhouse gas emissions from Category 6 A 1 1990-2002

6 A 1	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
CH_4 [Gg]	177.69	177.16	173.25	171.18	164.07	157.15	150.48	144.81	140.15	135.51	129.24	123.68	119.75

8.2.1.2 Methodological Issues

A country specific method was applied.

For calculation of emissions of solid waste disposal on land the directly deposited waste is separated into two categories: "residual waste" and "non residual waste", the methodology used for estimating emissions from these two subcategories are presented in the following subchapters.

Activity data and the implied emission factors for "Residual waste" and "Non Residual Waste" are presented in Table 192.

Table 192: Activity data and implied emission factors for "*Residual waste" and "Non Residual Waste" 1990–2002*

Year	Residual Waste	Non Residual Waste	Total Waste	IEF CH4
	[Mg/a]	[Mg/a]	[Mg/a]	[kg /Mg]
1990	1 995 747	809 752	2 805 499	63.3
1991	1 799 718	809 752	2 609 470	67.9
1992	1 614 157	809 752	2 423 909	71.5
1993	1 644 718	809 752	2 454 470	69.7
1994	1 142 067	809 752	1 951 819	84.1
1995	1 049 709	809 752	1 859 461	84.5
1996	1 124 169	809 752	1 933 921	77.8
1997	1 082 634	809 752	1 892 386	76.5
1998	1 081 114	809 752	1 890 866	74.1
1999	1 084 625	865 523	1 950 148	69.5
2000	1 052 061	869 315	1 921 376	67.3
2001	1 032 835	782 540	1 815 375	68.1
2002	1 032 835	782 540	1 815 375	66.0

8.2.1.2.1 Residual waste

Waste from households and similar establishments 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.

According to the "federal waste management plan 2001" recycling and treatment of waste from households and similar establishments followed the following routes in 1999:

- 34.3% recycling
- 15.4% recycling (biogenous waste)
- 0.8% treatment in plants for hazardous waste
- 6.3% mechanico-biological pre-treatment
- 14.7% thermal treatment (incineration)
- ***28.5% direct deposition at landfills ("residual waste")***;

"Residual waste" corresponds to waste from households and similar establishments directly deposited at landfills without any treatment.

Methodology

The detailed methodology for calculation of CH_4 emissions from "residual waste" is discussed in Table 193. The emissions are calculated according the methodology of Tabasaran and Rettenberger [described in BAUMELER et al. 1998]

First the overall amount of generated landfill gas per ton waste was calculated, taking into account the DOC-content (see Table 194) of the waste and the average temperature at the landfill (30°C). Once disposed, waste emits landfill-gas for many years. The amount of gas emitted per year is not constant, it declines exponentially over time. For the calculation the amount of landfill-gas produced in the year of disposal and in the 30 years after disposal are taken into account. To determine the total amount of landfill gas emissions for one year, the amounts generated by waste disposed in the last 31 years are summed up. After subtracting the collected gas and multiplying by the CH_4 content of landfill gas (approximately 55%) the emitted quantity of CH_4 from residual waste was obtained.

Activity data

The quantities of "residual waste" from 1998 to 2002 were taken from the database for solid waste disposals "Deponiedatenbank" ("Austrian landfill database"). According to the Landfill Ordinance [Deponieverordnung (Federal Gazette BGBl. Nr 164/1996)], which came into force in 1997, the operators of landfill sites have to report their activity data annually to the UMWELTBUNDESAMT, where they are stored in the database for solid waste disposals (*Deponiedatenbank*).

Table 193: Calculation of the CH_4 emissions of residual waste

Calculation of	Formula		Explanation
G_L...Long term specific quantity of generated landfill gas [m^3/ t waste]	G_L=1.868*DOC*(0.014T+ 0.28)	T…………	Temperature of the disposal site (approximately 30°C)
		DOC…….	Bio-degradable organic carbon content of directly deposited residual waste (estimated in [ROLLAND, SCHEIBENGRAF, 2003])
G_t…Cumulated specific quantity of gas after t years [m³/ t waste]	G_t=G_L*(1-$10^{(-kt)}$)	G_L……….	Long term specific amount of generated landfill gas
		k………...	Degrade constant =0.035
		t…………	Number of years

Calculation of	Formula		Explanation
$G_t(a)$...Specific accrued quantity of gas in the t^{th} year [m³/ t waste]	$G_t(a)=G_t-G_{t-1}$	G_t………. G_{t-1}……...	Cumulated specific amount of gas in the year t Cumulated specific amount of gas in the year before t
G_{geb}...Quantity of incidental landfill gas in the year t [m³]	$G_{geb}=G_t(a)*waste_{t=0}$	$G_t(a)$……. $waste_{t=0}$…	Specific accrued amount of gas in the year t Waste deposited in the year t=0
G_T...Total incidental gas in the year t [m³]	$G_T=\Sigma_0^{31}(G_{geb})$ Quantity of gas generated in the last 31 years is summed up	G_{geb}…….	Quantity of incidental landfill gas in the year t
G…Emitted gas [m³]	$G=G_T *(1-j)$	G_T………. j…………	Total incidental gas in the year t Collecting factor [ROLLAND, OLIVA, 2004]
EM…Emitted CH_4 [kg]	$EM=G*0.55*(1-v)*\rho$	G……….. 0,55……. v………... ρ………..	Emitted gas Concentration of CH_4 in landfill gas Percentage of methane, that is oxidized in the upper layer of the waste site, v=20% [HACKL, MAUSCHITZ 1999] Density of methane, $\rho=0.65kg/m^3$

Table 194: Time series of bio-degradable organic carbon content of directly deposited residual waste [ROLLAND, SCHEIBENGRAF, 2003]

	bio-degradable organic carbon [g/kg Waste (moist mass)]
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

8.2.1.2.2 Non Residual Waste

"Non Residual Waste" is directly deposited waste other than residual waste but with bio-degradable lots. Non Residual Waste comprises for example:

- bulk waste
- construction waste
- mixed industrial waste
- road sweepings
- sewage sludge
- rakings
- residual matter from waste treatment

Methodology

For the calculation the methodology of Marticorena [described in BAUMELER et al. 1998] was used. The deposited non residual waste was split up into two groups and the incidental quantity of gas was calculated for each group.

Well bio-degradable waste (half-life period: 1-20 years)

Hardly bio-degradable waste (half-life period: 20-100 years)

Because of an half-life period of more than 2.500 years the emissions of very hardly bio-degradable waste are not relevant.

After calculating the total emitted gas of each group the values were summed up, multiplied by the collecting factor and the share of CH_4 in the generated gas. This resulted in the emitted quantity of CH_4 of "Non Residual Waste".

The detailed calculation steps are shown in Table 195.

Table 195: Calculation of the CH_4 emissions of non residual waste

Calculation of	Formula		Explanation
Methodology of Marticorena to calculate the formation potential for 100 years	$M=M_0e^{-(kt)}$	M………	Incidental quantity of gas [m³]
		M_0……….	Formation potential of landfill gas [m³]*
		k………..	Velocity constant $k=-\ln(0.5)/t_{1/2}$
		$t_{1/2}$……….	Half life (calculated for each group, weighted by the quantity of the deposited waste [BAUMELER ET AL. 1998]) [a]
		t…………	Running parameter; years from 0-100
G…Total emitted quantity of landfill gas after 100 years under the restriction, that the quantity and the formation of the deposited waste is constant during 100 years [m³]	$G=\Sigma_1^3(M_{t=0}-M_{t=100})$	$M_{t=0}$……	Gas formation potential in the year 0
		$M_{t=100}$……	Gas formation potential in the year 100
		$M_{t=0}-M_{t=100}$	Total emitted quantity of landfill gas in each group after 100 years
		Σ_1^2………	Summation of the 2 groups
EM…Emitted CH_4 [kg]	$EM=G*(j-1)*0,55*$ $*(1-v)*\rho$	G………	Total emitted quantity of landfill gas [m³]
		j…………	Collecting factor; [ROLLAND, OLIVA, 2004]
		0,55……	Concentration of CH_4 in landfill gas
		v………..	Percentage of CH_4, that is oxidized in the upper layer of the waste site, v=20% [HACKEL, MAUSCHITZ 1999]
		ρ………..	Density of CH_4, ρ=0.65kg/m³ (30°C)

*For each of the 2 groups the kind of waste was specified, the quantity and the carbon-flow were listed. For each carbon flow, a formation potential of landfill gas was calculated, and the summed up formation potential was displayed as M_O.

Activity data

The quantities of "non residual waste" from 1998 to 2002 were taken from the database for solid waste disposals "Deponiedatenbank" ("Austrian landfill database"), whereas only the amount of waste with bio degradable lots was considered.

Because there are no data for "non residual waste" available for the years before 1998, the value for 1998 was used for these years.

8.2.1.3 Recalculations

The 2003 S&A report pointed out that the value 2001 of the CH_4 oxidation factor is (0.2) higher that IPPC default value (0.1). According to a new study [FELLNER et al, 2003] and expert judgement [ROLLAND, 2003] the CH_4 oxidation factor of 0.1 seems to be more appropriated for landfill sites without a covered surface. Because the surface of most of the Austrian landfill sites is covered with mineral systems like plates of Montmorillonite the CH_4 oxidation factor of 0.2 is more appropriate for the current landfill systems in Austria.

The following improvements have been made compared to last year's submission:

- The activity data of "residual waste" were updated. According to the Landfill Ordinance [Deponieverordnung (Federal Gazette BGBl. Nr 164/1996)] the operators of landfill sites have to report their activity data annually. Due to reports after the due-date there are minor changes of the activity data in this submission compared to the previous submission.
- In the previous submission the quantities of residual waste from 1950 to 1990 were taken from a study [HACKL, MAUSCHITZ; 1999] and from 1990 to 1997 from the current Bundesabfallwirtschaftsplan (Federal Waste Management Plan). However, in both references the amount of waste from administrative facilities of industry is not considered whereas it is included in the "Deponiedatenbank". Thus to achieve a consistent time series activity data have been recalculated. In fact the share of waste from administrative facilities of industry in the year 1998 was taken from the landfill database and it was assumed that it remained constant over the time series. According to this the activity data were adjusted.
- In the previous submission the amount of "non residual waste" was assumed to be constant for all years. In this submission the activity data for the years 1998 to 2002 were taken from the Austrian landfill database ("Deponiedatenbank"). As there are no data for "non residual waste" available in the years before 1998, the value for 1998 was used for these years.
- The DOC has been corrected according to a new study [ROLLAND, SCHEIBENGRAF; 2003].
- In the year 2003 the operators of landfill sites reported their annual collected landfill gas in the context of an investigation of the Umweltbundesamt [ROLLAND, OLIVA; 2004]. Emissions have been recalculated on the basis of these data.

Table 196: Recalculations with respect to previous submission from Category Managed Waste Disposal on Land 1990-2001

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
CH_4 [Gg Difference]	-57.0	-52.7	-53.8	-50.4	-52.5	-54.1	-56.5	-55.2	-52.1	-53.6	-55.7	-59.3

8.3 Wastewater Handling (CRF Source Category 6 B)

The anaerobic degradation of organic substances in wastewater treatment systems produces CH_4. In addition N_2O emission produced during the wastewater treatment process (denitrification) have been estimated.

8.3.1 Industrial Wastewater (6 B 1)

8.3.1.1 Source Category Description

Key Source: No

Emissions: *CH_4, N_2O*

Table 197 shows CH_4 and N_2O emissions from industrial wastewater handling for the period from 1990 to 2002.

As can be seen from the table, CH_4 and N_2O emissions increased from 1990 to 2000. But the emissions slightly decreased in the last two years due to decreasing number of inhabitants. During the considered period 1990 – 2002 CH_4 emissions increased by 3.9% and N_2O emissions by 8%.

Table 197: Greenhouse gas emissions from Subcategory Industrial Wastewater 1990-2002

	CH_4 emissions [Gg]	N_2O emissions [Gg]	Total [CO_2 equivalent Gg]
1990	4.669	0.016	103.09
1991	4.719	0.017	104.25
1992	4.780	0.017	105.64
1993	4.827	0.017	106.60
1994	4.851	0.017	107.17
1995	4.861	0.017	107.48
1996	4.868	0.018	107.72
1997	4.876	0.018	107.86
1998	4.880	0.018	108.10
1999	4.888	0.018	108.14
2000	4.899	0.018	108.38
2001	4.852	0.018	107.35
2002	4.852	0.018	107.35
Trend 1990-2002	*3.9%*	*8.0%*	*4.1%*

8.3.1.2 Methodological Issues

The calculation of CH_4 emissions for the year 1993 is shown in Table 198 and was taken from a study [STEINLECHNER et al., 1994].

First the amount of generated methane per unit of wastewater is determined for each of the three different types of treatments (mechanical/ biological/ further) separately. These factors were multiplied with the corresponding capacities of the Austrian wastewater treatment plants and then summed up, resulting in total CH_4 emissions for the subsector *Commercial and Domestic Wastewater* of the year 1993. Emissions from *Industrial Wastewater* were calculated separately, its wastewater was treated like biological treated wastewater.

By dividing the emissions of 1993 by the number of inhabitants of 1993 an implied emission factor for *Industrial* and *Domestic and Commercial Wastewater Treatment* was obtained.

For all other years the implied emission factors of 1993 was used to calculate emissions.

IEF (Industrial wastewater handling): 604.05 g CH_4 /inhabitant

IEF (Domestic and commercial wastewater handling): 171.94 g CH_4 /inhabitant

N_2O emissions were calculated in accordance with the IPCC methodology with the assumption that industry introduces additional 30% of the nitrogen from the human metabolism into the wastewater system [ORTHOFER et al., 1995]. Furthermore it was estimated in this study that about 10% of the nitrogen that enters wastewater treatment plants is denitrificated and that only 1% of the total nitrogen in the denitrification process is emitted as N_2O. This was taken into account when applying the following formula for estimating the N_2O emissions from this category:

$$N_2O\ Emissions = 0.3 * 0.1 * 0.01 * P * Frac_{NPR} * Inhabitants * F$$

Where:

P… annual protein intake per capita [kg protein/ person/ a][27]

$Frac_{NPR}$ ... Fraction of nitrogen in protein (IPCC default value – 0.16 kg N/kg protein)

Inhabitants … number of inhabitants in Austria

F … Factor (44/28) [1.57 kg N_2O/ kg N]

Table 198: Calculation of methane emissions for the year 1993

Explanation	Calculation factors and ratings/ Calculation results
The amount of methane generated (MG) per unit of organic substance is presumed.	MG = 0.22 kg CH_4/ kg organic substance
Apart from temperature sewage provides ideal conditions for methane production: moisture, pH value and nutrient supply. The temperature is too low, this is taken into account by applying a methane conversion factor (MCF). Calculations are made with an average temperature of 20°C for 8 months and 10°C for the rest of the year.	$MCF_{20°C}$= 35% (67% of a year) $MCF_{10°C}$= 10% (33% of a year)
Using MCF the effective amount of incidental methane (EM) is calculated: $EM=MCF_{20}*MG*0,67+MCF_{10}*MG*0,33$	EM = 0.058 kg CH_4/ kg organic substance

[27] Daily protein intake per capita taken from FAO statistics: http://apps.fao.org/page/collections?subset=nutrition

Explanation	Calculation factors and ratings/ Calculation results
For each of the three types of wastewater treatment (1: Mechanical/ 2: Biological/ 3: Further) the quantity of organic substance per inhabitant and day (G_1..G_3) as well as the share of dry substance for each type was assumed.	G_1= 45 g organic substance/ inhabitant/ day; including 70% dry substance G_2= 80 g organic substance/ inhabitant/ day; including 60% dry substance G_3= 45 g organic substance/ inhabitant/ day; including 35% dry substance
The factors G_1..G_3 are converted into the unit kg dry substance/ inhabitant/ year {e.g: I_1=G_1*days (365)*0,7 (share of dry substance)}	I_1= 11.5 kg/ inhabitant/ year I_2= 17.5 kg/ inhabitant/ year I_3= 12.8 kg/ inhabitant/ year
Multiplying the quantity of incidental dry organic substance per inhabitant and year (I_1..I_3) by the effective amount of incidental methane (EM) results in a factor for methane emissions per inhabitant and year (F_1..F_3)	F_1 = 0.67 kg CH_4/ inhabitant/ year F_2 = 1 kg CH_4/ inhabitant/ year F_3 = 0.75 kg CH_4/ inhabitant/ /year
The capacity (WWT) of Austrian wastewater treatment plants given in population equivalent [pe] for each type of wastewater treatment (1: Mechanical/ 2: Biological/ 3: Further) are:	WWT_1= 137 420 pe WWT_2= 6 965 411 pe WWT_3= 1 070 065 pe
Industrial wastewater treatment is calculated separately (IWWT): Inhabitants without public wastewater treatment are also considered (PWWT):	IWWT = 4 827 000 pe PWWT = 2 263 265 pe
Domestic and commercial wastewater: By multiplying the delivery rates (WWTs) with the factor for methane emission per inhabitant and year (EM) the methane emission for each treatment type is calculated. These values are summed up (7 849 Mg/a) and also the CH_4 emissions of inhabitants without waste water treatment (these are handled like mechanical treatment – 1 516 Mg/a) are added.	Total CH_4 emissions of domestic and commercial wastewater treatment amount to 9 365 Mg/a
Industrial wastewater: Industrial wastewater is managed like biological treatment, so methane emissions of biological treatment (F_2) are multiplied by the delivery rate of industrial treatment plants (IWWT).	CH_4 emissions from industrial wastewater treatment amount to 4 827 Mg/a

Main difference between the Austrian and the IPCC method

The main difference is that the Austrian method calculates emissions using an implied emission factor per inhabitant and not per kg DOC. To calculate emissions therefore the amount of produced biogas was estimated together for industrial and domestic and commercial wastewater, based on the amount of organic waste. It was not calculated on the basis of BOD (biochemical oxygen demand) and COD (chemical oxygen demand).

Activity data

The number of inhabitants was provided by STATISTIK AUSTRIA.

Table 199 presents the number of inhabitants in Austria as well as the amount of protein in sewage as reported by FAO for the period from 1990 to 2002. It was assumed that the value for protein in sewage of 1999 was still valid for the years until 2002.

Table 199: Number of inhabitants and protein per inhabitant in sewage 1990–2002.

Year	Inhabitants	Protein [g/ day/ inhabitant]
1990	7 729 000	102
1991	7 813 000	103
1992	7 914 000	104
1993	7 991 000	102
1994	8 030 000	103
1995	8 047 000	105
1996	8 059 000	107
1997	8 072 000	106
1998	8 078 000	109
1999	8 092 000	106
2000	8 110 000	106
2001	8 032 926	106
2002	8 032 926	106

8.3.1.3 Planned Improvements

For the next submission it is planned to review the methodology of estimating emissions (including emission factors).

8.3.2 Domestic and Commercial Wastewater (6 B 2)

8.3.2.1 Source Category Description

Key Source: No

Emissions: CH_4, N_2O

Table 200 presents CH_4 and N_2O emissions from domestic and commercial wastewater handling for the period from 1990 to 2002.

As can be seen from the table, CH_4 and N_2O emissions have increased from 1990 to 2000 by 5% and 9%.respectively. Due to the decreasing number of inhabitants in the last two years (2001/2002) CH_4 and N_2O emissions have decreased.

Table 200: Greenhouse gas emissions from Category Domestic and Commercial Wastewater 6 B 2 1990-2002

	CH_4 emissions [Gg]	N_2O emissions [Gg]	Total [CO_2 equivalent Gg]
1990	9.058	0.054	207.04
1991	9.156	0.055	209.42
1992	9.275	0.056	212.28
1993	9.365	0.056	214.11

1994	9.411	0.057	215.32
1995	9.431	0.058	216.04
1996	9.445	0.059	216.65
1997	9.460	0.059	216.86
1998	9.467	0.060	217.56
1999	9.483	0.059	217.45
2000	9.504	0.059	217.94
2001	9.414	0.059	215.86
2002	9.414	0.059	215.86
Trend 1990-2002	3.9%	8.0%	4.3%

8.3.2.2 Methodological Issues

The methodology applied to calculate CH_4 emissions is discussed in subchapter *6 B 1 Wastewater Handling – Industrial wastewater*.

N_2O emissions were calculated in accordance with IPCC methodology [ORTHOFER et al., 1995]. According to this study about 75% of the domestic and commercial sewage in Austria is treated in sewage plants. Furthermore in this study it was estimated that about 10% of the nitrogen that enters wastewater treatment plants is denitrificated and that only 1% of the total nitrogen in the denitrification process is emitted as N_2O. This was taken into account when applying the following formula for estimating the N_2O emissions from this category:

$$N_2O\ Emissions = 0.75 * 0.1 * 0.01 * P * Frac_{NPR} * Inhabitants * F$$

Where:

P… annual protein intake per capita [kg protein/ person/ a][28]

$Frac_{NPR}$ ... 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]

Activity data

The number of inhabitants was provided by STATISTIK AUSTRIA. The number of inhabitants during the period from 1990 to 2002 as well as the daily protein intake per capita are presented in Table 199.

[28] Daily protein intake per capita taken from FAO statistics: http://apps.fao.org/page/collections?subset=nutrition

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 0.5% for the year 1990 and 0.4% for the year 2002.

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 201: Greenhouse gas emissions from Category 6 C.

	CO_2 [Gg]	CH_4 [Gg]	N_2O [Gg]	CO_2 equiv. [Gg]
1990	21	0.002	0.0003	21
1991	18	0.002	0.0003	19
1992	8	NA	0.0000	8
1993	9	NA	0.0001	9
1994	10	NA	0.0001	10
1995	10	NA	0.0001	10
1996	10	NA	0.0001	10
1997	11	NA	0.0001	11
1998	11	NA	0.0001	11
1999	11	NA	0.0001	11
2000	11	NA	0.0001	11
2001	11	NA	0.0001	11
2002	11	NA	0.0001	11
Trend 1990-2002	*-45.7%*	*-100.0%*	*-77.4%*	*-46.0%*

Completeness

Table 202 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 subcategory have been estimated.

Table 202: Overview of subcategories of Category 6 C Waste Incineration,: transformation into SNAP Codes and status of estimation

IPCC Category	SNAP	Status		
		CO_2	CH_4	N_2O
6 C WASTE INCINERATION	090901 Incineration of corpses	✓	NO	NO
	090201 Incineration of domestic or municipal waste.	✓	✓	✓
	090208 Incineration of waste oil	✓	NA	✓

8.4.2 Methodological Issues

CORINAIR methodology is applied: the quantity of waste is multiplied with an emission factor for CO_2, CH_4 and N_2O.

Emission factors

National emission factors for CO_2 and CH_4 are taken from [BMWA-EB, 1990], [BMWA-EB, 1996] and [UBAVIE, 2001]. N_2O emission factors are taken from a national study [ORTHOFER et al., 1995].

For municipal solid waste, the emission factors for waste combustion in district heating plants were selected. The CO_2 emission factor in [BMWA-EB, 1996] is quoted as 100 kg CO_2 /TJ. In the national energy balance 62% of municipal solid waste is reported as non renewable waste and therefore an emission factor of 62 kg CO_2/TJ was selected. A heating value of 8.7 GJ/Mg Municipal Waste was used to convert the emission factors from [kg/TJ] to [kg/Mg].

For waste oil, the emission factors for heavy oil were selected and a heating value of 40.3 GJ/Mg Waste Oil was used to convert the emission factors from [kg/TJ] to [kg/Mg].

Table 203: Emission factors of IPCC Category 6 C Waste Incineration.

Waste Type	CO_2 [kg/ Mg]	CH_4 [g / Mg]	N_2O [g / Mg]
Municipal Waste	539.40	104.40	12.18
Waste Oil	3224.00	NA	24.18

For incineration of corpses only CO_2 emissions were considered, the emission factor of 175 kg CO_2/capita was taken from a Swiss study [BUWAL, 1995]. It was calculated based on measured values of CO_2 in the exhaust gases of crematories.

Activity data

For municipal solid waste the known capacity of 22 000 tons of waste per year of one waste incineration plant was taken.

For waste oil the activity data were taken from [UBAVIE IB-650, 2001].

For incineration of corpses the activity data as presented in Table 204 were taken from STATISTIK AUSTRIA. It was assumed that 12% of the total number of corpses was incinerated every year.

Table 204: Activity data for IPCC Category 6 C Waste Incineration.

Year	Municipal Waste [Mg]	Waste Oil [Mg]	Total number of corpses	Number of incinerated corpses
1990	22 000	2 200	82 952	9 954
1991	22 000	1 500	83 428	10 011
1992	0	1 800	83 162	9 979
1993	0	2 100	82 517	9 902
1994	0	2 500	80 684	9 682
1995	0	2 600	81 171	9 741
1996	0	2 700	80 790	9 695
1997	0	2 800	79 432	9 532
1998	0	2 900	78 339	9 401
1999	0	3 000	78 200	9 384
2000	0	3 000	76 780	9 214
2001	0	3 000	74 767	8 972
2002	0	3 000	74 767	8 972

8.4.3 Planned Improvements

Until the next submission of the National Inventory Report it is planned to review the methodology of estimating emissions (including emission factors) and to update activity data.

8.5 Other Waste (CRF Source Category 6 D)

8.5.1 Source Category Description

In this category compost production is addressed.

8.5.2 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 205 for the period from 1990 to 2002.

CH_4 and N_2O emissions, that arise from the subcategory compost production increased over the time period as a result of the increasing amount of composted waste.

Table 205: Greenhouse gas emissions from Category Compost Production 1990-2002

	CH_4 emissions [Gg]	N_2O emissions [Gg]	Total [CO_2 equivalent Gg]
1990	0.52	0.08	34.8
1991	0.54	0.08	36.4
1992	0.65	0.10	43.4
1993	0.82	0.12	54.2
1994	0.98	0.14	64.4
1995	1.04	0.15	68.2
1996	1.09	0.16	71.4
1997	1.01	0.14	66.1
1998	1.02	0.15	66.6
1999	1.05	0.15	68.3
2000	1.01	0.14	65.7
2001	1.01	0.14	65.7
2002	1.01	0.14	65.7
Trend 1990-2002	94.35%	86.51%	88.96%

8.5.2.1 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

CH_4 emissions were calculated by multiplying an emission factor by the quantity of waste .

Activity data

The activity data are taken from several national studies. For years where no data were available they are interpolated or extrapolated and the value of the year before was used respectively.

Table 206: Activity data for IPCC Category 6 D Other Waste (Compost Production)

	Total	Bio-waste, loppings, home composting(1)	mechanical biological treated residual waste		Sewage Sludge	
	[Gg/a]	[Gg/a]	[Gg/a]	references	[Gg/a]	references
1990	**765.0**	413.2	345.0	[BAUMELER et al., 1998]	6.8	
1991	**800.1**	448.3	345.0		6.8	[BAWP,1995]
1992	**947.5**	591.3	345.0		11.1	
1993	**1 176.7**	816.2	345.0		15.5	
1994	**1 393.3**	1 028.5	345.0		19.8	
1995	**1 470.8**	1 151.6	295.0	[ANGERER, 1997]	24.2	[SCHARF et al., 1998]
1996	**1 537.5**	1 233.5	280.0		24.0	
1997	**1 421.4**	1 152.5	245.0	[LAHL et al., 1998]	23.9	
1998	**1 433.1**	1 169.3	240.0	[LAHL et al, 2000]	23.8	[BAWP, 2001]
1999	**1 471.5**	1 182.7	265.0	[GRECH, ROLLAND 2001]	23.8	
2000	**1 415.6**	1 126.8	265.0		23.8	
2001	**1 415.6**	1 126.8	265.0		23.8	
2002	**1 415.6**	1 126.8	265.0		23.8	

1) [AMLINGER, 2003]

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 207: 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]

8.5.2.2 Recalculations

- In the previous submission a constant value for the composted waste was used. In this submission a time series was obtained from national studies.
- Emission factors have been updated according to national studies.
- In the previous submission sludge spreading was included in this category as well. Following the IPCC guidelines, emissions from sludge spreading have been reallocated to category *4 D 1*.

Table 208: Recalculations with respect to previous submission from sub category 6 D Other Waste 1990-2001

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
CH4 emissions [Gg]	-1.96	-1.94	-1.83	-1.66	-1.50	-1.44	-1.39	-1.47	-1.46	-1.43	-1.47	-1.47
N2O emissions [Gg]	0.08	0.08	0.10	0.12	0.14	0.15	0.16	0.14	0.15	0.15	0.14	0.14

9 RECALCULATIONS AND IMPROVEMENTS

This chapter quantifies the changes in emissions for all six greenhouse gases compared to the previous submission – UNFCCC 2003 (in the format of the IPCC Summary Table 1A).

9.1 Explanations and Justifications for Recalculations

Compiling an emission inventory includes data collecting, data transfer and data processing. Data must be collected from different sources, for instance statistic divisions, plant operators, studies, personal information or other publications. The provided data must be transferred from different data formats and units into a unique electronic format to be processed further. The calculation of emissions by applying methodologies on the collected data and the final computing of time series into a predefined format (CRF) are further steps in the preparation of the final submission. Finally the submission must be delivered in due time. Even though a QA/QC system gives assistance so that potential error sources are minimized it is sometimes necessary to make some revisions (called recalculations) under the following circumstances:

- An emission source was not considered in the previous inventory.
- A source/data supplier has delivered new data. The causes might be: Previous data were preliminary data only (by estimation, extrapolation), improvements in methodology.
- Occurrence of errors in data transfer or processing: wrong data, unit-conversion, software errors, ...
- Methodological changes: a new methodology must be applied to fulfil the reporting requirements because one of the following reasons:
    - Uncertainty must be decreased.
    - 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.
    - National 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.

Improvements in response to UNFCCC review

Energy/Industry:

Emissions due to combustion from cement industry and iron and steel industry that have been reported together with process-specific emissions in the industry sector until last submission are now reported in the energy sector.

Fugitive Emissions:

In response to the comments of the ERT, now a default EF for coal mining is used.

Industry:

CO_2 emissions from limestone and dolomite use, from soda ash use, carbide production, electric arc furnaces and aluminium production have been included in the inventory.

Data for 2 A 7 magnesia sinter plants have been updated according to plant specific information.

Agriculture:

The age class split for swine categories for the years 1990–1992 was adjusted because there is an inconsistency in the time series in the statistical data set resulting from a changing methodology of the statistical survey in 1992/1993. The time series has been adjusted using the split from 1993, resulting in higher emissions for the years 1990-1992.

Inconsistencies in the background table for Agriculture (Table 4.B(b)) that have been identified during the centralized review 2003 have been corrected.

Table 209 presents the issues raised at the centralized review 2003 together with a short description of improvements made in response to the UNFCCC review. For details please refer to the respective sub chapter of the NIR.

Table 209: Issues raised in the UNFCCC review 2003 and improvements made

Paragraphs from the review Report for Austria (Centralized Review 2003) FCCC/WEB/IRI(3)/2003/AUT	**Improvements made / Comments**
Energy	
Comparison of the reference approach with the sectoral approach and international statistics 20. The differences between the reference and sectoral approaches vary between 8.1 per cent and 12.5 per cent between 1990 and 2001; these are quite large differences. However, the NIR has provided an extremely detailed description of the differences. The ERT has considered the reasons provided by the Party and encourages Austria to try to quantify the larger items to enable better understanding and to enhance transparency. In response to the draft review report the Party has indicated that it plans to provide a more detailed quantification of the differences in the next submission.	Due to the changes in methodology the difference was reduced to a maximum 2.12% in 2001. It is expected that further harmonization of energy statistics with data from industry will limit the difference to a maximum of 2%.
International bunker fuels 21. A detailed description is provided for the calculation of CO2, N2O and CH4 emissions for aviation (including military aviation). Fuel consumption data for the different transport modes (national landing/take off cycle (LTO), international LTO, national cruise, international cruise) were obtained from the MEET model developed by the European Commission. The ERT notes that Austria is currently in the process of harmonizing the CRF and IEA AD for international bunkers.	Considered in the improvement plan.
Feedstocks and non-energy use of fuels 22. The Party reports in table 1.A(d) that some categories of fuel have been used either as feedstocks or for non-energy use. However, for all the fuels, in the reference approach the same value of fraction of carbon stored (i.e., 1.0) has been used. In the IPCC Guidelines, only bitumen has a default value of 1.0. The ERT recommends that the rationale for this choice be made explicit.	Considered in the improvement plan.
23. There is no additional information in the NIR as to the relationship be-	Information has been in-

tween the Energy sector and the Industrial Processes, Solvents and Other Product Use, and Waste sectors. The ERT recommends that the Party provide clear documentation on this issue in the NIR. In response to the draft review report the Party has indicated that it plans to provide a section on feedstocks and non energy use of fuels in the next submission.	cluded in the NIR
Stationary Combustion 24. CO2 from iron and steel (1.A.2.a) has been a key source by level assessment since 1990. The CO2 implied emission factors (IEFs) for solid, liquid and gaseous fuels are the lowest of those reported by the Parties. In the NIR, the Party has reported that fuel combustion in the iron and steel industry is under category 1.A.2.a except for two sites that are reported under 2.C.1 with industrial process emissions, which explains the lower IEFs. The Party plans to reallocate combustion emissions from the industrial processes sector to the energy sector in the next submission.	Combustion emissions have been reallocated from the industrial processes sector to the energy sector
Civil Aviation 25. For civil aviation (1.A.3.a), the AD for jet kerosene and aviation gasoline in the CRF are higher than those reported by the IEA. The Party has responded that these data have not yet been harmonized but has plans to do so for the next submission. The ERT encourages Austria to harmonize the two data sets.	Considered in the improvement plan.
Industrial Processes and Solvent Use	
26. In 2001, industrial process emissions accounted for 19 per cent of total CO2 equivalent emissions (without LUCF), less than in the base year 1990 (21 per cent). CO2 emissions represented 83 per cent of the Industrial Processes sector's emissions in 2001 (mostly from metal and cement production). N2O emissions (from nitric acid production) accounted for 6 per cent and actual emissions of fluorinated gases (F-gases) accounted for 11 per cent. In the period 1990–2001, industrial processes CO_2 equivalent emissions remained almost constant, mainly because of a decrease of 11 per cent in N2O emissions from nitric acid production, compensated by a 17 per cent increase in F-gases. Recalculations for the complete time series have been made, notably for N2O from nitric acid production. Both actual and potential emissions for individual F-gases are reported, except for PFCs for which no potential emissions are reported (although Austria reports PFC consumption for semiconductor manufacture). The Party indicated that this information will be included in the next submission.	Potential emissions of PFCs are now reported.
29. The transparency of the reporting of this sector could be improved by using the source allocation recommended in the IPCC Guidelines and the IPCC good practice guidance whenever possible (cement, iron and steel) and by using the correct notation keys in the CRF: for example the emissions in, 2.B.3 – N2O; and 2.C.3 – CO2, CH4, non-GHG; are all indicated as "not estimated" (NE) instead of "not occurring" (NO). As Austria uses mostly CORINAIR or country-specific methods as well as country- or plant-specific EFs, to assist transparency and comparability the ERT recommends that Austria report the corresponding IPCC tier of these methods in the NIR. Austria indicated in its response to the draft review report that it will include the corresponding tier in its future NIRs.	Combustion emissions have been reallocated from the industrial processes sector to the energy sector. The use of notation keys has been revised. Information on IPCC tiers has been added to the NIR.
30. Regarding completeness, Austria reports that not all sources are reported yet. Apart from the studies the Party has announced on CO2 from limestone and dolomite use, from production and use of soda ash and from carbide production, the ERT encourages the Party also to conduct a survey of CO2 from ferroalloys, CH4 from iron and steel production (including coke production) and SF6 from manufacture of electrical equip-	CO_2 from limestone and dolomite use, from production and use of soda ash and from carbide production are now reported. Other sources

ment. In response to the draft review report Austria indicated that this will be considered in the improvement plan. Moreover, the ERT encourages Austria to compile and report first-order estimates of exports of HFCs and SF6, since this factor may well explain the relatively high potential to actual emissions (P/A) ratios compared to figures reported by other Parties.	are considered in the improvement plan. An error regarding potential emissions has been identified and corrected.
Cement production – CO2 31. Austria applies the IPCC good practice guidance tier 2 method based on clinker production data, including CO2 emissions from fuel combustion since the emission factor is based on stack measurements, which is considered more accurate since the carbon content of the different kind of wastes used as fuel fluctuates. The NIR states that this could not be corrected due to lack of data on fuel consumption and combustion emission factors. However, the Party responded that these emissions are not double-counted since a correction in the fuel consumption is made in the Energy sector. Also, based on detailed analysis in the NIR a separation of emissions into non-combustion processes and fuel combustion is presented. The ERT recommends the Party improve the transparency for this source by reporting combustion and non-combustion emissions separately, which the Party plans to do in the next submission.	Combustion emissions have been reallocated from the industrial processes sector to the energy sector.
Lime production – CO2 32. The IEF for CO2 is constant, at 804 kg/t, until 1997, when it increased substantially. In the NIR Austria explains this increase as being due to an artefact. The ERT recommends the Party to recalculate the data set using consistent emission factors. Austria has identified plans to do this in the NIR.	Emissions from lime production have been recalculated based on plant-specific data.
Ammonia production – CO2 33. The IEF for CO2 peaks in 1998 (as does the IEF for CH4). Austria explained that the large interannual change was due to the number of shutdowns and start ups during the year, especially after a turn around with exchange of catalyst (as in 1998). The ERT recommends that Austria provides this explanation in the NIR. In response to the draft review report the Party has indicated that it plans to provide an explanation in the next submission.	Information has been included in the NIR.
Nitric Acid production – N20 34. The NIR states that new measurements used to recalculate the N2O EF are available for 1998 onwards but does not provide information about how the new EF for 1990–1997 was determined. The Party provided the ERT with an explanation of how the pre-1998 N2O emission factors were determined and the ERT recommends that this information be included in the NIR. The consistency of the time series will be improved by correction of the nitric acid production figures for 1992 and 1993, as announced in the NIR. In response to the draft review report the Party has indicated that it plans to include information on the pre-1998 emission factors in the next submission.	Information has been included in the NIR.
Nitric Acid production – CO2 35. Austria reports minor process emissions of CO2 from nitric acid production, whereas the IPCC Guidelines do not identify such a source of CO2. The ERT recommends Austria to describe the nature of these emissions (from oxidation of ammonia used as feedstock in which some methane is resolved) and the determination of the emission factor in the NIR. In response to the draft review report the Party has indicated that it plans to include this information in the next submission.	Information has been included in the NIR.

Iron and steel production – CO2 36. The NIR states that in 2000 CO2 emissions for one power plant were not reported, causing a time-series inconsistency. However, the NIR also states that the company involved did make an estimate of these emissions. The ERT recommends that the missing emissions be estimated on the basis of the company's estimates, where available, or previous years' production and emissions statistics. In response to the draft review report the Party has indicated that it will estimate emissions using the methods recommended by the ERT.	Emissions are now included.
Iron and steel production – CO2 37. The ERT recommends that the Party improves the transparency and consistency of the information provided by explaining how combustion and non-combustion emissions were accounted for and allocated. This includes CO2 emissions from electric arc furnaces and aluminium production for 1990-1992, which are presently not accounted for. Austria announced that these will be included in the next submission and provided a general explanation for the decrease over time of the implied emission factor for CO2.	Combustion emissions have been reallocated from the industrial processes sector to the energy sector; Information has been included in the NIR;
Consumption of ozone-depleting substances substitutes – SF6 38. Austria's explanations of the high P/A ratio for SF6 emissions (13.7 in 2001) as being caused by its use in sound-insulating windows and electric switchgear manufacture are not justified by the filling losses for windows and the emissions from gas-insulated switchgear (GIS). The ERT therefore recommends that Austria further elaborate on this issue when new data become available as indicated in the NIR, for example, by checking the data used for calculating and reporting potential emissions of SF6 (presently corresponding to the equipment stocks and exports reported as "NE"). In response to the draft review report the Austria indicated that the methodology will be reviewed in 2004.	An error regarding potential emissions has been identified and corrected.
Solvent and other product use – CO2 39. According to the NIR, CO2 emissions from solvent use are reported; however, no clear description is presented of how and where CO2 related to other product use is accounted for and similarly for fossil fuel feedstock/non-energy use of fuels. The ERT recommends that, for all feedstock/non energy product use sources of CO2, Austria provides in the NIR a description of the method and factors used, and in which categories these emissions are reported and in particular how the emissions were checked for completeness and avoiding double counting in the national inventory. Austria has indicated that it will include a chapter on feedstock use in the next submission.	Section on feedstocks has been added to the NIR; further investigations are planned;
Other production – CO2 40. Austria reports minor CO2 emissions from food and drink production related to bread, wine, spirits and beer, whereas the IPCC Guidelines do not identify such non-organic carbon sources of CO2. Austria confirmed that this was due to an error which will be corrected in the next submission.	Emissions are now reported as biogenic.
Agriculture	
Enteric fermentation – CH4 45. Austria now uses country-specific tier 2 methods to estimate emissions from cattle. These new methods represent a major improvement in the Austrian inventory and produce gross energy intakes (GEIs) that are comparable to those reported by other Parties. To assist transparency it would be useful if a brief summary of the inputs into the dairy model (eg	Information on GEIs is planned to be added until the next submission. A weighted average daily

would be useful if a brief summary of the inputs into the dairy model (eg. diets, liveweights) could be included in the NIR. For non-dairy cattle either a weighted average daily intake should be included in table 4.A or the detailed GEIs should be reported in the documentation box. Austria has indicated in its response to the draft review report that it will provide this information in its next submission.	intake value for non-dairy cattle is now reported.
Manure management – CH4 46. The NIR indicates that there is a time-series discontinuity in the numbers of swine in different age classes. This is due to changes in data collection in 1993. This only affects manure management emissions, as enteric fermentation is calculated using total swine numbers. As total swine numbers are available, the ERT recommends that the Party adjust the age class data for 1990–1992 so that they add up to the total number of swine. Total swine could be split into the different age classes using proportions derived from the 1993 data. In response to the draft review report the Party has indicated that it will use the approach recommended by the ERT to split age classes for the next submission.	The age class split for swine was adjusted.
Manure management – N2O 47. Austria estimates emissions for different animal waste management systems (AWMS) but reports all emissions under liquid systems in the CRF tables. The ERT recommends that the Party report emissions under the appropriate AWMS in the CRF. There is an inconsistency in the allocation of swine and sheep waste to AWMS in tables 4.B(a) and 4.B(b). For example, table 4.B(a) reports that over 70 per cent of swine waste is treated in liquid systems but no waste is allocated to this AWMS in table 4.B(b). The Party has indicated that there is an error in table 4.B(b) which will be corrected in the next submission. 48. Swine numbers for 1990–1992 should be corrected as described for manure management CH4.	Emissions are planned to be reported under the appropriate AMWS for next submission. Inconsistencies in Table 4.B(b) were corrected. The age class split for swine was adjusted.
Direct emissions from agricultural soils – N2O 49. The quantity of animal waste nitrogen (N) applied to soils is greater than the quantity of nitrogen reported for non-pasture AWMS in table 4.B(b). It is also inconsistent with the values reported in the NIR. The N reported in table 4.B(b) should represent the maximum N available for animal waste applied to soils. The Party has indicated that there is an error in table 4.B(b) which will be corrected in the next submission.	The quantity of animal waste nitrogen (N) applied to soils differs from the values reported in the NIR (Table 175) because in the NIR table NH_3 and NOx volitalizsation losses during spreading are not subtracted. Inconsistencies in Table 4.B(b) were corrected.
Animal production – N2O 50. The amount of nitrogen excreted onto pasture range and paddock reported in table 4.D is greater than that reported in table 4.B(b). The Party has indicated that there is an error in table 4.B(b) which will be corrected in the next submission.	Inconsistencies in Table 4.B(b) were corrected.
LUCF	
Changes in forest and other woody biomass stocks 55. A country-specific NFI-based methodology consistent with IPCC methodology is adopted. The average annual growth rates of 4.91 t/ha/yr for evergreen forest and 5.15 t/ha/yr for deciduous temperate forest include below-ground biomass and are within the IPCC default ranges. The CRF tables report 2000 ha of plantations but no growth rate or removals are	Considered in the improvement plan.

are estimated. The ERT recommends that the Party estimate removals from this source for the sake of completeness. To increase transparency, the biomass losses due to harvesting and forest conversion could be separately reported, using information from the NFI and other data sources. In response to the draft review report the Party has indicated that removals from plantations will be estimated for the next submission.	
Forest grassland conversion 56. To increase transparency, the ERT encourages the Party to report the biomass losses associated with forest harvesting and forest conversion separately. In response to the draft review report the Party has indicated that it plans to report these losses separately in the 2004 or 2005 submission. 57. Non-CO2 emissions associated with forest fires or biomass burning are reported as "NE" in Table 5. In response to the draft review report the Party has indicated that these emissions should be reported as "NO" as the practice of burning during forest conversion in not used in Austria. The ERT recommends that the correct notation keys be reported in the next submission.	Considered in the improvement plan.
Abandonment of managed lands 58. To increase transparency, the ERT encourages the Party to report the CO2 removals associated with the abandonment of managed lands. In response to the draft review report the Party has indicated that it plans to report CO2 from abandoned lands in the 2004 or 2005 submission.	Considered in the improvement plan.
Waste	
Solid waste disposal on land – CH4 63. The method for calculating the emissions from SWDS separates waste into two categories, "residual waste" and "non-residual waste". Because of lack of data, non-residual waste is assumed to be constant for all inventory years. The ERT recommends that the Party develop an extrapolation of the non-residual waste figures, taking into account population growth and changes in management practices such as incineration and recycling. The NIR indicates that Austria has plans to update these AD.	The data for "non-residual waste" has been updated.
64. The CRF additional information tables report the fraction of municipal solid waste (MSW) disposed of to SWDS as 0.29, with 0.15 and 0.34 disposed of to waste incineration and recycling, respectively. The sum is less than 1. The NIR states that an additional 0.15 is allocated to biogenous waste recycling and 0.06 to mechanico-biological pre-treatment. The ERT recommends that the Party include these data in the CRF additional information box. In response to the draft review report the Party has indicated that it plans to include this information in the next submission.	Information has been included in the documentation box.
65. The CH4 oxidation factor (0.2) is significantly higher that the IPCC default value (0.1) recommended for well-managed SWDS. The choice of oxidation factor should be explained in the NIR and the CRF. In response to the draft review report the Party has indicated that it plans to recalculate emissions for the next submission using the default IPCC oxidation factor.	The old oxidation factor is still in use, it has been confirmed by a study.
66. The quantity of waste composition reported as "other" (51 per cent) seems high in comparison to those reported by other Annex I Parties. It is unclear whether the "other" is inert or organic waste as the table reports "other – inert" as 2.41 per cent and "other – organic" as 0.00 per cent. Further explanation should be provided in the NIR and the CRF. The Party has indicated to the ERT that it plans to obtain more accurate information	Explanation has been provided in the NIR and the CRF.

of composition for the next submission.	
Waste incineration – CO2 67. Austria has informed the ERT that CO2 emissions from the incineration of waste oil are either reported under 6.C, when there is no energy recovery, or under 1.A Fuel combustion, when there is energy recovery. The ERT recommends that the Party improve the documentation of the allocation of incinerated waste in the NIR. In response to the draft review report the Party has indicated that it plans to improve the documentation in the next submission.	Explanation in the NIR has been improved.

9.2 Implication for Emission Levels

Subchapters 9.2.1 to 9.2.3 present the implication of recalculations for emission levels by category for CO_2, CH_4 and N_2O. No recalculations where done for HFCs, PFCs or SF_6.

Table 210: IPCC codes and names of categories

0	**TOTAL without sinks**
1	ENERGY
1 A	FUEL COMBUSTION ACTIVITIES
1 A 1	Energy Industries
1 A 2	Manufacturing Industries and Construction
1 A 3	Transport
1 A 4	Other Sectors
1 A 5	Other
1 B	FUGITIVE EMISSIONS FROM FUELS
1 B 2	Oil and natural gas
2	INDUSTRIAL PROCESSES
2 A	MINERAL PRODUCTS
2 A 1	Cement Production
2 A 2	Lime Production
2 A 3	Limestone and Dolomite Use
2 A 4	Soda Ash Production and use
2 A 7	Other
2 B	CHEMICAL INDUSTRY
2 B 4	Carbide Production
2 B 5	Other
2 C	METAL PRODUCTION
2 D	OTHER PRODUCTION
3	SOLVENT AND OTHER PRODUCT USE
4	AGRICULTURE
5	LAND USE CHANGE AND FORESTRY
6	WASTE
6 C	WASTE INCINERATION
7	OTHER
I B	International Bunkers
Bio	CO2 Emissions from Bio-mass

9.2.1 Recalculation of CO_2 Emissions by Categories

Explanations are provided in Chapter 9.1 and in the sector specific chapters of this report.

Table 211: Recalculation Difference of CO_2 Emissions.

IPCC Cat.	CO_2 [Gg]; Differences with respect to Submission 2003											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
0	786.72	940.42	625.53	2.78	-39.89	-152.41	-481.55	-494.92	-525.32	-684.22	136.24	-82.92
1	6 570.34	6 237.36	5 375.65	4 943.56	5 220.57	5 114.92	4 633.12	5 191.73	4 558.83	4 599.05	4 973.16	5 309.45
1 A	6 588.28	6 256.33	5 394.27	4 963.20	5 240.78	5 136.99	4 656.60	5 214.37	4 582.06	4 622.79	4 996.11	5 333.61
1 A 1	250.35	173.97	178.63	15.40	17.20	11.15	-4.54	-6.05	-3.95	-102.21	264.83	136.94
1 A 2	6 105.70	5 922.35	5 015.89	4 914.30	5 187.97	5 075.37	4 565.04	5 196.16	4 560.84	4 546.52	4 645.32	5 167.72
1 A 3	20.50	5.20	-11.59	-39.31	-41.80	-32.36	-38.87	-37.60	-42.28	54.77	-43.51	-181.26
1 A 4	176.71	117.69	177.65	33.39	35.81	50.24	96.05	24.72	25.01	82.09	84.51	166.81
1 A 5	NE--> 35.02	NE--> 37.11	NE--> 33.7	NE--> 39.43	NE--> 41.6	NE--> 32.59	NE--> 38.94	NE--> 37.13	NE--> 42.45	NE--> 41.62	NE--> 44.95	NE--> 43.4
1 B	-17.94	-18.97	-18.63	-19.65	-20.21	-22.07	-23.48	-22.63	-23.24	-23.74	-22.95	-24.16
1 B 2	-17.94	-18.97	-18.63	-19.65	-20.21	-22.07	-23.48	-22.63	-23.24	-23.74	-22.95	-24.16
2	-5 543.65	-5 097.26	-4 556.41	-4 767.25	-5 070.59	-5 076.57	-4 908.39	-5 471.28	-4 860.76	-5 046.00	-4 622.30	-5 190.28
2 A	-731.83	-737.39	-781.04	-676.03	-696.99	-406.27	-490.99	-432.07	-343.80	-357.43	-255.58	-259.46
2 A 1	-1 054.66	-1 037.78	-1 107.18	-1 038.29	-1 088.89	-867.07	-861.30	-881.63	-802.39	-793.04	-759.39	-759.39
2 A 2	78.65	61.87	68.59	74.06	103.00	90.83	78.96	108.69	150.00	157.60	202.00	211.08
2 A 3	NE--> 200.26	NE--> 202.93	NE--> 181.06	NE--> 180.87	NE--> 195.39	NE--> 225.39	NE--> 201.31	NE--> 228.47	NE--> 238.39	NE--> 221.63	NE--> 249.95	NE--> 245.28
2 A 4	NE--> 19.38	NE--> 22.3	NE--> 19.73	NE--> 19.75	NE--> 21.14	NE--> 21.15	NE--> 21.15	NE--> 19.73	NE--> 19.73	NE--> 21.64	NE--> 18.25	NE--> 21.44
2 A 7	24.55	13.28	56.76	87.59	72.37	123.42	68.88	92.68	50.47	34.75	33.62	22.15
2 B	37.50	35.18	41.32	32.86	25.10	26.22	32.81	32.80	35.04	32.41	48.11	46.67
2 B 4	NE--> 37.51	NE--> 35.19	NE--> 41.33	NE--> 32.88	NE--> 25.14	NE--> 26.22	NE--> 32.81	NE--> 32.8	NE--> 35.04	NE--> 32.45	NE--> 48.11	NE--> 46.68
2 B 5	-0.01	-0.01	-0.01	-0.01	-0.02	0.00	0.00	0.00	0.00	-0.05	0.00	0.00
2 C	-4 788.12	-4 330.52	-3 762.17	-4 076.51	-4 345.59	-4 644.62	-4 399.56	-5 024.37	-4 495.29	-4 663.26	-4 361.77	-4 924.44
2 D	61.21 -->NO	64.52 -->NO	54.51 -->NO	47.57 -->NO	53.11 -->NO	51.89 -->NO	50.65 -->NO	47.64 -->NO	56.7 -->NO	57.71 -->NO	53.06 -->NO	53.06 -->NO
3	-239.98	-199.68	-193.71	-173.52	-189.87	-190.76	-206.28	-215.38	-223.39	-237.27	-214.62	-202.04
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.04
6 C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.04
7												
I B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bio	0.01	0.02	0.00	-0.02	0.04	0.01	0.00	113.64	96.44	11.23	123.75	635.63

Blank fields indicate that no recalculation of emissions has been carried out.

9.2.2 Recalculation of CH_4 Emissions by Categories

Explanations are provided in Chapter 9.1 and in the sector specific chapters of this report.

Table 212: Recalculation Difference of CH_4 Emissions.

IPCC Cate-gories	CH_4 [Gg]; Differences with respect to Submission 2003											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
0	-61.78	-57.73	-58.50	-62.30	-61.72	-61.95	-64.37	-60.58	-58.35	-60.58	-63.98	-67.55
1	8.99	8.77	8.99	8.66	8.23	8.33	8.91	11.94	11.64	11.64	11.08	11.76
1 A	0.28	0.15	0.38	-0.07	-0.11	-0.12	-0.17	2.79	2.65	2.54	2.20	3.00
1 A 1	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	-0.03	-0.05	-0.11
1 A 2	-0.14	-0.14	-0.16	-0.15	-0.16	-0.17	-0.17	-0.17	-0.19	-0.18	-0.21	-0.17
1 A 3	-0.01	-0.01	-0.01	-0.02	-0.02	-0.01	-0.02	-0.01	-0.01	0.00	-0.02	-0.03
1 A 4	0.43	0.30	0.55	0.09	0.05	0.06	0.03	2.96	2.84	2.75	2.48	3.31
1 B	8.70	8.63	8.61	8.73	8.34	8.45	9.07	9.15	8.99	9.10	8.88	8.76
1 B 1	0.51	0.43	0.36	0.35	0.28	0.27	0.23	0.23	0.24	0.24	0.26	0.25
1 B 2	8.20	8.20	8.25	8.38	8.06	8.18	8.84	8.92	8.76	8.87	8.62	8.50
2	0.19	0.17	0.16	0.17	0.16	0.12	0.12	0.12	0.13	0.13	0.14	0.13
2 A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 B	0.19	0.17	0.16	0.17	0.16	0.12	0.12	0.12	0.13	0.13	0.14	0.13
2 C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3												
4	8.03	8.00	7.97	0.88	3.86	5.10	4.44	4.01	3.42	2.74	1.97	1.38
4 A	0.40	0.39	0.37	0.37	3.06	4.07	3.51	3.12	2.61	1.99	1.33	0.84
4 B	7.30	7.29	7.28	0.05	0.40	0.58	0.49	0.45	0.36	0.29	0.18	0.11
4 D	NE--> 0.33	NE--> 0.33	NE--> 0.31	NE--> 0.47	NE--> 0.4	NE--> 0.44	NE--> 0.45	NE--> 0.45	NE--> 0.45	NE--> 0.45	NE--> 0.45	NE--> 0.43
4 F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5												
6	-78.98	-74.67	-75.62	-72.01	-73.97	-75.50	-77.85	-76.65	-73.54	-75.08	-77.17	-80.82
6 A	-57.02	-52.74	-53.79	-50.35	-52.47	-54.06	-56.46	-55.19	-52.08	-53.65	-55.69	-59.28
6 B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.06
6 C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7												
I B	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02

Blank fields indicate that no recalculation of emissions has been carried out.

9.2.3 Recalculation of N_2O Emissions by Categories

Explanations are provided in Chapter 9.1 and in the sector specific chapters of this report.

Table 213: Recalculation Difference of N_2O Emissions

IPCC Cate-gories	CO_2 [Gg]; Differences with respect to Submission 2003											
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
0	0.59	0.60	1.44	0.45	0.16	0.04	-0.05	-0.13	-0.22	-0.27	-0.33	0.06
1	0.07	0.07	0.06	0.05	-0.09	-0.25	-0.33	-0.38	-0.46	-0.50	-0.52	-0.51
1 A	0.07	0.07	0.06	0.05	-0.09	-0.25	-0.33	-0.38	-0.46	-0.50	-0.52	-0.51
1 A 1	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02
1 A 2	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.06	0.08	0.07	0.08	0.12
1 A 3	0.00	0.00	0.00	0.00	-0.15	-0.31	-0.38	-0.45	-0.56	-0.59	-0.63	-0.67
1 A 4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02
1 B												
2	0.02	0.02	0.86	0.26	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
2 B	0.02	0.02	0.86	0.26	0.01	0.01	0.01	0.01	0.01	0.01	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	0.00	0.00
4	0.43	0.42	0.42	0.01	0.10	0.14	0.12	0.10	0.09	0.07	0.05	0.43
4 B	0.12	0.12	0.12	0.00	0.04	0.06	0.05	0.05	0.04	0.03	0.02	0.03
4 D	0.30	0.30	0.30	0.01	0.06	0.08	0.07	0.06	0.05	0.04	0.03	0.40
4 F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5												
6	0.08	0.08	0.10	0.12	0.14	0.15	0.16	0.14	0.15	0.15	0.14	0.14
6 D	0.08	0.08	0.10	0.12	0.14	0.15	0.16	0.14	0.15	0.15	0.14	0.14
7												
I B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Blank fields indicate that no recalculation of emissions has been carried out.

9.2.4 Recalculation of National Total GHG Emissions

Table 214 compares national total GHG emissions of UNFCCC submission 2004 with UNFCCC submission 2003. Due to the recalculations national total GHG emissions are now lower: for the base year they are 0.42% lower and for the year 2001 1.73%.

Table 214: Recalculation Difference of National Total CO_2 Equivalent Emissions

Year	National Total GHG emissions without LUCF		
	Submission 2003 [Gg CO_2e]	Submission 2004 [Gg CO_2e]	Recalculation Difference [%]
Base year	78 325	77 998	-0.42%
1990	78 073	77 746	-0.42%
1991	82 241	82 154	-0.11%
1992	75 291	75 135	-0.21%
1993	76 580	75 413	-1.52%
1994	77 768	76 480	-1.66%
1995	80 797	79 356	-1.78%
1996	84 624	82 776	-2.18%
1997	84 146	82 340	-2.15%
1998	83 819	82 000	-2.17%
1999	82 123	80 083	-2.48%
2000	81 951	80 640	-1.60%
2001	85 880	84 398	-1.73%

Table 215 presents recalculations for CO_2 and CH_4. The recalculation differences for CO_2 emissions are mainly due to revisions of the time series of the energy balance and the consideration of new sources of the industry sector. The recalculation differences for CH_4 emissions are mainly due to revisions of the time series of activity data of the waste sector. For further information see Chapter 9.1 and the sector specific chapters of this report.

Table 216 presents recalculations for N_2O and fluorinated compounds. N_2O estimates increased for the beginning of the reported time series, this is mainly due a revision of the time series of milk yield which resulted in higher emissions from agricultural soils and manure management. For the end of the time series emissions decreased, which is mainly due recalculations of emissions from the transport sector.

For fluorinated compounds no recalculations were done.

For further information see Chapter 9.1 and the sector specific chapters of this report.

Table 215: Recalculation Difference of National CO_2 and CH_4 Emissions.

Year	CO_2 [Gg]			CH_4 [Gg]		
	Submission 2002	Submission 2003	Recalculation Difference [%]	Submission 2002	Submission 2003	Recalculation Difference [%]
1990*	60 113	60 899	1.31%	508.17	446.39	-12.16%
1991	63 595	64 535	1.48%	502.46	444.74	-11.49%
1992	58 455	59 080	1.07%	489.50	431.01	-11.95%
1993	59 307	59 310	0.00%	491.31	429.01	-12.68%
1994	59 744	59 704	-0.07%	484.21	422.49	-12.75%
1995	62 627	62 474	-0.24%	479.73	417.78	-12.91%
1996	66 629	66 147	-0.72%	474.07	409.69	-13.58%
1997	66 208	65 713	-0.75%	457.57	397.00	-13.24%
1998	66 333	65 808	-0.79%	449.60	391.25	-12.98%
1999	65 020	64 336	-1.05%	442.84	382.26	-13.68%
2000	64 928	65 064	0.21%	434.97	370.98	-14.71%
2001	69 120	69 037	-0.12%	432.11	364.56	-15.63%

* 1990 is the base year for CO_2 and CH_4

Table 216: 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 2002	Submission 2003	Recalculation Difference [%]	Submission 2002	Submission 2003	Recalculation Difference [%]
1990*	18.72	19.32	3.17%	1 484.60	1 484.60	0.00%
1991	20.75	21.34	2.87%	1 663.08	1 663.08	0.00%
1992	16.92	18.37	8.52%	1 310.13	1 310.13	0.00%
1993	19.59	20.03	2.28%	883.12	883.12	0.00%
1994	21.78	21.94	0.72%	1 103.32	1 103.32	0.00%
1995*	20.51	20.55	0.19%	1 736.44	1 736.44	0.00%
1996	19.85	19.80	-0.24%	1 885.75	1 885.75	0.00%
1997	20.79	20.66	-0.61%	1 884.35	1 884.35	0.00%
1998	20.17	19.95	-1.09%	1 791.37	1 791.37	0.00%
1999	19.93	19.66	-1.36%	1 625.69	1 625.69	0.00%
2000	19.85	19.52	-1.68%	1 735.36	1 735.36	0.00%
2001	19.20	19.26	0.33%	1 735.36	1 735.36	0.00%

* 1990 is the base year for N_2O, for fluorinated gases the base year is 1995

9.3 Implications for Emission Trends

As can be seen in Table 214 and Figure 19, Austria's greenhouse gas emissions as reported in the UNFCCC submission 2004 are lower than the values reported last year due to recalculations: for the base year they are 0.42% lower and for the year 2001 1.73%. This results in a more moderate upward trend: last year the trend from the base year to 2001 was plus 9.65% whereas now it is plus 8.21%.

The main reason for the difference in trend is a slight increase of CO_2 emissions in the base year while emissions in 2001 decreased compared to the values reported in last year's submission. Recalculation of N_2O emissions led to the same change of the trend, and also CH_4 emissions have now a more decreasing trend and contributed to the overall more moderate increasing trend.

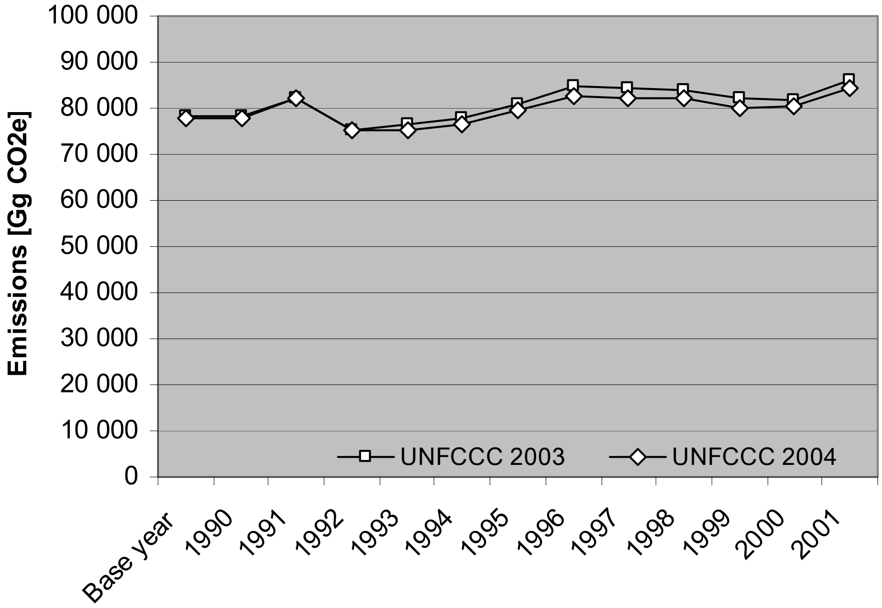


Figure 19: Emission estimate of the submission 2003 and recalculated values of the submission 2004

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 program 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 Federal Environment Agency.

The improvement programme is supported by the QA/QC programme based on international standards (EN 45000, ISO 9000).

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
BMLFUW	Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft Federal Ministry for Agriculture, Forestry, Environment and Water Management
BMUJF	Bundesministerium für Umwelt, Jugend und Familie Federal Ministry for Environment, Youth and Family (before 2000, now domain of Environment: BMLFUW)
BMWA	Bundesministerium für Wirtschaft und Arbeit Federal Ministry for Economic Affairs and Labour
BUWAL	Bundesamt für Umwelt, Wald und Landschaft, Bern The Swiss Agency for the Environment, Forests and Landscape (SAEFL), Bern
COP	Conference of the Parties
CORINAIR	Core Inventory Air
CORINE	Coordination d´information Environmentale
CRF	Common Reporting Format
DKDB	Dampfkesseldatenbank Austrian annual steam boiler inventory
DOC	Degradable Organic Carbon
EC	European Community
EEA	European Environment Agency
EFTA	European Free Trade Association
EIONET	European Environment Information and Observation NETwork
EMEP	Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe
EN	European Norm
EPER	European Pollutant Emission Register
ETC/AE	European Topic Centre on Air Emissions
EU	European Union
ERT	Expert Review Team (in context of the UNFCCC review process)
FAO	Food and Agricultural Organisation of the United Nations
GHG	Greenhouse Gas
GLOBEMI	Globale Modellbildung für Emissions- und Verbrauchsszenarien im Verkehrssektor (Global Modelling for Emission- and Fuel consumption Scenarios of the Transport Sector) see [HAUSBERGER, 1998]
GPG	Good Practice Guidance [IPCC GPG, 2000]
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change

IEA	International Energy Agency
ISO	International Standards Organisation
LTO	Landing/Take-Off cycle
LUCF	Land Use Change and Forestry – IPCC-CRF Category 5
LULUCF	Land Use and Land Use Change and Forestry
NACE	Nomenclature des activites economiques de la Communaute Europeenne
NAPFUE	Nomenclature for Air Pollution Fuels
NFI	National Forest Inventory
NFR	Nomenclature for Reporting (Format of Reporting under the UNECE/CLRTAP Convention)
NISA	National Inventory System Austria
OECD	Organisation for Economic Co-operation and Development
OLI	Österreichische Luftschadstoff Inventur Austrian Air Emission Inventory
OMV	Österreichische Mineralölverwaltung Austrian Mineraloil Company
PHARE	Phare is the acronym of the Programme's original name: '**P**oland and **H**ungary: **A**ction for the **R**estructuring of the **E**conomy'. It covers now 14 partner countries: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, the Former Yugoslav Republic of Macedonia (FYROM), Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. (However, Croatia was suspended from the Phare Programme in July 1995.)
QA/QC	Quality Assurance/ Quality Control
QMS	Quality Management System
RWA	Raiffeisen Ware Austria (see www.rwa.at)
SNAP	Selected Nomenclature on Air Pollutants
UMWELTBUNDESAMT	„Austria's Federal Environment Agency"
UNECE / CLRTAP	United Nations Economic Commission for Europe, Convention on Long-range Transboundary Air Pollution
UNFCCC	United Nations Framework Convention on Climate Change

Notation Keys

according to UNFCCC guidelines on reporting and review [FCCC/CP/2002/8]

"NO" (not occurring)	for activities or processes in a particular source or sink category that do not occur within a country;
"NE" (not estimated)	for existing emissions by sources and removals by sinks of greenhouse gases which have not been estimated. Where "NE" is used in an inventory for emissions or removals of CO_2 , CH_4 , N_2O, HFCs, PFCs, or SF_6 , the Party should indicate in both the NIR and the CRF completeness table why emissions or removals have not been estimated
"NA" (not applicable)	for activities in a given source/sink category that do not result in emissions or removals of a specific gas. If categories in the CRF for which "NA" is applicable are shaded, they do not need to be filled in;
"IE" (included elsewhere)	for emissions by sources and removals by sinks of greenhouse gases estimated but included elsewhere in the inventory instead of the expected source/sink category. Where "IE" is used in an inventory, the Annex I Party should indicate, using the CRF completeness table, where in the inventory the emissions or removals from the displaced source/sink category have been included and the Annex I Party should explain such a deviation from the expected category;
"C" (confidential)	for emissions by sources and removals by sinks of greenhouse gases which could lead to the disclosure of confidential information, given the provisions of paragraph 27 of above];

Chemical Symbols

Symbol	Name
Greenhouse gases	
CH_4	Methane
CO_2	Carbon Dioxide
N_2O	Nitrous Oxide
HFCs	Hydroflurocarbons
PFCs	Perfluorocarbons
SF_6	Sulphur hexafluoride
Further chemical compounds	
CO	Carbon Monoxide
Cd	Cadmium
NH_3	Ammonia
Hg	Mercury
NO_X	Nitrogen Oxides (NO plus NO_2)
NO_2	Nitrogen Dioxide
NMVOC	Non-Methane Volatile Organic Compounds
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
POP	Persistent Organic Pollutants
SO_2	Sulfur Dioxide
SO_X	Sulfur Oxides

Units and Metric Symbols

UNIT	Name	Unit for
g	gram	mass
t	ton	mass
W	watt	power
J	joule	calorific value
m	meter	length

Mass Unit Conversion		
1g		
1kg	= 1 000g	
1t	= 1 000kg	= 1Mg
1kt	= 1 000t	= 1Gg
1Mt	= 1 Mio t	= 1Tg

Metric Symbol	Prefix	Factor
P	peta	10^{15}
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
h	hecto	10^{2}
da	deca	10^{1}
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}

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ANNEX 1: KEY SOURCE ANALYSIS

The following tables present results from the key source analysis, the methodology of the analysis is presented in Chapter 1.5 of the NIR 2004.

Table A1.1 presents results from the Level Assessment of the key source analysis.

Table A1.2 presents results from the Trend Assessment of the key source analysis.

Table A1.3 presents emission sources in the level of aggregation as used for the key source analysis. Emissions from 1990 to 2002 for these sources are also included.

Table A1.4 summarizes the key sources identified including their ranking in the level and trend assessments.

Rank	IPCC Source Categories		GHG	Unit	BY	Level Assessment	Cumulative Total
1	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	10.15%	10.15%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	9.33%	19.48%
3	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	8.02%	27.49%
4	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	6.22%	33.71%
5	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	5.86%	39.57%
6	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	5.59%	45.16%
7	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	4.78%	49.95%
8	2 C 1	Iron and Steel	CO2	Gg	3 514.5	4.51%	54.45%
9	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	4.32%	58.78%
10	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	4.25%	63.02%
11	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	3.93%	66.95%
12	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	3.78%	70.73%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	3.24%	73.97%
14	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	2.88%	76.85%
15	2 A 1	Cement Production	CO2	Gg	2 033.4	2.61%	79.46%
16	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	2.02%	81.48%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1.76%	83.24%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1.49%	84.73%
19	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	1.17%	85.90%
20	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	1.05%	86.95%
21	4 B 1	Cattle	N2O	Gg CO2e	662.7	0.85%	87.80%
22	4 B 1	Cattle	CH4	Gg CO2e	547.3	0.70%	88.50%
23	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	0.70%	89.20%
24	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	0.62%	89.82%
25	4 B 8	Swine	CH4	Gg CO2e	447.7	0.57%	90.39%
26	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	0.57%	90.96%
27	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	442.5	0.57%	91.53%
28	1 A 1 b gaseous	Petroleum refining	CO2	Gg	442.5	0.57%	92.09%
29	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	0.52%	92.62%
30	2 A 2	Lime Production	CO2	Gg	396.2	0.51%	93.12%
31	2 B 1	Ammonia Production	CO2	Gg	396.0	0.51%	93.63%
32	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	314.7	0.40%	94.04%
33	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	293.6	0.38%	94.41%
34	3	Solvent and Other Product Use	CO2	Gg	282.7	0.36%	94.77%
35	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	265.0	0.34%	95.11%

Rank	IPCC Source Categories		GHG	Unit	1990	Level Assessment	Cumulative Total
1	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	10.18%	10.18%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	9.36%	19.54%
3	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	8.04%	27.58%
4	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	6.24%	33.82%
5	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	5.88%	39.70%
6	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	5.61%	45.31%
7	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	4.80%	50.11%
8	2 C 1	Iron and Steel	CO2	Gg	3 514.5	4.52%	54.63%
9	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	4.34%	58.97%
10	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	4.26%	63.23%
11	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	3.94%	67.17%
12	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	3.79%	70.96%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	3.25%	74.21%
14	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	2.89%	77.10%
15	2 A 1	Cement Production	CO2	Gg	2 033.4	2.62%	79.71%
16	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	2.03%	81.74%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1.77%	83.51%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1.49%	85.00%
19	2 C 3	Aluminium production	PFCs	Gg CO2e	936.9	1.21%	86.21%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	1.17%	87.38%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	1.06%	88.44%
22	4 B 1	Cattle	N2O	Gg CO2e	662.7	0.85%	89.29%
23	4 B 1	Cattle	CH4	Gg CO2e	547.3	0.70%	89.99%
24	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	0.62%	90.61%
25	4 B 8	Swine	CH4	Gg CO2e	447.7	0.58%	91.19%
26	1 A 1 b gaseous	Petroleum refining	CO2	Gg	442.5	0.57%	91.76%
27	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	0.52%	92.28%
28	2 A 2	Lime Production	CO2	Gg	396.2	0.51%	92.79%
29	2 B 1	Ammonia Production	CO2	Gg	396.0	0.51%	93.30%
30	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	314.7	0.40%	93.70%
31	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	293.6	0.38%	94.08%
32	3	Solvent and Other Product Use	CO2	Gg	282.7	0.36%	94.45%
33	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	265.0	0.34%	94.79%
34	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	253.3	0.33%	95.11%

Rank	IPCC Source Categories		GHG	Unit	1991	Level Assessment	Cumulative Total
1	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 678.8	10.56%	10.56%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 741.7	9.42%	19.99%
3	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 817.0	8.30%	28.29%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 004.2	6.09%	34.38%
5	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 708.2	5.73%	40.11%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 707.2	5.73%	45.84%
7	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 720.3	4.53%	50.37%
8	2 C 1	Iron and Steel	CO2	Gg	3 551.9	4.32%	54.69%
9	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 486.9	4.24%	58.93%
10	4 A 1	Cattle	CH4	Gg CO2e	3 319.3	4.04%	62.97%
11	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 165.5	3.85%	66.83%
12	1 A 4 solid	Other Sectors	CO2	Gg	3 052.1	3.72%	70.54%
13	1 A 4 gaseous	Other Sectors	CO2	Gg	2 849.9	3.47%	74.01%
14	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 833.3	3.45%	77.46%
15	2 A 1	Cement Production	CO2	Gg	2 005.0	2.44%	79.90%
16	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 695.3	2.06%	81.96%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 608.3	1.96%	83.92%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 189.6	1.45%	85.37%
19	2 C 3	Aluminium production	PFCs	Gg CO2e	940.7	1.15%	86.51%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	927.3	1.13%	87.64%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	873.2	1.06%	88.71%
22	4 B 1	Cattle	N2O	Gg CO2e	652.9	0.79%	89.50%
23	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	564.4	0.69%	90.19%
24	4 B 1	Cattle	CH4	Gg CO2e	538.0	0.65%	90.84%
25	1 A 1 b gaseous	Petroleum refining	CO2	Gg	442.2	0.54%	91.38%
26	4 B 8	Swine	CH4	Gg CO2e	441.6	0.54%	91.92%
27	2 B 1	Ammonia Production	CO2	Gg	408.0	0.50%	92.42%
28	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	391.6	0.48%	92.89%
29	2 A 2	Lime Production	CO2	Gg	361.3	0.44%	93.33%
30	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	341.7	0.42%	93.75%
31	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	296.8	0.36%	94.11%
32	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	277.2	0.34%	94.45%
33	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	266.5	0.32%	94.77%
34	3	Solvent and Other Product Use	CO2	Gg	236.8	0.29%	95.06%

Rank	IPCC Source Categories		GHG	Unit	1992	Level Assessment	Cumulative Total
1	1 A 3 b gasoline	Road Transportation	CO2	Gg	8 297.4	11.04%	11.04%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 217.7	9.61%	20.65%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 313.3	7.07%	27.72%
4	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 804.9	6.39%	34.12%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 195.0	5.58%	39.70%
6	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 009.5	5.34%	45.04%
7	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 638.2	4.84%	49.88%
8	4 A 1	Cattle	CH4	Gg CO2e	3 164.3	4.21%	54.09%
9	1 A 4 gaseous	Other Sectors	CO2	Gg	3 151.3	4.19%	58.28%
10	2 C 1	Iron and Steel	CO2	Gg	3 123.5	4.16%	62.44%
11	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	2 887.2	3.84%	66.28%
12	4 D	Direct Soil Emissions	N2O	Gg CO2e	2 599.5	3.46%	69.74%
13	1 A 4 solid	Other Sectors	CO2	Gg	2 550.1	3.39%	73.14%
14	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 290.6	3.05%	76.19%
15	2 A 1	Cement Production	CO2	Gg	2 105.0	2.80%	78.99%
16	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 826.0	2.43%	81.42%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 481.6	1.97%	83.39%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 232.8	1.64%	85.03%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	900.9	1.20%	86.23%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	837.5	1.11%	87.34%
21	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	655.7	0.87%	88.22%
22	4 B 1	Cattle	N2O	Gg CO2e	624.0	0.83%	89.05%
23	2 C 3	Aluminium production	PFCs	Gg CO2e	535.3	0.71%	89.76%
24	4 B 1	Cattle	CH4	Gg CO2e	514.6	0.68%	90.44%
25	4 B 8	Swine	CH4	Gg CO2e	451.6	0.60%	91.05%
26	1 A 1 b gaseous	Petroleum refining	CO2	Gg	410.8	0.55%	91.59%
27	2 B 1	Ammonia Production	CO2	Gg	371.1	0.49%	92.09%
28	2 A 2	Lime Production	CO2	Gg	355.1	0.47%	92.56%
29	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	336.1	0.45%	93.01%
30	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	316.4	0.42%	93.43%
31	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	281.5	0.37%	93.80%
32	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	276.5	0.37%	94.17%
33	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	253.3	0.34%	94.51%
34	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	252.8	0.34%	94.84%
35	3	Solvent and Other Product Use	N2O	Gg CO2e	232.5	0.31%	95.15%

Rank	IPCC Source Categories		GHG	Unit	1993	Level Assessment	Cumulative Total
1	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 958.2	10.55%	10.55%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 095.1	9.41%	19.96%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	5 783.4	7.67%	27.63%
4	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 981.7	6.61%	34.24%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 269.3	5.66%	39.90%
6	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 594.7	4.77%	44.66%
7	1 A 4 gaseous	Other Sectors	CO2	Gg	3 364.0	4.46%	49.12%
8	2 C 1	Iron and Steel	CO2	Gg	3 177.8	4.21%	53.34%
9	4 A 1	Cattle	CH4	Gg CO2e	3 155.7	4.18%	57.52%
10	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 116.8	4.13%	61.66%
11	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 009.9	3.99%	65.65%
12	4 D	Direct Soil Emissions	N2O	Gg CO2e	2 976.0	3.95%	69.59%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 729.2	3.62%	73.21%
14	1 A 4 solid	Other Sectors	CO2	Gg	2 184.0	2.90%	76.11%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 053.1	2.72%	78.83%
16	2 A 1	Cement Production	CO2	Gg	2 031.9	2.69%	81.53%
17	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 748.0	2.32%	83.84%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 271.4	1.69%	85.53%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	890.1	1.18%	86.71%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	878.7	1.17%	87.88%
21	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	729.2	0.97%	88.84%
22	4 B 1	Cattle	N2O	Gg CO2e	625.6	0.83%	89.67%
23	4 B 1	Cattle	CH4	Gg CO2e	496.9	0.66%	90.33%
24	4 B 8	Swine	CH4	Gg CO2e	463.7	0.61%	90.95%
25	1 A 1 b gaseous	Petroleum refining	CO2	Gg	439.1	0.58%	91.53%
26	2 B 1	Ammonia Production	CO2	Gg	402.9	0.53%	92.06%
27	2 A 2	Lime Production	CO2	Gg	365.2	0.48%	92.55%
28	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	353.5	0.47%	93.01%
29	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	324.6	0.43%	93.45%
30	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	316.1	0.42%	93.86%
31	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	289.0	0.38%	94.25%
32	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	277.2	0.37%	94.62%
33	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	266.4	0.35%	94.97%
34	3	Solvent and Other Product Use	N2O	Gg CO2e	232.5	0.31%	95.28%

Rank	IPCC Source Categories		GHG	Unit	1994	Level Assessment	Cumulative Total
1	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 784.8	10.18%	10.18%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 477.2	8.47%	18.65%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	6 048.2	7.91%	26.56%
4	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	5 649.6	7.39%	33.94%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 353.8	5.69%	39.64%
6	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 553.5	4.65%	44.28%
7	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 445.5	4.51%	48.79%
8	2 C 1	Iron and Steel	CO2	Gg	3 425.4	4.48%	53.27%
9	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 279.2	4.29%	57.55%
10	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 269.8	4.28%	61.83%
11	4 A 1	Cattle	CH4	Gg CO2e	3 202.0	4.19%	66.02%
12	1 A 4 gaseous	Other Sectors	CO2	Gg	3 133.7	4.10%	70.11%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 651.8	3.47%	73.58%
14	2 A 1	Cement Production	CO2	Gg	2 102.3	2.75%	76.33%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 907.1	2.49%	78.82%
16	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 881.0	2.46%	81.28%
17	1 A 4 solid	Other Sectors	CO2	Gg	1 852.7	2.42%	83.70%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 308.6	1.71%	85.42%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	932.9	1.22%	86.64%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	825.2	1.08%	87.71%
21	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	775.5	1.01%	88.73%
22	4 B 1	Cattle	N2O	Gg CO2e	636.6	0.83%	89.56%
23	4 B 1	Cattle	CH4	Gg CO2e	512.0	0.67%	90.23%
24	4 B 8	Swine	CH4	Gg CO2e	457.1	0.60%	90.83%
25	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	423.8	0.55%	91.38%
26	2 A 2	Lime Production	CO2	Gg	390.5	0.51%	91.89%
27	2 B 1	Ammonia Production	CO2	Gg	381.4	0.50%	92.39%
28	1 A 1 b gaseous	Petroleum refining	CO2	Gg	381.0	0.50%	92.89%
29	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	372.8	0.49%	93.38%
30	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	322.9	0.42%	93.80%
31	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	287.6	0.38%	94.18%
32	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	286.6	0.37%	94.55%
33	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	271.5	0.36%	94.90%
34	3	Solvent and Other Product Use	N2O	Gg CO2e	232.5	0.30%	95.21%

Rank	IPCC Source Categories		GHG	Unit	1995	Level Assessment	Cumulative Total
1	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 435.0	9.37%	9.37%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 113.6	8.96%	18.33%
3	1 A 3 b diesel oil	Road Transportation	CO2	Gg	6 481.5	8.17%	26.50%
4	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	5 755.0	7.25%	33.75%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 529.8	5.71%	39.46%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 498.8	5.67%	45.13%
7	2 C 1	Iron and Steel	CO2	Gg	3 940.8	4.97%	50.10%
8	1 A 4 gaseous	Other Sectors	CO2	Gg	3 723.0	4.69%	54.79%
9	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 555.8	4.48%	59.27%
10	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 300.1	4.16%	63.43%
11	4 A 1	Cattle	CH4	Gg CO2e	3 222.6	4.06%	67.49%
12	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 086.4	3.89%	71.38%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 446.8	3.08%	74.46%
14	1 A 4 solid	Other Sectors	CO2	Gg	1 795.7	2.26%	76.72%
15	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 784.7	2.25%	78.97%
16	2 A 1	Cement Production	CO2	Gg	1 631.3	2.06%	81.03%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 557.6	1.96%	82.99%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 344.4	1.69%	84.69%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	930.1	1.17%	85.86%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	857.2	1.08%	86.94%
21	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	744.1	0.94%	87.88%
22	4 B 1	Cattle	N2O	Gg CO2e	646.9	0.82%	88.69%
23	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	0.69%	89.38%
24	4 B 1	Cattle	CH4	Gg CO2e	507.0	0.64%	90.02%
25	2 B 1	Ammonia Production	CO2	Gg	468.3	0.59%	90.61%
26	4 B 8	Swine	CH4	Gg CO2e	458.5	0.58%	91.19%
27	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	0.56%	91.74%
28	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	442.5	0.56%	92.30%
29	1 A 1 b gaseous	Petroleum refining	CO2	Gg	418.3	0.53%	92.83%
30	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	409.9	0.52%	93.34%
31	2 A 2	Lime Production	CO2	Gg	394.6	0.50%	93.84%
32	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	316.0	0.40%	94.24%
33	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	302.4	0.38%	94.62%
34	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	275.3	0.35%	94.97%
35	2 F 8	Other Sources of SF6	SF6	Gg CO2e	241.9	0.30%	95.27%

Rank	IPCC Source Categories		GHG	Unit	1996	Level Assessment	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	8 709.8	10.52%	10.52%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	8 196.6	9.90%	20.42%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 855.1	8.28%	28.71%
4	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	5 860.1	7.08%	35.79%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 714.3	5.70%	41.48%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 430.4	5.35%	46.83%
7	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	4 346.3	5.25%	52.08%
8	1 A 4 gaseous	Other Sectors	CO2	Gg	4 083.9	4.93%	57.02%
9	2 C 1	Iron and Steel	CO2	Gg	3 684.8	4.45%	61.47%
10	4 A 1	Cattle	CH4	Gg CO2e	3 170.4	3.83%	65.30%
11	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 160.1	3.82%	69.12%
12	4 D	Direct Soil Emissions	N2O	Gg CO2e	2 868.4	3.47%	72.58%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 129.0	2.57%	75.15%
14	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 116.5	2.56%	77.71%
15	1 A 4 solid	Other Sectors	CO2	Gg	1 753.4	2.12%	79.83%
16	2 A 1	Cement Production	CO2	Gg	1 634.2	1.97%	81.80%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 551.1	1.87%	83.68%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 403.3	1.70%	85.37%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	924.5	1.12%	86.49%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	874.2	1.06%	87.55%
21	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	679.2	0.82%	88.37%
22	4 B 1	Cattle	N2O	Gg CO2e	637.9	0.77%	89.14%
23	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	622.9	0.75%	89.89%
24	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	610.6	0.74%	90.63%
25	4 B 1	Cattle	CH4	Gg CO2e	500.4	0.60%	91.23%
26	2 B 1	Ammonia Production	CO2	Gg	465.3	0.56%	91.79%
27	1 A 1 b gaseous	Petroleum refining	CO2	Gg	461.0	0.56%	92.35%
28	4 B 8	Swine	CH4	Gg CO2e	447.5	0.54%	92.89%
29	2 A 2	Lime Production	CO2	Gg	382.7	0.46%	93.35%
30	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	355.4	0.43%	93.78%
31	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	343.1	0.41%	94.20%
32	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	327.9	0.40%	94.59%
33	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	324.4	0.39%	94.98%
34	2 F 8	Other Sources of SF6	SF6	Gg CO2e	251.9	0.30%	95.29%

Rank	IPCC Source Categories		GHG	Unit	1997	Level Assessment	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	8 004.7	9.72%	9.72%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 137.8	8.67%	18.39%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 497.0	7.89%	26.28%
4	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	6 094.9	7.40%	33.68%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 002.8	6.08%	39.76%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 845.2	5.88%	45.64%
7	2 C 1	Iron and Steel	CO2	Gg	4 082.9	4.96%	50.60%
8	1 A 4 gaseous	Other Sectors	CO2	Gg	3 931.6	4.77%	55.38%
9	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 715.1	4.51%	59.89%
10	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 206.1	3.89%	63.78%
11	4 A 1	Cattle	CH4	Gg CO2e	3 116.2	3.78%	67.57%
12	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 041.1	3.69%	71.26%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 935.1	3.56%	74.82%
14	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 052.6	2.49%	77.32%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 921.3	2.33%	79.65%
16	2 A 1	Cement Production	CO2	Gg	1 760.9	2.14%	81.79%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 464.0	1.78%	83.57%
18	1 A 4 solid	Other Sectors	CO2	Gg	1 400.0	1.70%	85.27%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	960.9	1.17%	86.43%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	862.6	1.05%	87.48%
21	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	717.1	0.87%	88.35%
22	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	627.7	0.76%	89.11%
23	4 B 1	Cattle	N2O	Gg CO2e	627.6	0.76%	89.88%
24	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	506.0	0.61%	90.49%
25	4 B 1	Cattle	CH4	Gg CO2e	496.8	0.60%	91.10%
26	2 B 1	Ammonia Production	CO2	Gg	457.1	0.56%	91.65%
27	4 B 8	Swine	CH4	Gg CO2e	448.3	0.54%	92.19%
28	1 A 1 b gaseous	Petroleum refining	CO2	Gg	434.4	0.53%	92.72%
29	2 A 2	Lime Production	CO2	Gg	412.5	0.50%	93.22%
30	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	384.3	0.47%	93.69%
31	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	349.2	0.42%	94.11%
32	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	344.9	0.42%	94.53%
33	2 F 8	Other Sources of SF6	SF6	Gg CO2e	256.7	0.31%	94.84%
34	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	248.7	0.30%	95.15%

Rank	IPCC Source Categories		GHG	Unit	1998	Level Assessment	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 648.7	11.77%	11.77%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 169.3	8.74%	20.51%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 810.3	8.31%	28.82%
4	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	6 016.3	7.34%	36.15%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 303.3	5.25%	41.40%
6	1 A 4 gaseous	Other Sectors	CO2	Gg	4 022.4	4.91%	46.31%
7	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 983.6	4.86%	51.16%
8	2 C 1	Iron and Steel	CO2	Gg	3 889.3	4.74%	55.91%
9	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 514.0	4.29%	60.19%
10	4 A 1	Cattle	CH4	Gg CO2e	3 094.0	3.77%	63.97%
11	6 A 1	Managed Waste disposal	CH4	Gg CO2e	2 943.1	3.59%	67.55%
12	4 D	Direct Soil Emissions	N2O	Gg CO2e	2 918.5	3.56%	71.11%
13	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 746.6	3.35%	74.46%
14	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 238.2	2.73%	77.19%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	2 211.4	2.70%	79.89%
16	2 A 1	Cement Production	CO2	Gg	1 579.6	1.93%	81.82%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 520.8	1.85%	83.67%
18	1 A 4 solid	Other Sectors	CO2	Gg	1 223.1	1.49%	85.16%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	996.3	1.22%	86.38%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	896.7	1.09%	87.47%
21	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	814.7	0.99%	88.46%
22	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	634.1	0.77%	89.24%
23	4 B 1	Cattle	N2O	Gg CO2e	622.9	0.76%	90.00%
24	2 B 1	Ammonia Production	CO2	Gg	501.2	0.61%	90.61%
25	4 B 1	Cattle	CH4	Gg CO2e	494.2	0.60%	91.21%
26	4 B 8	Swine	CH4	Gg CO2e	462.4	0.56%	91.77%
27	2 A 2	Lime Production	CO2	Gg	453.8	0.55%	92.33%
28	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	451.3	0.55%	92.88%
29	1 A 1 b gaseous	Petroleum refining	CO2	Gg	401.8	0.49%	93.37%
30	1 A 3 e gaseous	Other Transportation	CO2	Gg	348.9	0.43%	93.79%
31	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	345.4	0.42%	94.22%
32	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	333.9	0.41%	94.62%
33	2 F 8	Other Sources of SF6	SF6	Gg CO2e	285.7	0.35%	94.97%
34	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	241.2	0.29%	95.27%

Rank	**IPCC Source Categories**		**GHG**	Unit	**1999**	**Level Assessment**	**Cumulative Total**
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	9 382.7	11.72%	11.72%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 180.0	8.97%	20.68%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 318.2	7.89%	28.57%
4	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	5 855.3	7.31%	35.88%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 249.7	5.31%	41.19%
6	1 A 4 gaseous	Other Sectors	CO2	Gg	4 139.8	5.17%	46.36%
7	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	4 074.7	5.09%	51.45%
8	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	3 805.7	4.75%	56.20%
9	2 C 1	Iron and Steel	CO2	Gg	3 792.7	4.74%	60.94%
10	4 A 1	Cattle	CH4	Gg CO2e	3 067.1	3.83%	64.77%
11	4 D	Direct Soil Emissions	N2O	Gg CO2e	2 888.4	3.61%	68.37%
12	6 A 1	Managed Waste disposal	CH4	Gg CO2e	2 845.7	3.55%	71.93%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 060.4	2.57%	74.50%
14	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 995.8	2.49%	76.99%
15	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 960.3	2.45%	79.44%
16	2 A 1	Cement Production	CO2	Gg	1 587.6	1.98%	81.42%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 574.0	1.97%	83.39%
18	1 A 4 solid	Other Sectors	CO2	Gg	1 133.9	1.42%	84.80%
19	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 025.3	1.28%	86.08%
20	2 B 2	Nitric Acid Production	N2O	Gg CO2e	923.5	1.15%	87.24%
21	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	869.4	1.09%	88.32%
22	4 B 1	Cattle	N2O	Gg CO2e	618.6	0.77%	89.09%
23	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	560.1	0.70%	89.79%
24	1 A 3 e gaseous	Other Transportation	CO2	Gg	526.3	0.66%	90.45%
25	4 B 1	Cattle	CH4	Gg CO2e	487.8	0.61%	91.06%
26	2 B 1	Ammonia Production	CO2	Gg	472.1	0.59%	91.65%
27	2 A 2	Lime Production	CO2	Gg	453.1	0.57%	92.21%
28	4 B 8	Swine	CH4	Gg CO2e	416.6	0.52%	92.74%
29	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	409.4	0.51%	93.25%
30	1 A 1 b gaseous	Petroleum refining	CO2	Gg	403.7	0.50%	93.75%
31	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	350.0	0.44%	94.19%
32	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	290.9	0.36%	94.55%
33	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	240.8	0.30%	94.85%
34	2 F 8	Other Sources of SF6	SF6	Gg CO2e	239.8	0.30%	95.15%

Rank	IPCC Source Categories		GHG	Unit	2000	Level Assessment	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	10 473.8	12.99%	12.99%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 389.8	7.92%	20.91%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 107.2	7.57%	28.49%
4	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	5 841.1	7.24%	35.73%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	4 981.0	6.18%	41.91%
6	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 611.4	5.72%	47.62%
7	1 A 4 gaseous	Other Sectors	CO2	Gg	4 268.1	5.29%	52.92%
8	2 C 1	Iron and Steel	CO2	Gg	4 228.7	5.24%	58.16%
9	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 460.0	4.29%	62.45%
10	4 A 1	Cattle	CH4	Gg CO2e	3 024.7	3.75%	66.20%
11	4 D	Direct Soil Emissions	N2O	Gg CO2e	2 870.6	3.56%	69.76%
12	6 A 1	Managed Waste disposal	CH4	Gg CO2e	2 714.1	3.37%	73.13%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 034.4	2.52%	75.65%
14	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 008.8	2.49%	78.14%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 622.0	2.01%	80.15%
16	2 A 1	Cement Production	CO2	Gg	1 587.6	1.97%	82.12%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 214.6	1.51%	83.63%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 061.6	1.32%	84.94%
19	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	1 032.2	1.28%	86.22%
20	1 A 4 solid	Other Sectors	CO2	Gg	980.8	1.22%	87.44%
21	2 B 2	Nitric Acid Production	N2O	Gg CO2e	951.6	1.18%	88.62%
22	4 B 1	Cattle	N2O	Gg CO2e	612.1	0.76%	89.38%
23	1 A 3 e gaseous	Other Transportation	CO2	Gg	530.8	0.66%	90.04%
24	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	516.5	0.64%	90.68%
25	2 A 2	Lime Production	CO2	Gg	497.5	0.62%	91.30%
26	4 B 1	Cattle	CH4	Gg CO2e	476.7	0.59%	91.89%
27	2 B 1	Ammonia Production	CO2	Gg	463.0	0.57%	92.46%
28	4 B 8	Swine	CH4	Gg CO2e	404.3	0.50%	92.96%
29	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	350.4	0.43%	93.40%
30	1 A 1 b gaseous	Petroleum refining	CO2	Gg	349.6	0.43%	93.83%
31	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	339.2	0.42%	94.25%
32	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	314.6	0.39%	94.64%
33	2 A 3	Limestone and Dolomite Use	CO2	Gg	249.9	0.31%	94.95%
34	2 F 8	Other Sources of SF6	SF6	Gg CO2e	247.6	0.31%	95.26%

Rank	IPCC Source Categories		GHG	Unit	2001	Level Assessment	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	11 740.8	13.91%	13.91%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 428.1	8.80%	22.71%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 151.9	7.29%	30.00%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 989.4	7.10%	37.10%
5	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	5 434.7	6.44%	43.54%
6	1 A 4 gaseous	Other Sectors	CO2	Gg	4 508.9	5.34%	48.88%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 361.3	5.17%	54.05%
8	2 C 1	Iron and Steel	CO2	Gg	4 320.6	5.12%	59.17%
9	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 359.2	3.98%	63.15%
10	4 A 1	Cattle	CH4	Gg CO2e	2 966.9	3.52%	66.66%
11	4 D	Direct Soil Emissions	N2O	Gg CO2e	2 956.4	3.50%	70.17%
12	6 A 1	Managed Waste disposal	CH4	Gg CO2e	2 597.3	3.08%	73.24%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 076.1	2.46%	75.70%
14	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 796.0	2.13%	77.83%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 642.4	1.95%	79.78%
16	2 A 1	Cement Production	CO2	Gg	1 587.6	1.88%	81.66%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 573.4	1.86%	83.52%
18	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 080.6	1.28%	84.80%
19	1 A 4 solid	Other Sectors	CO2	Gg	1 051.9	1.25%	86.05%
20	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	1 032.2	1.22%	87.27%
21	2 B 2	Nitric Acid Production	N2O	Gg CO2e	786.5	0.93%	88.20%
22	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	767.2	0.91%	89.11%
23	4 B 1	Cattle	N2O	Gg CO2e	600.1	0.71%	89.82%
24	2 A 2	Lime Production	CO2	Gg	506.6	0.60%	90.42%
25	1 A 3 e gaseous	Other Transportation	CO2	Gg	500.0	0.59%	91.02%
26	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	486.9	0.58%	91.59%
27	4 B 1	Cattle	CH4	Gg CO2e	464.6	0.55%	92.14%
28	2 B 1	Ammonia Production	CO2	Gg	442.0	0.52%	92.67%
29	4 B 8	Swine	CH4	Gg CO2e	422.5	0.50%	93.17%
30	1 A 1 b gaseous	Petroleum refining	CO2	Gg	405.9	0.48%	93.65%
31	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	350.4	0.42%	94.06%
32	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	340.7	0.40%	94.47%
33	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	334.0	0.40%	94.86%
34	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	256.6	0.30%	95.17%

Rank	IPCC Source Categories		GHG	Unit	2002	Level Assessment	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	13 321.8	15.74%	15.74%
2	1 A 4 stat-liquid	Other Sectors	CO2	Gg	6 778.8	8.01%	23.75%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	6 616.9	7.82%	31.57%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	5 855.3	6.92%	38.49%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	5 155.7	6.09%	44.59%
6	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	4 790.0	5.66%	50.25%
7	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 269.5	5.05%	55.29%
8	1 A 4 gaseous	Other Sectors	CO2	Gg	4 161.8	4.92%	60.21%
9	2 C 1	Iron and Steel	CO2	Gg	4 063.6	4.80%	65.01%
10	4 A 1	Cattle	CH4	Gg CO2e	2 911.0	3.44%	68.45%
11	4 D	Direct Soil Emissions	N2O	Gg CO2e	2 702.1	3.19%	71.64%
12	6 A 1	Managed Waste disposal	CH4	Gg CO2e	2 514.9	2.97%	74.62%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	2 160.5	2.55%	77.17%
14	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	1 860.5	2.20%	79.37%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 655.2	1.96%	81.32%
16	2 A 1	Cement Production	CO2	Gg	1 587.6	1.88%	83.20%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	1 100.8	1.30%	84.50%
18	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	1 032.2	1.22%	85.72%
19	1 A 4 solid	Other Sectors	CO2	Gg	866.7	1.02%	86.75%
20	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	835.3	0.99%	87.73%
21	2 B 2	Nitric Acid Production	N2O	Gg CO2e	807.2	0.95%	88.69%
22	4 B 1	Cattle	N2O	Gg CO2e	588.8	0.70%	89.38%
23	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	571.0	0.67%	90.06%
24	2 A 2	Lime Production	CO2	Gg	546.6	0.65%	90.70%
25	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	517.4	0.61%	91.31%
26	4 B 1	Cattle	CH4	Gg CO2e	454.5	0.54%	91.85%
27	2 B 1	Ammonia Production	CO2	Gg	445.1	0.53%	92.38%
28	1 A 1 b gaseous	Petroleum refining	CO2	Gg	404.6	0.48%	92.86%
29	4 B 8	Swine	CH4	Gg CO2e	403.3	0.48%	93.33%
30	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	396.4	0.47%	93.80%
31	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	373.5	0.44%	94.24%
32	1 A 3 e gaseous	Other Transportation	CO2	Gg	360.5	0.43%	94.67%
33	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	350.4	0.41%	95.08%

Rank	IPCC Source Categories		GHG	Unit	BY	1991	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	2 C 3	Aluminium production	PFCs	Gg CO2e	0.0	940.7	1.15%	0.011	14.15%	14.15%
2	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	2.8	0.00%	0.007	8.60%	22.75%
3	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	2 849.9	3.47%	0.006	7.27%	30.02%
4	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	5 004.2	6.09%	0.005	6.16%	36.18%
5	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 707.2	5.73%	0.005	6.01%	42.19%
6	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	8 678.8	10.56%	0.004	5.13%	47.32%
7	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	3 165.5	3.85%	0.004	4.87%	52.19%
8	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	3 486.9	4.24%	0.003	3.90%	56.09%
9	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	442.5	209.5	0.26%	0.003	3.86%	59.95%
10	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 319.3	4.04%	0.003	3.50%	63.45%
11	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	6 817.0	8.30%	0.003	3.45%	66.90%
12	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	3 720.3	4.53%	0.002	3.16%	70.05%
13	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	277.2	0.34%	0.002	2.85%	72.90%
14	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	2 833.3	3.45%	0.002	2.58%	75.48%
15	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1 608.3	1.96%	0.002	2.43%	77.91%
16	2 C 1	Iron and Steel	CO2	Gg	3 514.5	3 551.9	4.32%	0.002	2.25%	80.17%
17	2 A 1	Cement Production	CO2	Gg	2 033.4	2 005.0	2.44%	0.002	2.06%	82.23%
18	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	564.4	0.69%	0.002	2.03%	84.26%
19	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	391.6	0.48%	0.001	1.73%	85.99%
20	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	4 708.2	5.73%	0.001	1.58%	87.57%
21	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	7 741.7	9.42%	0.001	1.20%	88.77%
22	2 F 8	Other Sources of SF6	SF6	Gg CO2e	241.9	179.7	0.22%	0.001	1.13%	89.90%
23	3	Solvent and Other Product Use	CO2	Gg	282.7	236.8	0.29%	0.001	0.92%	90.82%
24	2 A 2	Lime Production	CO2	Gg	396.2	361.3	0.44%	0.001	0.84%	91.66%
25	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	3 052.1	3.72%	0.001	0.78%	92.43%
26	4 B 1	Cattle	N2O	Gg CO2e	662.7	652.9	0.79%	0.001	0.68%	93.11%
27	4 B 1	Cattle	CH4	Gg CO2e	547.3	538.0	0.65%	0.000	0.58%	93.69%
28	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	1 695.3	2.06%	0.000	0.53%	94.22%
29	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	927.3	1.13%	0.000	0.50%	94.72%
30	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 189.6	1.45%	0.000	0.49%	95.21%

Rank		**IPCC Source Categories**	**GHG**	Unit	**BY**	**1992**	**Level Assessment**	**Trend Assessment**	**Contribution to Trend**	**Cumulative Total**
1	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	4 009.5	5.34%	0.028	18.60%	18.60%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	5 313.3	7.07%	0.015	10.25%	28.85%
3	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	3 151.3	4.19%	0.014	9.11%	37.96%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	8 297.4	11.04%	0.009	6.20%	44.16%
5	2 C 3	Aluminium production	PFCs	Gg CO2e	0.0	535.3	0.71%	0.007	4.94%	49.10%
6	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	4.1	0.01%	0.007	4.81%	53.91%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 195.0	5.58%	0.007	4.39%	58.30%
8	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	4 804.9	6.39%	0.006	3.72%	62.02%
9	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	2 599.5	3.46%	0.005	3.25%	65.27%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	1 826.0	2.43%	0.004	2.84%	68.11%
11	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	2 887.2	3.84%	0.004	2.81%	70.91%
12	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	2 550.1	3.39%	0.004	2.66%	73.57%
13	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	655.7	0.87%	0.004	2.43%	76.00%
14	2 C 1	Iron and Steel	CO2	Gg	3 514.5	3 123.5	4.16%	0.004	2.42%	78.42%
15	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	7 217.7	9.61%	0.003	1.94%	80.36%
16	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	253.3	0.34%	0.002	1.60%	81.96%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1 481.6	1.97%	0.002	1.46%	83.42%
18	2 A 1	Cement Production	CO2	Gg	2 033.4	2 105.0	2.80%	0.002	1.35%	84.77%
19	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	442.5	281.5	0.37%	0.002	1.34%	86.11%
20	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	2 290.6	3.05%	0.002	1.33%	87.44%
21	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	336.1	0.45%	0.002	1.18%	88.61%
22	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 232.8	1.64%	0.002	1.06%	89.67%
23	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	252.8	0.34%	0.002	1.00%	90.68%
24	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	900.9	1.20%	0.002	1.00%	91.68%
25	2 C 3	Aluminium production	CO2	Gg	158.4	63.0	0.08%	0.001	0.83%	92.50%
26	3	Solvent and Other Product Use	CO2	Gg	282.7	187.7	0.25%	0.001	0.78%	93.29%
27	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 164.3	4.21%	0.001	0.78%	94.06%
28	1 A 1 c liquid	Manufacture of Solid fuels and Other Energy	CO2	Gg	72.0	0.2	0.00%	0.001	0.64%	94.70%
29	2 F 8	Other Sources of SF6	SF6	Gg CO2e	241.9	182.1	0.24%	0.001	0.47%	95.17%

Rank	**IPCC Source Categories**		**GHG**	Unit	**BY**	**1993**	**Level Assessment**	**Trend Assessment**	**Contribution to Trend**	**Cumulative Total**
1	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	3 116.8	4.13%	0.040	24.55%	24.55%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	5 783.4	7.67%	0.021	13.11%	37.66%
3	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	3 364.0	4.46%	0.016	9.98%	47.65%
4	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	2 053.1	2.72%	0.010	6.07%	53.72%
5	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	2 184.0	2.90%	0.009	5.57%	59.29%
6	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	4 981.7	6.61%	0.008	4.72%	64.01%
7	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	6.3	0.01%	0.007	4.37%	68.38%
8	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 269.3	5.66%	0.006	3.50%	71.88%
9	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	729.2	0.97%	0.005	2.81%	74.69%
10	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	7 958.2	10.55%	0.004	2.55%	77.24%
11	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	2 729.2	3.62%	0.004	2.39%	79.63%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	1 748.0	2.32%	0.003	1.87%	81.51%
13	2 C 1	Iron and Steel	CO2	Gg	3 514.5	3 177.8	4.21%	0.003	1.84%	83.35%
14	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	3 009.9	3.99%	0.003	1.62%	84.97%
15	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	277.2	0.37%	0.002	1.27%	86.24%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 271.4	1.69%	0.002	1.25%	87.49%
17	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	324.6	0.43%	0.002	1.18%	88.67%
18	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	266.4	0.35%	0.002	1.02%	89.69%
19	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	265.0	142.0	0.19%	0.002	0.96%	90.64%
20	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 155.7	4.18%	0.001	0.88%	91.52%
21	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	890.1	1.18%	0.001	0.80%	92.32%
22	3	Solvent and Other Product Use	CO2	Gg	282.7	187.4	0.25%	0.001	0.72%	93.04%
23	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	442.5	353.5	0.47%	0.001	0.62%	93.66%
24	1 A 1 c liquid	Manufacture of Solid fuels and Other Energy	CO2	Gg	72.0	2.8	0.00%	0.001	0.56%	94.22%
25	2 A 1	Cement Production	CO2	Gg	2 033.4	2 031.9	2.69%	0.001	0.55%	94.77%
26	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	7 095.1	9.41%	0.001	0.52%	95.29%

Rank	IPCC Source Categories		GHG	Unit	BY	1994	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	3 279.2	4.29%	0.038	21.39%	21.39%
2	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	6 048.2	7.91%	0.024	13.27%	34.66%
3	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	5 649.6	7.39%	0.016	8.76%	43.42%
4	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	1 852.7	2.42%	0.014	7.77%	51.20%
5	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	3 133.7	4.10%	0.012	6.98%	58.17%
6	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	6 477.2	8.47%	0.009	4.91%	63.09%
7	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1 907.1	2.49%	0.007	4.20%	67.29%
8	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	3 553.5	4.65%	0.007	4.11%	71.40%
9	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	9.7	0.01%	0.007	3.94%	75.34%
10	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 353.8	5.69%	0.005	3.00%	78.34%
11	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	775.5	1.01%	0.005	2.82%	81.16%
12	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	1 881.0	2.46%	0.004	2.51%	83.67%
13	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	3 445.5	4.51%	0.003	1.60%	85.27%
14	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	2 651.8	3.47%	0.002	1.30%	86.57%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 308.6	1.71%	0.002	1.28%	87.85%
16	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	322.9	0.42%	0.002	1.12%	88.97%
17	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	932.9	1.22%	0.002	0.95%	89.92%
18	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	271.5	0.36%	0.002	0.94%	90.85%
19	2 A 1	Cement Production	CO2	Gg	2 033.4	2 102.3	2.75%	0.001	0.81%	91.67%
20	3	Solvent and Other Product Use	CO2	Gg	282.7	171.5	0.22%	0.001	0.79%	92.46%
21	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 202.0	4.19%	0.001	0.79%	93.24%
22	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	265.0	166.0	0.22%	0.001	0.70%	93.95%
23	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	825.2	1.08%	0.001	0.52%	94.46%
24	1 A 1 c liquid	Manufacture of Solid fuels and Other Energy	CO2	Gg	72.0	2.0	0.00%	0.001	0.51%	94.98%
25	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	372.8	0.49%	0.001	0.46%	95.44%

Table A1.2: Trend Assessment

Rank		**IPCC Source Categories**	**GHG**	Unit	**BY**	**1995**	**Level Assessment**	**Trend Assessment**	**Contribution to Trend**	**Cumulative Total**
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	6 481.5	8.17%	0.025	15.81%	15.81%
2	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	4 529.8	5.71%	0.023	14.19%	30.00%
3	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	3 723.0	4.69%	0.018	11.12%	41.12%
4	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	1 795.7	2.26%	0.015	9.30%	50.43%
5	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	5 755.0	7.25%	0.014	8.56%	58.98%
6	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	7 435.0	9.37%	0.008	4.79%	63.77%
7	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	3 300.1	4.16%	0.006	3.84%	67.61%
8	2 A 1	Cement Production	CO2	Gg	2 033.4	1 631.3	2.06%	0.005	3.39%	71.00%
9	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 498.8	5.67%	0.005	3.36%	74.35%
10	2 C 1	Iron and Steel	CO2	Gg	3 514.5	3 940.8	4.97%	0.005	2.83%	77.18%
11	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	744.1	0.94%	0.004	2.55%	79.73%
12	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	7 113.6	8.96%	0.004	2.22%	81.95%
13	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 222.6	4.06%	0.003	1.61%	83.57%
14	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	3 555.8	4.48%	0.002	1.43%	85.00%
15	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	1 784.7	2.25%	0.002	1.40%	86.40%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 344.4	1.69%	0.002	1.27%	87.67%
17	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1 557.6	1.96%	0.002	1.24%	88.91%
18	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	2 446.8	3.08%	0.002	0.96%	89.87%
19	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	275.3	0.35%	0.002	0.95%	90.82%
20	3	Solvent and Other Product Use	CO2	Gg	282.7	189.9	0.24%	0.001	0.76%	91.58%
21	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	265.0	174.6	0.22%	0.001	0.74%	92.31%
22	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	930.1	1.17%	0.001	0.72%	93.03%
23	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	409.9	0.52%	0.001	0.62%	93.65%
24	1 A 1 c liquid	Manufacture of Solid fuels and Other Energy	CO2	Gg	72.0	0.7	0.00%	0.001	0.56%	94.21%
25	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	857.2	1.08%	0.001	0.55%	94.76%
26	2 B 1	Ammonia Production	CO2	Gg	396.0	468.3	0.59%	0.001	0.51%	95.26%

Table A1.2: Trend Assessment

Rank	IPCC Source Categories		GHG	Unit	BY	1996	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	8 709.8	10.52%	0.046	21.15%	21.15%
2	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	4 714.3	5.70%	0.022	9.97%	31.12%
3	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	4 083.9	4.93%	0.019	8.81%	39.93%
4	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	6 855.1	8.28%	0.018	8.01%	47.94%
5	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	1 753.4	2.12%	0.016	7.12%	55.06%
6	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	5 860.1	7.08%	0.012	5.24%	60.30%
7	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	4 346.3	5.25%	0.009	4.31%	64.61%
8	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	3 160.1	3.82%	0.009	4.15%	68.75%
9	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 430.4	5.35%	0.008	3.71%	72.46%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	2 116.5	2.56%	0.006	2.93%	75.39%
11	2 A 1	Cement Production	CO2	Gg	2 033.4	1 634.2	1.97%	0.006	2.71%	78.10%
12	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	8 196.6	9.90%	0.005	2.47%	80.58%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	2 129.0	2.57%	0.005	2.36%	82.94%
14	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 170.4	3.83%	0.005	2.12%	85.06%
15	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	2 868.4	3.47%	0.004	1.99%	87.05%
16	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	679.2	0.82%	0.003	1.28%	88.32%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 403.3	1.70%	0.002	0.89%	89.21%
18	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	327.9	0.40%	0.002	0.88%	90.09%
19	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	355.4	0.43%	0.002	0.81%	90.90%
20	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	293.6	166.2	0.20%	0.002	0.75%	91.65%
21	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	610.6	0.74%	0.002	0.73%	92.38%
22	3	Solvent and Other Product Use	CO2	Gg	282.7	172.8	0.21%	0.001	0.66%	93.04%
23	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	442.5	343.1	0.41%	0.001	0.66%	93.69%
24	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	874.2	1.06%	0.001	0.49%	94.18%
25	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1 551.1	1.87%	0.001	0.48%	94.66%
26	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	265.0	193.0	0.23%	0.001	0.46%	95.12%

Table A1.2: Trend Assessment

Rank	IPCC Source Categories		GHG	Unit	BY	1997	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	8 004.7	9.72%	0.039	18.75%	18.75%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	6 497.0	7.89%	0.021	10.26%	29.01%
3	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	1 400.0	1.70%	0.020	9.44%	38.45%
4	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	5 002.8	6.08%	0.018	8.83%	47.27%
5	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	3 931.6	4.77%	0.018	8.60%	55.88%
6	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	6 094.9	7.40%	0.015	7.01%	62.89%
7	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	3 041.1	3.69%	0.010	4.95%	67.84%
8	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	7 137.8	8.67%	0.006	2.99%	70.83%
9	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1 921.3	2.33%	0.005	2.60%	73.42%
10	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 116.2	3.78%	0.005	2.45%	75.87%
11	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	2 052.6	2.49%	0.004	2.14%	78.02%
12	2 A 1	Cement Production	CO2	Gg	2 033.4	1 760.9	2.14%	0.004	2.13%	80.14%
13	2 C 1	Iron and Steel	CO2	Gg	3 514.5	4 082.9	4.96%	0.004	2.06%	82.20%
14	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 845.2	5.88%	0.003	1.51%	83.71%
15	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	2 935.1	3.56%	0.003	1.47%	85.18%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 464.0	1.78%	0.003	1.32%	86.50%
17	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	3 715.1	4.51%	0.003	1.20%	87.70%
18	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	627.7	0.76%	0.002	1.09%	88.79%
19	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	344.9	0.42%	0.002	1.03%	89.82%
20	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	717.1	0.87%	0.002	0.78%	90.60%
21	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	384.3	0.47%	0.001	0.68%	91.28%
22	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	349.2	0.42%	0.001	0.65%	91.94%
23	3	Solvent and Other Product Use	CO2	Gg	282.7	190.1	0.23%	0.001	0.60%	92.53%
24	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	293.6	204.0	0.25%	0.001	0.58%	93.12%
25	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	265.0	175.6	0.21%	0.001	0.57%	93.69%
26	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	862.6	1.05%	0.001	0.55%	94.25%
27	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	960.9	1.17%	0.001	0.51%	94.76%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	314.7	248.7	0.30%	0.001	0.46%	95.22%

Table A1.2: Trend Assessment

Rank	IPCC Source Categories		GHG	Unit	BY	1998	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	9 648.7	11.77%	0.059	21.74%	21.74%
2	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	3 514.0	4.29%	0.036	13.15%	34.89%
3	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	1 223.1	1.49%	0.022	8.05%	42.94%
4	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	4 022.4	4.91%	0.019	7.13%	50.07%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	6 810.3	8.31%	0.018	6.49%	56.57%
6	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	6 016.3	7.34%	0.014	5.21%	61.77%
7	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	2 943.1	3.59%	0.011	4.21%	65.98%
8	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 303.3	5.25%	0.009	3.41%	69.39%
9	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	2 211.4	2.70%	0.009	3.30%	72.68%
10	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	2 238.2	2.73%	0.007	2.49%	75.18%
11	2 A 1	Cement Production	CO2	Gg	2 033.4	1 579.6	1.93%	0.006	2.40%	77.57%
12	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	3 983.6	4.86%	0.006	2.15%	79.73%
13	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	7 169.3	8.74%	0.006	2.05%	81.78%
14	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 094.0	3.77%	0.005	1.94%	83.72%
15	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	2 918.5	3.56%	0.004	1.30%	85.02%
16	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	164.2	0.20%	0.003	1.30%	86.31%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 520.8	1.85%	0.003	1.29%	87.61%
18	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	814.7	0.99%	0.003	1.04%	88.64%
19	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	634.1	0.77%	0.002	0.88%	89.52%
20	2 C 1	Iron and Steel	CO2	Gg	3 514.5	3 889.3	4.74%	0.002	0.84%	90.36%
21	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	265.0	99.0	0.12%	0.002	0.77%	91.13%
22	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	333.9	0.41%	0.002	0.76%	91.89%
23	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	345.4	0.42%	0.002	0.69%	92.58%
24	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	293.6	164.4	0.20%	0.002	0.62%	93.20%
25	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	996.3	1.22%	0.002	0.57%	93.76%
26	3	Solvent and Other Product Use	CO2	Gg	282.7	172.2	0.21%	0.001	0.54%	94.30%
27	1 A 3 e gaseous	Other Transportation	CO2	Gg	222.7	348.9	0.43%	0.001	0.49%	94.79%
28	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	2 746.6	3.35%	0.001	0.39%	95.18%

Rank	IPCC Source Categories		GHG	Unit	BY	1999	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	9 382.7	11.72%	0.060	21.01%	21.01%
2	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	3 805.7	4.75%	0.032	11.21%	32.22%
3	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	1 133.9	1.42%	0.023	8.11%	40.33%
4	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	4 139.8	5.17%	0.022	7.85%	48.18%
5	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	6 318.2	7.89%	0.022	7.75%	55.93%
6	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	5 855.3	7.31%	0.014	4.98%	60.92%
7	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	2 845.7	3.55%	0.012	4.22%	65.14%
8	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 249.7	5.31%	0.009	3.12%	68.26%
9	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	4 074.7	5.09%	0.008	2.88%	71.14%
10	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	1 960.3	2.45%	0.008	2.72%	73.86%
11	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1 995.8	2.49%	0.007	2.51%	76.37%
12	2 A 1	Cement Production	CO2	Gg	2 033.4	1 587.6	1.98%	0.006	2.14%	78.51%
13	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	2 060.4	2.57%	0.005	1.89%	80.41%
14	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	22.2	0.03%	0.005	1.85%	82.26%
15	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 067.1	3.83%	0.005	1.69%	83.96%
16	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 574.0	1.97%	0.005	1.64%	85.60%
17	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	869.4	1.09%	0.004	1.33%	86.92%
18	1 A 3 e gaseous	Other Transportation	CO2	Gg	222.7	526.3	0.66%	0.004	1.28%	88.20%
19	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	7 180.0	8.97%	0.004	1.24%	89.43%
20	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	2 888.4	3.61%	0.003	1.10%	90.54%
21	2 C 1	Iron and Steel	CO2	Gg	3 514.5	3 792.7	4.74%	0.002	0.79%	91.33%
22	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	1 025.3	1.28%	0.002	0.78%	92.10%
23	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	350.0	0.44%	0.002	0.62%	92.72%
24	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	560.1	0.70%	0.002	0.61%	93.33%
25	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	290.9	0.36%	0.002	0.59%	93.91%
26	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	293.6	165.9	0.21%	0.002	0.58%	94.49%
27	3	Solvent and Other Product Use	CO2	Gg	282.7	158.4	0.20%	0.002	0.56%	95.06%

Rank	IPCC Source Categories		GHG	Unit	BY	2000	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	10 473.8	12.99%	0.072	24.39%	24.39%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	6 107.2	7.57%	0.025	8.49%	32.88%
3	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	980.8	1.22%	0.025	8.45%	41.33%
4	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	4 268.1	5.29%	0.023	7.96%	49.28%
5	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	4 981.0	6.18%	0.018	6.07%	55.36%
6	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	2 714.1	3.37%	0.014	4.68%	60.04%
7	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	6 389.8	7.92%	0.014	4.62%	64.66%
8	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	5 841.1	7.24%	0.013	4.57%	69.23%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	2 008.8	2.49%	0.007	2.47%	71.70%
10	2 C 1	Iron and Steel	CO2	Gg	3 514.5	4 228.7	5.24%	0.007	2.43%	74.13%
11	2 A 1	Cement Production	CO2	Gg	2 033.4	1 587.6	1.97%	0.006	2.10%	76.23%
12	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	1 032.2	1.28%	0.006	1.91%	78.15%
13	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	3 024.7	3.75%	0.006	1.89%	80.04%
14	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	7.6	0.01%	0.005	1.84%	81.88%
15	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 622.0	2.01%	0.005	1.73%	83.61%
16	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	2 034.4	2.52%	0.005	1.65%	85.26%
17	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 611.4	5.72%	0.005	1.64%	86.90%
18	1 A 3 e gaseous	Other Transportation	CO2	Gg	222.7	530.8	0.66%	0.004	1.23%	88.13%
19	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	2 870.6	3.56%	0.004	1.22%	89.35%
20	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	1 061.6	1.32%	0.003	0.86%	90.21%
21	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	1 214.6	1.51%	0.002	0.84%	91.05%
22	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	314.6	0.39%	0.002	0.65%	91.71%
23	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	339.2	0.42%	0.002	0.65%	92.35%
24	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	293.6	146.6	0.18%	0.002	0.64%	93.00%
25	3	Solvent and Other Product Use	CO2	Gg	282.7	181.0	0.22%	0.001	0.45%	93.45%
26	1 A 1 b gaseous	Petroleum refining	CO2	Gg	442.5	349.6	0.43%	0.001	0.44%	93.89%
27	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	442.5	350.4	0.43%	0.001	0.44%	94.33%
28	1 A 4 biomass	Other Sectors	CH4	Gg CO2e	314.7	225.7	0.28%	0.001	0.41%	94.74%
29	1 A 3 b gasoline	Road Transportation	N2O	Gg CO2e	407.7	516.5	0.64%	0.001	0.39%	95.13%

Rank	**IPCC Source Categories**		**GHG**	Unit	**BY**	**2001**	**Level Assessment**	**Trend Assessment**	**Contribution to Trend**	**Cumulative Total**
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	11 740.8	13.91%	0.077	27.15%	27.15%
2	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	6 151.9	7.29%	0.026	9.34%	36.49%
3	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	1 051.9	1.25%	0.023	8.26%	44.75%
4	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	4 508.9	5.34%	0.023	8.04%	52.79%
5	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	2 597.3	3.08%	0.016	5.57%	58.36%
6	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	1 796.0	2.13%	0.010	3.63%	61.99%
7	1 A 2 solid	Manufacturing Industries and Construction	CO2	Gg	4 848.4	4 361.3	5.17%	0.010	3.42%	65.41%
8	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	5 989.4	7.10%	0.009	3.01%	68.43%
9	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	2 966.9	3.52%	0.007	2.64%	71.06%
10	2 A 1	Cement Production	CO2	Gg	2 033.4	1 587.6	1.88%	0.007	2.37%	73.43%
11	2 C 1	Iron and Steel	CO2	Gg	3 514.5	4 320.6	5.12%	0.006	2.00%	75.44%
12	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	5 434.7	6.44%	0.005	1.89%	77.33%
13	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	7.6	0.01%	0.005	1.82%	79.16%
14	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	293.6	767.2	0.91%	0.005	1.74%	80.89%
15	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	7 428.1	8.80%	0.005	1.71%	82.61%
16	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	1 032.2	1.22%	0.005	1.71%	84.32%
17	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 642.4	1.95%	0.004	1.50%	85.81%
18	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	2 076.1	2.46%	0.004	1.43%	87.25%
19	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	2 956.4	3.50%	0.004	1.39%	88.64%
20	1 A 3 e gaseous	Other Transportation	CO2	Gg	222.7	500.0	0.59%	0.003	1.00%	89.64%
21	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	3 359.2	3.98%	0.002	0.87%	90.51%
22	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	786.5	0.93%	0.002	0.78%	91.28%
23	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	1 080.6	1.28%	0.002	0.74%	92.02%
24	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	334.0	0.40%	0.002	0.72%	92.74%
25	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	340.7	0.40%	0.002	0.69%	93.43%
26	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	442.5	350.4	0.42%	0.001	0.50%	93.93%
27	4 B 1	Cattle	CH4	Gg CO2e	547.3	464.6	0.55%	0.001	0.49%	94.43%
28	4 B 1	Cattle	N2O	Gg CO2e	662.7	600.1	0.71%	0.001	0.45%	94.88%
29	3	Solvent and Other Product Use	CO2	Gg	282.7	193.6	0.23%	0.001	0.43%	95.31%

Table A1.2: Trend Assessment

Rank	IPCC Source Categories		GHG	Unit	BY	2002	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1 A 3 b diesel oil	Road Transportation	CO2	Gg	4 362.4	13 321.8	15.74%	0.094	29.88%	29.88%
2	1 A 4 solid	Other Sectors	CO2	Gg	2 946.8	866.7	1.02%	0.025	8.11%	37.99%
3	1 A 3 b gasoline	Road Transportation	CO2	Gg	7 915.9	6 616.9	7.82%	0.021	6.86%	44.85%
4	1 A 4 gaseous	Other Sectors	CO2	Gg	2 246.6	4 161.8	4.92%	0.019	6.00%	50.84%
5	6 A 1	Managed Waste disposal	CH4	Gg CO2e	3 731.4	2 514.9	2.97%	0.017	5.33%	56.18%
6	1 A 1 a gaseous	Public Electricity and Heat Production	CO2	Gg	3 312.8	4 790.0	5.66%	0.013	4.16%	60.34%
7	1 A 4 stat-liquid	Other Sectors	CO2	Gg	7 274.2	6 778.8	8.01%	0.012	3.87%	64.21%
8	1 A 1 a solid	Public Electricity and Heat Production	CO2	Gg	6 254.6	5 855.3	6.92%	0.010	3.24%	67.45%
9	1 A 2 stat-liquid	Manufacturing Industries and Construction	CO2	Gg	2 527.0	1 860.5	2.20%	0.010	3.07%	70.51%
10	4 A 1	Cattle	CH4	Gg CO2e	3 372.5	2 911.0	3.44%	0.008	2.60%	73.12%
11	1 A 2 gaseous	Manufacturing Industries and Construction	CO2	Gg	4 569.8	4 269.5	5.05%	0.007	2.39%	75.51%
12	1 A 1 a liquid	Public Electricity and Heat Production	CO2	Gg	1 373.5	835.3	0.99%	0.007	2.28%	77.79%
13	4 D	Direct Soil Emissions	N2O	Gg CO2e	3 064.2	2 702.1	3.19%	0.007	2.16%	79.95%
14	2 A 1	Cement Production	CO2	Gg	2 033.4	1 587.6	1.88%	0.007	2.15%	82.10%
15	2 C 4	SF6 used in Al and Mg Foundries	SF6	Gg CO2e	443.1	7.6	0.01%	0.005	1.65%	83.75%
16	1 A 1 b liquid	Petroleum refining	CO2	Gg	1 576.4	2 160.5	2.55%	0.005	1.57%	85.32%
17	2 F 1/2/3	ODS Substitutes	HFCs	Gg CO2e	545.6	1 032.2	1.22%	0.005	1.53%	86.85%
18	1 A 4 mobile-diesel	Other Sectors	CO2	Gg	1 160.3	1 655.2	1.96%	0.004	1.38%	88.23%
19	1 A 1 c gaseous	Manufacture of Solid fuels and Other Energy	CO2	Gg	293.6	571.0	0.67%	0.003	0.88%	89.11%
20	2 C 1	Iron and Steel	CO2	Gg	3 514.5	4 063.6	4.80%	0.003	0.87%	89.98%
21	1 A 1 a other	Public Electricity and Heat Production	CO2	Gg	149.7	396.4	0.47%	0.003	0.81%	90.79%
22	1 A 2 mobile-liquid	Manufacturing Industries and Construction	CO2	Gg	822.4	1 100.8	1.30%	0.002	0.73%	91.52%
23	2 B 2	Nitric Acid Production	N2O	Gg CO2e	912.0	807.2	0.95%	0.002	0.63%	92.15%
24	1 A 2 other	Manufacturing Industries and Construction	CO2	Gg	265.0	117.6	0.14%	0.002	0.59%	92.74%
25	2 A 7 b	Magnesit Sinter Plants	CO2	Gg	481.2	373.5	0.44%	0.002	0.52%	93.26%
26	4 B 1	Cattle	CH4	Gg CO2e	547.3	454.5	0.54%	0.002	0.48%	93.74%
27	4 B 1	Cattle	N2O	Gg CO2e	662.7	588.8	0.70%	0.001	0.45%	94.20%
28	2 F 6	Semiconductor Manufacture	FC	Gg CO2e	442.5	350.4	0.41%	0.001	0.45%	94.65%
29	1 A 3 e gaseous	Other Transportation	CO2	Gg	222.7	360.5	0.43%	0.001	0.41%	95.06%

IPCC 96	Gas	Unit	BY	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1 A 1 a biomass	CH4	Gg CO2e	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.3	0.5	0.7	0.7
1 A 1 a gaseous	CH4	Gg CO2e	0.5	0.5	0.5	0.5	0.6	0.6	0.7	1.1	1.2	1.1	1.2	1.0	0.8	1.7
1 A 1 a liquid	CH4	Gg CO2e	0.3	0.3	0.4	0.4	0.6	0.5	0.4	0.5	0.6	0.6	0.5	0.3	0.5	0.2
1 A 1 a other	CH4	Gg CO2e	0.6	0.6	0.7	1.1	1.1	1.1	1.2	1.4	1.4	1.4	1.2	1.3	1.5	2.3
1 A 1 a solid	CH4	Gg CO2e	1.5	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
1 A 1 c gaseous	CH4	Gg CO2e	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.4	0.3
1 A 1 c liquid	CH4	Gg CO2e	0.0	0.0	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 2 biomass	CH4	Gg CO2e	1.2	1.2	1.2	1.2	1.4	1.4	1.4	1.4	1.6	1.4	1.6	1.5	1.6	1.8
1 A 2 gaseous	CH4	Gg CO2e	2.4	2.4	2.5	2.5	2.6	3.0	3.0	3.1	3.2	3.1	3.0	3.1	2.8	2.2
1 A 2 mobile-liquid	CH4	Gg CO2 e	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.2	1.2
1 A 2 other	CH4	Gg CO2e	1.4	1.4	1.4	1.3	0.7	0.9	0.9	1.2	1.3	0.9	1.7	1.2	1.4	0.7
1 A 2 solid	CH4	Gg CO2e	1.3	1.3	1.5	1.5	1.5	1.4	1.4	1.5	1.7	1.7	1.4	1.7	1.5	1.2
1 A 2 stat-liquid	CH4	Gg CO2 e	0.9	0.9	1.1	0.8	0.9	1.1	0.8	0.6	0.9	0.8	0.6	0.5	0.5	0.7
1 A 3 a jet kerosene	CH4	Gg CO2e	0.0	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
1 A 3 b diesel oil	CH4	Gg CO2e	2.7	2.7	2.8	2.8	2.8	2.8	2.8	3.3	2.7	2.9	2.6	2.6	2.7	3.0
1 A 3 b gasoline	CH4	Gg CO2e	56.7	56.7	58.7	54.8	51.5	49.1	44.8	39.8	36.7	36.5	32.8	30.4	29.0	29.2
1 A 3 c liquid	CH4	Gg CO2e	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	CH4	Gg CO2e	0.0	0.0	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/diesel oil	CH4	Gg CO2e	0.0	0.0	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 gasoline	CH4	Gg CO2e	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 gaseous	CH4	Gg CO2e	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.2
1 A 4 biomass	CH4	Gg CO2e	314.7	314.7	341.7	316.4	316.1	286.6	302.4	324.4	248.7	241.2	240.8	225.7	256.6	248.2
1 A 4 gaseous	CH4	Gg CO2e	3.7	3.7	3.8	3.3	2.7	1.7	1.1	1.2	1.2	1.2	1.3	1.3	1.4	1.3
1 A 4 mobile-diesel	CH4	Gg CO2 e	2.5	2.5	2.5	2.6	2.7	2.7	2.8	2.8	2.9	2.9	2.9	2.8	2.7	2.6
1 A 4 mobile-gasoline	CH4	Gg CO2 e	1.2	1.2	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.0
1 A 4 mobile-liquid	CH4	Gg CO2 e	2.2	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 A 4 other	CH4	Gg CO2e	0.1	0.1	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.1
1 A 4 solid	CH4	Gg CO2e	70.2	70.2	71.7	60.3	51.9	44.8	44.2	44.0	29.8	26.1	24.2	20.9	22.5	18.5
1 A 4 stat-liquid	CH4	Gg CO2 e	0.7	0.7	0.8	0.7	0.7	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6
1 A 5 liquid	CH4	Gg CO2e	0.0	0.0	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 B 1 a 2 a	CH4	Gg CO2e	11.0	11.0	9.4	7.8	7.6	6.2	5.8	5.0	5.1	5.1	5.1	5.6	5.5	5.5
1 B 2 a	CH4	Gg CO2e	101.1	101.1	101.4	101.6	101.1	100.4	98.4	99.9	101.9	98.6	93.1	90.5	91.9	93.8
1 B 2 b	CH4	Gg CO2e	165.6	165.6	170.7	170.2	178.4	175.3	189.0	208.6	204.4	207.4	217.2	210.4	212.7	204.1
2 A 5	CH4	Gg CO2e	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.8	0.7	0.7	0.7	0.8	0.8
2 B 1	CH4	Gg CO2e	1.3	1.3	1.3	1.2	1.3	1.3	1.3	1.2	1.7	2.1	1.2	1.3	1.1	1.4
2 B 5 f	CH4	Gg CO2e	4.7	4.7	4.5	4.1	4.4	4.5	3.7	3.8	3.7	3.9	3.7	3.5	3.4	6.0
2 C 1	CH4	Gg CO2e	0.0	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
4 A 1	CH4	Gg CO2e	3 372.5	3 372.5	3 319.3	3 164.3	3 155.7	3 202.0	3 222.6	3 170.4	3 116.2	3 094.0	3 067.1	3 024.7	2 966.9	2 911.0
4 A 3	CH4	Gg CO2e	52.1	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
4 A 4	CH4	Gg CO2e	3.9	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
4 A 6	CH4	Gg CO2e	18.6	18.6	21.8	23.2	24.5	25.2	27.4	27.7	28.0	28.5	30.8	31.4	32.1	32.1
4 A 8	CH4	Gg CO2e	116.2	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

4 B 1	CH4	Gg CO2e	547.3	547.3	538.0	514.6	496.9	512.0	507.0	500.4	496.8	494.2	487.8	476.7	464.6	454.5
4 B 13	CH4	Gg CO2e	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4 B 3	CH4	Gg CO2e	1.2	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
4 B 4	CH4	Gg CO2e	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	CH4	Gg CO2e	1.4	1.4	1.7	1.8	1.9	1.9	2.1	2.1	2.2	2.2	2.4	2.4	2.5	2.5
4 B 8	CH4	Gg CO2e	447.7	447.7	441.6	451.6	463.7	457.1	458.5	447.5	448.3	462.4	416.6	404.3	422.5	403.3
4 B 9	CH4	Gg CO2e	22.6	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
4 D 1	CH4	Gg CO2e	6.9	6.9	6.9	6.6	9.8	8.4	9.3	9.4	9.4	9.4	9.4	9.4	9.1	9.1
4 F	CH4	Gg CO2e	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
6 A 1	CH4	Gg CO2e	3 731.4	3 731.4	3 720.3	3 638.2	3 594.7	3 445.5	3 300.1	3 160.1	3 041.1	2 943.1	2 845.7	2 714.1	2 597.3	2 514.9
6 B 1	CH4	Gg CO2e	98.0	98.0	99.1	100.4	101.4	101.9	102.1	102.2	102.4	102.5	102.6	102.9	101.9	101.9
6 B 2	CH4	Gg CO2e	190.2	190.2	192.3	194.8	196.7	197.6	198.0	198.3	198.7	198.8	199.2	199.6	197.7	197.7
6 C 2 c	CH4	Gg CO2e	0.0	0.0	0.0	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6 D 2	CH4	Gg CO2e	10.9	10.9	11.4	13.7	17.2	20.6	21.9	23.0	21.3	21.5	22.0	21.1	21.1	21.1
1 A 1 a gaseous	CO2	Gg	3 312.8	3 312.8	3 165.5	2 887.2	3 009.9	3 269.8	3 555.8	4 346.3	3 715.1	3 983.6	4 074.7	3 460.0	3 359.2	4 790.0
1 A 1 a liquid	CO2	Gg	1 373.5	1 373.5	1 608.3	1 481.6	2 053.1	1 907.1	1 557.6	1 551.1	1 921.3	2 211.4	1 995.8	1 214.6	1 573.4	835.3
1 A 1 a other	CO2	Gg	149.7	149.7	179.7	252.8	266.4	271.5	275.3	327.9	344.9	333.9	290.9	314.6	340.7	396.4
1 A 1 a solid	CO2	Gg	6 254.6	6 254.6	6 817.0	4 009.5	3 116.8	3 279.2	4 529.8	4 714.3	5 002.8	3 514.0	3 805.7	4 981.0	5 989.4	5 855.3
1 A 1 b gaseous	CO2	Gg	442.5	442.5	442.2	410.8	439.1	381.0	418.3	461.0	434.4	401.8	403.7	349.6	405.9	404.6
1 A 1 b liquid	CO2	Gg	1 576.4	1 576.4	1 695.3	1 826.0	1 748.0	1 881.0	1 784.7	2 129.0	2 052.6	2 238.2	2 060.4	2 034.4	2 076.1	2 160.5
1 A 1 c gaseous	CO2	Gg	293.6	293.6	296.8	276.5	289.0	287.6	316.0	166.2	204.0	164.4	165.9	146.6	767.2	571.0
1 A 1 c liquid	CO2	Gg	72.0	72.0	62.0	0.2	2.8	2.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 2 gaseous	CO2	Gg	4 569.8	4 569.8	4 708.2	4 804.9	4 981.7	5 649.6	5 755.0	5 860.1	6 094.9	6 016.3	5 855.3	5 841.1	5 434.7	4 269.5
1 A 2 mobile-liquid	CO2	Gg	822.4	822.4	873.2	900.9	890.1	932.9	930.1	924.5	960.9	996.3	1 025.3	1 061.6	1 080.6	1 100.8
1 A 2 other	CO2	Gg	265.0	265.0	266.5	205.9	142.0	166.0	174.6	193.0	175.6	99.0	228.1	183.7	247.7	117.6
1 A 2 solid	CO2	Gg	4 848.4	4 848.4	4 707.2	4 195.0	4 269.3	4 353.8	4 498.8	4 430.4	4 845.2	4 303.3	4 249.7	4 611.4	4 361.3	5 155.7
1 A 2 stat-liquid	CO2	Gg	2 527.0	2 527.0	2 833.3	2 290.6	2 729.2	2 651.8	2 446.8	2 116.5	2 935.1	2 746.6	1 960.3	2 008.8	1 796.0	1 860.5
1 A 3 a aviation gasoli	CO2	Gg	7.8	7.8	8.1	8.3	8.6	8.8	7.1	6.8	7.6	8.2	8.7	6.4	6.4	6.4
1 A 3 a jet kerosene	CO2	Gg	24.2	24.2	29.4	34.7	40.0	45.3	50.5	56.7	62.9	69.1	72.4	75.7	73.0	68.3
1 A 3 b diesel oil	CO2	Gg	4 362.4	4 362.4	5 004.2	5 313.3	5 783.4	6 048.2	6 481.5	8 709.8	8 004.7	9 648.7	9 382.7	10 473.8	11 740.8	13 321.8
1 A 3 b gasoline	CO2	Gg	7 915.9	7 915.9	8 678.8	8 297.4	7 958.2	7 784.8	7 435.0	6 855.1	6 497.0	6 810.3	6 318.2	6 107.2	6 151.9	6 616.9
1 A 3 c liquid	CO2	Gg	167.5	167.5	174.4	173.7	169.7	171.4	159.6	143.8	145.3	143.4	177.8	177.5	167.4	165.7
1 A 3 c solid	CO2	Gg	6.6	6.6	6.0	6.3	5.7	5.6	5.8	5.8	3.3	2.9	2.7	2.5	2.3	2.2
1 A 3 d gas/diesel oil	CO2	Gg	42.8	42.8	37.9	37.0	37.3	46.3	44.6	44.7	52.6	53.2	53.7	54.2	54.8	55.3
1 A 3 d gasoline	CO2	Gg	9.3	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
1 A 3 e gaseous	CO2	Gg	222.7	222.7	223.6	218.3	212.6	207.9	225.1	231.9	230.9	348.9	526.3	530.8	500.0	360.5
1 A 4 gaseous	CO2	Gg	2 246.6	2 246.6	2 849.9	3 151.3	3 364.0	3 133.7	3 723.0	4 083.9	3 931.6	4 022.4	4 139.8	4 268.1	4 508.9	4 161.8
1 A 4 mobile-diesel	CO2	Gg	1 160.3	1 160.3	1 189.6	1 232.8	1 271.4	1 308.6	1 344.4	1 403.3	1 464.0	1 520.8	1 574.0	1 622.0	1 642.4	1 655.2
1 A 4 mobile-gasoline	CO2	Gg	42.9	42.9	42.7	43.3	42.3	44.5	43.9	45.1	44.8	44.1	44.1	43.9	43.8	43.7
1 A 4 mobile-liquid	CO2	Gg	141.8	141.8	142.2	143.6	144.5	143.5	144.3	143.3	142.3	141.4	140.6	140.5	140.4	140.5
1 A 4 other	CO2	Gg	2.3	2.3	6.9	10.9	7.5	8.8	6.5	4.3	5.5	5.8	6.3	7.3	9.2	4.3
1 A 4 solid	CO2	Gg	2 946.8	2 946.8	3 052.1	2 550.1	2 184.0	1 852.7	1 795.7	1 753.4	1 400.0	1 223.1	1 133.9	980.8	1 051.9	866.7
1 A 4 stat-liquid	CO2	Gg	7 274.2	7 274.2	7 741.7	7 217.7	7 095.1	6 477.2	7 113.6	8 196.6	7 137.8	7 169.3	7 180.0	6 389.8	7 428.1	6 778.8

1 A 5 liquid	CO2	Gg	35.0	35.0	37.1	33.7	39.4	41.6	32.6	38.9	37.1	42.4	41.6	45.0	43.4	40.7
1 B 2 a	CO2	Gg	43.0	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
1 B 2 b	CO2	Gg	59.0	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
2 A 1	CO2	Gg	2 033.4	2 033.4	2 005.0	2 105.0	2 031.9	2 102.3	1 631.3	1 634.2	1 760.9	1 579.6	1 587.6	1 587.6	1 587.6	1 587.6
2 A 2	CO2	Gg	396.2	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
2 A 3	CO2	Gg	200.3	200.3	202.9	181.1	180.9	195.4	225.4	201.3	228.5	238.4	221.6	249.9	245.3	264.7
2 A 4 b	CO2	Gg	19.4	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
2 A 7 a	CO2	Gg	112.3	112.3	117.5	121.5	130.6	134.7	143.4	143.4	132.2	128.8	116.7	111.7	119.3	119.3
2 A 7 b	CO2	Gg	481.2	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
2 B 1	CO2	Gg	396.0	396.0	408.0	371.1	402.9	381.4	468.3	465.3	457.1	501.2	472.1	463.0	442.0	445.1
2 B 2	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
2 B 4 b	CO2	Gg	37.5	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
2 B 5 f	CO2	Gg	27.4	27.4	25.2	23.4	24.7	24.2	20.0	18.4	17.6	19.0	19.9	20.8	20.0	24.0
2 C 1	CO2	Gg	3 514.5	3 514.5	3 551.9	3 123.5	3 177.8	3 425.4	3 940.8	3 684.8	4 082.9	3 889.3	3 792.7	4 228.7	4 320.6	4 063.6
2 C 3	CO2	Gg	158.4	158.4	158.4	63.0	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3	CO2	Gg	282.7	282.7	236.8	187.7	187.4	171.5	189.9	172.8	190.1	172.2	158.4	181.0	193.6	193.6
6 C 2 a	CO2	Gg	1.7	1.7	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6
6 C 2 c	CO2	Gg	11.9	11.9	11.9	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6 C 2 f	CO2	Gg	7.1	7.1	4.8	5.8	6.8	8.1	8.4	8.7	9.0	9.3	9.7	9.7	9.7	9.7
2 F 6	FC	Gg CO2e	442.5	127.9	209.5	281.5	353.5	423.8	442.5	343.1	506.0	451.3	409.4	350.4	350.4	350.4
2 F 1/2/3	HFCs	Gg CO2e	545.6	1.8	2.8	4.1	6.3	9.7	545.6	622.9	717.1	814.7	869.4	1 032.2	1 032.2	1 032.2
1 A 1 a biomass	N2O	Gg CO2e	2.5	2.5	3.7	4.4	4.6	4.9	5.6	7.8	7.8	7.9	8.8	10.7	14.1	16.3
1 A 1 a gaseous	N2O	Gg CO2e	8.9	8.9	8.7	8.0	8.0	9.3	10.0	10.4	7.5	9.9	9.6	8.2	8.9	9.5
1 A 1 a liquid	N2O	Gg CO2e	7.4	7.4	8.3	7.0	9.8	9.5	7.4	7.6	10.1	11.5	10.8	6.0	7.4	4.3
1 A 1 a other	N2O	Gg CO2e	1.0	1.0	1.3	1.8	1.9	2.0	2.0	2.3	2.5	2.4	2.1	2.3	2.5	4.0
1 A 1 a solid	N2O	Gg CO2e	23.0	23.0	27.3	17.4	15.2	14.9	19.6	15.5	14.2	15.0	16.5	22.0	24.4	23.6
1 A 1 b gaseous	N2O	Gg CO2e	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2
1 A 1 b liquid	N2O	Gg CO2e	3.7	3.7	3.9	3.9	4.4	4.7	4.4	4.7	4.9	4.7	4.1	3.7	3.8	3.2
1 A 1 c gaseous	N2O	Gg CO2e	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.4	0.3
1 A 1 c liquid	N2O	Gg CO2e	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1 A 2 biomass	N2O	Gg CO2e	20.4	20.4	20.7	21.3	23.9	23.8	23.4	22.3	26.0	22.1	25.0	23.8	26.7	26.6
1 A 2 gaseous	N2O	Gg CO2e	2.8	2.8	2.8	2.9	3.0	3.3	3.3	3.4	3.6	3.5	3.4	3.4	3.2	2.5
1 A 2 mobile-liquid	N2O	Gg CO2 e	88.8	88.8	94.3	97.2	96.1	103.5	103.5	103.9	110.4	116.4	113.7	113.3	111.2	109.5
1 A 2 other	N2O	Gg CO2e	2.4	2.4	2.4	2.2	1.3	1.5	1.6	2.1	2.2	1.6	2.9	2.1	2.4	1.2
1 A 2 solid	N2O	Gg CO2e	15.2	15.2	16.1	14.7	14.5	14.9	16.1	15.7	18.2	17.4	16.3	18.6	18.4	15.5
1 A 2 stat-liquid	N2O	Gg CO2 e	8.3	8.3	9.4	7.8	9.0	9.2	8.0	6.5	9.7	8.9	6.7	6.7	6.3	6.6
1 A 3 a jet kerosene	N2O	Gg CO2e	0.3	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
1 A 3 b diesel oil	N2O	Gg CO2e	66.9	66.9	74.6	77.4	82.4	83.9	88.1	114.5	105.1	124.4	122.3	134.7	147.3	165.7
1 A 3 b gasoline	N2O	Gg CO2e	407.7	407.7	564.4	655.7	729.2	775.5	744.1	679.2	627.7	634.1	560.1	516.5	486.9	517.4
1 A 3 c liquid	N2O	Gg CO2e	6.6	6.6	6.9	6.7	6.5	6.5	5.9	5.2	5.2	5.1	6.2	6.2	5.8	5.7
1 A 3 c solid	N2O	Gg CO2e	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
1 A 3 d gas/diesel oil	N2O	Gg CO2e	3.8	3.8	3.4	3.2	3.2	3.9	3.7	3.7	4.3	4.2	4.2	4.2	4.2	4.2
1 A 3 d gasoline	N2O	Gg CO2e	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

1 A 3 e gaseous	N2O	Gg CO2e	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.2
1 A 4 biomass	N2O	Gg CO2e	85.3	85.3	94.0	88.4	89.7	82.5	88.7	96.5	90.5	87.7	87.6	82.2	93.5	90.5
1 A 4 gaseous	N2O	Gg CO2e	12.7	12.7	16.1	17.8	19.0	17.7	21.0	23.0	22.2	22.7	23.3	24.1	25.4	23.5
1 A 4 mobile-diesel	N2O	Gg CO2 e	121.9	121.9	125.0	129.5	133.6	138.3	143.8	151.9	160.4	166.9	170.1	171.7	169.6	165.4
1 A 4 mobile-gasoline	N2O	Gg CO2 e	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-liquid	N2O	Gg CO2 e	7.4	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
1 A 4 other	N2O	Gg CO2e	0.1	0.1	0.3	0.5	0.3	0.4	0.3	0.2	0.2	0.3	0.3	0.3	0.4	0.2
1 A 4 solid	N2O	Gg CO2e	22.6	22.6	23.5	19.7	16.8	14.3	13.8	13.4	10.7	9.2	8.7	7.5	7.8	6.4
1 A 4 stat-liquid	N2O	Gg CO2 e	24.5	24.5	27.1	24.9	25.6	23.6	25.9	30.1	27.4	27.4	27.1	23.8	28.2	25.5
1 A 5 liquid	N2O	Gg CO2e	0.9	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 B 2	N2O	Gg CO2e	912.0	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
3	N2O	Gg CO2e	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5	232.5
4 B 1	N2O	Gg CO2e	662.7	662.7	652.9	624.0	625.6	636.6	646.9	637.9	627.6	622.9	618.6	612.1	600.1	588.8
4 B 13	N2O	Gg CO2e	0.0	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
4 B 3	N2O	Gg CO2e	2.9	2.9	3.0	2.9	3.1	3.2	3.4	3.5	3.6	3.3	3.3	3.1	3.0	2.8
4 B 4	N2O	Gg CO2e	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	N2O	Gg CO2e	0.2	0.2	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	N2O	Gg CO2e	94.2	94.2	92.9	95.0	97.5	96.0	96.0	93.5	93.7	97.6	88.1	85.5	89.3	85.0
4 B 9	N2O	Gg CO2e	26.2	26.2	27.8	26.3	28.0	27.4	26.8	24.9	28.2	27.3	27.4	22.7	24.0	24.0
4 D	N2O	Gg CO2e	3 064.2	3 064.2	3 486.9	2 599.5	2 976.0	3 553.5	3 086.4	2 868.4	3 206.1	2 918.5	2 888.4	2 870.6	2 956.4	2 702.1
4 F	N2O	Gg CO2e	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
6 B 1	N2O	Gg CO2e	5.0	5.0	5.1	5.3	5.2	5.3	5.4	5.5	5.5	5.6	5.5	5.5	5.5	5.5
6 B 2	N2O	Gg CO2e	16.8	16.8	17.1	17.5	17.4	17.7	18.0	18.3	18.2	18.8	18.3	18.3	18.2	18.2
6 C 2 c	N2O	Gg CO2e	0.1	0.1	0.1	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6 C 2 f	N2O	Gg CO2e	0.0	0.0	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 2	N2O	Gg CO2e	23.9	23.9	25.0	29.7	37.0	43.8	46.3	48.4	44.8	45.2	46.4	44.6	44.6	44.6
2 C 3	PFCs	Gg CO2e	0.0	936.9	940.7	535.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 C 4	SF6	Gg CO2e	443.1	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
2 F 8	SF6	Gg CO2e	241.9	127.1	179.7	182.1	190.5	222.3	241.9	251.9	256.7	285.7	239.8	247.6	247.6	247.6
2 F 7	SF6	Gg CO2e	63.4	37.6	53.1	53.7	55.5	74.7	63.4	57.2	55.3	75.6	84.9	97.6	97.6	97.6
0		**Gg CO2e**	**77 998**	**77 746**	**82 154**	**75 135**	**75 413**	**76 480**	**79 356**	**82 776**	**82 340**	**82 000**	**80 083**	**80 640**	**84 398**	**84 621**

IPCC Category	Description	Gas	**BY**	LA90	LA91	LA92	LA93	LA94	LA95	LA96	LA97	LA98	LA99	LA00	LA01	**LA02**	TA91	TA92	TA93	TA94	TA95	TA96	TA97	TA98	TA99	TA00	TA01	**TA02**
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	**10**	10	11	11	11	10	9	7	9	7	7	9	9	**6**	7	11	14		14	7	17	12	9		21	**6**
1 A 1 a liquid	Public Electricity and Heat Production	CO2	**17**	17	17	17	15	15	17	17	15	15	14	17	17	**20**	15	17	4	7	17	25	9	9	11	21		**12**
1 A 1 a other	Public Electricity and Heat Production	CO2				34		33	34	32	32	32	32	32	32	**30**		23	18	18	19	18	19	22	25	22	25	**21**
1 A 1 a solid	Public Electricity and Heat Production	CO2	**3**	3	3	6	10	9	5	5	5	9	8	5	4	**4**	11	1	1	1	2	2	4	2	2	5	8	**8**
1 A 1 b gaseous	Petroleum refining	CO2	**28**	26	25	26	25	28	29	27	28	29	30	30	30	**28**										26		
1 A 1 b liquid	Petroleum refining	CO2	**16**	16	16	16	17	16	15	13	14	14	13	13	13	**13**	28	10	12	12	15	13	11	10	13	16	18	**16**
1 A 1 c liquid	Manuf. of Solid fuels and Other Energy Ind	CO2																28	24	24	24							
1 A 1 c gaseous	Manuf. of Solid fuels and Other Energy Ind	CO2	**33**	31	31	32	31	31	32						22	**23**						20	24	24	26	24	14	**19**
1 A 2 gaseous	Manufacturing Industries and Constr.	CO2	**5**	5	5	4	4	4	4	4	4	4	4	4	5	**7**	20	8	6	3	5	6	6	6	6	8	12	**11**
1 A 2 mob-liquid	Manufacturing Industries and Constr.	CO2	**20**	21	21	19	19	19	19	19	19	19	19	18	18	**17**		24	21	17	22		27	25	22	20	23	**22**
1 A 2 solid	Manufacturing Industries and Constr.	CO2	**4**	4	6	5	5	5	6	6	6	5	5	6	7	**5**	5	7	8	10	9	9	14	8	8	17	7	
1 A 2 stat-liquid	Manufacturing Industries and Constr.	CO2	**13**	13	14	14	13	13	13	14	13	13	15	14	14	**14**	14	20	11	14	18	10	15	28	10	9	6	**9**
1 A 2 other	Manufacturing Industries and Constr.	CO2	**35**	33	33		33												19	22	21	26	25	21				**24**
1 A 3 b diesel oil	Road Transportation	CO2	**6**	6	4	3	3	3	3	1	1	1	1	1	1	**1**	4	2	2	2	1	1	1	1	1	1	1	**1**
1 A 3 b gasoline	Road Transportation	CO2	**1**	1	1	1	1	1	1	3	3	3	3	3	3	**3**	6	4	10		6	4	2	5	5	2	2	**3**
1 A 3 b gasoline	Road Transportation	N2O	**29**	27	23	21	21	21	21	21	22	22	23	24	26	**25**	18	13	9	11	11	16	18	19	24	29	20	**29**
1 A 3 e gaseous	Transport-Other	CO2										30	24	23	25	**32**								27	18	18		
1 A 4 mob-diesel	Other Sectors	CO2	**18**	18	18	18	18	18	18	18	17	17	17	15	15	**15**	30	22	16	15	16	17	16	17	16	15	17	**18**
1 A 4 biomass	Other Sectors	CH4	**32**	30	30	30	30	32	33	33	34	34	33		34								28			28		
1 A 4 gaseous	Other Sectors	CO2	**14**	14	13	9	7	12	8	8	8	6	6	7	6	**8**	3	3	3	5	3	3	5	4	4	4	4	**4**
1 A 4 stat-liquid	Other Sectors	CO2	**2**	2	2	2	2	2	2	2	2	2	2	2	2	**2**	21	15	26	6	12	12	8	13	19	7	15	**7**
1 A 4 solid	Other Sectors	CO2	**12**	12	12	13	14	17	14	15	18	18	18	20	19	**19**	25	12	5	4	4	5	3	3	3	3	3	**2**
2 A 1	Cement Production	CO2	**15**	15	15	15	16	14	16	16	16	16	16	16	16	**16**	17	18	25	19	8	11	12	11	12	11	10	**14**
2 A 2	Lime Production	CO2	**30**	28	29	28	27	26	31	29	29	27	27	25	24	**24**	24											
2 A 3	Limestone and Dolomite Use	CO2												33														
2 A 7 b	Magnesit Sinter Plants	CO2	**24**	24	28	29	29	30	30	30	30	31	31	31	33	**31**	19	21	17	16	23	19	21	23	23	23	24	**25**
2 B 1	Ammonia Production	CO2	**31**	29	27	27	26	27	25	26	26	24	26	27	28	**27**					26							
2 B 2	Nitric Acid Production	N2O	**19**	20	20	20	20	20	20	20	20	20	20	21	21	**21**	29			23	25	24	26			10	22	**23**
2 C 1	Iron and Steel Production	CO2	**8**	8	8	10	8	8	7	9	7	8	9	8	8	**9**	16	14	13		10		13	20	21	14	11	**20**
2 C 4	SF6 used in Al and Mg Foundries	SF6	**26**	34	32	33	32	29	27	24	31						13	16	15	25		21	22	16	14	12	13	**15**
2 C 3	Aluminium production	PFCs		19	19	23											1	5										
2 C 3	Aluminium production	CO2																25										
2 F 6	Semiconductor Manufacture	FCs	**27**			31	28	25	28	31	24	28	29	29	31	**33**	9	19	23			23				25	26	**28**
2 F 1/2/3	ODS Substitutes	HFCs	**23**						23	23	21	21	21	19	20	**18**	2	6	7	9			20	18	17	27	16	**17**
2 F 8	Other Sources of SF6	SF6							35	34	33	33	34	34			22	29										
3	Solvent and Other Product Use	CO2	**34**	32	34												23	26	22	20	20	22	23	26	27		29	
3	Solvent and Other Product Use	N2O				35	34	34																				
4 A 1	Cattle	CH4	**9**	9	10	8	9	11	11	10	11	10	10	10	10	**10**	10	27	20	21	13	14	10	14	15	13	9	**10**
4 B 1	Cattle	N2O	**21**	22	22	22	22	22	22	22	23	23	22	22	23	**22**	26										27	**26**
4 B 1	Cattle	CH4	**22**	23	24	24	23	23	24	25	25	25	25	26	27	**26**	27									19	28	**27**
4 B 8	Swine	CH4	**25**	25	26	25	24	24	26	28	27	26	28	28	29	**29**												
4 D	Agricultural Soils	N2O	**11**	11	9	12	12	6	12	12	10	12	11	11	11	**11**	8	9		8		15		15	20		19	**13**
6 A 1	Managed Waste disposal	CH4	**7**	7	7	7	6	7	10	11	12	11	12	12	12	**12**	12			13	7	8	7	7	7	6	5	**5**
	LA00= Level Assessment 2000																									
	TA00= Trend Assessment BY-2001																									

Table A1.4: Ranking of Key Sources

ANNEX 2: SECTOR 1 A FUEL COMBUSTION

This annex includes 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, at the beginning of this Annex, the revision of the national energy balance as well as the implication of this revision on activity data is described.

Recalculations

In 2003 STATISTIK AUSTRIA revised the energy balance: the following improvements have been made:

- From 1999 onwards a new industry inquiry (Gütereinsatzstatistik) of the 2000 most important Austrian companies have been considered.
- From 1990 onwards fuel consumption of iron and steel industry and petroleum refinery have been revised by means of energy efficiency information.
- From 1990 on the transformation sector has been revised by information provided in the "KWK-Statistik" (statistical data from CHPs).

The revisions above affected the final energy consumption of manufacturing industry and the small combustion sector.

Implications on Activity Data

The most important effects of the revisions are cited for each fuel category below:

Liquid Fuels

A share of *Non Energy Use of Other Oil Products* in petrochemical industry for the years 1990-1992 was shifted to *Refinery Fuels*[1].

Additionally there was a shift of fuel consumption from autoproducers in manufacturing industries (*1 A 2 f*) to petroleum refining for the years 1993-2001.

Gross Inland Consumption of *Fuel Oil* is revised for the years 1990-1992 due to [KWK-Statistik], see above. The *Fuel Oil* consumption for the base year 1990 is 151 kt higher than in the last version.

Motor Gasoline Consumption of 1994 has been reduced by 35 kt.

Solid Fuels

Gross Inland Consumption - Coke Oven Coke consumption was revised for the years 1991 to 1994 and for 1999-2001; it had the biggest effect for the year 1993, where it amounted to 60 kt.

Gaseous Fuels

No revision of the *Gross Inland Consumption* except for 2001 where it is 915 TJ less.

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[1] This did not effect emissions, as emission data was directly reported from the only refinery in Austria for preparation of the inventory.

For 1990 to 1992 a share is shifted from *Final Consumption* of *Industry* and *Other Sectors* to *Final Consumption* of *Pipeline Transport* which is 1005 TJ for the base year 1990.

<u>*Renewable Fuels*</u>

No revision of *Gross Inland Consumption* of total renewable fuels from 1990 to 1996 but a shift from *Municipal Solid Waste* to *Industrial Waste* which is 11 kt for the base year 1990 and up to 336 kt in 1992. *Gross Inland Consumption* of *Fuel Wood* and *Wood Waste* is higher from 1997 on, up to 5.6 PJ more in 2001.

Table 1 presents the recalculation difference of fuel consumption for the base year 1990 and the years 2000 and 2001. It has to be noted that the difference of the iron and steel sector – solid is not due to a revision of the energy balance but due to a methodological change in inventory preparation: last year non-energy use of coke was considered as fuel consumption for the preparation of the inventory, however, this did not affect emissions from the iron and steel sector, as emissions were reported directly from industry and were considered as a total in the industrial processes sector; this year emissions from iron and steel production have been split into process-specific emissions and emissions due to combustion, and non-energy use of coke has not been considered as fuel consumption.

Table 1: Recalculation difference of fuel consumption [PJ] with respect to previous submission.

IPCC Category / Fuel Group	Fuel Consumption [PJ]								
	1990			2000			2001		
	Subm. 2003	Subm. 2004	Difference	Subm. 2003	Subm. 2004	Difference	Subm. 2003	Subm. 2004	Difference
1 A FUEL COMBUSTION ACTIVITIES	**844.13**	**825.48**	**-18.65**	**978.77**	**930.70**	**-48.08**	**1 033.43**	**996.63**	**-36.81**
1 A liquid	358.73	380.40	21.67	426.25	428.10	1.85	460.69	462.16	1.47
1 A solid	181.20	140.87	-40.33	164.34	114.65	-49.70	166.15	124.63	-41.52
1 A gaseous	201.60	201.60	0.00	265.39	265.39	0.00	273.20	272.29	-0.92
1 A biomass	94.38	94.38	0.00	110.54	111.66	1.12	119.49	125.27	5.78
1 A other	8.23	8.23	0.00	12.26	10.91	-1.35	13.90	12.28	-1.62
1 A 1 Energy Industries	**176.19**	**193.60**	**17.40**	**175.85**	**185.22**	**9.38**	**206.30**	**213.99**	**7.68**
1 A 1 liquid	38.26	54.05	15.80	42.43	47.94	5.51	46.94	52.72	5.78
1 A 1 solid	61.47	61.47	0.00	50.87	50.87	0.00	59.96	61.13	1.17
1 A 1 gaseous	72.00	73.62	1.62	67.28	71.93	4.65	80.86	82.41	1.54
1 A 1 biomass	2.04	2.04	0.00	7.91	9.17	1.26	9.28	11.91	2.64
1 A 1 other	2.42	2.41	-0.01	7.36	5.31	-2.05	9.26	5.81	-3.45
1 A 1 a Public Electricity and Heat Production	**140.87**	**143.63**	**2.76**	**137.99**	**143.55**	**5.56**	**167.34**	**159.90**	**-7.44**
1 A 1 a liquid	16.32	17.47	1.15	13.58	15.29	1.70	18.46	19.97	1.51
1 A 1 a solid	61.47	61.47	0.00	50.87	50.87	0.00	59.96	61.13	1.17
1 A 1 a gaseous	58.61	60.23	1.62	58.25	62.91	4.65	70.38	61.08	-9.31

IPCC Category / Fuel Group	Fuel Consumption [PJ]								
	1990			2000			2001		
	Subm. 2003	Subm. 2004	Difference	Subm. 2003	Subm. 2004	Difference	Subm. 2003	Subm. 2004	Difference
1 A 1 a biomass	2.04	2.04	0.00	7.91	9.17	1.26	9.28	11.91	2.64
1 A 1 a other	2.42	2.41	-0.01	7.36	5.31	-2.05	9.26	5.81	-3.45
1 A 1 b Petroleum refining	**29.98**	**43.70**	**13.72**	**35.20**	**39.01**	**3.81**	**35.86**	**40.13**	**4.27**
1 A 1 b liquid	21.94	35.66	13.72	28.84	32.65	3.81	28.48	32.75	4.27
1 A 1 b solid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 1 b gaseous	8.04	8.04	0.00	6.36	6.36	0.00	7.38	7.38	0.00
1 A 1 b biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 1 b other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 1 c Manufacture of Solid fuels and Other Energy Industries	**5.34**	**6.26**	**0.92**	**2.67**	**2.67**	**0.00**	**3.10**	**13.95**	**10.85**
1 A 1 c liquid	0.00	0.92	0.92	0.00	0.00	0.00	0.00	0.00	0.00
1 A 1 c solid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 1 c gaseous	5.34	5.34	0.00	2.67	2.67	0.00	3.10	13.95	10.85
1 A 1 c biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 1 c other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 2 Manufacturing Industries and Construction	**247.69**	**208.68**	**-39.01**	**300.16**	**241.98**	**-58.19**	**277.20**	**233.67**	**-43.53**
1 A 2 liquid	38.37	43.85	5.48	45.82	40.36	-5.46	42.29	37.93	-4.36
1 A 2 solid	90.03	48.05	-41.98	102.89	53.29	-49.60	97.11	52.23	-44.88
1 A 2 gaseous	85.61	83.09	-2.52	110.16	106.20	-3.96	98.10	98.81	0.71
1 A 2 biomass	28.11	28.11	0.00	37.11	37.26	0.15	35.80	39.16	3.35
1 A 2 other	5.57	5.58	0.01	4.18	4.86	0.68	3.90	5.55	1.65
1 A 2 a Iron and Steel	**94.02**	**53.50**	**-40.53**	**115.70**	**64.74**	**-50.96**	**110.96**	**67.26**	**-43.70**
1 A 2 a liquid	3.84	3.83	-0.01	8.83	10.63	1.81	8.33	11.03	2.70
1 A 2 a solid	79.59	39.21	-40.38	91.30	40.62	-50.67	88.81	40.99	-47.83
1 A 2 a gaseous	10.59	10.46	-0.14	15.58	13.48	-2.10	13.82	15.25	1.43
1 A 2 a biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 2 a other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 2 b Non-ferrous Metals	**1.92**	**1.89**	**-0.03**	**3.38**	**3.20**	**-0.18**	**3.04**	**3.49**	**0.45**
1 A 2 b liquid	0.53	0.51	-0.02	0.63	0.61	-0.03	0.58	0.51	-0.07
1 A 2 b solid	0.03	0.04	0.01	0.22	0.23	0.01	0.21	0.40	0.19

IPCC Category / Fuel Group	Fuel Consumption [PJ]								
	1990			2000			2001		
	Subm. 2003	Subm. 2004	Difference	Subm. 2003	Subm. 2004	Difference	Subm. 2003	Subm. 2004	Difference
1 A 2 b gaseous	1.36	1.34	-0.02	2.53	2.36	-0.17	2.24	2.58	0.34
1 A 2 b biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 2 b other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 2 c Chemicals	**14.10**	**14.49**	**0.39**	**16.10**	**15.86**	**-0.24**	**14.13**	**15.28**	**1.16**
1 A 2 c liquid	0.93	0.93	0.00	0.95	0.61	-0.34	0.89	0.25	-0.63
1 A 2 c solid	0.22	0.23	0.01	1.94	1.55	-0.39	1.06	1.74	0.68
1 A 2 c gaseous	7.76	7.66	-0.10	10.81	10.10	-0.71	9.59	7.48	-2.11
1 A 2 c biomass	2.90	2.90	0.00	0.76	0.86	0.10	0.88	2.37	1.50
1 A 2 c other	2.29	2.76	0.47	1.63	2.74	1.11	1.71	3.43	1.72
1 A 2 d Pulp, Paper and Print	**36.58**	**36.39**	**-0.19**	**45.88**	**42.86**	**-3.02**	**42.07**	**42.60**	**0.52**
1 A 2 d liquid	5.09	5.09	0.00	2.96	2.13	-0.84	2.81	1.80	-1.02
1 A 2 d solid	2.33	2.31	-0.02	2.69	3.39	0.70	1.22	3.04	1.82
1 A 2 d gaseous	12.95	12.78	-0.17	18.01	16.83	-1.19	15.98	17.20	1.22
1 A 2 d biomass	16.21	16.21	0.00	22.19	20.49	-1.70	22.04	20.53	-1.51
1 A 2 d other	0.00	0.00	0.00	0.02	0.02	0.00	0.02	0.02	0.00
1 A 2 e Food Processing, Beverages and Tobacco	**12.43**	**12.31**	**-0.12**	**12.37**	**14.90**	**2.53**	**11.12**	**14.51**	**3.39**
1 A 2 e liquid	3.31	3.31	-0.01	1.89	1.68	-0.21	1.82	1.41	-0.41
1 A 2 e solid	0.05	0.06	0.00	0.15	0.38	0.23	0.15	0.30	0.16
1 A 2 e gaseous	8.94	8.82	-0.12	10.30	12.81	2.52	9.14	12.77	3.63
1 A 2 e biomass	0.13	0.13	0.00	0.02	0.02	0.00	0.01	0.02	0.01
1 A 2 e other	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00
1 A 2 f Other	**88.63**	**90.10**	**1.47**	**106.75**	**100.42**	**-6.32**	**95.88**	**90.53**	**-5.36**
1 A 2 f liquid	24.66	30.18	5.52	30.55	24.70	-5.85	27.86	22.93	-4.92
1 A 2 f solid	7.81	6.20	-1.61	6.60	7.12	0.52	5.65	5.74	0.09
1 A 2 f gaseous	44.01	42.02	-1.98	52.93	50.62	-2.32	47.32	43.52	-3.80
1 A 2 f biomass	8.87	8.87	0.00	14.13	15.88	1.75	12.88	16.23	3.35
1 A 2 f other	3.28	2.82	-0.46	2.53	2.10	-0.43	2.17	2.09	-0.08
1 A 3 Transport	**171.23**	**171.75**	**0.52**	**239.47**	**238.87**	**-0.60**	**259.01**	**255.94**	**-3.07**
1 A 3 gasoline	105.42	105.42	0.00	82.75	82.75	0.00	83.32	83.35	0.04
1 A 3 diesel	61.80	61.78	-0.02	145.34	145.31	-0.03	162.41	162.38	-0.03
1 A 3 natural gas	3.05	4.05	1.00	9.63	9.65	0.02	11.60	9.09	-2.51
1 A 3 solid	0.07	0.07	0.00	0.03	0.03	0.00	0.02	0.02	0.00

IPCC Cate-gory / Fuel Group	Fuel Consumption [PJ]								
	1990			2000			2001		
	Subm. 2003	Subm. 2004	Differ-ence	Subm. 2003	Subm. 2004	Differ-ence	Subm. 2003	Subm. 2004	Differ-ence
1 A 3 biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 a Civil Aviation	**0.89**	**0.44**	**-0.46**	**1.72**	**1.13**	**-0.59**	**1.66**	**1.09**	**-0.57**
1 A 3 a aviation gasoline	0.10	0.10	0.00	0.09	0.09	0.00	0.09	0.09	0.00
1 A 3 a jet kerosene	0.79	0.33	-0.46	1.63	1.04	-0.59	1.58	1.00	-0.57
1 A 3 b Road Transportation	**164.26**	**164.24**	**-0.03**	**224.83**	**224.81**	**-0.03**	**242.60**	**242.60**	**0.01**
1 A 3 b gasoline	105.30	105.30	0.00	82.63	82.63	0.00	83.19	83.23	0.04
1 A 3 b diesel oil	58.96	58.94	-0.02	142.20	142.17	-0.03	159.40	159.37	-0.03
1 A 3 b natural gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 b biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 b other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 c Rail-ways	**2.33**	**2.33**	**0.00**	**2.43**	**2.43**	**0.00**	**2.29**	**2.29**	**0.00**
1 A 3 c solid	0.07	0.07	0.00	0.03	0.03	0.00	0.02	0.02	0.00
1 A 3 c liquid	2.26	2.26	0.00	2.40	2.40	0.00	2.26	2.26	0.00
1 A 3 c other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 d Naviga-tion	**0.70**	**0.70**	**0.00**	**0.86**	**0.86**	**0.00**	**0.87**	**0.87**	**0.00**
1 A 3 d coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 d residual oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 d gas/diesel oil	0.58	0.58	0.00	0.74	0.74	0.00	0.74	0.74	0.00
1 A 3 d other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 d gasoline	0.12	0.12	0.00	0.12	0.12	0.00	0.12	0.12	0.00
1 A 3 e Other	**3.05**	**4.05**	**1.00**	**9.63**	**9.65**	**0.02**	**11.60**	**9.09**	**-2.51**
1 A 3 e liquid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 e solid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 3 e gaseous	3.05	4.05	1.00	9.63	9.65	0.02	11.60	9.09	-2.51
1 A 4 Other Sectors	**249.02**	**250.96**	**1.94**	**263.30**	**264.01**	**0.71**	**290.93**	**292.44**	**1.51**
1 A 4 liquid	113.99	114.38	0.39	108.19	109.98	1.79	124.07	124.09	0.02
1 A 4 solid	29.63	31.28	1.65	10.55	10.46	-0.10	9.06	11.24	2.18
1 A 4 gaseous	40.95	40.85	-0.10	78.32	77.60	-0.72	82.65	81.98	-0.67

IPCC Category / Fuel Group	Fuel Consumption [PJ]								
	1990			2000			2001		
	Subm. 2003	Subm. 2004	Difference	Subm. 2003	Subm. 2004	Difference	Subm. 2003	Subm. 2004	Difference
1 A 4 biomass	64.22	64.22	0.00	65.52	65.23	-0.29	74.41	74.20	-0.21
1 A 4 other	0.23	0.23	0.00	0.72	0.73	0.02	0.74	0.92	0.18
1 A 4 a Commercial/Institutional	**27.23**	**27.57**	**0.34**	**29.27**	**29.33**	**0.06**	**32.07**	**32.63**	**0.55**
1 A 4 a liquid	16.12	16.46	0.34	5.92	7.21	1.28	11.22	11.29	0.07
1 A 4 a solid	0.93	1.04	0.10	0.69	0.52	-0.17	0.30	0.48	0.18
1 A 4 a gaseous	7.76	7.66	-0.10	20.50	19.64	-0.86	18.19	18.49	0.31
1 A 4 a biomass	2.18	2.18	0.00	1.43	1.23	-0.20	1.64	1.45	-0.19
1 A 4 a other	0.23	0.23	0.00	0.72	0.73	0.02	0.74	0.92	0.18
1 A 4 b Residential	**192.70**	**194.23**	**1.53**	**202.45**	**202.65**	**0.20**	**225.79**	**226.82**	**1.03**
1 A 4 b liquid	73.73	73.73	0.00	76.59	76.63	0.05	86.51	86.53	0.02
1 A 4 b solid	28.09	29.63	1.53	9.65	9.73	0.08	8.55	10.54	1.99
1 A 4 b gaseous	32.83	32.83	0.00	57.20	57.34	0.14	63.77	62.81	-0.96
1 A 4 b biomass	58.05	58.05	0.00	59.00	58.94	-0.06	66.96	66.94	-0.01
1 A 4 b other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 4 c Agriculture/Forestry/Fisheries	**29.09**	**29.16**	**0.07**	**31.58**	**32.03**	**0.45**	**33.06**	**32.99**	**-0.07**
1 A 4 c liquid	24.14	24.20	0.05	25.68	26.15	0.47	26.34	26.27	-0.07
1 A 4 c solid	0.60	0.62	0.02	0.21	0.21	0.00	0.21	0.22	0.01
1 A 4 c gaseous	0.35	0.35	0.00	0.62	0.62	0.00	0.69	0.68	-0.01
1 A 4 c biomass	4.00	4.00	0.00	5.08	5.06	-0.02	5.82	5.82	-0.01
1 A 4 c other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 5 Other	**0.00**	**0.48**	**0.48**	**0.00**	**0.62**	**0.62**	**0.00**	**0.60**	**0.60**
1 A 5 liquid	0.00	0.48	0.48	0.00	0.62	0.62	0.00	0.60	0.60
1 A 5 solid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 5 gaseous	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 5 biomass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1 A 5 other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
International Bunkers	**12.26**	**12.26**	**0.00**	**23.08**	**23.03**	**-0.06**	**22.25**	**22.20**	**-0.06**

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 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 2004.

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 2001 and the new energy balance for 2002 has been submitted to the IEA in February 2004. The revised time series 1990 to 2000 is not yet submitted to IEA/EUROSTAT. This is due to a planned improvement and finalization of the whole time series by Statistik Austria in 2004. It is planned to submit the finalised time series to IEA/EUROSTAT until the end of 2004.

There are five different IEA questionnaires for each of: oil; natural gas; coal; renewable fuels; electricity and heat. Table 2 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 2: IEA-Questionnaires 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	In the inventory plant specific data are considered.	0101 0102	1 A 1 a Public Electricity and Heat Production
Public CHP plants			
Public Heat plants			
Auto Producer Electricity plants		0301	1 A 2 Manufacturing Industries and Construction
Auto Producer CHP plants		0301	1 A 2 Manufacturing Industries and Construction
Auto Producer Heat plants		0301	1 A 2 Manufacturing Industries and Construction
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*		

IEA-Category and ISIC Codes*	Comments	SNAP	IPCC-Category
	Gas .		
Petrochemical Industry	No consumption (1)		
Patent Fuel Plants	No consumption (1)		
Not Elsewhere Specified	No consumption (1)		
Energy Sector, of which (ISIC 10, 11, 12, 23, 40):			
Coal Mines	No consumption (1)		
Oil and Gas Extraction		0105	1 A 1 c Manufacture of Solid fuels and Other Energy Industries
Inputs to oil refineries		0103	1 A 1 b Petroleum Refining
Coke Ovens	*Coke Oven Gas* and *Blast Furnace Gas*.	0301	1 A 2 a Iron and Steel
Blast furnaces	*Coke Oven Coke*.	030326	1 A 2 a Iron and Steel
Gas Works	*Natural Gas*.	0101	1 A 1 a Public Electricity and Heat Production
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	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

IEA-Category and ISIC Codes*	Comments	SNAP	IPCC-Category
Machinery (ISIC 28, 29, 30, 31, 32)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Mining and Quarrying (ISIC 13, 14)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Food, Beverages and Tobacco (ISIC 15, 16)		0301	1 A 2 e Food Processing, Beverages and Tobacco
Pulp, Paper and Printing (ISIC 21, 22)		0301	1 A 2 d Pulp, Paper and Print
Wood and Wood Products (ISIC 20)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Construction (ISIC 45)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Textiles and Leather (ISIC 17, 18, 19)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Non Specified (ISIC 25, 33, 36, 37)		0301	1 A 2 f Manuf. Ind. and Constr. - Other
Total Other sectors, of which:			
Commercial and Public Services (ISIC 41, 50, 51, 52, 55, 63, 64, 65, 66, 67, 70, 71, 72, 73, 74, 75, 80, 85, 90, 91, 92, 93, 99)		0201	1 A 4 a Commercial/ Institutional
Residential (ISIC 95)		0202	1 A 4 b Residential
Agriculture (ISIC 01, 02, 05)		0203	1 A 4 c Agriculture/Forestry/ Fisheries
Non Specified	No consumption (1)		

*Sector names may differ to original IEA questionnaire naming convention. Note that the ISIC codes cited in this table are consistent with the NACE nomenclature.

(1) Indicates that no fuel consumption is reported in the energy balance for the specific category. In some cases this may be interpreted as "included elsewhere" if the energy statistic has lack of detailed sectoral data.

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 3.

Table 3: Fuel categories used for the inventory and correspondence to IPCC fuel categories

Inventory Fuel Category		IEA Fuel Category		IPCC Fuel Category (3)
Code (1)	Category	Category	Average Net Calorific Value(2)	
102 A	Hard Coal	Bituminous Coal and Anthracite	27.50	Solid (coal)
104 A	Hard Coal Briquettes	Patent Fuel	31.00	Solid (coal)
105 A	Brown Coal	Lignite/Brown Coal	9.82	Solid (coal)
106 A	Brown Coal Briquettes	BKB/PB	19.30	Solid (coal)
107 A	Coke	Coke Oven Coke	28.20	Solid (coal)
113 A	Peat	Peat	8.80	Solid
304 A	Coke Oven Gas	Coke Oven Gas	-	Solid
305 A	Blast Furnace Gas	Blast Furnace Gas	-	Solid
203 B	Light Fuel Oil Sulphur Content < 0,2 %	Residual Fuel Oil	40.81	Liquid (residual oil)
203 C	Medium Fuel Oil Sulphur Content < 0,4%	Residual Fuel Oil	40.81	Liquid (residual oil)
203 D	Heavy Fuel Oil Sulphur Content >= 1%	Residual Fuel Oil	40.81	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	43.91	Liquid
303 A	Liquified Petroleum Gas (LPG)	LPG	46.00	Liquid
308 A	Refinery Gas	Refinery Gas	45.93	Liquid
301 A	Natural Gas	Natural Gas	35.92	Gaseous (natural gas)
114 B	Municipal Waste	Municipal Solid Waste	8.70	Other Fuels

Inventory Fuel Category		IEA Fuel Category		IPCC Fuel Category (3)
Code (1)	Category	Category	Average Net Calorific Value(2)	
114 C	Hazardous Waste	Industrial Wastes	8.70	Other Fuels
115 A	Industrial Waste	Industrial Wastes	8.70	Other Fuels
111 A	Fuel Wood	*Wood/Wood wastes/Other Solid Wastes, of which:* Wood	14.35	Biomass
116 A	Wood Wastes	*Wood/Wood wastes/Other Solid Wastes, of which:* Other vegetal materials and waste (including straw, sawdust, wood chips)	8.70	Biomass
118 A	Sewage Sludge	Industrial Wastes	8.70	Biomass
215 A	Black Liquor	*Wood/Wood wastes/Other Solid Wastes, of which:* Black Liquor	8.70	Biomass
309 A	Biogas	Biogas	23.40	Biomass
309 B	Sewage Sludge Gas	Sewage Sludge Gas	27.00	Biomass
310 A	Landfill Gas	Landfill Gas	25.00	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 2002. 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

Energy Consumption and CO_2 Emissions by Sectors and Fuel Types

In the following Table 4 detailed data on fuel consumption and CO_2 emissions for each fuel type according to Table 3 and each sector of *1 A Fuel Combustion* are provided for the period from 1990 to 2002. For information on completeness, in particular on CO_2 emissions included elsewhere, please refer to the documentation boxes of the CRF and to Chapter 3.1, subsection *Completeness* of the NIR.

Table 4: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**59.80**	**45.54**	**0.02**	**9.25**	**114.60**	**5.86**	**5.16**	**0.00**	**0.87**	**11.88**
102A	Hard Coal	46.34	5.65	0.02	2.51	54.52	4.38	0.53	0.00	0.23	5.15
104A	Hard Coal Briquettes				0.02	0.02				0.00	0.00
105A	Brown Coal	13.45	1.57		0.44	15.46	1.47	0.15		0.05	1.67
106A	Brown Coal Briquettes		0.00		1.26	1.26		0.00		0.12	0.12
107A	Coke		28.57		5.01	33.58		2.97		0.46	3.43
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		9.74			9.74		1.50			1.50
	Total Liquid	**39.73**	**38.65**	**274.94**	**115.65**	**468.98**	**3.00**	**2.96**	**20.24**	**8.62**	**34.86**
203B	Light Fuel Oil	0.59	0.84		10.75	12.18	0.05	0.07		0.83	0.94
203C	Medium Fuel Oil		0.94		0.94	1.87		0.07		0.07	0.15
203D	Heavy Fuel Oil	10.11	16.22			26.33	0.80	1.27			2.07
204A	Gasoil	0.09	0.15		74.45	74.70	0.01	0.01		5.58	5.60
2050	Diesel	0.03	14.85	183.85	23.32	222.05	0.00	1.09	13.54	1.72	16.36
206A	Other Kerosene		0.03		0.16	0.19		0.00		0.01	0.02
206B	Jet Kerosene			1.47		1.47			0.07		0.11
207A	Aviation Gasoline			0.09		0.09			0.01		0.01
2080	Motor Gasoline		0.09	89.53	1.64	91.26		0.01	6.63	0.12	6.75
224A	Other Petroleum Products	14.70	2.22			16.92	1.15	0.23			1.38
303A	Liquified Petroleum Gas (LPG)	0.13	3.31		4.40	7.84	0.01	0.21		0.28	0.50
308A	Refinery Gas	14.07				14.07	0.98				0.98
301A	**Total Gaseous** (Natural Gas)	**104.83**	**77.63**	**6.55**	**75.67**	**264.68**	**5.77**	**4.27**	**0.36**	**4.16**	**14.56**
	Total Other Fuel	**9.22**	**2.82**		**0.43**	**12.47**	**0.40**	**0.12**		**0.00**	**0.52**
114B	Municipal Waste	4.91				4.91	0.30				0.30
114C	Hazardous Waste	1.22				1.22	0.06				0.06
115A	Industrial Waste	3.08	2.82		0.43	6.33	0.03	0.12		0.00	0.15
	Total Biomass(1)	**13.60**	**43.76**		**71.79**	**129.16**	**(1.5)**	**(4.82)**		**(7.25)**	**(13.56)**
111A	Fuel Wood	0.02	0.17		64.68	64.87	0.00	0.02		6.47	6.49
116A	Wood Wastes	12.95	11.01		7.11	31.07	1.42	1.21		0.78	3.42
118A	Sewage Sludge	0.52				0.52	0.06				0.06
215A	Black Liquor		31.11			31.11		3.42			3.42
309A	Biogas		0.39			0.39		0.04			0.04
309B	Sewage Sludge Gas	0.06	0.76			0.81	0.01	0.08			0.09
310A	Landfill Gas	0.06	0.32			0.38	0.01	0.04			0.04
	Total(1)	**227.17**	**208.40**	**281.52**	**272.79**	**989.88**	**15.01**	**12.50**	**20.61**	**13.65**	**61.81**

(1) CO_2 emissions of Biomass are not included in Total.

Table 5: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**61.13**	**52.23**	**0.02**	**11.24**	**124.63**	**5.99**	**4.36**	**0.00**	**1.05**	**11.40**
102A	Hard Coal	46.61	8.88	0.02	2.71	58.22	4.41	0.83	0.00	0.25	5.50
104A	Hard Coal Briquettes				0.01	0.01				0.00	0.00
105A	Brown Coal	13.96	1.40		0.43	15.79	1.53	0.14		0.05	1.71
106A	Brown Coal Briquettes	0.56	0.00		1.52	2.09	0.05	0.00		0.15	0.20
107A	Coke		32.17		6.56	38.73		3.35		0.60	3.95
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		9.78			9.78		0.05			0.05
	Total Liquid	**52.72**	**37.93**	**247.42**	**124.09**	**462.16**	**3.65**	**2.88**	**18.20**	**9.25**	**34.03**
203B	Light Fuel Oil	2.03	2.71		11.60	16.34	0.16	0.21		0.89	1.26
203C	Medium Fuel Oil		0.76		0.76	1.51		0.06		0.06	0.12
203D	Heavy Fuel Oil	21.98	16.22			38.20	1.74	1.27			3.01
204A	Gasoil	0.79	0.45		82.79	84.03	0.06	0.03		6.21	6.30
2050	Diesel	0.01	14.58	162.41	23.14	200.14	0.00	1.07	11.96	1.70	14.74
206A	Other Kerosene		0.01		0.04	0.04		0.00		0.00	0.00
206B	Jet Kerosene			1.57		1.57			0.07		0.11
207A	Aviation Gasoline			0.09		0.09			0.01		0.01
2080	Motor Gasoline		0.09	83.35	1.64	85.08		0.01	6.16	0.12	6.29
224A	Other Petroleum Products	12.82	0.67			13.49	1.00	0.07			1.07
303A	Liquified Petroleum Gas (LPG)		2.45		4.12	6.58		0.16		0.26	0.42
308A	Refinery Gas	15.08				15.08	0.69				0.69
301A	**Total Gaseous** (Natural Gas)	**82.41**	**98.81**	**9.09**	**81.98**	**272.29**	**4.53**	**5.43**	**0.50**	**4.51**	**14.98**
	Total Other Fuel	**5.81**	**5.55**		**0.92**	**12.28**	**0.34**	**0.25**		**0.01**	**0.60**
114B	Municipal Waste	4.61				4.61	0.29				0.29
114C	Hazardous Waste	1.07				1.07	0.05				0.05
115A	Industrial Waste	0.13	5.55		0.92	6.60	0.00	0.25		0.01	0.26
	Total Biomass(1)	**11.91**	**39.16**		**74.20**	**125.27**	**(1.31)**	**(4.31)**		**(7.49)**	**(13.11)**
111A	Fuel Wood	0.07	0.13		67.04	67.24	0.01	0.01		6.70	6.72
116A	Wood Wastes	11.05	13.37		7.17	31.59	1.22	1.47		0.79	3.47
118A	Sewage Sludge	0.65				0.65	0.07				0.07
215A	Black Liquor		23.30			23.30		2.56			2.56
309A	Biogas	0.02	0.28			0.30	0.00	0.03			0.03
309B	Sewage Sludge Gas	0.05	0.76			0.81	0.01	0.09			0.09
310A	Landfill Gas	0.07	1.31			1.38	0.01	0.15			0.15
	Total(1)	**213.99**	**233.67**	**256.53**	**292.44**	**996.63**	**14.51**	**12.92**	**18.71**	**14.82**	**61.01**

(1) CO_2 emissions of Biomass are not included in Total.

Table 6: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**50.87**	**53.29**	**0.03**	**10.46**	**114.65**	**4.98**	**4.61**	**0.00**	**0.98**	**10.58**
102A	Hard Coal	39.11	10.34	0.03	2.38	51.86	3.70	0.97	0.00	0.22	4.89
104A	Hard Coal Briquettes				0.11	0.11				0.01	0.01
105A	Brown Coal	11.40	1.35		0.47	13.22	1.25	0.13		0.05	1.43
106A	Brown Coal Briquettes	0.35	0.00		1.71	2.06	0.03	0.00		0.17	0.20
107A	Coke		31.14		5.78	36.93		3.24		0.53	3.77
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		10.47			10.47		0.27			0.27
	Total Liquid	**47.94**	**40.36**	**229.81**	**109.98**	**428.10**	**3.25**	**3.07**	**16.90**	**8.20**	**31.46**
203B	Light Fuel Oil	1.82	6.16		11.91	19.90	0.14	0.48		0.92	1.54
203C	Medium Fuel Oil		0.80		0.80	1.60		0.06		0.06	0.12
203D	Heavy Fuel Oil	19.03	15.35			34.39	1.52	1.20			2.72
204A	Gasoil	0.01	0.19		68.19	68.38	0.00	0.01		5.11	5.13
2050	Diesel	0.01	14.36	145.34	22.87	182.58	0.00	1.06	10.71	1.68	13.45
206A	Other Kerosene		0.02		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	82.75	1.64	84.48		0.01	6.12	0.12	6.24
224A	Other Petroleum Products	11.78	0.81			12.59	0.92	0.08			1.00
303A	Liquified Petroleum Gas (LPG)	0.94	2.58		4.33	7.85	0.06	0.17		0.28	0.50
308A	Refinery Gas	14.35				14.35	0.61				0.61
301A	**Total Gaseous** (Natural Gas)	**71.93**	**106.20**	**9.65**	**77.60**	**265.39**	**3.96**	**5.84**	**0.53**	**4.27**	**14.60**
	Total Other Fuel	**5.31**	**4.86**		**0.73**	**10.91**	**0.31**	**0.18**		**0.01**	**0.51**
114B	Municipal Waste	4.52				4.52	0.28				0.28
114C	Hazardous Waste	0.66				0.66	0.03				0.03
115A	Industrial Waste	0.13	4.86		0.73	5.73	0.00	0.18		0.01	0.19
	Total Biomass(1)	**9.17**	**37.26**		**65.23**	**111.66**	**(1.01)**	**(4.1)**		**(6.58)**	**(11.69)**
111A	Fuel Wood	0.04	0.10		59.30	59.44	0.00	0.01		5.93	5.94
116A	Wood Wastes	8.30	11.55		5.93	25.79	0.91	1.27		0.65	2.84
118A	Sewage Sludge	0.70				0.70	0.08				0.08
215A	Black Liquor		24.12			24.12		2.65			2.65
309A	Biogas	0.02	0.35			0.37	0.00	0.04			0.04
309B	Sewage Sludge Gas	0.05	0.74			0.79	0.01	0.08			0.09
310A	Landfill Gas	0.06	0.40			0.46	0.01	0.04			0.05
	Total(1)	**185.22**	**241.98**	**239.49**	**264.01**	**930.70**	**12.50**	**13.71**	**17.44**	**13.45**	**57.14**

(1) CO_2 emissions of Biomass are not included in Total.

Table 7: 1999 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A	1 A 1	1 A 2	1 A 3 + 1 A 5	1 A 4	1 A
		Energy Ind.	Industry	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**38.03**	**49.69**	**0.03**	**12.09**	**99.84**	**3.81**	**4.25**	**0.00**	**1.13**	**9.19**
102A	Hard Coal	24.14	8.67	0.03	2.69	35.54	2.28	0.82	0.00	0.25	3.35
104A	Hard Coal Briquettes				0.12	0.12				0.01	0.01
105A	Brown Coal	13.89	0.92		0.53	15.33	1.53	0.09		0.06	1.67
106A	Brown Coal Briquettes		0.00		2.05	2.05		0.00		0.20	0.20
107A	Coke		27.88		6.69	34.57		2.90		0.62	3.51
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		12.22			12.22		0.45			0.45
	Total Liquid	**59.29**	**39.12**	**217.85**	**119.85**	**436.11**	**4.06**	**2.99**	**16.02**	**8.94**	**32.04**
203B	Light Fuel Oil	1.35	4.03		11.22	16.59	0.11	0.31		0.86	1.28
203C	Medium Fuel Oil	0.09	1.23		1.14	2.46	0.01	0.10		0.09	0.19
203D	Heavy Fuel Oil	30.76	15.58			46.34	2.45	1.22			3.66
204A	Gasoil	0.29	0.52		78.81	79.62	0.02	0.04		5.91	5.97
2050	Diesel	0.10	13.87	130.53	22.22	166.71	0.01	1.02	9.61	1.64	12.28
206A	Other Kerosene		0.12		0.58	0.70		0.01		0.04	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	85.66	1.64	87.40		0.01	6.33	0.12	6.46
224A	Other Petroleum Products	12.11	1.19			13.30	0.94	0.12			1.07
303A	Liquified Petroleum Gas (LPG)	0.20	2.49		4.25	6.94	0.01	0.16		0.27	0.44
308A	Refinery Gas	14.39				14.39	0.51				0.51
301A	**Total Gaseous** (Natural Gas)	**84.44**	**106.46**	**9.57**	**75.27**	**275.74**	**4.64**	**5.86**	**0.53**	**4.14**	**15.17**
	Total Other Fuel	**4.84**	**6.78**		**0.63**	**12.25**	**0.29**	**0.23**		**0.01**	**0.53**
114B	Municipal Waste	4.52				4.52	0.28				0.28
114C	Hazardous Waste	0.19				0.19	0.01				0.01
115A	Industrial Waste	0.13	6.78		0.63	7.54	0.00	0.23		0.01	0.24
	Total Biomass(1)	**7.21**	**37.86**		**69.55**	**114.62**	**(0.79)**	**(4.16)**		**(7.01)**	**(11.96)**
111A	Fuel Wood	0.02	0.95		64.10	65.07	0.00	0.09		6.41	6.51
116A	Wood Wastes	6.98	11.70		5.44	24.12	0.77	1.29		0.60	2.65
118A	Sewage Sludge	0.15				0.15	0.02				0.02
215A	Black Liquor		23.67			23.67		2.60			2.60
309A	Biogas	0.01	0.36			0.37	0.00	0.04			0.04
309B	Sewage Sludge Gas	0.02	0.70			0.71	0.00	0.08			0.08
310A	Landfill Gas	0.03	0.50			0.52	0.00	0.06			0.06
	Total(1)	**193.81**	**239.91**	**227.44**	**277.39**	**938.55**	**12.80**	**13.32**	**16.55**	**14.22**	**56.93**

(1) CO_2 emissions of Biomass are not included in Total.

Table 8: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**35.96**	**52.36**	**0.03**	**13.05**	**101.40**	**3.51**	**4.30**	**0.00**	**1.22**	**9.04**
102A	Hard Coal	28.48	11.92	0.03	3.19	43.62	2.69	1.12	0.00	0.30	4.11
104A	Hard Coal Briquettes				0.12	0.12				0.01	0.01
105A	Brown Coal	7.48	0.52		0.57	8.57	0.82	0.05		0.06	0.94
106A	Brown Coal Briquettes		0.00		1.99	1.99		0.00		0.19	0.19
107A	Coke		27.75		7.17	34.92		2.89		0.66	3.55
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		12.17			12.17		0.25			0.25
	Total Liquid	**67.69**	**49.14**	**227.33**	**118.88**	**463.04**	**4.45**	**3.74**	**16.74**	**8.88**	**33.85**
203B	Light Fuel Oil	2.11	10.95		9.90	22.96	0.16	0.85		0.76	1.78
203C	Medium Fuel Oil	0.14	1.24		1.10	2.47	0.01	0.10		0.09	0.19
203D	Heavy Fuel Oil	34.09	19.49			53.58	2.71	1.52			4.23
204A	Gasoil	0.20	0.52		80.48	81.21	0.02	0.04		6.04	6.09
2050	Diesel	0.09	13.40	133.36	21.46	168.31	0.01	0.99	9.85	1.58	12.43
206A	Other Kerosene		0.01		0.73	0.73		0.00		0.06	0.06
206B	Jet Kerosene			1.51		1.51			0.07		0.11
207A	Aviation Gasoline			0.11		0.11			0.01		0.01
2080	Motor Gasoline		0.09	92.35	1.64	94.08		0.01	6.82	0.12	6.95
224A	Other Petroleum Products	13.88	0.40			14.28	1.08	0.04			1.12
303A	Liquified Petroleum Gas (LPG)	0.13	3.05		3.57	6.74	0.01	0.19		0.23	0.43
308A	Refinery Gas	17.04				17.04	0.45				0.45
301A	**Total Gaseous** (Natural Gas)	**82.72**	**109.39**	**6.34**	**73.14**	**271.59**	**4.55**	**6.02**	**0.35**	**4.02**	**14.94**
	Total Other Fuel	**5.53**	**3.72**		**0.58**	**9.83**	**0.33**	**0.10**		**0.01**	**0.44**
114B	Municipal Waste	4.78				4.78	0.30				0.30
114C	Hazardous Waste	0.75				0.75	0.04				0.04
115A	Industrial Waste		3.72		0.58	4.30		0.10		0.01	0.10
	Total Biomass(1)	**6.90**	**33.87**		**69.42**	**110.19**	**(0.76)**	**(3.73)**		**(6.99)**	**(11.47)**
111A	Fuel Wood	0.21	0.15		64.52	64.88	0.02	0.02		6.45	6.49
116A	Wood Wastes	6.02	9.62		4.89	20.53	0.66	1.06		0.54	2.26
118A	Sewage Sludge	0.59				0.59	0.07				0.07
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)	**198.81**	**248.48**	**233.70**	**275.06**	**956.04**	**12.85**	**14.16**	**17.09**	**14.13**	**58.27**

(1) CO_2 emissions of Biomass are not included in Total.

Table 9: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**50.96**	**53.50**	**0.03**	**14.92**	**119.42**	**5.00**	**4.85**	**0.00**	**1.40**	**11.25**
102A	Hard Coal	39.25	12.15	0.03	3.58	55.02	3.71	1.14	0.00	0.33	5.19
104A	Hard Coal Briquettes				0.22	0.22				0.02	0.02
105A	Brown Coal	11.71	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		29.06		7.93	36.99		3.02		0.73	3.75
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		11.60			11.60		0.61			0.61
	Total Liquid	**64.70**	**51.12**	**200.75**	**117.69**	**434.26**	**3.97**	**3.90**	**14.78**	**8.79**	**31.48**
203B	Light Fuel Oil	1.12	11.03		9.55	21.70	0.09	0.86		0.74	1.68
203C	Medium Fuel Oil	0.09	1.19		1.10	2.37	0.01	0.09		0.09	0.18
203D	Heavy Fuel Oil	31.41	22.53			53.94	2.50	1.76			4.25
204A	Gasoil	0.11	0.48		81.01	81.60	0.01	0.04		6.08	6.12
2050	Diesel	0.35	12.92	111.11	20.70	145.08	0.03	0.95	8.20	1.53	10.71
206A	Other Kerosene		0.00		0.42	0.43		0.00		0.03	0.03
206B	Jet Kerosene			1.35		1.35			0.06		0.10
207A	Aviation Gasoline			0.10		0.10			0.01		0.01
2080	Motor Gasoline		0.09	88.19	1.66	89.93		0.01	6.51	0.12	6.64
224A	Other Petroleum Products	14.34	0.11			14.45	1.12	0.01			1.13
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	0.22				0.22
301A	**Total Gaseous** (Natural Gas)	**79.15**	**110.82**	**4.20**	**71.48**	**265.65**	**4.35**	**6.09**	**0.23**	**3.93**	**14.61**
	Total Other Fuel	**5.72**	**4.99**		**0.55**	**11.26**	**0.34**	**0.18**		**0.01**	**0.53**
114B	Municipal Waste	4.89				4.89	0.30				0.30
114C	Hazardous Waste	0.83				0.83	0.04				0.04
115A	Industrial Waste		4.99		0.55	5.54		0.18		0.01	0.18
	Total Biomass(1)	**6.72**	**37.66**		**71.33**	**115.71**	**(0.74)**	**(4.14)**		**(7.18)**	**(12.06)**
111A	Fuel Wood	0.07	0.20		66.93	67.21	0.01	0.02		6.69	6.72
116A	Wood Wastes	6.01	14.61		4.39	25.00	0.66	1.61		0.48	2.75
118A	Sewage Sludge	0.56				0.56	0.06				0.06
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)	**207.27**	**258.09**	**204.98**	**275.97**	**946.30**	**13.68**	**15.01**	**15.01**	**14.13**	**57.86**

(1) CO_2 emissions of Biomass are not included in Total.

Table 10: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**47.72**	**47.66**	**0.06**	**18.69**	**114.12**	**4.71**	**4.43**	**0.01**	**1.75**	**10.90**
102A	Hard Coal	33.71	9.51	0.06	4.32	47.60	3.19	0.89	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		0.25		2.97	3.22		0.02		0.29	0.31
107A	Coke		25.36		10.46	35.83		2.64		0.96	3.60
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		11.42			11.42		0.77			0.77
	Total Liquid	**59.96**	**40.19**	**214.98**	**130.79**	**445.92**	**3.68**	**3.04**	**15.83**	**9.79**	**32.37**
203B	Light Fuel Oil	1.81	9.51		20.96	32.28	0.14	0.74		1.61	2.50
203C	Medium Fuel Oil	0.34	1.10		0.76	2.20	0.03	0.09		0.06	0.17
203D	Heavy Fuel Oil	25.82	13.32			39.15	2.05	1.04			3.09
204A	Gasoil	0.06	0.49		83.18	83.74	0.00	0.04		6.24	6.28
2050	Diesel	0.18	12.43	120.53	19.88	153.03	0.01	0.92	8.90	1.47	11.30
206A	Other Kerosene		0.01		0.51	0.51		0.00		0.04	0.04
206B	Jet Kerosene			1.29		1.29			0.06		0.09
207A	Aviation Gasoline			0.09		0.09			0.01		0.01
2080	Motor Gasoline		0.09	93.07	1.67	94.83		0.01	6.86	0.12	6.99
224A	Other Petroleum Products	13.79	0.13			13.92	1.08	0.01			1.09
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	0.34				0.34
301A	**Total Gaseous** (Natural Gas)	**90.43**	**106.55**	**4.22**	**74.25**	**275.44**	**4.97**	**5.86**	**0.23**	**4.08**	**15.15**
	Total Other Fuel	**5.41**	**4.88**		**0.43**	**10.72**	**0.33**	**0.19**		**0.00**	**0.53**
114B	Municipal Waste	4.77				4.77	0.30				0.30
114C	Hazardous Waste	0.64				0.64	0.03				0.03
115A	Industrial Waste		4.88		0.43	5.31		0.19		0.00	0.20
	Total Biomass(1)	**6.66**	**33.42**		**75.41**	**115.49**	**(0.73)**	**(3.67)**		**(7.57)**	**(11.97)**
111A	Fuel Wood	0.04	0.74		72.50	73.29	0.00	0.07		7.25	7.33
116A	Wood Wastes	6.03	10.59		2.87	19.50	0.66	1.16		0.32	2.14
118A	Sewage Sludge	0.52				0.52	0.06				0.06
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)	**210.18**	**232.68**	**219.26**	**299.57**	**961.69**	**13.70**	**13.52**	**16.06**	**15.63**	**58.95**

(1) CO_2 emissions of Biomass are not included in Total.

Table 11: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**45.49**	**48.04**	**0.06**	**19.11**	**112.70**	**4.53**	**4.50**	**0.01**	**1.80**	**10.83**
102A	Hard Coal	29.91	7.41	0.06	4.12	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		0.27		3.06	3.32		0.03		0.30	0.32
107A	Coke		27.16		10.79	37.95		2.82		0.99	3.82
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		10.91			10.91		0.73			0.73
	Total Liquid	**56.63**	**44.43**	**192.73**	**115.73**	**409.51**	**3.34**	**3.38**	**14.19**	**8.65**	**29.59**
203B	Light Fuel Oil	1.39	8.59		18.05	28.03	0.11	0.67		1.39	2.17
203C	Medium Fuel Oil	0.11	0.94		1.51	2.56	0.01	0.07		0.12	0.20
203D	Heavy Fuel Oil	27.09	19.01			46.10	2.16	1.48			3.64
204A	Gasoil	0.09	0.20		70.50	70.80	0.01	0.02		5.29	5.31
2050	Diesel	0.30	12.53	90.57	19.09	122.49	0.02	0.93	6.69	1.41	9.05
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	100.95	1.65	102.70		0.01	7.44	0.12	7.57
224A	Other Petroleum Products	11.64	0.19			11.83	0.91	0.02			0.93
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	0.06				0.06
301A	**Total Gaseous** (Natural Gas)	**78.00**	**104.64**	**4.09**	**67.69**	**254.42**	**4.29**	**5.76**	**0.23**	**3.72**	**13.99**
	Total Other Fuel	**4.57**	**3.67**		**0.65**	**8.89**	**0.28**	**0.17**		**0.01**	**0.46**
114B	Municipal Waste	3.91				3.91	0.24				0.24
114C	Hazardous Waste	0.66				0.66	0.03				0.03
115A	Industrial Waste		3.67		0.65	4.32		0.17		0.01	0.18
	Total Biomass(1)	**4.93**	**34.47**		**69.02**	**108.42**	**(0.54)**	**(3.78)**		**(6.93)**	**(11.25)**
111A	Fuel Wood		1.07		66.28	67.35		0.11		6.63	6.74
116A	Wood Wastes	4.33	11.24		2.69	18.27	0.48	1.24		0.30	2.01
118A	Sewage Sludge	0.56				0.56	0.06				0.06
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)	**189.61**	**235.23**	**196.88**	**272.20**	**893.93**	**12.44**	**13.81**	**14.42**	**14.17**	**54.87**

(1) CO_2 emissions of Biomass are not included in Total.

Table 12: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**32.97**	**45.17**	**0.06**	**19.70**	**97.89**	**3.28**	**4.35**	**0.01**	**1.85**	**9.49**
102A	Hard Coal	22.73	6.38	0.06	4.05	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	0.46		3.21	3.86	0.02	0.04		0.31	0.38
107A	Coke		25.33		11.15	36.48		2.63		1.03	3.66
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		10.79			10.79		0.86			0.86
	Total Liquid	**63.48**	**47.03**	**191.70**	**106.83**	**409.04**	**3.79**	**3.58**	**14.11**	**7.97**	**29.50**
203B	Light Fuel Oil	1.88	5.59		14.94	22.41	0.15	0.44		1.15	1.73
203C	Medium Fuel Oil	0.09	1.11		1.90	3.10	0.01	0.09		0.15	0.24
203D	Heavy Fuel Oil	31.23	24.19			55.42	2.48	1.89			4.37
204A	Gasoil	0.08	0.20		64.72	65.00	0.01	0.01		4.85	4.88
2050	Diesel	0.28	12.51	84.68	18.55	116.02	0.02	0.93	6.27	1.37	8.59
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	105.73	1.67	107.49		0.01	7.79	0.12	7.92
224A	Other Petroleum Products	13.08	0.35			13.43	1.02	0.04			1.06
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	0.10				0.10
301A	**Total Gaseous** (Natural Gas)	**71.61**	**102.72**	**3.78**	**56.98**	**235.08**	**3.94**	**5.65**	**0.21**	**3.13**	**12.93**
	Total Other Fuel	**4.51**	**3.39**		**0.88**	**8.79**	**0.27**	**0.17**		**0.01**	**0.45**
114B	Municipal Waste	3.82				3.82	0.24				0.24
114C	Hazardous Waste	0.69				0.69	0.03				0.03
115A	Industrial Waste		3.39		0.88	4.27		0.17		0.01	0.17
	Total Biomass(1)	**4.28**	**33.77**		**63.89**	**101.94**	**(0.47)**	**(3.71)**		**(6.41)**	**(10.59)**
111A	Fuel Wood		0.90		61.49	62.39		0.09		6.15	6.24
116A	Wood Wastes	3.71	12.62		2.32	18.65	0.41	1.39		0.25	2.05
118A	Sewage Sludge	0.57				0.57	0.06				0.06
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)	**176.85**	**232.08**	**195.54**	**248.27**	**852.74**	**11.28**	**13.75**	**14.33**	**12.97**	**52.37**

(1) CO_2 emissions of Biomass are not included in Total.

Table 13: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**31.10**	**44.03**	**0.06**	**23.22**	**98.41**	**3.12**	**4.27**	**0.01**	**2.18**	**9.58**
102A	Hard Coal	20.22	7.61	0.06	4.68	32.58	1.95	0.72	0.01	0.44	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	0.28		3.67	4.18	0.02	0.03		0.36	0.41
107A	Coke		23.02		13.32	36.34		2.39		1.23	3.62
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		10.64			10.64		0.89			0.89
	Total Liquid	**62.98**	**47.30**	**190.27**	**114.42**	**414.98**	**3.80**	**3.62**	**14.01**	**8.55**	**30.02**
203B	Light Fuel Oil	2.22	10.57		18.42	31.21	0.17	0.82		1.42	2.42
203C	Medium Fuel Oil	0.39	1.04		2.66	4.09	0.03	0.08		0.21	0.32
203D	Heavy Fuel Oil	31.54	20.30			51.84	2.50	1.58			4.08
204A	Gasoil	0.11	0.26		67.95	68.32	0.01	0.02		5.10	5.12
2050	Diesel	0.26	11.93	80.96	18.06	111.22	0.02	0.88	5.99	1.34	8.23
206A	Other Kerosene				0.62	0.62				0.05	0.05
206B	Jet Kerosene			1.07		1.07			0.04		0.08
207A	Aviation Gasoline			0.12		0.12			0.01		0.01
2080	Motor Gasoline		0.09	108.12	1.63	109.85		0.01	7.97	0.12	8.10
224A	Other Petroleum Products	12.60	0.55			13.15	0.98	0.06			1.04
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	0.08				0.08
301A	**Total Gaseous** (Natural Gas)	**67.96**	**90.58**	**3.87**	**61.16**	**223.57**	**3.74**	**4.98**	**0.21**	**3.36**	**12.30**
	Total Other Fuel	**4.43**	**2.91**		**0.75**	**8.08**	**0.27**	**0.14**		**0.01**	**0.42**
114B	Municipal Waste	3.76				3.76	0.23				0.23
114C	Hazardous Waste	0.67				0.67	0.03				0.03
115A	Industrial Waste		2.91		0.75	3.66		0.14		0.01	0.15
	Total Biomass(1)	**4.11**	**32.75**		**68.90**	**105.76**	**(0.45)**	**(3.6)**		**(6.92)**	**(10.96)**
111A	Fuel Wood		0.80		66.37	67.18		0.08		6.64	6.72
116A	Wood Wastes	3.52	12.77		2.45	18.74	0.39	1.40		0.27	2.06
118A	Sewage Sludge	0.59				0.59	0.07				0.07
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)	**170.58**	**217.56**	**194.19**	**268.45**	**850.79**	**10.92**	**13.01**	**14.22**	**14.11**	**52.31**

(1) CO_2 emissions of Biomass are not included in Total.

Table 14: 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	Trans-port	Other Sectors	Total	Energy Ind.	Industry	Trans-port	Other Sectors	Total
	Total Solid	**39.96**	**44.97**	**0.07**	**27.10**	**112.10**	**4.01**	**4.20**	**0.01**	**2.55**	**10.76**
102A	Hard Coal	27.97	8.06	0.07	5.48	41.58	2.73	0.76	0.01	0.51	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	0.32		4.30	4.87	0.03	0.03		0.42	0.47
107A	Coke		23.16		15.42	38.57		2.41		1.42	3.83
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		11.16			11.16		0.78			0.78
	Total Liquid	**53.73**	**41.72**	**186.05**	**115.25**	**396.75**	**3.31**	**3.19**	**13.87**	**8.64**	**29.04**
203B	Light Fuel Oil	1.88	6.89		26.40	35.16	0.15	0.54		2.03	2.72
203C	Medium Fuel Oil	0.12	0.89		2.98	3.99	0.01	0.07		0.23	0.31
203D	Heavy Fuel Oil	22.10	18.65			40.75	1.75	1.45			3.20
204A	Gasoil	0.04	0.18		60.38	60.61	0.00	0.01		4.53	4.55
2050	Diesel		12.08	74.66	17.53	104.27		0.89	5.52	1.30	7.72
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			0.11		0.11			0.01		0.01
2080	Motor Gasoline		0.09	110.36	1.61	112.06		0.01	8.31	0.12	8.44
224A	Other Petroleum Products	12.76	0.66			13.43	1.00	0.07			1.06
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	0.39				0.39
301A	**Total Gaseous** (Natu-ral Gas)	**64.99**	**87.36**	**3.97**	**57.30**	**213.62**	**3.57**	**4.80**	**0.22**	**3.15**	**11.75**
	Total Other Fuel	**4.22**	**5.05**		**1.09**	**10.35**	**0.25**	**0.21**		**0.01**	**0.47**
114B	Municipal Waste	3.48				3.48	0.22				0.22
114C	Hazardous Waste	0.74				0.74	0.04				0.04
115A	Industrial Waste		5.05		1.09	6.13		0.21		0.01	0.22
	Total Biomass(1)	**3.91**	**29.18**		**67.47**	**100.56**	**(0.43)**	**(3.2)**		**(6.77)**	**(10.4)**
111A	Fuel Wood		0.71		65.28	65.98		0.07		6.53	6.60
116A	Wood Wastes	3.40	10.40		2.19	16.00	0.37	1.14		0.24	1.76
118A	Sewage Sludge	0.51				0.51	0.06				0.06
215A	Black Liquor		18.07			18.07		1.99			1.99
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**166.81**	**208.28**	**190.08**	**268.20**	**833.37**	**11.14**	**12.40**	**14.10**	**14.35**	**52.02**

(1) CO_2 emissions of Biomass are not included in Total.

Table 15: 1991 energy consumption and CO_2 emissions from category 1 A Fuel Combustion by fuel type and sector.

		Consumption (PJ)					CO_2 emissions (Tg)				
		1 A 1 Energy Ind.	1 A 2 Industry	1 A 3 + 1 A 5 Trans-port	1 A 4 Other Sectors	1 A Total	1 A 1 Energy Ind.	1 A 2 Industry	1 A 3 + 1 A 5 Trans-port	1 A 4 Other Sectors	1 A Total
	Total Solid	**67.34**	**49.41**	**0.06**	**32.41**	**149.23**	**6.82**	**4.71**	**0.01**	**3.05**	**14.58**
102A	Hard Coal	41.79	6.86	0.06	6.89	55.60	4.13	0.64	0.01	0.64	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	0.47		5.05	6.15	0.06	0.05		0.49	0.60
107A	Coke		26.91		18.08	45.00		2.80		1.66	4.46
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		12.28			12.28		0.94			0.94
	Total Liquid	**55.86**	**48.56**	**186.95**	**121.30**	**412.67**	**3.37**	**3.71**	**13.94**	**9.12**	**30.17**
203B	Light Fuel Oil	2.08	8.46		29.33	39.87	0.16	0.66		2.26	3.08
203C	Medium Fuel Oil	0.06	1.34		3.63	5.03	0.00	0.10		0.28	0.39
203D	Heavy Fuel Oil	23.85	22.68			46.53	1.88	1.77			3.65
204A	Gasoil	0.01	0.19		64.86	65.07	0.00	0.01		4.86	4.88
2050	Diesel		11.71	70.51	16.94	99.15		0.87	5.22	1.25	7.34
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	115.45	1.60	117.13		0.01	8.69	0.12	8.82
224A	Other Petroleum Products	13.28	0.59			13.87	1.04	0.06			1.10
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	0.24				0.24
301A	**Total Gaseous** (Natural Gas)	**70.99**	**85.60**	**4.07**	**51.82**	**212.48**	**3.90**	**4.71**	**0.22**	**2.85**	**11.69**
	Total Other Fuel	**2.90**	**5.44**		**0.69**	**9.03**	**0.18**	**0.27**		**0.01**	**0.45**
114B	Municipal Waste	2.90				2.90	0.18				0.18
114C	Hazardous Waste										
115A	Industrial Waste		5.44		0.69	6.13		0.27		0.01	0.27
	Total Biomass(1)	**3.02**	**28.46**		**71.36**	**102.84**	**(0.33)**	**(3.12)**		**(7.16)**	**(10.61)**
111A	Fuel Wood		0.73		69.23	69.96		0.07		6.92	7.00
116A	Wood Wastes	3.02	9.98		2.14	15.14	0.33	1.10		0.23	1.67
118A	Sewage Sludge										
215A	Black Liquor		17.74			17.74		1.95			1.95
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**200.11**	**217.47**	**191.08**	**277.58**	**886.24**	**14.27**	**13.39**	**14.17**	**15.03**	**56.89**

(1) CO_2 emissions of Biomass are not included in Total.

Table 16: 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 Energy Ind.	1 A 2 Industry	1 A 3 + 1 A 5 Trans-port	1 A 4 Other Sectors	1 A Total	1 A 1 Energy Ind.	1 A 2 Industry	1 A 3 + 1 A 5 Trans-port	1 A 4 Other Sectors	1 A Total
	Total Solid	**61.47**	**48.05**	**0.07**	**31.28**	**140.87**	**6.25**	**4.85**	**0.01**	**2.95**	**14.06**
102A	Hard Coal	38.44	5.59	0.07	6.87	50.97	3.85	0.53	0.01	0.64	5.03
104A	Hard Coal Briquettes										
105A	Brown Coal	22.80	2.11		2.36	27.28	2.38	0.21		0.26	2.84
106A	Brown Coal Briquettes	0.23	0.85		4.84	5.91	0.02	0.08		0.47	0.57
107A	Coke		26.39		17.20	43.59		2.74		1.58	4.33
113A	Peat				0.01	0.01				0.00	0.00
304A	Coke Oven Gas		13.12			13.12		1.29			1.29
	Total Liquid	**54.05**	**43.85**	**168.12**	**114.38**	**380.40**	**3.02**	**3.35**	**12.53**	**8.62**	**27.56**
203B	Light Fuel Oil	1.61	8.81		36.24	46.66	0.13	0.69		2.79	3.60
203C	Medium Fuel Oil	0.29	1.02		3.57	4.88	0.02	0.08		0.28	0.38
203D	Heavy Fuel Oil	20.88	19.26			40.14	1.64	1.50			3.15
204A	Gasoil	0.00	0.06		52.94	53.00	0.00	0.00		3.97	3.97
2050	Diesel		11.03	61.81	16.54	89.38		0.82	4.57	1.22	6.62
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			0.10		0.10			0.01		0.01
2080	Motor Gasoline		0.08	105.42	1.60	107.10		0.01	7.93	0.12	8.05
224A	Other Petroleum Products	12.58	0.59			13.17	0.98	0.06			1.04
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	0.22				0.22
301A	**Total Gaseous** (Natural Gas)	**73.62**	**83.09**	**4.05**	**40.85**	**201.60**	**4.05**	**4.57**	**0.22**	**2.25**	**11.09**
	Total Other Fuel	**2.41**	**5.58**		**0.23**	**8.23**	**0.15**	**0.27**		**0.00**	**0.42**
114B	Municipal Waste	2.41				2.41	0.15				0.15
114C	Hazardous Waste										
115A	Industrial Waste		5.58		0.23	5.81		0.27		0.00	0.27
	Total Biomass(1)	**2.04**	**28.11**		**64.22**	**94.38**	**(0.22)**	**(3.09)**		**(6.44)**	**(9.75)**
111A	Fuel Wood		0.66		62.46	63.12		0.07		6.25	6.31
116A	Wood Wastes	2.04	9.65		1.77	13.46	0.22	1.06		0.19	1.48
118A	Sewage Sludge										
215A	Black Liquor		17.80			17.80		1.96			1.96
309A	Biogas										
309B	Sewage Sludge Gas										
310A	Landfill Gas										
	Total(1)	**193.60**	**208.68**	**172.24**	**250.96**	**825.48**	**13.48**	**13.03**	**12.76**	**13.81**	**53.12**

(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 (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.
- Petroleum Coke is included in Other Oil.
- 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 is calculated for each fuel by multiplying its non–energy use with the corresponding default IPCC carbon emission factor.

It is assumed that 100% of the carbon of non–energy use of all types of fuels is stored in products, which implies that the fraction of carbon stored is 1.00. For next submission it is planned to use the IPCC default values for carbon stored. In the Sectoral Approach the release of stored carbon as emissions is considered as quoted in the NIR, chapter *3.3 Feedstocks*.

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	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Crude Oil	24 681	25 675	27 102	26 450	27 615	26 751	27 168	29 094	28 522	26 800	25 573	27 308	27 766
Orimulsion	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Liquids	116	116	113	113	133	121	150	122	637	201	302	154	154
Gasoline	-251	1 217	664	709	-184	386	-235	-933	-90	-278	514	225	671
Jet Kerosene	-843	-967	-1 081	-1 087	-1 076	-1 206	-1 379	-1 464	-1 536	-1 445	-1 550	-1 445	-1 362
Other Kerosene	-44	-39	-62	45	-33	-7	21	31	51	48	16	-1	11
Shale Oil	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas / Diesel Oil	1 815	2 048	1 983	1 936	1 903	3 719	6 143	4 404	6 165	6 599	6 789	8 492	9 344
Residuel Fuel Oil	995	749	378	1 328	1 502	1 212	1 183	1 222	1 893	922	1 097	949	-68
LPG	252	364	331	218	407	373	409	259	341	389	405	422	434
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	-863	-902	-1 220	-912	-998	-815	-838	-960	-950	-1 046	-1 100	-1 291	-1 336
Lubricants	-90	-90	-79	-73	-76	-210	-318	-330	-312	-306	-323	-340	-291
Petroleum Coke	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Feedstocks	3 031	3 467	2 843	3 262	2 300	1 445	2 366	2 590	1 719	2 592	1 600	1 983	1 514
OtherOil	-693	-1 124	-1 429	-1 472	-1 840	-1 588	-1 918	-1 952	-1 969	-1 954	-1 773	-2 156	-2 103
Liquid Fossil Totals	**28 106**	**30 513**	**29 544**	**30 518**	**29 652**	**30 179**	**32 752**	**32 084**	**34 470**	**32 521**	**31 548**	**34 300**	**34 735**
Anthracite	0	0	0	0	0	0	0	0	0	0	0	0	0
Coking Coal	6 065	5 441	5 178	4 873	4 991	4 953	5 433	5 479	5 638	5 688	4 875	4 911	4 927
Other Bit. Coal	4 725	5 155	3 854	3 020	3 080	3 847	4 413	5 100	4 044	3 409	4 810	5 384	5 167
Sub- Bit. Coal	0	0	0	0	0	0	0	0	0	0	0	0	0
Lignite	2 705	2 995	1 577	1 454	1 342	1 885	1 752	1 423	936	1 696	1 474	1 768	1 715
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	452	388	358	308	299	250	192	197	197	195	118
Coke Oven / Gas Coke	-536	168	-355	-379	-456	-347	-861	-762	-1 076	-1 142	-226	-63	-611
Solid Fuel Totals	**13 509**	**14 328**	**10 707**	**9 358**	**9 315**	**10 646**	**11 036**	**11 491**	**9 734**	**9 849**	**11 130**	**12 195**	**11 318**
Gaseous Fossil	11 405	12 047	12 106	12 562	13 222	14 461	15 415	14 841	15 259	15 531	14 802	15 804	15 031
TOTAL	**53 020**	**56 889**	**52 357**	**52 437**	**52 190**	**55 287**	**59 203**	**58 416**	**59 463**	**57 901**	**57 480**	**62 298**	**61 083**
Biomass Total	**9 105**	**9 921**	**9 653**	**10 155**	**9 789**	**10 416**	**11 104**	**11 124**	**10 589**	**11 063**	**10 725**	**12 053**	**12 430**

Fuel Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Solid Biomass	9 105	9 921	9 653	10 078	9 710	10 324	10 994	10 987	10 451	10 888	10 549	11 783	12 258
Liquid Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Biomass	0	0	0	77	79	92	110	137	138	174	175	270	172

Table 2 presents the apparent fuel consumption for each fuel type of the Reference Approach.

Table 2: Apparent Consumption (TJ)

Fuel Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Crude Oil	339 954	353 655	373 311	364 329	380 375	368 466	374 218	400 742	392 864	369 149	352 242	376 144	382 450
Orimulsion	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Liquids	1 854	1 854	1 809	1 809	2 125	1 944	2 400	1 961	10 206	3 217	4 842	2 473	2 473
Gasoline	-3 341	17 855	9 690	10 332	-2 683	5 621	-3 419	-13 579	-1 144	-4 059	7 522	3 308	9 785
Jet Kerosene	-11 906	-13 667	-15 270	-15 351	-15 207	-17 043	-19 484	-20 686	-21 705	-20 411	-21 904	-20 411	-19 236
Other Kerosene	-623	-551	-870	633	-461	-105	290	440	716	674	218	-14	148
Shale Oil	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas / Diesel Oil	24 755	27 930	27 038	26 399	25 959	50 721	83 770	60 058	84 070	90 000	92 585	115 805	127 424
Residuel Fuel Oil	12 990	9 782	4 941	17 342	19 611	15 825	15 450	15 949	24 720	12 033	14 316	12 388	-887
LPG	4 029	5 825	5 306	3 486	6 517	5 974	6 545	4 147	5 464	6 224	6 486	6 763	6 956
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	10 820	8 480	2 452	5 064	5 426	7 475	9 324	9 766	11 092	9 407	9 798	8 685	7 412
Lubricants	5 334	4 541	3 738	2 693	2 532	563	-161	-201	-40	-82	-111	-355	-538
Petroleum Coke	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Feedstocks	41 754	47 758	39 162	44 933	31 675	19 905	32 591	35 673	23 671	35 705	22 032	27 307	20 851
OtherOil	7 068	3 344	5 920	3 831	-274	-27	-609	5 713	-75	698	1 338	-1 573	-447
Liquid Fossil Totals	**432 688**	**466 806**	**457 228**	**465 501**	**455 593**	**459 320**	**500 916**	**499 983**	**529 839**	**502 556**	**489 364**	**530 520**	**536 389**
Anthracite	0	0	0	0	0	0	0	0	0	0	0	0	0
Coking Coal	65 423	58 690	55 855	52 568	53 834	53 427	58 604	59 096	60 811	61 358	52 579	52 969	53 149
Other Bit. Coal	51 016	55 653	41 633	32 626	33 254	41 541	47 629	55 053	43 654	36 807	51 917	58 113	55 781
Sub- Bit. Coal	0	0	0	0	0	0	0	0	0	0	0	0	0
Lignite	27 278	30 194	15 906	14 663	13 532	19 004	17 671	14 347	9 441	17 101	14 862	17 826	17 295
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	4 872	4 185	3 858	3 323	3 221	2 694	2 066	2 126	2 127	2 099	1 277
Coke Oven / Gas Coke	19 100	26 605	19 290	19 534	20 818	25 238	18 090	22 623	18 769	17 540	29 618	32 011	24 345
Solid Fuel Totals	**168 733**	**177 293**	**137 560**	**123 581**	**125 300**	**142 538**	**145 218**	**153 817**	**134 744**	**134 936**	**151 108**	**163 023**	**151 851**
Gaseous Fossil	219 239	231 794	227 610	240 044	246 908	269 583	286 941	276 551	283 920	288 876	275 682	293 067	279 606

Fuel Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
TOTAL	**820 661**	**875 894**	**822 398**	**829 126**	**827 802**	**871 441**	**933 075**	**930 351**	**948 503**	**926 368**	**916 154**	**986 610**	**967 847**
Biomass Total	**94 376**	**102 837**	**100 050**	**105 164**	**101 375**	**107 860**	**114 968**	**115 145**	**109 593**	**114 466**	**110 960**	**124 620**	**128 641**
Solid Biomass	94 376	102 837	100 050	104 456	100 649	107 011	113 954	113 882	108 324	112 859	109 344	122 130	127 058
Liquid Biomass	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Biomass	0	0	0	708	726	849	1 014	1 263	1 269	1 607	1 615	2 491	1 584

Table 3 presents the carbon stored for each fuel type of the Reference Approach.

Table 3: Carbon Stored (Gg C)

Fuel Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
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 Liq-uids	0.0	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	5.9	2.3	0.2	0.0	0.0	0.0	0.0	0.3	3.2	0.0	0.6	0.6	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	0.0	0.0	0.0
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	389.9	362.5	394.3	389.0	435.9	479.2	505.8	495.1	518.7	546.7	531.0
Lubricants	131.6	115.7	96.5	73.9	71.5	69.1	84.4	86.8	85.2	82.8	86.9	86.6	69.4
Petroleum Coke	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refinery Feed-stocks	0.0	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	332.2	376.6	512.1	482.1	501.4	437.1	516.3	652.0	540.9	552.3	515.0	562.5	570.3
Liquid Fossil To-tals	**945.3**	**929.6**	**998.7**	**918.6**	**967.3**	**895.2**	**1 036.6**	**1 218.3**	**1 135.0**	**1 130.2**	**1 121.2**	**1 196.3**	**1 170.8**
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	0.0	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 Bit. Coal	1.2	1.3	1.5	1.3	0.8	1.0	0.8	0.9	0.8	0.8	0.8	0.9	1.1
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	712.5	738.2	668.0	681.6	741.0	841.2	773.3	879.3	853.1	835.3	936.7	961.9	888.2
Solid Fuel Totals	**713.8**	**739.5**	**669.5**	**682.9**	**741.8**	**842.3**	**774.1**	**880.3**	**853.9**	**836.1**	**937.5**	**962.8**	**889.3**

Fuel Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Gaseous Fossil	228.2	244.3	164.2	229.6	153.6	160.9	164.9	163.2	161.5	162.9	160.7	152.2	158.1
TOTAL	**1 887.3**	**1 913.3**	**1 832.5**	**1 831.1**	**1 862.6**	**1 898.4**	**1 975.6**	**2 261.8**	**2 150.4**	**2 129.2**	**2 219.4**	**2 311.3**	**2 218.2**
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 Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Jet Kerosene	275	309	334	354	368	409	453	471	488	475	516	498	466

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/Unit)	Carbon emission factor (t C/TJ)	Fraction ob carbon oxidised (t C/t C)
Crude Oil	42.75	20.00	0.99
Orimulsion	-	-	-
Natural Gas Liquids	45.22	17.20	0.99
Gasoline	44.80	18.90	0.99
Jet Kerosene	44.59	19.50	0.99
Other Kerosene	44.75	19.60	0.99
Shale Oil	-	-	-
Gas / Diesel Oil	43.33	20.20	0.99
Residuel Fuel Oil	40.19	21.10	0.99
LPG	47.31	17.20	0.99
Ethane	-	-	-
Naphtha	-	-	-
Bitumen	40.19	22.00	0.99
Lubricants	40.19	20.00	0.99
Petroleum Coke	-	-	-
Refinery Feedstocks	42.50	20.00	0.99
OtherOil	40.19	20.00	0.99
Anthracite	-	-	-
Coking Coal	28.00	25.80	0.98

Fuel Type	Conversion Factor (TJ/Unit)	Carbon emission factor (t C/TJ)	Fraction ob carbon oxidised (t C/t C)
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 December 2003.

Coal

Table 1: National Energy Balance 1990-2002. Coking Coal [1000 tons].

101A, Coking Coal	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	2 376	2 071	2 120	1 766	1 919	1 778	2 013	2 167	2 089	2 146	1 738	1 861	1 864
Total Exports (Balance)	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
Stock Change (National Territory)	-39	25	-125	111	4	130	80	-57	83	45	139	30	34
Gross Inland Deliveries (Obs.)	2 337	2 096	1 995	1 877	1 923	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 337	2 096	1 995	1 877	1 923	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	2 337	2 096	1 995	1 877	1 923	1 908	2 093	2 111	2 172	2 191	1 878	1 892	1 898
Blast Furnaces (Transformation)	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
BKB (Transformation)	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
Total Energy Sector	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
Patent Fuel Plants	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
Blast Furnaces (Energy)	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
BKB (Transformation)	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
Power Plants	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
Distribution Losses	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
Total Transport	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
Inland Waterways	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
Total Industry	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
Chemical (incl.Petro-Chemical)	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
Non metallic Mineral Products	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
Machinery	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
Food, Beverages and Tobacco	0	0	0	0	0	0	0	0	0	0	0	0	0

101A, Coking Coal	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Pulp, Paper and Printing	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
Construction	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
Non Specified (Industry)	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
Commerce - Public Services	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
Agriculture	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
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2: National Energy Balance 1990-2002. Bituminous Coal & Anthracite [1000 tons].

102A; Bituminous Coal & Anthracite	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	0	0	1	1	1	1	0	0	0	0	0	0	0
Total Imports (Balance)	1 233	1 717	1 692	1 422	1 096	1 216	1 724	1 623	1 657	1 215	1 675	1 863	2 168
Total Exports (Balance)	0	0	9	0	0	1	2	4	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	589	270	-197	-257	91	268	-21	348	-97	100	179	213	-176
Gross Inland Deliveries (Obs.)	1 822	1 987	1 487	1 165	1 188	1 484	1 701	1 966	1 559	1 315	1 854	2 075	1 992
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1 421	1 561	1 075	746	822	1 082	1 245	1 437	1 061	912	1 414	1 678	1 709
Public Electricity	964	957	647	394	485	550	1 076	1 275	890	740	1 203	1 390	1 440
Public Combined Heat and Power	409	535	352	318	327	518	128	127	127	140	161	244	194
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	6	0
Auto Producers of Electricity	0	0	0	0	0	0	19	5	4	4	10	13	36
Auto Producers for CHP	48	68	76	34	10	14	22	31	40	29	40	26	39
Auto Producer Heat Plants	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
Coke Ovens (Transformation)	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
Patent Fuel Plants	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
Non Specified (Transformation)	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	7	33	2	0
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	0	0	0	0	0	0	0	0	0	7	33	2	0
Non Specified (Energy)	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
Final Consumption	400	425	410	417	365	400	455	528	497	394	406	393	281
Total Transport	3	0	1	0	0	0	1	1	1	1	1	1	0
Rail	3	0	1	0	0	0	1	1	1	1	1	1	0
Inland Waterways	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
Total Industry	152	177	212	248	218	250	299	399	382	292	320	296	189
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	6	8	27	42	42	45	49	73	70	86	55	62	44
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	145	142	164	167	142	163	191	208	199	131	170	152	78

102A; Bituminous Coal & Anthracite	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	1	27	22	38	35	43	58	118	113	74	95	81	67
Wood and Wood Products	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
Textiles and Leather	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
Total Other Sectors	245	248	198	169	146	149	156	128	113	101	85	97	92
Commerce - Public Services	16	19	11	12	9	10	12	12	11	8	7	7	4
Residential	226	226	184	155	135	137	142	114	101	92	78	89	87
Agriculture	3	3	3	2	2	2	2	2	1	1	1	1	1
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	2	2	2	2	1	1	1	1	1	1	1	1	2

Table 3: National Energy Balance 1990-2002. Patent Fuel [1000 tons].

104A; Patent Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	0	0	0	0	0	0	0	7	4	4	4	1	1
Total Exports (Balance)	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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	0	0	0	0	7	4	4	4	1	1
Statistical Difference	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
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
BKB (Transformation)	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
Total Energy Sector	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
Patent Fuel Plants	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
Blast Furnaces (Energy)	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
BKB (Transformation)	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
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	0	0	0	0	0	0	0	7	4	4	4	0	1
Total Transport	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
Inland Waterways	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
Total Industry	0	0	0	0	0	0	0	0	0	0	0	0	0

104A; Patent Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Iron and Steel	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
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	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
Construction	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
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	0	0	0	0	0	0	0	7	4	4	4	0	1
Commerce - Public Services	0	0	0	0	0	0	0	1	1	1	1	0	0
Residential	0	0	0	0	0	0	0	6	3	3	3	0	1
Agriculture	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
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4: National Energy Balance 1990-2002. Lignite and Brown Coal [1000 tons].

105A; Lignite and brown coal	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	2 448	2 081	1 771	1 691	1 369	1 297	1 108	1 130	1 140	1 137	1 249	1 206	1 412
Total Imports (Balance)	36	53	22	1	19	29	43	23	13	13	34	6	5
Total Exports (Balance)	3	3	3	1	0	0	0	0	0	1	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	23	639	-330	-347	-146	417	470	163	-287	419	81	424	170
Gross Inland Deliveries (Obs.)	2 503	2 770	1 459	1 345	1 241	1 743	1 621	1 316	866	1 569	1 363	1 635	1 587
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 133	2 338	1 167	1 068	984	1 524	1 495	1 205	763	1 403	1 200	1 470	1 412
Public Electricity	1 182	1 445	583	301	405	1 081	1 358	1 164	738	1 372	1 168	1 418	1 339
Public Combined Heat and Power	881	830	484	668	509	339	48	13	3	9	8	30	43
Public Heat Plants	16	8	9	7	7	9	9	4	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	4	0	0	0	0	0	0
Auto Producers for CHP	54	54	91	92	63	95	76	23	22	22	23	22	31
Auto Producer Heat Plants	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
Coke Ovens (Transformation)	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
Patent Fuel Plants	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
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	6	3	1	0	1	0	0	1	0	15	2	0	1
Coal Mines	3	1	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Petroleum refineries	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Plants	3	2	1	0	1	0	0	1	0	15	2	0	1
Non Specified (Energy)	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
Final Consumption	364	429	291	277	257	219	126	111	103	150	162	165	174
Total Transport	0	0	0	0	0	0	0	0	0	0	0	0	0

105A; Lignite and brown coal	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Rail	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
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	147	211	118	136	139	115	33	46	45	94	114	121	130
Iron and Steel	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
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	11	14	4	0	1	4	6	3	3	14	38	44	59
Transportation Equipment	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
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	2	1	1	1	0	0	0	0	0	0	0	0	0
Pulp, Paper and Printing	132	193	112	133	139	111	26	43	42	80	76	77	70
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	2	3	1	1	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
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	217	218	173	141	117	104	93	65	58	57	47	44	44
Commerce - Public Services	9	14	6	9	10	5	3	3	3	7	5	5	7
Residential	208	205	168	132	108	99	90	62	55	50	42	39	37
Agriculture	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
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5: National Energy Balance 1990-2002. Brown Coal Briquettes [1000 tons].

106A; BKB-PB	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	295	286	239	237	181	173	167	133	103	106	95	108	65
Total Exports (Balance)	0	0	0	0	0	1	1	0	0	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	12	32	13	-20	19	1	0	0	0	0	11	0	0
Gross Inland Deliveries (Obs.)	306	318	252	217	200	172	167	133	103	106	107	108	65
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	12	32	13	12	10	0	0	0	0	0	18	29	0
Public Electricity	7	13	6	5	5	0	0	0	0	0	18	29	0
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	5	19	8	7	5	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
BKB (Transformation)	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
Total Energy Sector	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
Patent Fuel Plants	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
Blast Furnaces (Energy)	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
BKB (Transformation)	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
Power Plants	0	0	0	0	0	0	0	0	0	0	0	0	0

106A; BKB-PB	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Non Specified (Energy)	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
Final Consumption	295	286	239	205	190	172	167	133	103	106	88	79	65
Total Transport	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
Inland Waterways	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
Total Industry	44	25	17	15	24	14	13	0	0	0	0	0	0
Iron and Steel	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
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	43	23	16	15	24	14	13	0	0	0	0	0	0
Wood and Wood Products	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
Textiles and Leather	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
Total Other Sectors	251	261	223	190	166	158	154	132	103	106	88	79	65
Commerce - Public Services	6	11	8	7	11	6	6	20	11	11	6	4	3
Residential	235	240	206	176	149	146	142	108	88	91	79	72	60
Agriculture	10	11	9	8	7	6	6	5	4	4	3	3	3
Non Specified (Others)	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

Table 6: National Energy Balance 1990-2002. Coke Oven Coke [1000 tons].

107A; Coke Oven Coke	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	1 725	1 540	1 487	1 402	1 432	1 448	1 559	1 566	1 598	1 608	1 385	1 394	1 395
Total Imports (Balance)	815	893	685	580	607	718	652	764	642	654	981	1 091	818
Total Exports (Balance)	1	2	2	0	0	1	0	0	0	2	1	1	2
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-136	52	1	113	132	178	-10	39	24	-30	71	46	48
Gross Inland Deliveries (Obs.)	2 402	2 483	2 171	2 094	2 171	2 343	2 200	2 369	2 264	2 230	2 435	2 530	2 258
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	596	609	526	521	569	647	601	683	660	638	718	747	686
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	596	609	526	521	569	647	601	683	660	638	718	747	686
Patent Fuel Plants	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
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	97	63	79	97	106	121	112	127	123	119	134	139	128
Coal Mines	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
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0
Blast Furnaces (Energy)	97	63	79	97	106	121	112	127	123	119	134	139	128

107A; Coke Oven Coke	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Gas Works (Energy)	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
Petroleum refineries	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
Non Specified (Energy)	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
Final Consumption	853	924	763	657	605	564	557	502	455	469	458	487	376
Total Transport	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
Inland Waterways	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
Total Industry	243	283	216	190	214	185	186	221	201	232	252	255	199
Iron and Steel	233	229	137	153	160	168	164	179	166	183	217	221	188
Chemical (incl.Petro-Chemical)	3	12	17	9	17	6	8	13	11	1	0	0	0
Non ferrous Metals	1	6	10	5	8	3	4	7	6	7	8	14	5
Non metallic Mineral Products	4	19	33	12	10	4	4	14	12	36	13	9	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	1	3	8	4	7	2	2	3	2	3	0	0	0
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	1	5	10	5	10	2	3	5	4	3	14	11	5
Pulp, Paper and Printing	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
Construction	0	8	2	1	2	0	0	0	0	0	0	0	0
Textiles and Leather	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
Total Other Sectors	610	641	547	467	391	379	371	281	254	237	205	232	178
Commerce - Public Services	13	14	12	10	9	8	8	6	6	5	5	5	2
Residential	585	615	524	448	375	363	356	269	244	227	196	223	172
Agriculture	12	12	11	9	8	7	7	5	5	5	4	5	3
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	857	887	803	819	891	1 011	930	1 057	1 025	1 004	1 126	1 156	1 068

Table 7: National Energy Balance 1990-2001. Peat [1000 tons].

113A; Peat	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	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
Total Exports (Balance)	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
Stock Change (National Territory)	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
Statistical Difference	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
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
BKB (Transformation)	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
Total Energy Sector	0	0	0	0	0	0	0	0	0	0	0	0	0

113A; Peat	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Petroleum refineries	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
Non Specified (Energy)	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
Final Consumption	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
Rail	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
Non Specified (Transport)	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
Iron and Steel	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
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	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
Construction	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
Non Specified (Industry)	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
Commerce - Public Services	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
Agriculture	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
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 8: National Energy Balance 1990-2002. Coke Oven Gas [TJ].

304A; Coke Oven Gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	13 117	12 276	11 164	10 636	10 790	10 906	11 419	11 605	12 166	12 220	10 466	9 776	9 742
Total Imports (Balance)	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
International Marine Bunkers	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
Gross Inland Deliveries (Obs.)	13 117	12 276	11 164	10 636	10 790	10 906	11 419	11 605	12 166	12 220	10 466	9 776	9 742
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	3 385	2 763	2 885	2 960	3 490	6 228	3 545	3 087	3 087	4 005	3 794	1 761	3 092
Public Electricity	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
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	2 183	2 002	2 033	2 649	3 256	0	2 639
Auto Producers for CHP	3 385	2 763	2 885	2 960	3 490	6 228	1 362	1 085	1 054	1 357	489	1 761	453
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	0	50	0	0
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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

304A; Coke Oven Gas	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
BKB (Transformation)	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
Total Energy Sector	3 621	3 188	2 863	2 474	2 274	1 987	3 058	2 781	3 279	2 951	3 115	3 099	3 099
Coal Mines	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
Coke Ovens (Energy)	3 621	3 188	2 863	2 474	2 274	1 987	3 058	2 781	3 279	2 951	3 115	3 099	3 099
Blast Furnaces (Energy)	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
BKB (Transformation)	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
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	6 111	6 325	5 416	5 202	5 026	2 691	4 816	5 737	5 801	5 264	3 557	4 917	3 552
Total Transport	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
Inland Waterways	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
Total Industry	6 111	6 325	5 416	5 202	5 026	2 691	4 816	5 737	5 801	5 264	3 557	4 917	3 552
Iron and Steel	6 111	6 325	5 416	5 202	5 026	2 691	4 816	5 737	5 801	5 264	3 557	4 917	3 552
Chemical (incl.Petro-Chemical)	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
Non metallic Mineral Products	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
Machinery	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
Food, Beverages and Tobacco	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
Wood and Wood Products	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
Textiles and Leather	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
Total Other Sectors	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
Residential	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
Non Specified (Others)	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

Table 9: National Energy Balance 1990-2002. Blast Furnace Gas [TJ].

305A; Blast Furnace Gas	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Indigenous Production	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	1 983	2 026	1 749	1 750	1 914	2 175	633	720	723	672	757	787	724
Total Exports (Balance)	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
Stock Change (National Territory)	1 983	2 026	1 749	1 750	1 914	2 175	633	720	723	672	757	787	724
Gross Inland Deliveries (Obs.)	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
Total Transformation Sector	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
Public Combined Heat and Power	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
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers for CHP	9 370	10 152	7 119	7 525	8 224	9 622	9 360	10 083	12 241	9 937	12 474	17 039	9 884
Auto Producer Heat Plants	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
Coke Ovens (Transformation)	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

305A; Blast Furnace Gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Patent Fuel Plants	9 370	10 152	7 119	7 525	8 224	9 622	9 360	10 083	12 241	9 937	12 474	17 039	9 884
BKB (Transformation)	9 370	10 152	7 119	7 525	8 224	9 622	9 360	10 083	12 241	9 937	12 474	17 039	9 884
Non Specified (Transformation)	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Petroleum refineries	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
Non Specified (Energy)	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
Final Consumption	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
Rail	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
Non Specified (Transport)	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
Iron and Steel	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
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	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
Construction	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
Non Specified (Industry)	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
Commerce - Public Services	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
Agriculture	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
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0

Oil

Table 10: National Energy Balance 1990-2002. Crude Oil [1000 tons].

Crude Oil	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	1 149	1 280	1 180	1 154	1 099	1 035	992	972	959	1 002	971	957	833
Refinery Losses	121	129	181	155	60	153	103	82	156	76	35	66	10
Refinery Intake (Calculated)	7 952	8 273	8 732	8 522	8 898	8 619	8 754	9 374	9 190	8 635	8 240	8 799	8 945
Refinery Intake (Observed)	7 952	8 273	8 732	8 522	8 898	8 619	8 754	9 374	9 190	8 635	8 240	8 799	8 945
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	1
Total Imports (Balance)	6 797	7 000	7 550	7 453	7 790	7 590	7 737	8 450	8 269	7 698	7 315	7 940	8 118
Total Exports (Balance)	0	0	0	0	0	0	51	25	44	51	61	63	0
Stock Change (National Territory)	6	-8	3	-84	9	-6	75	-23	6	-14	16	-36	-5
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 11: National Energy Balance 1990-2002. Natural Gas Liquids [1000 tons].

Natural Gas Liquids	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	41	41	40	40	47	43	53	55	88	61	101	55	55
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	41	41	40	40	47	43	53	43	226	71	107	55	55
Refinery Intake (Observed)	41	41	40	40	47	43	53	43	226	71	107	55	55
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	0	0	0	0	0	0	0	0	135	0	6	0	0
Total Exports (Balance)	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	0	0	0	0	0	-12	2	10	0	0	0
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 12: National Energy Balance 1990-2002. Refinery Feedstocks [1000 tons].

Refinery Feedstocks	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Refinery Intake (Calculated)	1 069	1 225	1 001	1 158	861	582	858	853	564	873	540	652	492
Refinery Intake (Observed)	1 069	1 225	1 001	1 158	861	582	858	853	564	873	540	652	492
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	1 009	1 154	902	708	915	600	886	761	746	740	627	570	593
Total Exports (Balance)	0	0	0	0	116	103	62	14	7	15	76	42	6
Stock Change (National Territory)	-26	-30	19	349	-54	-28	-58	92	-182	115	-32	115	-96

Table 13: National Energy Balance 1990-2002. Residual Fuel Oil [1000 tons].

203X; Residual Fuel Oil	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	1 913	1 981	1 821	1 678	1 472	1 502	1 441	1 540	1 347	1 308	979	1 044	1 012
Refinery Fuel	131	141	134	207	231	232	214	219	214	177	133	117	7
Total Imports (Balance)	602	480	376	541	456	532	386	449	671	468	262	280	241
Total Exports (Balance)	185	149	65	110	77	38	121	53	18	37	152	228	146
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-93	-88	-188	1	109	-100	119	1	-38	-131	246	256	-117
Gross Inland Deliveries (Obs.)	2 105	2 084	1 810	1 903	1 729	1 663	1 612	1 717	1 748	1 431	1 202	1 236	982
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	557	677	556	708	651	573	536	634	732	642	386	488	271
Public Electricity	28	37	10	102	95	88	198	389	351	271	117	183	61
Public Combined Heat and Power	253	297	338	408	398	316	177	149	230	281	161	184	168
Public Heat Plants	99	124	104	110	80	70	105	52	106	63	87	96	26
Auto Producers of Electricity	0	0	0	0	0	0	22	11	9	5	6	4	1
Auto Producers for CHP	176	218	102	87	77	97	33	32	33	19	14	21	14

203X; Residual Fuel Oil	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Auto Producer Heat Plants	1	1	2	1	1	1	1	1	1	2	1	1	1
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
Patent Fuel Plants	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
Total Energy Sector	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
Oil and Gas Extraction	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
Blast Furnaces (Energy)	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
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	1 548	1 407	1 255	1 195	1 078	1 091	1 076	1 083	1 016	789	816	748	711
Total Transport	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
Domestic Air Transport	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
Rail	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
Pipeline Transport	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
Total Industry	577	605	540	685	670	607	537	819	743	485	512	450	425
Iron and Steel	88	92	88	109	125	142	112	283	257	200	253	265	311
Chemical (incl.Petro-Chemical)	23	23	17	20	25	24	23	29	27	19	14	6	4
Non ferrous Metals	4	4	4	5	5	6	8	13	12	9	9	7	7
Non metallic Mineral Products	113	108	108	162	134	119	102	142	129	79	57	32	11
Transportation Equipment	13	15	13	16	17	15	5	4	4	2	3	3	3
Machinery	28	30	26	33	33	28	34	48	44	26	31	21	10
Mining and Quarrying	6	6	5	7	7	6	8	8	7	3	4	4	3
Food, Beverages and Tobacco	77	85	78	91	83	79	54	61	56	30	36	28	23
Pulp, Paper and Printing	123	131	116	145	140	96	76	101	92	56	49	42	26
Wood and Wood Products	15	15	13	15	15	19	21	30	27	19	10	3	1
Construction	32	34	21	25	25	19	28	32	29	13	15	7	1
Textiles and Leather	26	30	24	28	28	22	28	35	32	11	9	11	6
Non Specified (Industry)	29	32	26	30	33	32	39	32	29	18	23	20	20
Total Other Sectors	971	802	715	510	408	484	538	264	273	304	304	298	286
Commerce - Public Services	309	225	199	167	163	211	231	52	47	31	32	28	27
Residential	471	410	367	244	174	194	219	151	161	194	193	194	187
Agriculture	191	167	149	99	71	79	89	61	65	79	78	76	73
Non Specified (Others)	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

Table 14: National Energy Balance 1990-2002. Heating and Oher Gas Oil [1000 tons].

204A; Heating and Other Gas Oil	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	1 239	1 575	1 412	1 639	1 614	1 454	1 598	1 604	1 280	1 245	1 062	1 301	1 062
Refinery Fuel	0	0	1	0	0	0	0	1	2	6	0	0	0
Total Imports (Balance)	0	0	0	88	18	165	376	355	577	615	533	626	734
Total Exports (Balance)	0	28	0	59	48	0	0	0	0	0	1	3	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	5	-20	11	-65	-58	39	-17	-53	41	1	4	39	-51
Gross Inland Deliveries (Obs.)	1 244	1 527	1 422	1 604	1 526	1 658	1 956	1 906	1 895	1 854	1 598	1 963	1 745

204A; Heating and Other Gas Oil	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	2	2	2	1	2	3	1	0	19	2
Public Electricity	0	0	0	0	0	0	0	0	0	0	0	15	0
Public Combined Heat and Power	0	0	0	2	2	2	0	0	0	0	0	4	2
Public Heat Plants	0	0	0	0	0	0	1	2	2	0	0	0	0
Auto Producers of Electricity	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
Auto Producer Heat Plants	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
Coke Ovens (Transformation)	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
Petrochemical Industry	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
Non Specified (Transformation)	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Non Specified (Energy)	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
Final Consumption	1 244	1 527	1 422	1 601	1 524	1 656	1 955	1 904	1 893	1 853	1 597	1 944	1 743
Total Transport	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
Domestic Air Transport	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
Rail	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
Pipeline Transport	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
Total Industry	1	5	4	6	5	5	11	11	12	12	4	10	3
Iron and Steel	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
Non ferrous Metals	0	0	0	0	0	0	0	0	0	2	0	0	0
Non metallic Mineral Products	0	1	1	1	1	1	2	2	2	1	1	2	1
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	1	1	2	1	1	3	3	3	2	1	3	1
Mining and Quarrying	0	0	0	0	0	0	1	1	1	0	0	0	0
Food, Beverages and Tobacco	0	0	0	1	0	1	1	1	1	2	0	1	0
Pulp, Paper and Printing	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	1	0	0	0
Construction	0	1	1	1	1	1	3	3	3	2	1	2	1
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	1	1	1	1	0	1	0
Total Other Sectors	1 243	1 523	1 417	1 595	1 519	1 651	1 944	1 893	1 880	1 841	1 593	1 934	1 740
Commerce - Public Services	26	87	84	119	89	92	222	219	237	217	82	197	67
Residential	1 216	1 434	1 333	1 475	1 429	1 558	1 720	1 673	1 643	1 623	1 510	1 735	1 671
Agriculture	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
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 15: National Energy Balance 1990-2002. Diesel [1000 tons].

2050; Diesel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	1 531	1 634	1 833	1 965	2 034	1 920	2 008	2 311	2 615	2 430	2 662	2 658	2 922
Refinery Fuel	0	0	0	2	2	1	1	1	1	0	0	0	0
Total Imports (Balance)	576	686	589	609	800	937	1 777	1 159	1 898	1 877	2 075	2 433	2 728
Total Exports (Balance)	3	68	73	104	88	83	97	271	467	459	415	415	520
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-7	74	97	140	-24	112	-106	195	-108	44	-59	-8	49
Gross Inland Deliveries (Obs.)	2 097	2 326	2 446	2 608	2 720	2 885	3 581	3 394	3 937	3 892	4 263	4 668	5 180
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	5	5	8	4	7	1	3	1	0	0
Public Electricity	0	0	0	2	1	4	1	2	0	2	0	0	0
Public Combined Heat and Power	0	0	0	0	0	0	0	2	1	0	0	0	0
Public Heat Plants	0	0	0	1	2	1	1	2	0	0	0	0	0
Auto Producers of Electricity	0	0	0	1	0	2	1	0	0	1	1	0	0
Auto Producers for CHP	0	0	0	1	2	1	1	1	0	0	0	0	0
Auto Producer Heat Plants	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
Coke Ovens (Transformation)	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
Petrochemical Industry	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
Non Specified (Transformation)	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Non Specified (Energy)	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
Final Consumption	2 096	2 326	2 446	2 603	2 715	2 877	3 578	3 388	3 936	3 889	4 261	4 668	5 179
Total Transport	1 477	1 653	1 746	1 867	1 954	2 077	2 629	2 479	2 915	2 879	3 181	3 505	3 912
International Civil Aviation	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
Road	1 416	1 596	1 689	1 812	1 899	2 026	2 582	2 432	2 869	2 831	3 128	3 451	3 858
Rail	54	50	49	48	49	45	41	41	41	42	47	47	47
Inland Waterways	7	7	7	7	6	6	6	6	6	6	6	7	8
Pipeline Transport	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
Total Industry	275	321	343	373	393	426	559	524	626	617	681	756	850
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	3	4	4	4	5	5	6	6	7	7	8	9	10
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	4	5	5	6	6	6	8	8	9	9	10	11	13
Transportation Equipment	19	22	24	26	27	29	39	36	43	43	47	52	59
Machinery	1	1	1	1	1	1	2	2	2	2	2	2	3
Mining and Quarrying	19	23	24	26	28	30	40	37	44	44	48	54	60
Food, Beverages and Tobacco	1	1	1	1	2	2	2	2	2	2	3	3	3
Pulp, Paper and Printing	1	1	1	1	1	1	1	1	1	1	1	2	2
Wood and Wood Products	4	4	5	5	5	6	8	7	8	8	9	10	11
Construction	219	256	274	298	314	340	446	418	499	492	543	603	678
Textiles and Leather	3	4	4	4	4	5	6	6	7	7	7	8	9
Non Specified (Industry)	0	1	1	1	1	1	1	1	1	1	1	1	1
Total Other Sectors	344	352	357	363	368	374	389	384	395	393	399	407	417
Commerce - Public Services	33	38	41	44	47	50	66	62	74	73	81	89	101

2050; Diesel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	312	314	317	319	321	324	323	322	321	320	319	318	317
Non Specified (Others)	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

Table 16: National Energy Balance 1990-2002. Other Kerosene [1000 tons].

206A Other Kerosene	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	31	43	49	0	13	8	5	0	1	1	1	1	1
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	14	4	18	0	0	4	10	10	16	15	5	0	3
Total Exports (Balance)	21	13	31	9	13	6	5	2	1	0	0	0	0
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-7	-4	-6	23	2	0	1	2	1	0	0	0	0
Gross Inland Deliveries (Obs.)	18	31	30	14	2	6	12	10	17	16	6	1	4
Statistical Difference	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
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
Patent Fuel Plants	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
Total Energy Sector	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
Oil and Gas Extraction	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
Blast Furnaces (Energy)	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
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	18	31	30	14	2	6	12	10	17	16	6	1	4
Total Transport	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
Domestic Air Transport	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
Rail	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
Pipeline Transport	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
Total Industry	0	0	1	0	0	0	0	0	0	3	0	0	1
Iron and Steel	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
Non ferrous Metals	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
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	0	0	0	1	0	0	0
Mining and Quarrying	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	2	0	0	0

206A Other Kerosene	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Pulp, Paper and Printing	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
Construction	0	0	1	0	0	0	0	0	0	0	0	0	0
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	18	31	29	14	2	6	12	10	17	13	6	1	4
Commerce - Public Services	18	31	29	14	2	6	12	10	17	13	6	1	4
Residential	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
Non Specified (Others)	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

Table 17: National Energy Balance 1990-2002. Kerosene Type Jet Fuel [1000 tons].

206B; Kerosene Type Jet Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	291	334	371	377	376	420	479	508	541	508	544	513	484
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	13	8	9	10	27	23	24	12	9	21	35	37	38
Total Exports (Balance)	5	5	10	1	0	0	0	0	6	5	5	1	1
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	-1	-7	1	0	4	-8	-4	-2	2	-4	4	-3
Gross Inland Deliveries (Obs.)	299	336	363	386	403	447	495	515	542	525	569	553	519
Statistical Difference	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
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
Patent Fuel Plants	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
Total Energy Sector	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
Oil and Gas Extraction	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
Blast Furnaces (Energy)	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
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	299	336	363	386	403	447	495	515	542	525	569	553	519
Total Transport	299	336	363	386	403	447	495	515	542	525	569	553	519
International Civil Aviation	269	307	335	363	378	425	466	496	512	489	537	447	484
Domestic Air Transport	30	29	28	24	25	22	29	19	30	36	32	106	34
Road	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
Inland Waterways	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
Non Specified (Transport)	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
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0

206B; Kerosene Type Jet Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Chemical (incl.Petro-Chemical)	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
Non metallic Mineral Products	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
Machinery	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
Food, Beverages and Tobacco	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
Wood and Wood Products	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
Textiles and Leather	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
Total Other Sectors	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
Residential	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
Non Specified (Others)	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

Table 18: National Energy Balance 1990-2001. Gasoline Type Jet Fuel [1000 tons].

207A Gasoline Type Jet Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	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
Total Imports (Balance)	2	3	3	3	3	4	2	3	3	3	3	4	3
Total Exports (Balance)	0	0	0	0	0	0	1	1	0	1	1	1	2
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	1	0	0	0	0	-2	1	0	0	0	0	-1	0
Gross Inland Deliveries (Obs.)	3	3	3	3	3	2	2	2	3	3	2	2	2
Statistical Difference	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
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
Patent Fuel Plants	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
Total Energy Sector	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
Oil and Gas Extraction	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
Blast Furnaces (Energy)	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
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	3	3	3	3	3	2	2	2	3	3	2	2	2
Total Transport	3	3	3	3	3	2	2	2	3	3	2	2	2
International Civil Aviation	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic Air Transport	3	3	3	3	3	2	2	2	3	3	2	2	2

207A Gasoline Type Jet Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Road	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
Inland Waterways	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
Non Specified (Transport)	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
Iron and Steel	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
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	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
Construction	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
Non Specified (Industry)	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
Commerce - Public Services	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
Agriculture	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
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 19: National Energy Balance 1990-2002. Motor Gasoline [1000 tons].

2080 Motor Gasoline	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	2 631	2 400	2 462	2 340	2 541	2 271	2 297	2 410	2 232	2 141	1 815	1 922	1 927
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	257	387	506	541	583	698	612	547	759	762	670	603	706
Total Exports (Balance)	281	127	214	311	640	596	700	831	824	824	472	582	496
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-54	136	-78	-2	-6	20	10	-22	36	-31	-33	51	7
Gross Inland Deliveries (Obs.)	2 553	2 796	2 675	2 568	2 478	2 395	2 219	2 105	2 204	2 047	1 980	1 994	2 144
Statistical Difference	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
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
Patent Fuel Plants	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
Total Energy Sector	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
Oil and Gas Extraction	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
Blast Furnaces (Energy)	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

2080 Motor Gasoline	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	2 553	2 796	2 675	2 568	2 478	2 395	2 219	2 105	2 204	2 047	1 980	1 994	2 144
Total Transport	2 371	2 600	2 494	2 395	2 311	2 231	2 068	1 962	2 054	1 906	1 844	1 857	1 995
International Civil Aviation	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
Road	2 371	2 600	2 494	2 395	2 311	2 231	2 068	1 962	2 054	1 906	1 844	1 857	1 995
Rail	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
Pipeline Transport	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
Total Industry	175	187	173	166	160	156	144	137	143	135	131	131	142
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	7	3	0	0	0	0	0	0	4	0	1	1	0
Non ferrous Metals	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
Transportation Equipment	138	151	141	135	130	128	117	111	113	110	106	106	116
Machinery	2	2	2	2	2	2	2	2	2	2	2	2	2
Mining and Quarrying	0	1	1	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
Pulp, Paper and Printing	3	3	3	3	2	2	2	2	2	2	2	2	2
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	23	25	24	23	22	22	20	19	20	19	18	18	20
Textiles and Leather	2	2	2	2	2	2	2	2	2	2	2	2	2
Non Specified (Industry)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Other Sectors	7	8	8	7	7	7	6	6	6	6	6	6	6
Commerce - Public Services	7	8	8	7	7	7	6	6	6	6	6	6	6
Residential	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
Non Specified (Others)	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	4	0	1	1	0

Table 20: National Energy Balance 1990-2002. Lubricants [1000 tons].

219A; Lubricants	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	31	31	27	25	26	73	109	113	107	105	111	117	100
Refinery Fuel	0	0	0	0	0	1	0	0	0	0	0	0	0
Total Imports (Balance)	177	171	115	98	105	51	50	51	53	52	57	51	47
Total Exports (Balance)	32	30	48	35	34	41	49	57	53	51	58	65	62
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-12	-28	26	4	-8	4	-5	1	-1	-3	-1	5	2
Gross Inland Deliveries (Obs.)	164	144	120	92	89	86	105	108	106	103	108	108	86
Statistical Difference	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
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
Patent Fuel Plants	0	0	0	0	0	0	0	0	0	0	0	0	0

219A; Lubricants	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	18	16	13	10	10	9	11	12	12	11	12	12	9
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	1	1	1	1	0	0	1	1	1	1	1	1	0
Coke Ovens (Energy)	5	5	4	3	3	3	3	4	3	3	4	4	3
Blast Furnaces (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	1	1	1	0	0	0	1	1	1	1	1	1	0
Power Plants	2	1	1	1	1	1	1	1	1	1	1	1	1
Non Specified (Energy)	9	8	7	5	5	5	6	6	6	6	6	6	5
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	146	128	107	82	79	77	94	96	94	92	96	96	77
Total Transport	67	59	49	38	36	35	43	44	43	42	44	44	35
International Civil Aviation	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
Road	66	58	48	37	35	34	42	43	42	41	43	43	35
Rail	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
Pipeline Transport	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Transport)	1	1	1	1	1	1	1	1	1	1	1	1	1
Total Industry	76	66	55	42	41	40	48	50	49	48	50	50	40
Iron and Steel	14	13	10	8	8	8	9	9	9	9	9	9	7
Chemical (incl.Petro-Chemical)	6	6	5	4	3	3	4	4	4	4	4	4	3
Non ferrous Metals	2	2	2	1	1	1	1	2	1	1	2	2	1
Non metallic Mineral Products	10	9	7	6	5	5	6	7	6	6	7	7	5
Transportation Equipment	2	2	1	1	1	1	1	1	1	1	1	1	1
Machinery	3	3	2	2	2	2	2	2	2	2	2	4	9
Mining and Quarrying	3	3	2	2	2	2	2	2	2	2	2	2	4
Food, Beverages and Tobacco	10	9	8	6	6	5	7	7	7	7	7	7	1
Pulp, Paper and Printing	8	7	6	5	4	4	5	5	5	5	5	5	2
Wood and Wood Products	3	2	2	1	1	1	2	2	2	2	2	2	2
Construction	2	1	1	1	1	1	1	1	1	1	1	1	1
Textiles and Leather	4	4	3	2	2	2	3	3	3	3	3	3	2
Non Specified (Industry)	8	7	6	5	5	4	5	6	5	5	6	4	3
Total Other Sectors	3	3	2	2	2	2	2	2	2	2	2	2	2
Commerce - Public Services	3	3	2	2	2	2	2	2	2	2	2	2	1
Residential	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
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	164	144	120	92	89	86	105	108	106	103	108	108	86

Table 21: National Energy Balance 1990-2002. White Spirit [1000 tons].

220A; White Spirit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	0	7	8	7	7	5	5	0	0	0	0	0	0
Refinery Fuel	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Imports (Balance)	11	9	8	8	6	8	8	11	12	12	7	6	9
Total Exports (Balance)	0	2	3	1	0	0	1	1	1	0	0	0	1
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	0	0	1	0	1	-1	0	1	0	1	1	0	0
Gross Inland Deliveries (Obs.)	11	14	14	14	14	12	12	11	11	13	7	7	9
Statistical Difference	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
Public Electricity	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
Public Heat Plants	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

220A; White Spirit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
Patent Fuel Plants	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
Total Energy Sector	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
Oil and Gas Extraction	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
Blast Furnaces (Energy)	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
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	11	14	14	14	14	12	12	11	11	13	7	7	9
Total Transport	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
Domestic Air Transport	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
Rail	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
Pipeline Transport	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
Total Industry	11	14	14	14	14	12	12	11	11	13	7	7	9
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	11	14	10	10	10	10	9	8	5	4	3	3	5
Non ferrous Metals	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
Transportation Equipment	0	0	4	4	4	2	3	3	6	8	3	4	4
Machinery	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
Food, Beverages and Tobacco	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
Wood and Wood Products	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	1	1	0	0
Textiles and Leather	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
Total Other Sectors	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
Residential	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
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	11	14	10	10	10	10	9	8	5	4	3	3	5

Table 22: National Energy Balance 1990-2002. Bitumen [1000 tons].

222A; Bitumen	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	269	281	380	284	311	254	263	299	300	326	343	402	416
Refinery Fuel	0	0	0	0	0	0	2	0	4	0	0	0	0
Total Imports (Balance)	284	232	70	154	162	187	250	242	279	231	292	296	248
Total Exports (Balance)	1	21	15	22	25	5	11	6	1	1	45	78	62
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-14	0	6	-6	-2	4	-7	7	-2	4	-3	-1	-1

222A; Bitumen	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Gross Inland Deliveries (Obs.)	538	492	441	410	446	440	493	542	572	560	587	618	601
Statistical Difference	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
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
Patent Fuel Plants	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
Total Energy Sector	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
Oil and Gas Extraction	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
Blast Furnaces (Energy)	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
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	538	492	441	410	446	440	493	542	572	560	587	618	601
Total Transport	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
Domestic Air Transport	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
Rail	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
Pipeline Transport	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
Total Industry	538	492	441	410	446	440	493	542	572	560	587	618	601
Iron and Steel	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
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	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
Construction	538	492	441	410	446	440	493	542	572	560	587	618	601
Textiles and Leather	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
Total Other Sectors	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
Residential	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
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	538	492	441	410	446	440	493	542	572	560	587	618	601

Table 23: National Energy Balance 1990-2002. Other Oil Products [1000 tons].

224A; Other Oil Products	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	555	713	810	819	952	827	989	1 018	1 025	990	906	1 055	1 111
Refinery Fuel	279	299	305	301	312	278	330	343	332	276	271	293	335
Total Imports (Balance)	208	107	86	204	3	36	18	147	118	136	173	105	153
Total Exports (Balance)	3	0	3	96	1	39	54	6	137	131	139	162	169
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	-39	-31	59	-19	-16	-4	14	-9	7	0	-7	11	-3
Gross Inland Deliveries (Obs.)	442	491	647	607	626	541	637	806	680	718	662	716	759
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	22	19	0	1	1	0	0	0	0	0	0	0	0
Public Electricity	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
Public Heat Plants	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
Auto Producers for CHP	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
Gas Works (Transformation)	22	19	0	1	1	0	0	0	0	0	0	0	0
Coke Ovens (Transformation)	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
Petrochemical Industry	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
Non Specified (Transformation)	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Non Specified (Energy)	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
Final Consumption	419	472	647	606	625	541	637	806	680	718	662	716	759
Total Transport	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
Domestic Air Transport	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
Rail	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
Pipeline Transport	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
Total Industry	419	472	647	606	625	541	637	806	680	718	662	716	759
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	402	454	627	590	614	534	633	803	668	683	638	697	693
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	17	17	19	16	11	7	4	3	12	35	24	20	66
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	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
Construction	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
Non Specified (Industry)	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
Commerce - Public Services	0	0	0	0	0	0	0	0	0	0	0	0	0

224A; Other Oil Products	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Residential	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
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	402	454	627	590	614	534	633	803	668	683	638	697	705

Table 24: National Energy Balance 1990-2002. LPG [1000 tons].

303A; LPG	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	47	43	51	96	37	60	20	45	30	19	34	0	23
Refinery Fuel	8	8	1	2	0	19	6	0	1	4	20	0	2
Total Imports (Balance)	97	149	151	114	210	149	184	148	132	152	159	140	155
Total Exports (Balance)	14	44	40	34	58	42	42	55	19	20	17	4	7
International Marine Bunkers	0	0	0	0	0	0	0	0	0	0	0	0	0
Stock Change (National Territory)	2	18	1	-6	-15	20	-3	-5	3	0	-5	6	-2
Gross Inland Deliveries (Obs.)	125	158	162	168	174	166	152	132	144	147	150	143	168
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	1	4	4	3	3	3	3	2	1	1	0	0	1
Public Electricity	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	1
Public Heat Plants	1	4	4	3	3	3	3	2	1	1	0	0	0
Auto Producers of Electricity	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
Auto Producer Heat Plants	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
Coke Ovens (Transformation)	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
Petrochemical Industry	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
Non Specified (Transformation)	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Non Specified (Energy)	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
Final Consumption	124	153	158	165	172	163	150	130	143	147	150	143	168
Total Transport	9	9	10	10	10	11	15	11	13	14	14	14	14
International Civil Aviation	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
Road	9	9	10	10	10	11	15	11	13	14	14	14	14
Rail	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
Pipeline Transport	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
Total Industry	65	76	48	55	65	62	67	60	66	54	56	53	72
Iron and Steel	4	5	4	4	4	3	12	12	13	1	1	0	1
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	0	0	0	0
Non ferrous Metals	8	7	6	5	7	6	6	4	5	9	5	4	6
Non metallic Mineral Products	12	14	12	15	21	23	21	13	14	15	15	14	19
Transportation Equipment	1	2	1	1	1	3	2	10	11	0	1	1	1
Machinery	11	13	11	12	14	13	12	10	11	11	14	13	17
Mining and Quarrying	1	1	0	1	1	1	1	1	1	1	1	1	2
Food, Beverages and Tobacco	3	4	4	4	3	3	2	2	2	5	4	5	6

303A; LPG	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Pulp, Paper and Printing	1	1	1	2	1	1	2	1	1	1	2	1	1
Wood and Wood Products	0	0	0	1	0	0	0	0	0	1	1	1	1
Construction	23	30	9	10	11	9	8	7	7	9	13	6	8
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	0	1	1	1	1	1	1	0	1	1	0	7	9
Total Other Sectors	50	68	101	100	97	90	68	59	64	79	80	76	81
Commerce - Public Services	32	47	80	76	73	61	34	19	21	31	32	22	29
Residential	16	19	19	22	22	26	31	36	39	43	44	50	48
Agriculture	2	2	2	2	2	3	3	4	4	4	5	4	4
Non Specified (Others)	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

Table 25: National Energy Balance 1990-2002. Refinery Gas [1000 tons].

308A; Refinery Gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Refinery Gross Output	373	327	339	319	341	305	359	351	348	341	312	328	306
Refinery Fuel	373	327	339	319	341	305	359	351	348	338	310	324	306
Total Imports (Balance)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Exports (Balance)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
International Marine Bunkers	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
Gross Inland Deliveries (Obs.)	0	0	0	0	0	0	0	0	0	2	2	4	0
Statistical Difference	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	2	0
Public Electricity	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
Public Heat Plants	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	1	0
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	1	0
Auto Producer Heat Plants	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
Coke Ovens (Transformation)	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
Petrochemical Industry	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
Non Specified (Transformation)	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Non Specified (Energy)	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
Final Consumption	0	0	0	0	0	0	0	0	0	2	2	1	0
Total Transport	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
Domestic Air Transport	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
Rail	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
Pipeline Transport	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
Total Industry	0	0	0	0	0	0	0	0	0	2	2	1	0
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0

308A; Refinery Gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Chemical (incl.Petro-Chemical)	0	0	0	0	0	0	0	0	0	2	2	1	0
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	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
Construction	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
Non Specified (Industry)	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
Commerce - Public Services	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
Agriculture	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
Total Non-Energy Use	0	0	0	0	0	0	0	0	0	0	0	0	0

Natural Gas

Table 26: National Energy Balance 1990-2002. Natural Gas [TJ].

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	46 376	47 729	51 722	53 559	48 776	53 336	53 701	51 404	56 440	62 524	64 826	62 194	67 541
Total Imports (Balance)	187 917	184 138	183 846	193 697	179 430	229 114	236 579	216 911	224 009	219 485	222 784	226 491	227 356
Total Exports (Balance)	0	0	12	0	189	576	0	0	698	0	633	14 713	27 577
Stock Change (National Territory)	-15 054	-73	-7 946	-7 212	18 891	-12 290	-3 340	8 236	4 168	6 867	-11 295	19 095	12 287
Gross Inland Deliveries (Obs.)	219 239	231 794	227 610	240 044	246 908	269 583	286 941	276 551	283 920	288 876	275 682	293 067	279 606
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	74 710	76 968	74 215	80 159	94 010	95 817	108 595	96 897	100 564	102 673	83 591	79 342	103 630
Public Electricity	28 100	25 602	20 818	20 129	23 477	21 731	30 433	27 422	34 382	30 571	22 405	24 030	37 658
Public Combined Heat and Power	23 810	24 752	24 529	25 628	27 342	30 757	34 179	31 061	29 381	35 099	30 594	31 800	39 416
Public Heat Plants	8 295	7 200	7 148	8 135	7 517	11 513	13 681	8 373	7 741	7 455	8 975	4 335	8 217
Auto Producers of Electricity	1 265	1 303	1 256	1 357	1 591	1 622	19 953	22 299	21 190	18 436	12 715	11 749	6 919
Auto Producers for CHP	13 240	18 111	20 464	24 910	34 084	30 195	10 349	7 741	7 870	10 443	8 449	7 344	11 413
Auto Producer Heat Plants	0	0	0	0	0	0	0	0	0	669	454	84	6
Gas Works (Transformation)	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
Blast Furnaces (Transformation)	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
Non Specified (Transformation)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Energy Sector	13 411	13 437	12 495	14 070	13 271	14 001	12 134	12 297	11 219	11 316	9 957	22 241	19 537
Coal Mines	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and Gas Extraction	5 339	5 396	5 027	5 255	5 228	5 746	3 022	3 709	2 989	3 017	2 665	13 949	10 381
Inputs to Oil Refineries	8 045	8 041	7 469	7 983	6 928	7 606	8 382	7 898	7 305	7 339	6 356	7 380	7 356
Coke Ovens (Energy)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gas Works (Energy)	28	1	0	833	1 115	650	731	690	926	960	935	912	1 799
Power Plants	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
Distribution Losses	2 726	3 352	3 259	1 471	1 788	4 643	718	230	1 776	2 493	-207	10 835	4 593
Final Consumption	113 479	122 072	126 906	129 338	127 802	144 603	154 713	156 458	159 807	161 750	171 837	170 704	141 512
Total Transport	4 050	4 065	3 968	3 865	3 780	4 092	4 216	4 199	6 344	9 570	9 650	9 090	6 555
Road	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipeline Transport	4 050	4 065	3 968	3 865	3 780	4 092	4 216	4 199	6 344	9 570	9 650	9 090	6 555
Non Specified (Transport)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Industry	68 583	66 190	65 641	64 308	67 046	72 820	76 245	80 776	80 328	76 912	84 585	79 634	59 288
Iron and Steel	10 456	9 496	9 472	9 424	10 481	11 142	11 875	14 256	14 177	13 602	13 483	15 249	10 996
Chemical (incl.Petro-Chemical)	7 661	7 069	7 348	7 491	7 603	8 176	8 165	9 894	9 839	9 384	10 100	7 485	7 261
Non ferrous Metals	1 343	1 196	1 567	1 899	2 025	2 134	1 975	2 314	2 301	2 195	2 362	2 580	1 861
Non metallic Mineral Products	10 021	10 199	9 298	9 631	10 126	10 997	11 690	12 957	12 885	12 290	13 227	9 802	7 068
Transportation Equipment	1 525	1 759	1 915	2 071	2 381	2 532	2 361	1 137	1 131	1 078	1 161	1 449	1 045
Machinery	4 320	4 361	4 736	5 005	5 543	6 077	6 159	5 400	5 370	5 122	5 512	4 986	3 596
Mining and Quarrying	2 614	2 462	1 811	1 829	1 990	2 496	2 586	2 469	2 455	2 342	2 520	2 112	1 523
Food, Beverages and Tobacco	8 822	8 793	8 183	7 732	8 705	9 333	8 999	9 422	9 370	8 937	12 814	12 769	9 208
Pulp, Paper and Printing	12 780	12 134	12 188	9 976	8 812	9 695	10 703	16 485	16 393	15 636	16 828	17 205	12 406
Wood and Wood Products	1 706	1 688	1 776	1 657	1 919	2 026	2 206	1 620	1 611	1 675	1 654	1 865	1 345
Construction	726	703	871	1 208	1 386	1 519	1 446	538	535	586	549	556	401
Textiles and Leather	3 485	3 236	3 482	3 279	2 985	3 364	3 625	2 351	2 338	2 230	2 401	2 114	1 525
Non Specified (Industry)	3 122	3 095	2 995	3 107	3 091	3 328	4 455	1 934	1 923	1 834	1 974	1 463	1 055
Total Other Sectors	40 847	51 817	57 296	61 164	56 976	67 691	74 252	71 484	73 135	75 269	77 602	81 980	75 669
Commerce - Public Services	7 664	11 978	18 043	17 929	15 762	23 148	24 117	18 756	18 652	17 859	19 640	18 491	13 334
Residential	32 828	39 412	38 833	42 772	40 774	44 066	49 599	52 164	53 901	56 796	57 341	62 810	61 668
Agriculture	355	426	420	462	441	476	536	564	583	614	620	679	667
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Non-Energy Use	14 913	15 965	10 735	15 006	10 036	10 518	10 781	10 669	10 554	10 644	10 504	9 945	10 336

Renewable Fuels

Table 27: National Energy Balance 1990-2002. Fuel Wood [TJ].

111A; Fuel Wood	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	61 401	66 501	63 235	64 028	60 260	65 763	70 726	65 357	63 416	63 619	57 814	65 618	63 149
Total Imports (Balance)	2 288	2 832	2 421	3 064	2 382	1 623	2 423	2 017	1 604	1 486	1 803	1 803	2 104
Total Exports (Balance)	28	80	57	29	73	222	107	114	140	34	180	180	379
Stock Change (National Territory)	-545	706	382	113	-179	189	243	-54	0	0	0	0	0
Gross Inland Deliveries (Obs.)	63 116	69 960	65 982	67 176	62 390	67 354	73 285	67 206	64 881	65 071	59 437	67 241	64 874
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	0	0	0	210	0	0	0	0
Public Electricity	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
Public Heat Plants	0	0	0	0	0	0	0	0	210	0	0	0	0
Auto Producers of Electricity	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
Auto Producer Heat Plants	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Petroleum refineries	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
Non Specified (Energy)	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
Final Consumption	63 116	69 960	65 982	67 176	62 390	67 354	73 285	67 206	64 672	65 071	59 437	67 240	64 874
Total Transport	2	2	1	1	1	1	1	0	0	0	0	0	0
Rail	2	2	1	1	1	1	1	0	0	0	0	0	0
Inland Waterways	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
Total Industry	661	734	706	802	904	1 074	783	272	151	968	135	204	189
Iron and Steel	0	0	0	0	0	0	0	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	0	0	0	10	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
Non metallic Mineral Products	47	44	43	41	42	62	7	1	1	1	1	1	1
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	47	52	60	51	52	62	12	17	9	9	8	10	9
Mining and Quarrying	0	9	0	0	0	0	2	0	0	0	0	0	0
Food, Beverages and Tobacco	121	114	77	144	94	93	23	15	8	8	7	9	8
Pulp, Paper and Printing	9	26	0	0	0	0	54	1	1	0	0	1	0
Wood and Wood Products	233	253	221	226	291	300	319	76	42	862	38	91	84
Construction	0	0	102	113	156	289	142	79	44	43	39	46	43
Textiles and Leather	19	26	17	21	21	21	5	0	0	0	0	0	0
Non Specified (Industry)	186	210	187	195	249	248	219	83	46	45	41	48	44
Total Other Sectors	62 454	69 225	65 275	66 374	61 485	66 278	72 501	66 934	64 520	64 102	59 302	67 036	64 685
Commerce - Public Services	1 330	1 294	1 177	1 145	1 091	1 167	1 063	873	486	476	434	506	468
Residential	57 500	63 902	60 298	61 361	56 812	61 250	67 202	62 144	60 237	59 853	55 377	62 585	60 408
Agriculture	3 625	4 028	3 801	3 868	3 581	3 861	4 236	3 917	3 797	3 773	3 491	3 945	3 808
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 28: National Energy Balance 1990-2002. Wood Waste [TJ].

116A; Wood waste; Other	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	13 668	14 819	15 705	18 136	18 456	18 739	20 571	27 344	23 217	27 619	29 476	35 474	33 452
Total Imports (Balance)	1 864	2 437	2 536	2 116	2 418	2 144	1 744	2 838	2 344	2 641	2 819	4 095	4 472
Total Exports (Balance)	2 072	2 116	2 240	1 517	2 221	2 617	2 819	5 181	5 034	6 137	6 509	7 978	6 855
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	13 461	15 139	16 001	18 736	18 653	18 265	19 496	25 001	20 527	24 123	25 786	31 590	31 069
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	2 452	3 888	4 348	7 460	9 204	8 874	10 038	13 040	7 092	11 410	13 144	13 800	16 638
Public Electricity	0	0	0	0	0	0	0	0	13	17	9	517	547
Public Combined Heat and Power	0	0	0	0	0	0	47	101	98	81	130	297	730
Public Heat Plants	2 045	3 020	3 404	3 515	3 714	4 332	5 988	5 904	5 905	6 886	8 165	10 235	11 670
Auto Producers of Electricity	0	0	0	0	0	189	2 493	3 041	34	2 711	1 872	824	2 076
Auto Producers for CHP	407	868	944	3 945	5 490	4 353	1 510	3 921	964	1 623	2 884	1 786	1 490
Auto Producer Heat Plants	0	0	0	0	0	0	0	72	79	92	83	142	125
Total Energy Sector	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
Patent Fuel Plants	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
Blast Furnaces (Energy)	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
BKB (Transformation)	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
Power Plants	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
Distribution Losses	0	0	0	0	0	0	0	0	0	0	0	0	0
Final Consumption	11 009	11 251	11 653	11 275	9 449	9 391	9 458	11 962	13 435	12 713	12 642	17 790	14 431
Total Transport	79	87	113	165	171	233	250	272	291	340	367	404	402
Rail	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
Non Specified (Transport)	79	87	113	165	171	233	250	272	291	340	367	404	402
Total Industry	9 243	9 116	9 460	8 826	7 133	6 699	6 584	7 577	8 544	7 270	6 714	10 621	7 323
Iron and Steel	0	0	0	0	0	0	20	0	0	0	0	0	0
Chemical (incl.Petro-Chemical)	2 898	2 902	3 258	2 173	1 808	1 722	2 062	2 413	1 575	639	726	2 282	1 982
Non ferrous Metals	0	0	0	0	0	0	0	0	0	0	0	0	0
Non metallic Mineral Products	0	0	0	0	0	0	2	0	0	0	0	0	0
Transportation Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	0	0	0	0	0	0	22	18	17	35	34	115	61
Mining and Quarrying	0	0	0	0	0	0	0	0	0	0	0	0	0
Food, Beverages and Tobacco	10	10	10	9	9	9	6	1	1	1	0	6	3
Pulp, Paper and Printing	3 660	3 468	3 920	4 527	3 582	3 901	2 502	2 761	5 831	4 376	3 589	4 483	3 069
Wood and Wood Products	2 570	2 620	2 185	2 035	1 652	968	1 810	2 076	910	2 126	2 266	3 591	2 128
Construction	39	39	29	28	28	27	47	71	55	17	39	43	24
Textiles and Leather	0	0	0	0	0	0	0	0	0	0	0	0	0
Non Specified (Industry)	68	78	58	55	55	72	114	236	154	75	59	101	55
Total Other Sectors	1 687	2 048	2 080	2 284	2 144	2 459	2 624	4 114	4 600	5 103	5 562	6 765	6 706
Commerce - Public Services	765	854	793	731	736	698	581	1 425	1 351	525	430	537	439
Residential	551	739	804	1 009	996	1 137	1 330	1 795	2 198	3 182	3 565	4 357	4 388
Agriculture	371	455	483	545	412	624	713	894	1 051	1 397	1 566	1 871	1 879
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 29: National Energy Balance 1990-2002. Black Liquor [TJ].

215A; Black Liquor	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	17 799	17 737	18 067	18 544	19 606	21 392	21 174	21 675	22 916	23 665	24 121	23 299	31 115
Total Imports (Balance)	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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	17 799	17 737	18 067	18 544	19 606	21 392	21 174	21 675	22 916	23 665	24 121	23 299	31 115
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	5 260	5 670	6 076	7 091	8 897	9 267	9 505	8 580	11 354	10 003	7 197	7 247	9 994
Public Electricity	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
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	2 618	2 822	3 024	4 033	5 060	5 271	5 406	5 140	8 867	6 158	2 001	3 116	2 782
Auto Producers for CHP	2 642	2 848	3 052	3 058	3 837	3 997	4 099	3 440	2 487	3 845	5 196	4 130	7 212
Auto Producer Heat Plants	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Petroleum refineries	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
Non Specified (Energy)	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
Final Consumption	12 540	12 067	11 991	11 453	10 709	12 125	11 669	13 094	11 562	13 662	16 924	16 052	21 121
Total Transport	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
Inland Waterways	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
Total Industry	12 540	12 067	11 991	11 453	10 709	12 125	11 669	13 094	11 562	13 662	16 924	16 052	21 121
Iron and Steel	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	3 482
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	12 540	12 067	11 991	11 453	10 709	12 125	11 669	13 094	11 562	13 616	16 864	15 992	17 582
Wood and Wood Products	0	0	0	0	0	0	0	0	0	46	61	61	57
Construction	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
Non Specified (Industry)	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
Commerce - Public Services	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
Agriculture	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

Table 30: National Energy Balance 1990-2002. Biogas [TJ].

309A; Biogas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	0	0	0	0	0	35	39	48	27	369	367	297	389
Total Imports (Balance)	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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	0	0	35	39	48	27	369	367	297	389
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	35	39	48	27	127	179	142	98
Public Electricity	0	0	0	0	0	0	0	0	0	13	20	20	0
Public Combined Heat and Power	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
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	29	69	64	0
Auto Producers for CHP	0	0	0	0	0	35	39	48	27	85	89	58	98
Auto Producer Heat Plants	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Petroleum refineries	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
Non Specified (Energy)	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
Final Consumption	0	0	0	0	0	0	0	0	0	243	188	155	291
Total Transport	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
Inland Waterways	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
Total Industry	0	0	0	0	0	0	0	0	0	243	188	155	291
Iron and Steel	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	211	138	91	185
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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	15	8	8	3
Pulp, Paper and Printing	0	0	0	0	0	0	0	0	0	17	41	56	103
Wood and Wood Products	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
Textiles and Leather	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
Total Other Sectors	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
Residential	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
Non Specified (Others)	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 31: National Energy Balance 1990-2002. Sewage Sludge Gas [TJ].

309B; Sewage sludge gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	0	0	0	631	638	619	668	691	715	714	791	812	813
Total Imports (Balance)	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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	631	638	619	668	691	715	714	791	812	813
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	631	638	619	668	691	715	714	791	812	813
Public Electricity	0	0	0	0	0	10	31	52	50	17	49	52	57
Public Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0
Public Heat Plants	0	0	0	0	0	0	0	4	2	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	0	0	0	0	0	39	40	0
Auto Producers for CHP	0	0	0	631	638	609	637	635	663	696	703	720	756
Auto Producer Heat Plants	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Petroleum refineries	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
Non Specified (Energy)	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
Final Consumption	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
Rail	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
Non Specified (Transport)	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
Iron and Steel	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
Non ferrous Metals	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
Transportation Equipment	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
Mining and Quarrying	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
Pulp, Paper and Printing	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
Construction	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
Non Specified (Industry)	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
Commerce - Public Services	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
Agriculture	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

Table 32: National Energy Balance 1990-2002. Landfill Gas [TJ].

310A; Landfill Gas	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Indigenous Production	0	0	0	77	88	195	307	524	527	524	457	1 382	381
Total Imports (Balance)	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
Stock Change (National Territory)	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Inland Deliveries (Obs.)	0	0	0	77	88	195	307	524	527	524	457	1 382	381
Statistical Difference	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Transformation Sector	0	0	0	0	0	146	271	519	520	524	457	1 382	381
Public Electricity	0	0	0	0	0	0	0	0	0	25	58	63	58
Public Combined Heat and Power	0	0	0	0	0	29	31	27	30	0	0	4	0
Public Heat Plants	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto Producers of Electricity	0	0	0	0	0	117	240	492	490	499	399	1 275	298
Auto Producers for CHP	0	0	0	0	0	0	0	0	0	0	0	39	26
Auto Producer Heat Plants	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
Coal Mines	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
Coke Ovens (Energy)	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
Gas Works (Energy)	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
Petroleum refineries	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
Non Specified (Energy)	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
Final Consumption	0	0	0	77	88	49	36	5	7	0	0	0	0
Total Transport	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
Inland Waterways	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
Total Industry	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
Chemical (incl.Petro-Chemical)	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
Non metallic Mineral Products	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
Machinery	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
Food, Beverages and Tobacco	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
Wood and Wood Products	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
Textiles and Leather	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
Total Other Sectors	0	0	0	77	88	49	36	5	7	0	0	0	0
Commerce - Public Services	0	0	0	77	88	49	36	5	7	0	0	0	0
Residential	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
Non Specified (Others)	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 33 presents the net calorific values from [IEA JQ 2003] which are used for unit conversion.

Table 33: Net calorific values for 1990-2002 in [MJ/kg], [MJ/m³] taken from [IEA JQ 2003].

Fuel Code	Fuel Name	Usage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
101A	Coking Coal	Transf.	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	Final Cons.	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	26.65	27.94	27.99	27.50
		Transf.	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	27.23	28.00	28.09	27.37
104A	Hard Coal Briquettes	Average								31.00	31.00	31.00	31.00	31.00	31.00
105A	Brown Coal	Final Cons.	10.90	10.90	10.90	10.90	10.90	10.90	9.90	9.90	9.90	9.77	9.82	9.82	9.82
		Transf.	10.90	10.90	10.90	10.90	10.90	10.90	9.90	9.90	9.90	9.77	9.68	9.64	9.74
106A	Brown Coal Briquettes	Average	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	Average	28.20	28.20	28.20	28.50	28.50	28.50	28.20	28.20	28.20	28.20	28.20	28.20	28.20
113A	Peat	Final Cons.	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	Production	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52	17.52
305A	Blast Furnace Gas	Production	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
201A	Crude Oil	Average	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.51	42.50	42.52	42.52	42.50	42.50
203X	Residual Fuel Oil	Average	41.00	41.10	41.10	41.30	41.30	40.46	40.33	40.28	40.27	40.68	41.85	41.45	40.81
204A	Gasoil	Average	42.60	42.60	42.60	42.60	42.60	42.70	42.80	42.80	42.80	42.80	42.80	42.80	42.80
2050	Diesel	Average	42.60	42.60	42.60	42.60	42.60	42.70	42.70	42.70	42.70	42.80	42.80	42.80	42.80
206A	Petroleum	Average	43.60	43.60	43.60	43.60	43.60	43.30	43.39	43.41	43.41	43.31	43.30	43.30	43.30
206B	Kerosene	Average	43.60	43.60	43.60	43.60	43.60	43.30	43.39	43.41	43.41	43.31	43.30	43.30	43.30
207A	Aviation Gasoline	Average	41.60	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.52	42.49
2080	Motor Gasoline	Average	41.60	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.52	42.49
217A	Refinery Feedstocks	Average	42.24	42.31	42.10	42.38	42.46	42.49	43.07	42.24	42.27	42.52	42.57	42.59	41.93
219A	Lubricants	Average	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	43.83	43.49	43.84	43.91
220A	White Spirit	Average	41.60	41.60	41.60	42.50	42.50	42.50	42.50	42.50	42.50	44.10	44.10	44.10	44.10
222A	Bitumen	Average	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	41.80	43.83	43.49	43.84	43.91
224A	Other Petroleum Products	Final Cons.	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	26.65	27.94	27.99	27.50
		Non Energy Use	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	27.23	28.00	28.09	27.37
302A	Natural Gas Liquids (NGL)	Average	42.50	42.50	42.50	42.50	42.50	42.50	42.50	42.51	42.50	42.52	42.52	42.50	42.50
303A	Liquified Petroleum Gas (LPG)	Average	46.30	46.20	46.20	46.20	46.20	46.30	46.32	46.31	46.32	46.00	46.00	46.00	46.00
308A	Refinery Gas	Average	49.00	49.00	49.00	49.00	49.00	49.00	49.00	49.00	49.00	42.23	45.93	45.93	45.93
301A	Natural Gas	Average	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	35.85	35.85	35.85	35.85

Legend: Transf. ...Transformation; Final Cons. ... Final Consumption

Table 34 presents the net calorific values from STATISTIK AUSTRIA which are used for unit conversion.

Table 34: Net calorific values for 1990-2002 in [MJ/kg] from STATISTIK AUSTRIA.

Fuel Code	Fuel Name	Usage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
114B	Municipal Waste	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70	8.70
114C	Hazardous Waste	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70	8.70
115A	Industrial Waste	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70	8.70
111A	Fuel Wood	Average	15.50	15.50	15.50	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35
116A	Wood Wastes	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70	8.70
118A	Sewage Sludge	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70	8.70
215A	Black Liquor	Average	9.20	9.20	9.20	9.20	9.20	9.20	8.50	8.70	8.70	8.70	8.70	8.70	8.70

Table 35 presents IPCC default values of net calorific values of gaseous biofuels which are used for unit conversion.

Table 35: Net calorific values of gaseous biofuels for 1990 to 2002 in [MJ/m³] from IPCC Guidelines.

Fuel Code	Fuel Name	Usage	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
309A	Biogas	Average	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40	23.40
309B	Sewage Sludge Gas	Average	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
310A	Gas from Waste Disposal Site	Average	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00

ANNEX 5: CRF FOR 2002

This Annex includes the CRF-Tables for the year 2002 as included in Austria's data submission 2004 to the UNFCCC.

TABLE 1 SECTORAL REPORT FOR ENERGY
(Sheet 1 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_X	CO	NMVOC	SO_2
	(Gg)						
Total Energy	**61 981.95**	**29.69**	**3.99**	**197.88**	**748.27**	**86.95**	**31.97**
A. Fuel Combustion Activities (Sectoral Approach)	**61 814.92**	**15.24**	**3.99**	**197.88**	**748.27**	**83.56**	**31.83**
1. Energy Industries	**15 013.10**	**0.26**	**0.20**	**14.94**	**4.10**	**0.58**	**8.23**
a. Public Electricity and Heat Production	11 877.06	0.25	0.19	9.95	3.32	0.57	4.54
b. Petroleum Refining	2 565.08	0.00	0.01	3.44	0.72	IE	3.69
c. Manufacture of Solid Fuels and Other Energy Industries	570.96	0.02	0.00	1.56	0.05	0.01	0.00
2. Manufacturing Industries and Construction	**12 504.07**	**0.37**	**0.52**	**34.08**	**157.11**	**4.01**	**11.04**
a. Iron and Steel	6 219.79	0.04	0.05	5.63	135.02	0.13	6.06
b. Non-Ferrous Metals	157.65	0.00	0.00	0.17	0.04	0.00	0.17
c. Chemicals	541.87	0.05	0.02	1.45	1.38	0.23	1.19
d. Pulp, Paper and Print	1 010.17	0.08	0.04	3.55	4.20	0.74	0.85
e. Food Processing, Beverages and Tobacco	613.07	0.02	0.00	0.59	0.09	0.01	0.37
f. Other *(please specify)*	3 961.51	0.19	0.41	22.69	16.39	2.89	2.39
Industry (not disaggregated to subsectors)	3 961.51	0.19	0.41	22.69	16.39	2.89	2.39
3. Transport	**20 606.16**	**1.56**	**2.24**	**109.37**	**198.79**	**29.61**	**2.25**
a. Civil Aviation	74.76	0.00	0.00	0.24	1.79	0.07	0.02
b. Road Transportation	19 938.76	1.53	2.20	105.91	193.71	28.64	2.11
c. Railways	167.87	0.01	0.02	1.66	0.48	0.23	0.09
d. Navigation	64.24	0.01	0.01	0.57	2.78	0.67	0.02
e. Other Transportation *(please specify)*	360.52	0.01	0.00	0.98	0.03	0.00	0.00
Pipeline Compressors	360.52	0.01	0.00	0.98	0.03	0.00	0.00

TABLE 1 SECTORAL REPORT FOR ENERGY
(Sheet 2 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	CH_4	N_2O	NO_X	CO	NMVOC	SO_2
	(Gg)						
4. Other Sectors	**13 650.84**	**13.04**	**1.03**	**39.40**	**388.04**	**49.34**	**10.30**
a. Commercial/Institutional	1 206.54	0.24	0.02	1.10	6.00	0.67	0.57
b. Residential	10 447.59	11.75	0.44	15.14	335.14	38.41	8.93
c. Agriculture/Forestry/Fisheries	1 996.71	1.04	0.56	23.15	46.90	10.26	0.80
5. Other *(please specify)* [1]	**40.75**	**0.00**	**0.00**	**0.09**	**0.24**	**0.02**	**0.01**
a. Stationary	0.00	0.00	0.00	0.00	0.00	0.00	0.00
b. Mobile	40.75	0.00	0.00	0.09	0.24	0.02	0.01
Military	40.75	0.00	0.00	0.09	0.24	0.02	0.01
B. Fugitive Emissions from Fuels	**167.03**	**14.45**	**0.00**	**0.00**	**0.00**	**3.39**	**0.14**
1. Solid Fuels	**0.00**	**0.26**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
a. Coal Mining	0.00	0.26	NA	NA	NA	NA	
b. Solid Fuel Transformation	IE	IE	IE	IE	IE	IE	IE
c. Other *(please specify)*	NO	NO	0.00	0.00	0.00	0.00	0.00
2. Oil and Natural Gas	**167.03**	**14.19**	**0.00**	**0.00**	**0.00**	**3.39**	**0.14**
a. Oil	84.00	4.47		NA	NA	3.24	NA
b. Natural Gas	83.03	9.72				0.15	0.14
c. Venting and Flaring	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Venting	IE	IE				IE	IE
Flaring	IE	IE	IE	IE	IE	IE	IE
d. Other *(please specify)*	NO	NO	NO	0.00	0.00	0.00	0.00
Memo Items: [2]							
International Bunkers	**1 512.24**	**0.03**	**0.05**	**4.84**	**1.49**	**0.60**	**0.48**
Aviation	1 512.24	0.03	0.05	4.84	1.49	0.60	0.48
Marine	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	IE	IE	IE	IE	IE	IE	IE
CO_2 Emissions from Biomass	**13 562.05**						

[1] Include military fuel use under this category.
[2] Please do not include in energy totals.

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)	[1]	(t/TJ)	(kg/TJ)	(kg/TJ)		(Gg)	(Gg)	(Gg)
1.A. Fuel Combustion	**989 881.84**	NCV					**61 814.92**	**15.24**	**3.99**
Liquid Fuels	468 977.31	NCV	74.33	4.11	6.99		34 859.49	1.93	3.28
Solid Fuels	114 600.89	NCV	103.66	8.30	1.29		11 879.87	0.95	0.15
Gaseous Fuels	264 677.97	NCV	55.00	1.02	0.44		14 557.29	0.27	0.12
Biomass	129 160.17	NCV	105.00	92.44	3.33	[3]	13 562.05	11.94	0.43
Other Fuels	12 465.50	NCV	41.58	12.00	1.40		518.27	0.15	0.02
1.A.1. Energy Industries	**227 166.35**	NCV					**15 013.10**	**0.26**	**0.20**
Liquid Fuels	39 725.68	NCV	75.41	0.29	0.61		2 995.82	0.01	0.02
Solid Fuels	59 795.03	NCV	97.92	0.19	1.28		5 855.34	0.01	0.08
Gaseous Fuels	104 827.99	NCV	55.00	0.92	0.31		5 765.54	0.10	0.03
Biomass	13 602.06	NCV	110.00	2.41	3.87	[3]	1 496.25	0.03	0.05
Other Fuels	9 215.60	NCV	43.01	12.00	1.40		396.40	0.11	0.01
a. Public Electricity and Heat Production	180 249.39	NCV					11 877.06	0.25	0.19
Liquid Fuels	10 545.96	NCV	79.21	1.08	1.32		835.33	0.01	0.01
Solid Fuels	59 795.03	NCV	97.92	0.19	1.28		5 855.34	0.01	0.08
Gaseous Fuels	87 090.75	NCV	55.00	0.93	0.35		4 789.99	0.08	0.03
Biomass	13 602.06	NCV	110.00	2.41	3.87	[3]	1 496.25	0.03	0.05
Other Fuels	9 215.60	NCV	43.01	12.00	1.40		396.40	0.11	0.01
b. Petroleum Refining	36 535.88	NCV					2 565.08	0.00	0.01
Liquid Fuels	29 179.72	NCV	74.04	0.00	0.36		2 160.49	IE	0.01
Solid Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Gaseous Fuels	7 356.16	NCV	55.00	0.00	0.10		404.59	IE	0.00
Biomass	0.00	NCV	0.00	0.00	0.00	[3]	0.00	0.00	0.00
Other Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
c. Manufacture of Solid Fuels and Other Energy Industries	10 381.08	NCV					570.96	0.02	0.00
Liquid Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Solid Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Gaseous Fuels	10 381.08	NCV	55.00	1.50	0.10		570.96	0.02	0.00
Biomass	0.00	NCV	0.00	0.00	0.00	[3]	0.00	0.00	0.00
Other Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00

[1] Activity data should be calculated using net calorific values (NCV) as specified by the IPCC Guidelines. If gross calorific values (GCV) were used, please indicate this by replacing "NCV" with "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 fuel characteristics. Therefore, caution should be used when comparing the implied emission factors.

[3] Carbon dioxide emissions from biomass are reported under Memo Items. The content of the cells is not included in the totals.

Note: For the coverage of fuel categories, please 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 work gas, coke oven gas, blast gas, oxygen steel furnace gas, etc.) are considered, Parties should provide information on the allocation of these derived gases under the above fuel categories (liquid, soild, gaseous, biomass, other fuels) in the documentation box at the end of sheet 4 of this table.

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)	[1]	(t/TJ)	(kg/TJ)	(kg/TJ)		(Gg)	(Gg)	(Gg)
1.A.2 Manufacturing Industries and Construction	**208 404.00**	NCV					**12 504.07**	**0.37**	**0.52**
Liquid Fuels	38 654.31	NCV	76.61	2.32	9.69		2 961.34	0.09	0.37
Solid Fuels	45 535.87	NCV	113.22	1.28	1.10		5 155.68	0.06	0.05
Gaseous Fuels	77 626.45	NCV	55.00	1.32	0.11		4 269.45	0.10	0.01
Biomass	43 764.99	NCV	110.03	1.98	1.96	[3]	4 815.41	0.09	0.09
Other Fuels	2 822.39	NCV	41.67	12.00	1.40		117.60	0.03	0.00
a. Iron and Steel	65 035.52	NCV					6 219.79	0.04	0.05
Liquid Fuels	12 733.24	NCV	77.97	1.15	1.00		992.79	0.01	0.01
Solid Fuels	38 018.62	NCV	116.82	0.48	1.04		4 441.41	0.02	0.04
Gaseous Fuels	14 283.45	NCV	55.00	0.59	0.10		785.59	0.01	0.00
Biomass	0.20	NCV	110.00	2.00	4.00	[3]	0.02	0.00	0.00
Other Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
b. Non-Ferrous Metals	2 569.38	NCV					157.65	0.00	0.00
Liquid Fuels	560.98	NCV	71.20	1.60	0.53		39.94	0.00	0.00
Solid Fuels	147.88	NCV	104.00	2.00	1.40		15.38	0.00	0.00
Gaseous Fuels	1 860.52	NCV	55.00	1.50	0.10		102.33	0.00	0.00
Biomass	0.00	NCV	0.00	0.00	0.00	[3]	0.00	0.00	0.00
Other Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
c. Chemicals	15 878.25	NCV					541.87	0.05	0.02
Liquid Fuels	158.17	NCV	77.37	1.73	0.91		12.24	0.00	0.00
Solid Fuels	1 216.71	NCV	94.00	5.00	1.40		114.37	0.01	0.00
Gaseous Fuels	7 260.56	NCV	55.00	1.50	0.10		399.33	0.01	0.00
Biomass	5 649.40	NCV	110.07	1.98	2.27	[3]	621.80	0.01	0.01
Other Fuels	1 593.41	NCV	10.00	12.00	1.40		15.93	0.02	0.00
d. Pulp, Paper and Print	36 839.01	NCV					1 010.17	0.08	0.04
Liquid Fuels	1 139.09	NCV	77.17	1.92	0.94		87.91	0.00	0.00
Solid Fuels	2 529.16	NCV	94.82	5.55	1.40		239.81	0.01	0.00
Gaseous Fuels	12 406.41	NCV	55.00	1.50	0.10		682.35	0.02	0.00
Biomass	20 754.63	NCV	110.01	2.00	1.78	[3]	2 283.21	0.04	0.04
Other Fuels	9.72	NCV	10.00	12.00	1.40		0.10	0.00	0.00
e. Food Processing, Beverages and Tobacco	10 598.65	NCV					613.07	0.02	0.00
Liquid Fuels	1 229.56	NCV	74.61	1.68	0.74		91.73	0.00	0.00
Solid Fuels	143.02	NCV	103.99	2.01	1.40		14.87	0.00	0.00
Gaseous Fuels	9 207.75	NCV	55.00	1.50	0.10		506.43	0.01	0.00
Biomass	14.06	NCV	104.84	1.89	3.31	[3]	1.47	0.00	0.00
Other Fuels	4.27	NCV	10.00	12.00	1.40		0.04	0.00	0.00
f. Other *(please specify)*	77 483.19	NCV					3 961.51	0.19	0.41
Liquid Fuels	22 833.27	NCV	76.06	3.05	15.74		1 736.73	0.07	0.36
Solid Fuels	3 480.48	NCV	94.77	5.50	1.40		329.83	0.02	0.00
Gaseous Fuels	32 607.75	NCV	55.00	1.48	0.11		1 793.43	0.05	0.00
Biomass	17 346.70	NCV	110.04	1.97	2.07	[3]	1 908.90	0.03	0.04
Other Fuels	1 215.00	NCV	83.56	12.00	1.40		101.53	0.01	0.00

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 3 of 4)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

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)	[1]	(t/TJ)	(kg/TJ)	(kg/TJ)		(Gg)	(Gg)	(Gg)
1.A.3 Transport	**280 961.09**	NCV					**20 606.16**	**1.56**	**2.24**
Gasoline	90 556.60	NCV	73.99	15.52	18.46		6 700.68	1.41	1.67
Diesel	183 826.69	NCV	73.67	0.80	3.08		13 542.79	0.15	0.57
Natural Gas	6 554.95	NCV	55.00	1.50	0.10		360.52	0.01	0.00
Solid Fuels	22.85	NCV	95.00	6.83	6.83		2.17	0.00	0.00
Biomass	0.00	NCV	0.00	0.00	0.00	[3]	0.00	0.00	0.00
Other Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
a. Civil Aviation	1 026.07	NCV					74.76	0.00	0.00
Aviation Gasoline	86.64	NCV	74.14	0.00	0.00		6.42	0.00	0.00
Jet Kerosene	939.43	NCV	72.74	5.19	3.04		68.34	0.00	0.00
b. Road Transportation	270 244.61	NCV					19 938.76	1.53	2.20
Gasoline	89 409.48	NCV	74.01	15.54	18.67		6 616.93	1.39	1.67
Diesel Oil	180 835.14	NCV	73.67	0.78	2.96		13 321.83	0.14	0.53
Natural Gas	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Biomass	0.00	NCV	0.00	0.00	0.00	[3]	0.00	0.00	0.00
Other Fuels *(please specify)*	0.00	NCV					0.00	0.00	0.00
		NCV	0.00	0.00	0.00				
c. Railways	2 264.33	NCV					167.87	0.01	0.02
Solid Fuels	22.85	NCV	95.00	6.83	6.83		2.17	0.00	0.00
Liquid Fuels	2 241.47	NCV	73.93	2.27	8.19		165.70	0.01	0.02
Other Fuels *(please specify)*	0.00	NCV					0.00	0.00	0.00
		NCV	0.00	0.00	0.00				
d. Navigation	871.13	NCV					64.24	0.01	0.01
Coal	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Residual Oil	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Gas/Diesel Oil	750.08	NCV	73.67	1.62	17.86		55.26	0.00	0.01
Other Fuels *(please specify)*	121.05	NCV					8.98	0.01	0.00
Gasoline	121.05	NCV	74.21	89.22	1.21		8.98	0.01	0.00
		NCV	0.00	0.00	0.00				
e. Other Transportation	6 554.95	NCV					360.52	0.01	0.00
Liquid Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Solid Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Gaseous Fuels	6 554.95	NCV	55.00	1.50	0.10		360.52	0.01	0.00

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel Combustion Activities - Sectoral Approach
(Sheet 4 of 4)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

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)	[1]	(t/TJ)	(kg/TJ)	(kg/TJ)		(Gg)	(Gg)	(Gg)
1.A.4 Other Sectors	**272 790.59**	NCV					**13 650.84**	**13.04**	**1.03**
Liquid Fuels	115 654.23	NCV	74.52	2.34	5.52		8 618.11	0.27	0.64
Solid Fuels	9 247.14	NCV	93.72	95.28	2.24		866.68	0.88	0.02
Gaseous Fuels	75 668.58	NCV	55.00	0.80	1.00		4 161.77	0.06	0.08
Biomass	71 793.13	NCV	100.99	164.64	4.07	[3]	7 250.39	11.82	0.29
Other Fuels	427.51	NCV	10.00	12.00	1.40		4.28	0.01	0.00
a. Commercial/Institutional	21 486.06	NCV					1 206.54	0.24	0.02
Liquid Fuels	6 139.30	NCV	72.00	0.90	0.69		442.02	0.01	0.00
Solid Fuels	276.30	NCV	97.28	90.00	2.89		26.88	0.02	0.00
Gaseous Fuels	13 333.80	NCV	55.00	0.80	1.00		733.36	0.01	0.01
Biomass	1 309.15	NCV	106.42	150.00	3.00	[3]	139.32	0.20	0.00
Other Fuels	427.51	NCV	10.00	12.00	1.40		4.28	0.01	0.00
b. Residential	218 508.34	NCV					10 447.59	11.75	0.44
Liquid Fuels	83 252.09	NCV	74.87	1.11	1.18		6 232.82	0.09	0.10
Solid Fuels	8 791.67	NCV	93.62	95.56	2.22		823.04	0.84	0.02
Gaseous Fuels	61 668.02	NCV	55.00	0.80	1.00		3 391.74	0.05	0.06
Biomass	64 796.56	NCV	100.68	166.22	4.07	[3]	6 523.54	10.77	0.26
Other Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
c. Agriculture/Forestry/Fisheries	32 796.19	NCV					1 996.71	1.04	0.56
Liquid Fuels	26 262.84	NCV	73.99	6.56	20.41		1 943.27	0.17	0.54
Solid Fuels	179.16	NCV	93.59	90.00	2.57		16.77	0.02	0.00
Gaseous Fuels	666.77	NCV	55.00	0.80	1.00		36.67	0.00	0.00
Biomass	5 687.41	NCV	103.30	150.00	4.32	[3]	587.54	0.85	0.02
Other Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
1.A.5 Other (Not elsewhere specified)[4]	**559.81**	NCV					**40.75**	**0.00**	**0.00**
Liquid Fuels	559.81	NCV	72.79	2.43	5.78		40.75	0.00	0.00
Solid Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Gaseous Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00
Biomass	0.00	NCV	0.00	0.00	0.00	[3]	0.00	0.00	0.00
Other Fuels	0.00	NCV	0.00	0.00	0.00		0.00	0.00	0.00

[4] Include military fuel use under this category.

Documentation Box:
1 A 1 c Petroleum Refining: CH4 and NMVOC emissions are included in "1 B 2 fugitive emissions from fuels".

TABLE 1.A(b) SECTORAL BACKGROUND DATA FOR ENERGY
CO_2 from Fuel Combustion Activities - Reference Approach (IPCC Worksheet 1-1)
(Sheet 1 of 1)

FUEL TYPES			Unit	Production	Imports	Exports	International bunkers	Stock change	Apparent consumption	Conversion factor [1] (TJ/Unit)	[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	832.84	8 118.19	0.00		4.83	8 946.20	42.75	NCV	382 449.96	20.00	7 649.00	0.00	7 649.00	0.99	27 765.87
		Orimulsion	Gg	NO	NO	NO		NO	0.00		NCV	0.00		0.00		0.00		0.00
		Natural Gas Liquids	Gg	54.68	0.00	0.00		0.00	54.68	45.22	NCV	2 472.72	17.20	42.53	0.00	42.53	0.99	154.39
	Secondary Fuels	Gasoline	Gg		708.79	498.09	0.00	-7.71	218.42	44.80	NCV	9 785.08	18.90	184.94	0.00	184.94	0.99	671.33
		Jet Kerosene	Gg		38.27	0.63	466.22	2.83	-431.40	44.59	NCV	-19 236.29	19.50	-375.11	0.00	-375.11	0.99	-1 361.64
		Other Kerosene	Gg		2.97	0.00	0.00	-0.35	3.32	44.75	NCV	148.39	19.60	2.91	0.00	2.91	0.99	10.56
		Shale Oil	Gg		NO	NO		NO	0.00		NCV	0.00		0.00		0.00		0.00
		Gas / Diesel Oil	Gg		3 462.73	519.88	0.00	2.06	2 940.78	43.33	NCV	127 424.13	20.20	2 573.97	0.00	2 573.97	0.99	9 343.50
		Residual Fuel Oil	Gg		241.44	146.04	0.00	117.48	-22.08	40.19	NCV	-887.23	21.10	-18.72		-18.72	0.99	-67.96
		LPG	Gg		155.44	6.70		1.71	147.02	47.31	NCV	6 955.52	17.20	119.63	0.00	119.63	0.99	434.27
		Ethane	Gg		IE	IE		IE	0.00		NCV	0.00		0.00	0.00	0.00		0.00
		Naphtha	Gg		IE	IE		IE	0.00		NCV	0.00		0.00	0.00	0.00		0.00
		Bitumen	Gg		248.22	62.38		1.42	184.42	40.19	NCV	7 411.68	22.00	163.06	531.01	-367.95	0.99	-1 335.65
		Lubricants	Gg		46.73	61.75	0.00	-1.65	-13.38	40.19	NCV	-537.78	20.00	-10.76	69.42	-80.17	0.99	-291.02
		Petroleum Coke	Gg		IE	IE		IE	0.00		NCV	0.00		0.00		0.00		0.00
		Refinery Feedstocks	Gg		593.35	6.45		96.30	490.60	42.50	NCV	20 850.54	20.00	417.01	0.00	417.01	0.99	1 513.75
		Other Oil	Gg		162.16	169.77		3.53	-11.13	40.19	NCV	-447.44	20.00	-8.95	570.33	-579.28	0.99	-2 102.80
Liquid Fossil Totals												536 389.28		10 739.51	1 170.76	9 568.76		34 734.59
Solid Fossil	Primary Fuels	Anthracite [2]	Gg	IE	IE	IE		IE	0.00		NCV	0.00		0.00		0.00		0.00
		Coking Coal	Gg	0.00	1 863.79	0.00		-34.39	1 898.19	28.00	NCV	53 149.24	25.80	1 371.25	0.00	1 371.25	0.98	4 927.36
		Other Bit. Coal	Gg	0.00	2 167.83	0.06	0.00	175.61	1 992.16	28.00	NCV	55 780.54	25.80	1 439.14	1.08	1 438.05	0.98	5 167.41
		Sub-bit. Coal	Gg	NO	NO	NO	NO	NO	0.00		NCV	0.00		0.00		0.00		0.00
		Lignite	Gg	1 411.82	5.39	0.12		-169.59	1 586.68	10.90	NCV	17 294.79	27.60	477.34	0.00	477.34	0.98	1 715.23
		Oil Shale	Gg	NO	NO	NO		NO	0.00		NCV	0.00		0.00		0.00		0.00
		Peat	Gg	0.50	0.00	0.00		0.00	0.50	8.80	NCV	4.40	28.90	0.13	0.00	0.13	0.98	0.46
	Secondary Fuels	BKB & Patent Fuel	Gg		66.17	0.00		0.00	66.17	19.30	NCV	1 277.10	25.80	32.95	0.00	32.95	0.98	118.40
		Coke Oven/Gas Coke	Gg		817.70	2.49		-48.08	863.30	28.20	NCV	24 345.00	29.50	718.18	888.21	-170.03	0.98	-610.98
Solid Fuel Totals												151 851.07		4 038.98	889.29	3 149.69		11 317.87
Gaseous Fossil		Natural Gas (Dry)	TJ	67 540.85	227 355.56	27 576.74		-12 286.55	279 606.22	1.00	NCV	279 606.22	15.30	4 277.98	158.13	4 119.84	1.00	15 030.55
Total												**967 846.56**		**19 056.47**	**2 218.18**	**16 838.28**		**61 083.01**
Biomass total												128 641.06		3 846.37	0.00	3 846.37		12 430.04
		Solid Biomass	TJ	127 715.37	6 576.55	7 234.41		0.00	127 057.52	1.00	NCV	127 057.52	29.90	3 799.02	0.00	3 799.02	0.88	12 258.17
		Liquid Biomass	TJ	IE	IE	IE		IE	0.00		NCV	0.00		0.00		0.00		0.00
		Gas Biomass	TJ	1 583.54	0.00	0.00		0.00	1 583.54	1.00	NCV	1 583.54	29.90	47.35	0.00	47.35	0.99	171.87

[1] To convert quantities expressed in natural units to energy units, use net calorific values (NCV). If gross calorific values (GCV) are used in this table, please indicate this by replacing "NCV" with "GCV" in this colur

[2] If Anthracite is not separately available, include with Other Bituminous Coa

TABLE 1.A(c) COMPARISON OF CO_2 EMISSIONS FROM FUEL COMBUSTION
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

FUEL TYPES	Reference approach		National approach [1]		Difference [2]	
	Energy consumption (PJ)	CO_2 emissions (Gg)	Energy consumption (PJ)	CO_2 emissions (Gg)	Energy consumption (%)	CO_2 emissions (%)
Liquid Fuels (excluding international bunkers)	536.39	34 734.59	468.98	34 859.49	14.37	-0.36
Solid Fuels (excluding international bunkers)	151.85	11 317.87	114.60	11 879.87	32.50	-4.73
Gaseous Fuels	279.61	15 030.55	264.68	14 557.29	5.64	3.25
Other [3]	NE	NE	12.47	518.27	-100.00	-100.00
Total [3]	**967.85**	**61 083.01**	**860.72**	**61 814.92**	**12.45**	**-1.18**

[1] "National approach" is used to indicate the approach (if different from the Reference approach) followed by the Party to estimate its CO_2 emissions from fuel combustion reported in the national GHG inventory.

[2] Difference of the Reference approach over the National approach (i.e. difference = 100% x ((RA-NA)/NA), where NA = National approach and RA = Reference approach).

[3] Emissions from biomass are not included.

Note: In addition to estimating CO_2 emissions from fuel combustion by sector, Parties should also estimate these emissions using the IPCC Reference approach, as found in the IPCC Guidelines, Worksheet 1-1(Volume 2. Workbook). The Reference approach is to assist in verifying the sectoral data. Parties should also complete the above tables to compare the alternative estimates, and if the emission estimates lie more than 2 percent apart, should explain the source of this difference in the documentation box provided.

Documentation Box:

Solid fuels: Energy consumption: National approach doesn't include non-energy use
CO2 emissions: CO2 emissions and fuel consumption from 2 iron & steel plants are reported by plant operators. The reported coke oven coke consumption of is not consistent with the energy balance for the year 2002

Gaseous fuels: Energy consumption: National approach doesn't include losses and non-energy-use.
CO2 emissions: National aproach uses sector specific carbon contents (different from IPCC reference factor).

Liquid fuels: Energy consumption: National approach doesn't include non-energy use and energy losses.
CO2 emissions: Heat values and carbon contents are sector and fuel specific. The energy statistic is mass balanced only.

Other fuels: The national 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)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

Additional information [a]

FUEL TYPE [1]	ACTIVITY DATA AND RELATED INFORMATION		IMPLIED EMISSION FACTOR	ESTIMATE	CO_2 not emitted	Subtracted from energy sector *(specify source category)*
	Fuel quantity (TJ)	Fraction of carbon stored	Carbon emission factor (t C/TJ)	of carbon stored in non-energy use of fuels (Gg C)	(Gg CO_2)	
Naphtha [2]	0.00	0.00	0.00	0.00	0.00	NA
Lubricants	3 470.81	1.00	20.00	69.42	254.53	NA
Bitumen	24 136.63	1.00	22.00	531.01	1 947.02	NA
Coal Oils and Tars (from Coking Coal)	0.00	1.00	0.00	0.00	0.00	NA
Natural Gas[2]	10 335.56	1.00	15.30	158.13	579.82	NA
Gas/Diesel Oil [2]	0.00	1.00	0.00	0.00	0.00	NA
LPG [2]	0.00	1.00	0.00	0.00	0.00	NA
Butane [2]	0.00	1.00	0.00	0.00	0.00	NA
Ethane [2]	0.00	0.00	0.00	0.00	0.00	NA
Other *(please specify)*						
Coke Oven Coke	30 108.77	1.00	29.50	888.21	3 256.77	NA
Other Bituminous Coal	42.03	1.00	25.80	1.08	3.98	NA
Gasoline	0.00	1.00	0.00	0.00	0.00	NA
Other Oil Products	28 516.73	1.00	20.00	570.33	2 091.23	NA
			0.00		0.00	

[1] Where fuels are used in different industries, please enter in different rows.
[2] Enter these fuels when they are used as feedstocks.

[a] The fuel lines continue from the table to the left.

Note: The table is consistent with the IPCC Guidelines. Parties that take into account the emissions associated with the use and disposal of these feedstocks could continue to use their methodology, and provide explanation notes in the documentation box below.

Documentation box: 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 the use of the energy carriers in the industrial production (e.g. fertilizer production), or during the use of the products (e.g. solvents, lubricants), or in both (e.g. monomers). To report associated emissions use the above table, filling an extra "Additional information" table, as shown below.

Associated CO_2 emissions (Gg)	Allocated under *(Specify source category)* [a]

[a] e.g. Industrial Processes, Waste Incineration, etc.

TABLE 1.B.1 SECTORAL BACKGROUND DATA FOR ENERGY
Fugitive Emissions from Solid Fuels
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTOR		EMISSIONS	
	Amount of fuel produced [1]	CH_4	CO_2	CH_4	CO_2
	(Mt)	(kg/t)	(kg/t)	(Gg)	(Gg)
1. B. 1. a. Coal Mining and Handling	1.23			0.26	0.00
i. Underground Mines[2]	NO	0.00	0.00	NO	NO
Mining Activities		0.00	0.00	NO	NO
Post-Mining Activities		0.00	0.00	NO	NO
ii. Surface Mines[2]	1.23	0.21	0.00	0.26	0.00
Mining Activities		0.21	0.00	0.26	NA
Post-Mining Activities		0.00	0.00	IE	NA
1. B. 1. b. Solid Fuel Transformation	1.40	0.00	0.00	IE	IE
1. B. 1. c. Other *(please specify)* [3]				NO	NO
		0.00	0.00		

Additional information [a]

Description	Value
Amount of CH_4 drained (recovered) and utilized or flared (Gg)	0.00
Number of active underground mines	0.00
Number of mines with drainage (recovery) systems	NE

[a] For underground mines.

[1] Use the documentation box to specify whether the fuel amount is based on the run-of-mine (ROM) production or on the saleable production.
[2] Emissions both for Mining Activities and Post-Mining Activities are calculated with the activity data in lines Underground Mines and Surface Mines respectively.
[3] Please click on the button to enter 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 (IE) and make a reference in Table 9 (completeness) and/or in the documentation box.

Documentation box:
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

TABLE 1.B.2 SECTORAL BACKGROUND DATA FOR ENERGY
Fugitive Emissions from Oil and Natural Gas
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA			IMPLIED EMISSION FACTORS			EMISSIONS		
	Description [1]	Unit	Value	CO_2 (kg/unit) [2]	CH_4 (kg/unit) [2]	N_2O (kg/unit) [2]	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)
1. B. 2. a. Oil [3]							**84.00**	**4.47**	
i. Exploration	(e.g. number of wells drilled)			0.00	0.00		IE	IE	
ii. Production[4]	Oil throughput	Mt	0.94	89 266 737.51	4 444 208.29		84.00	4.18	
iii. Transport	(e.g. PJ oil loaded in tankers)			0.00	0.00		NE	NE	
iv. Refining / Storage	Oil refined (SNAP 0401)	Mt	9.02	0.00	31 662.50		NA	0.29	
v. Distribution of oil products	Gasoline Consumption (SNAP 050	Mt	2.14	0.00	0.00		NA	NA	
vi. Other				0.00	0.00		NE	NE	
1. B. 2. b. Natural Gas							**83.03**	**9.72**	
Exploration				0.00	0.00				
i. Production [4] / Processing	Gas throughput (a)	Mm3 G	1 769.00	46 919.16	0.00		83.00	IE	
ii. Transmission	Pipelines length (km)	km	1 357.70	24.50	2 900.00		0.03	3.94	
Distribution	Gas Consumption	Mm3 G	7 799.34	0.00	741.39		0.00	5.78	
iii. Other Leakage	(e.g. PJ gas consumed)			0.00	0.00		NE	NE	
at industrial plants and power stations				0.00	0.00		NE	NE	
in residential and commercial sectors				0.00	0.00		NE	NE	
1. B. 2. c. Venting [5]							IE	IE	
i. Oil	(e.g. PJ oil produced)			0.00	0.00		IE	IE	
ii. Gas	(e.g. PJ gas produced)			0.00	0.00		IE	IE	
iii. Combined				0.00	0.00		IE	IE	
Flaring							IE	IE	IE
i. Oil	(e.g. PJ gas consumption)			0.00	0.00	0.00	IE	IE	IE
ii. Gas	(e.g. PJ gas consumption)			0.00	0.00	0.00	IE	IE	IE
iii. Combined				0.00	0.00	0.00	IE	IE	IE
1.B.2.d. Other *(please specify)* [6]							NO	NO	NO
				0.00	0.00	0.00			

Additional information

Description	Value	Unit
Pipelines length (km)	1 357.70	km
Number of oil wells	844.00	NUMBER
Number of gas wells	202.00	NUMBER
Gas throughput [a]	1 769.00	Mm3 GAS
Oil throughput [a]	0.94	Mt
Other relevant information *(specify)*		

[a] In the context of oil and gas production, throughput is a measure of the total production, such as barrels per day of oil, or cubic meters of gas per year. Specify the units of the reported value in the unit column. Take into account that these values should be consistent with the activity data reported under the production rows of the main table.

[1] Specify the activity data used and fill in the activity data description column, as given in the examples in brackets. Specify the unit of the activity data in the unit column. Use the document box to specify whether the fuel amount is based on the raw material production or on the saleable production. Note cases where more than one variable is used as activity data.

[2] The unit of the implied emission factor will depend on the units of the activity data used, and is therefore not specified in this column. The unit of the implied emission factor for each activity will be kg/unit of activity data.

[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.iii, 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 here. Parties using the IPCC software could report those emissions together, indicating so in the documentation box.

[6] For example, fugitive CO_2 emissions from production of geothermal power could be reported here.

Documentation box:
1 B 2 a i, 1 B 2 b Exploration and 1 B 2 b i 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 ii Transmission includes fugitve and venting.

TABLE 1.C SECTORAL BACKGROUND DATA FOR ENERGY
International Bunkers and Multilateral Operations
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS			EMISSIONS		
	Consumption (TJ)	CO_2 (t/TJ)	CH_4 (kg/TJ)	N_2O (kg/TJ)	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)
Marine Bunkers	**0.00**				NO	NO	NO
Gasoline	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gas/Diesel Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residual Fuel Oil	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lubricants	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other *(please specify)*	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0.00	0.00	0.00			
Aviation Bunkers	**20 788.70**				**1 512.24**	**0.03**	**0.05**
Jet Kerosene	20 788.70	72.74	1.25	2.61	1 512.24	0.03	0.05
Gasoline	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multilateral Operations [1]	**0.00**				**IE**	**IE**	**IE**

Additional information

Fuel consumption	Allocation [a] (percent)	
	Domestic	International
Marine	100.00	0.00
Aviation	4.70	95.30

[a] For calculating the allocation of fuel consumption, use the sums of fuel consumption by domestic navigation and aviation (Table 1.A(a)) and by international bunkers (Table 1.C).

[1] Parties may choose to report or not report the activity data and emission factors for multilateral operation consistent with the principle of confidentiality stated in the UNFCCC reporting guidelines on inventories. 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 marine bunker fuel emissions from fuel sold to ships or aircraft engaged in international transport should be excluded from national totals and reported separately for informational purposes only.

Documentation box: Please explain how the consumption of international marine and aviation bunkers fuels was estimated and separated from the domestic consumption.
Kerosene consumption in Austria is divided into national and international traffic by using national LTO-statistics.

TABLE 2(I) SECTORAL REPORT FOR INDUSTRIAL PROCESSES
(Sheet 1 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

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	**7 484.49**	**0.39**	**2.60**	**5 090.46**	**1 033.25**	**199.00**	**25.16**	**0.38**	**0.03**	**1.71**	**52.36**	**21.00**	**3.93**
A. Mineral Products	**2 910.66**	**0.04**	**0.00**							**0.00**	**10.03**	**5.41**	**0.00**
1. Cement Production	1 587.56												NA
2. Lime Production	546.61												
3. Limestone and Dolomite Use	264.75												
4. Soda Ash Production and Use	18.94												
5. Asphalt Roofing	NE	0.04									10.03	5.16	
6. Road Paving with Asphalt	NE									NE	NE	0.25	NE
7. Other *(please specify)*	492.81	0.00	0.00							0.00	0.00	0.00	0.00
Bricks and Tiles (decarbonizing)	119.28	NA	NA							NA	NA	NA	NA
MgCO3 Sinter Plants	373.53	NA	NA							NA	NA	NA	NA
B. Chemical Industry	**510.25**	**0.35**	**2.60**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.66**	**11.10**	**12.34**	**3.19**
1. Ammonia Production	445.12	0.07								0.22	0.03	IE	IE
2. Nitric Acid Production	0.37		2.60							0.37			
3. Adipic Acid Production			NO							NO	NO	NO	
4. Carbide Production	40.80	NE									NA	NA	NA
5. Other *(please specify)*	23.97	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	11.07	12.34	3.19
Other Chemical Products	23.97	0.28	NA	NA	NA	NA	NA	NA	NA	0.07	11.07	12.34	3.19
C. Metal Production	**4 063.58**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.23**	**30.64**	**0.41**	**0.75**
1. Iron and Steel Production	4 063.58	0.00								0.21	30.34	0.25	0.35
2. Ferroalloys Production	NE	NE								NE	NE	NE	NE
3. Aluminium Production	NO	NO					NO			NO	NO	NO	NO
4. SF_6 Used in Aluminium and Magnesium Foundries									0.00				
5. Other *(please specify)*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.30	0.16	0.40
SNAP 040309 Processes in non-ferrous metal industries	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02	0.30	0.16	0.40

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 only applies in sectors where methods exist for both tiers.

(1) The emissions of HFCs and PFCs are to be expressed as CO_2 equivalent emissions. Data on disaggregated emissions of HFCs and PFCs are to be provided in Table 2(II) of this common reporting format.

TABLE 2(I) SECTORAL REPORT FOR INDUSTRIAL PROCESSES
(Sheet 2 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

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**									**0.82**	**0.60**	**2.85**	**0.00**
1. Pulp and Paper										0.82	0.60	0.60	IE
2. Food and Drink[2]	NA											2.24	
E. Production of Halocarbons and SF_6					NO		NO		NO				
1. By-product Emissions					NO		NO		NO				
Production of HCFC-22					NO								
Other					NO		NO		NO				
2. Fugitive Emissions					NO		NO		NO				
3. Other *(please specify)*					NO		NO		NO				
F. Consumption of Halocarbons and SF_6				**5 090.46**	**1 033.25**	**199.00**	**25.16**	**0.38**	**0.03**				
1. Refrigeration and Air Conditioning Equipment				IE	288.72	IE	NO	IE	NO				
2. Foam Blowing				IE	737.60	IE	NO	IE	NO				
3. Fire Extinguishers				IE	5.87	IE	NO	IE	NO				
4. Aerosols/ Metered Dose Inhalers				IE	NO	IE	NO	IE	NO				
5. Solvents				IE	NO	IE	NO	IE	NO				
6. Semiconductor Manufacture				IE	1.06	IE	25.16	IE	0.01				
7. Electrical Equipment				IE	NO	IE	NO	IE	0.00				
8. Other *(please specify)*				NO	NO	NO	NO	NO	0.01				
G. Other *(please specify)*	**NO**	**NO**	**NO**	NO	NO	NO	NO	NO	NO	**0.00**	**0.00**	**0.00**	**0.00**

[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.

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			EMISSIONS[(2)]					
	Production/Consumption quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
	Description [(1)]	(kt)	(t/t)	(t/t)	(t/t)	(Gg)	(2)	(Gg)	(2)	(Gg)	(2)
A. Mineral Products						**2 910.66**		**0.04**		**0.00**	
1. Cement Production	Clinker Production [kt]	2 853.44	0.56			1 587.56					
2. Lime Production	Lime Produced [kt]	719.25	0.76			546.61					
3. Limestone and Dolomite Use	Limestone and Dolomite used [kt]	601.33	0.44			264.75					
4. Soda Ash						18.94					
Soda Ash Production	Soda Ash Production	NE	0.00			NE					
Soda Ash Use	Soda Ash Used [kt]	45.63	0.42			18.94					
5. Asphalt Roofing	Roofing Material Production [Mio m2	28.65	0.00			NE		0.04			
6. Road Paving with Asphalt	Asphalt Production [kt]	416.55	0.00			NE					
7. Other *(please specify)*						492.81		0.00		0.00	
Bricks and Tiles (decarbonizing)	Bricks Production [kt]	1 959.40	0.06			119.28					
MgCO3 Sinter Plants	MgCO3 sintered [kt]	307.77	1.21	0.00	0.00	373.53					
			0.00	0.00	0.00						
B. Chemical Industry						**510.25**		**0.35**		**2.60**	
1. Ammonia Production [(3)]	Ammonia Production [kt]	464.03	0.96	0.00	0.00	445.12		0.07		NA	
2. Nitric Acid Production	Nitric Acid Production [kt]	522.41			0.00	0.366				2.60	
3. Adipic Acid Production	Adipic Acid Production	NO			0.00					NO	
4. Carbide Production	Carbide Production	31.49	1.30	0.00		40.80		NE			
Silicon Carbide	Silicon Carbide Production	NO	0.00	0.00		NO		NO			
Calcium Carbide	Calcium Carbide Production	31.49	1.30	0.00		40.80		NE			
5. Other *(please specify)*						23.97		0.28		0.00	
Carbon Black	Carbon Black Production	NE		0.00				NE			
Ethylene	Ethylene Production [kt]	NE	0.00	0.00	0.00	NE		NE		NE	
Dichloroethylene	Dichloroethylene Production	NO		0.00				NO			
Styrene	Styrene Production [kt]	NO		0.00				NO			
Methanol	Methanol Production	NE		0.00				NE			
Other Chemical Products	Other Chemical Products [kt]	NA	0.00	0.00	0.00	23.97		0.28		NA	
			0.00	0.00	0.00						

[(1)] Where the IPCC Guidelines provide options for activity data, e.g. cement or clinker for estimating the emissions from Cement Production, specify the activity data used (as shown in the example in brackets) in order to make the choice of emission factor more transparent and to facilitate comparisons of implied emission factors.

[(2)] Enter cases in which the final emissions are reduced with the quantities of emission recovery, oxidation, destruction, transformation. Adjusted emissions are reported and the quantitative information on recovery, oxidation, destruction, and transformation should be given in the additional columns provided.

[(3)] To avoid double counting make offsetting deductions from fuel consumption (e.g. natural gas) in Ammonia Production, first for feedstock use of the fuel, and then to a sequestering use of the feedstock.

TABLE 2(I).A-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO_2, CH_4 and N_2O
(Sheet 2 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS			EMISSIONS[2]					
	Production/Consumption Quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
	Description [1]	(kt)	(t/t)	(t/t)	(t/t)	(Gg)	[2]	(Gg)	[2]	(Gg)	[2]
C. Metal Production [4]						**4 063.58**		**0.00**		**0.00**	
1. Iron and Steel Production			0.00			4 063.58		0.00			
Steel	Steel Production [kt]	6 192.98	0.12			714.68		0.00			
Pig Iron	Iron Production [kt]	4 712.49	0.71	0.00		3 348.91		NE			
Sinter	Sinter Production [kt]	3 527.74	0.00	0.00		IE		NE			
Coke	Coke Production [kt]	1 395.17	0.00	0.00		IE		NE			
Other *(please specify)*						0.00		0.00			
			0.00	0.00	0.00						
2. Ferroalloys Production	Ferroalloys Production [kt]	NE	0.00	0.00		NE		NE			
3. Aluminium Production	Aluminium production [kt]	NO	0.00	0.00		NO		NO			
4. SF_6 Used in Aluminium and Magnesium Foundries											
5. Other *(please specify)*						0.00		0.00		0.00	
SNAP 040309 Processes in non-ferrous r	Non-ferrous metal Productior	116.23	0.00	0.00	0.00	NA		NA		NA	
			0.00	0.00	0.00						
D. Other Production						**0.00**					
1. Pulp and Paper											
2. Food and Drink	Beer, Spirits Production [kt]	1 451.53	0.00			NA					
G. Other *(please specify)*						NO		NO		NO	
			0.00	0.00	0.00						

[4] More specific information (e.g. data on virgin and recycled steel production) could be provided in the documentation box

Note: In case of confidentiality of the activity data information, the entries should provide aggregate figures but there should be a note in the documentation box indicating this

Documentation box:
Emissions from Sinter and Coke Production is included in 1 A 2 a Iron and Steel. Soda Ash is only produced in the Solvay process in which no CO2 emissions are released.

TABLE 2(II) SECTORAL REPORT FOR INDUSTRIAL PROCESSES - EMISSIONS OF HFCs, PFCs AND SF_6
(Sheet 1 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

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	Total HFCs[1]	CF_4	C_2F_6	C_3F_8	C_4F_{10}	$c\text{-}C_4F_8$	C_5F_{12}	C_6F_{14}	Total PFCs[1]	SF_6
	(t)[2]																						
Total Actual Emissions of Halocarbons (by chemical) and SF_6	**0.55**	**1.75**	**0.00**	**0.00**	**21.90**	**0.00**	**653.07**	**452.23**	**0.00**	**13.57**	**0.17**	**0.00**	**0.00**		**1.47**	**1.70**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**		**28.32**
C. Metal Production															NO	NO	0.00	0.00	0.00	0.00	0.00		**0.32**
Aluminium Production															NO	NO	0.00	0.00	0.00	0.00	0.00		
SF_6 Used in Aluminium Foundries																							0.32
SF_6 Used in Magnesium Foundries																							NA
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
1. By-product Emissions	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
Production of HCFC-22	NO																						
Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
2. Fugitive Emissions	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
3. Other *(please specify)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		0.00
F(a). Consumption of Halocarbons and SF_6 (actual emissions - Tier 2)	0.55	1.75	NO	NO	21.90	NO	653.07	452.23	NO	13.57	0.17	NO	NO		1.47	1.70	NO	NO	NO	NO	NO		**28.00**
1. Refrigeration and Air Conditioning Equipment	NO	1.75	NO	NO	21.90	NO	134.30	0.79	NO	13.57	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
2. Foam Blowing	NO	NO	NO	NO	NO	NO	518.76	451.44	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
3. Fire Extinguishers	0.46	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.17	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
4. Aerosols/Metered Dose Inhalers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
5. Solvents	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
6. Semiconductor Manufacture	0.09	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		1.47	1.70	NO	NO	NO	NO	NO		13.56
7. Electrical Equipment																							4.08
8. Other *(please specify)*	NO	NO	NO	NO	NO	NO	0.00	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		10.36
research and other use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		1.86
stock or not identifiable	NO	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
heat pumps	NO	NO	NO	NO	NO	NO	0.00	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
Noise insulating windows	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		8.50
G. Other *(please specify)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO

(1) Although shaded, the columns with HFCs and PFCs totals on sheet 1 are kept for consistency with sheet 2 of the table.
(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].

Note: Where information is confidential the entries should provide aggregate figures but there should be a note indicating this in the relevant documentation boxes of the Sectoral background data tables or as a comment to the corresponding cell.
Gases with GWP not yet agreed upon by the COP, should be reported in Table 9 (Completeness), sheet 2.

TABLE 2(II) SECTORAL REPORT FOR INDUSTRIAL PROCESSES - EMISSIONS OF HFCs, PFCs AND SF_6
(Sheet 2 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

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	Total HFCs	CF_4	C_2F_6	C_3F_8	C_4F_{10}	$c\text{-}C_4F_8$	C_5F_{12}	C_6F_{14}	Total PFCs	SF_6
	(t)(2)																						
F(p). Total Potential Emissions of Halocarbons (by chemical) and SF_6 (3)	6.15	12.54	NO	NO	73.84	NO	1 668.07	753.64	NO	53.30	4.00	NO	NO		18.11	8.84	NO	NO	NO	NO	NO		44.21
Production(4)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		NO	NO	NO	NO	NO	NO	NO		NO
Import:	6.15	12.54	NO	NO	73.84	NO	1 668.07	753.64	NO	53.30	4.00	NO	NO		18.11	8.84	NO	NO	NO	NO	NO		44.21
In bulk	6.15	12.54	NO	NO	73.84	NO	1 668.07	753.64	NO	53.30	4.00	NO	NO		18.11	8.84	NO	NO	NO	NO	NO		44.21
In products (5)	IE	IE	NO	NO	IE	NO	IE	IE	NO	IE	IE	NO	NO		IE	IE	NO	NO	NO	NO	NO		IE
Export:	0.00	0.00	NO	NO	0.00	NO	0.00	0.00	NO	0.00	0.00	NO	NO		0.00	0.00	NO	NO	NO	NO	NO		0.00
In bulk	NE	NE	NO	NO	NE	NO	NE	NE	NO	NE	NE	NO	NO		NE	NE	NO	NO	NO	NO	NO		NE
In products (5)	NE	NE	NO	NO	NE	NO	NE	NE	NO	NE	NE	NO	NO		NE	NE	NO	NO	NO	NO	NO		NE
Destroyed amount	NE	NE	NO	NO	NE	NO	NE	NE	NO	NE	NE	NO	NO		NE	NE	NO	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 (6) (Gg CO_2 eq.)	**6.44**	**1.14**	**0.00**	**0.00**	**61.33**	**0.00**	**848.99**	**63.31**	**0.00**	**51.55**	**0.50**	**0.00**	**0.00**	**1 033.25**	**9.53**	**15.63**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**25.16**	**676.95**
C. Metal Production															NO	NO	NO	NO	NO	NO	NO	NO	7.65
E. Production of Halocarbons and SF_6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F(a). Consumption of Halocarbons and SF_6	6.44	1.14	NO	NO	61.33	NO	848.99	63.31	NO	51.55	0.50	NO	NO	1 033.25	9.53	15.63	NO	NO	NO	NO	NO	25.16	669.30
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Ratio of Potential/Actual Emissions from Consumption of Halocarbons and SF_6																							
Actual emissions - F(a) (Gg CO_2 eq.)	6.44	1.14	NO	NO	61.33	NO	848.99	63.31	NO	51.55	0.50	NO	NO	1 033.25	9.53	15.63	NO	NO	NO	NO	NO	25.16	669.30
Potential emissions - F(p) (7) (Gg CO_2 eq.)	71.96	8.15	NO	NO	206.75	NO	2 168.49	105.51	NO	202.54	11.60	NO	NO	2 774.99	117.72	81.28	NO	NO	NO	NO	NO	199.00	1 056.62
Potential/Actual emissions ratio	11.18	7.18	0.00	0.00	3.37	0.00	2.55	1.67	0.00	3.93	23.42	0.00	0.00	2.69	12.35	5.20	0.00	0.00	0.00	0.00	0.00	7.91	1.58

(3) Potential emissions of each chemical of halocarbons and SF6 estimated using Tier 1a or Tier 1b of the IPCC Guidelines (Volume 3. Reference Manual, pp. 2.47-2.50). When potential emissions estimates are available in a disaggregated manner corresponding to the subsectors for actual emissions defined on sheet 1 of this table, these should be reported in an annex to sheet 2, using the format of sheet 1, sector F(a). Use Summary 3 of this common reporting format to indicate whether Tier 1a or Tier 1b was used.

(4) Production refers to production of new chemicals. Recycled substances could be included here, but it should be ensured that double counting of emissions is avoided. Relevant explanations should be provided as a comment to the corresponding cell.

(5) Relevant just for Tier 1b.

(6) Sums of the actual emissions of each chemical of halocarbons and SF6 from the source categories given in sheet 1 of the table multiplied by the corresponding GWP values.

(7) Potential emissions of each chemical of halocarbons and SF6 taken from row F(p) multiplied by the corresponding GWP values.

Note: As stated in the revised UNFCCC 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 equivalents. 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.

TABLE 2(II). C, E SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Metal Production; Production of Halocarbons and SF_6
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS[2]	EMISSIONS[2]	
	Description [1]	(t)	(kg/t)	(t)	[3]
C. PFCs and SF_6 from Metal Production					
PFCs from Aluminium Production					
CF_4	Aluminium production [kt]	NO	0.00	NO	
C_2F_6	Aluminium production [kt]	NO	0.00	NO	
SF_6				0.32	
Aluminium Foundries	cast Aluminium [t]	C	0.00	0.32	
Magnesium Foundries	cast Magnesium [t]	3 600.00	#WERT!	NA	
E. Production of Halocarbons and SF_6					
1. By-product Emissions					
Production of HCFC-22					
HFC-23	HFC-23 production	NO	0.00	NO	
Other *(specify chemical)*					
			0.00		
2. Fugitive Emissions					
HFCs *(specify chemical)*					
			0.00		
PFCs *(specify chemical)*					
			0.00		
SF_6	NO		0.00	NO	
3. Other *(please specify)*					
			0.00		

[1] Specify the activity data used as shown in the examples within brackets. Where applying Tier 1b (for C), Tier 2 (for E) and country specific methods, specify any other relevant activity data used in the documentation box below.

[2] Emissions and implied emission factors are after recovery.

[3] Enter cases in which the final emissions are reported after subtracting the quantities of emission recovery, oxidation, destruction, transformation. Enter these quantities in the specified column and use the documentation box for further explanations.

Note: Where the activity data are confidential, the entries should provide aggregate figures, but there should be a note in the documentation box indicating this

Documentation box:
Potential emissions of HFC-23, HFC-32, HFC-125, HFC-143a, HFC-227ea, CF4, C2F6 and SF6 of "import in products" are included in "import in bulk".

TABLE 2(II).F SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Consumption of Halocarbons and SF_6
(Sheet 1 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA *Amount of fluid*			IMPLIED EMISSION FACTORS			EMISSIONS		
	Filled in new manufactured products	In operating systems (average annual stocks)	Remained in products at decommissioning [1]	Product manufacturing factor	Product life factor	Disposal loss factor	From manufacturing	From stocks	From disposal
	(t)			(% per annum)			(t)		
1 Refrigeration									
Air Conditioning Equipment									
Domestic Refrigeration *(Specify chemical)* [2]									
HFC-134a	0.00	74.88	NE	NE	1.50	NE	NE	1.12	NE
Commercial Refrigeration									
HFC-134a	4.00	32.00	NE	NE	1.50	NE	NE	0.48	NE
Transport Refrigeration									
HFC-134a	5.00	37.27	2.50	NE	10.00	NE	NO	3.73	NE
Industrial Refrigeration									
HFC-152a	1.24	10.60	NE	NE	7.48	NE	NE	0.79	NE
HFC-32	2.42	6.14	NE	NE	7.59	NE	NE	0.47	NE
HFC-143a	52.78	176.96	NE	NE	7.58	NE	NE	13.41	NE
HFC-125	62.40	270.17	NE	NE	7.54	NE	NE	20.38	NE
HFC-134a	126.40	551.90	NE	NE	7.53	NE	NE	41.58	NE
Stationary Air-Conditioning									
HFC-32	10.12	18.46	NE	NE	6.93	NE	NE	1.28	NE
HFC-143a	0.52	2.08	NE	NE	7.55	NE	NE	0.16	NE
HFC-125	11.44	21.83	NE	NE	6.98	NE	NE	1.52	NE
HFC-134a	32.92	126.76	NE	NE	6.63	NE	NE	8.41	NE
Mobile Air-Conditioning									
HFC-134a	145.93	659.60	NE	NE	11.98	NE	NE	78.99	NE
2 Foam Blowing									
Hard Foam									
HFC-152a	752.40	451.44	NE	NE	100.00	NE	NE	451.44	NE
HFC-134a	752.40	299.15	NE	NE	1.51	NE	NE	4.51	NE
Soft Foam									
HFC-134a	530.40	519.92	NE	NE	98.91	NE	NE	514.25	NE

[1] Parties should use the documentation box to provide information on the amount of the chemical recovered (recovery efficiency) and other relavant information used in the emission estima

[2] Please click on the button to specify the chemical consumed, as given in the example. If needed, new rows could be added for reporting the disagregated chemicals from a source by clicking on the corresponding but

Note: Table 2.(II).F provides for reporting of the activity data and emission factors used to calculate actual emissions from consumption of halocarbons and SF6 using the "bottom-up approach" (based on the total stock of equipr and estimated emission rates from this equipment). Some Parties may prefer to estimate their actual emissions following the alternative "top-down approach" (based on annual sales of equipment and/or gas). These Parties should provide the activity data used in the current format and any other relevant information in the documentation box at the end of Table2(II)Fs2. Data these Parties should provide includes (1) the amount of fluid used to fill new products, (2) the amount of fluid used to service existing products, (3) the amount of fluid originally used to fill retiring products (the total nameplate capacity of retiring products), (4) the product lifetime, and (5) the growth rate of product sales, if this has been used to calculate the amount of fluid originally used to fill retiring products. Alternatively, Parties may provide alternative formats with equivalent information. These formats may be considered for future versions of the common reporting format after the trial period.

TABLE 2(II).F SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Consumption of Halocarbons and SF_6
(Sheet 2 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA *Amount of fluid*			IMPLIED EMISSION FACTORS			EMISSIONS		
	Filled in new manufactured products	In operating systems (average annual stocks)	Remained in products at decommissioning [1]	Product manufacturing factor	Product life factor	Disposal loss factor	From manufacturing	From stocks	From disposal
	(t)			(% per annum)			(t)		
3 Fire Extinguishers									
HFC-227ea	4.00	11.50	NE	NE	1.50	NE	NE	0.17	NE
HFC-23	5.00	31.00	NE	NE	1.50	NE	NE	0.46	NE
4 Aerosols									
Metered Dose Inhalers									
Other									
5 Solvents									
6 Semiconductors									
SF6	14.75	13.56	NE	NE	NE	NE	NE	13.56	NE
C2F6	8.84	NE	NE	NE	NE	NE	NE	1.70	NE
CF4	18.11	NE	NE	NE	NE	NE	NE	1.47	NE
HFC-23	1.15	NE	NE	NE	NE	NE	NE	0.09	NE
7 Electric Equipment									
SF6	4.77	104.60	NE	NE	NE	NE	NE	4.08	NE
8 Other *(please specify)*									
research and other use	2.49	3.81	NE	NE	NE	NE	NE	1.86	NE
stock or not identifiable	65.60	NE	NE	NE	NE	NE	NE	NE	NE
heat pumps	5.42	95.29	NE	NE	0.00	NE	NE	0.00	NE
Noise insulating windows	22.20	262.00	NE	NE	NE	NE	NE	8.50	NE

Note: Where the activity data are confidential, the entries should provide aggregate figures, but there should be a note indicating this and explanations in the documentation box.

Documentation box:
For the category 2 F 8 stock or not identifiable only potential emissions are reported.

TABLE 3 SECTORAL REPORT FOR SOLVENT AND OTHER PRODUCT USE
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2	N_2O	NMVOC
	(Gg)		
Total Solvent and Other Product Use	**193.60**	**0.75**	**82.63**
A. Paint Application	**59.60**	**NA**	**23.48**
B. Degreasing and Dry Cleaning	**25.64**	**NA**	**9.58**
C. Chemical Products, Manufacture and Processing	**25.84**		**11.77**
D. Other *(please specify)*	82.52	0.75	37.80
Use of N2O for Anaesthesia	NA	0.35	NA
N2O from Fire Extinguishers	NA	NE	NA
N2O from Aerosol Cans	NA	0.40	NA
Other Solvent Use	82.52	NA	37.80

Please account for the quantity of carbon released in the form of NMVOC in both the NMVOC and the CO_2 columns.

Note: 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 additional information (activity data and emission factors) used to make these estimates in the documentation box to Table 3.A-D.

TABLE 3.A-D SECTORAL BACKGROUND DATA FOR SOLVENT AND OTHER PRODUCT USE
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS	
	Description	(kt)	CO_2 (t/t)	N_2O (t/t)
A. Paint Application	Solvents used [kt]	53.16	**1.12**	**0.00**
B. Degreasing and Dry Cleaning	Solvents used [kt]	17.77	**1.44**	**0.00**
C. Chemical Products, Manufacture and Processing	**Solvents used [kt]**	**97.37**		
D. Other *(please specify)* [(1)]				
Use of N2O for Anaesthesia	Use of N2O for Anaesthesia [kt	0.35	0.00	1.00
N2O from Fire Extinguishers	N2O from Fire Extinguishers	NE	0.00	0.00
N2O from Aerosol Cans	N2O from Aerosol Cans	0.40	0.00	1.00
Other Solvent Use	Solvents used [kt]	52.23	1.58	0.00

(1) Some probable sources are provided in brackets. Complement the list with other relevant sources. Make sure that the order is the same as in Table 3.

Note: The table follows the format of the IPCC Sectoral Report for Solvent and Other Product Use, although some of the source categories are not relevant to the direct GHG emissions.

Documentation box:

TABLE 4 SECTORAL REPORT FOR AGRICULTURE
(Sheet 1 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4	N_2O	NO_x	CO	NMVOC
	(Gg)				
Total Agriculture	**190.35**	**10.98**	**4.85**	**1.72**	**1.94**
A. Enteric Fermentation	**147.83**				
1. Cattle	138.62				
Dairy Cattle	60.93				
Non-Dairy Cattle	77.69				
2. Buffalo	NO				
3. Sheep	2.43				
4. Goats	0.29				
5. Camels and Llamas	NO				
6. Horses	1.53				
7. Mules and Asses	IE				
8. Swine	4.96				
9. Poultry	NE				
10. Other *(please specify)*	NE				
Deer	NE				
B. Manure Management	**42.02**	**2.26**			**NE**
1. Cattle	21.65				
Dairy Cattle	11.19				
Non-Dairy Cattle	10.45				
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	19.20				
9. Poultry	0.98				

TABLE 4 SECTORAL REPORT FOR AGRICULTURE
(Sheet 2 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4	N_2O	NO_x	CO	NMVOC
	(Gg)				
B. Manure Management (continued)					
10. Anaerobic Lagoons		NO			NE
11. Liquid Systems		2.26			NA
12. Solid Storage and Dry Lot		IE			NE
13. Other *(please specify)*		0.00			0.00
Deer	0.01	IE			NA
C. Rice Cultivation	NO				NO
1. Irrigated	NO				NO
2. Rainfed	NO				NO
3. Deep Water	NO				NO
4. Other *(please specify)*	NO				0.00
D. Agricultural Soils [(1)]	**0.43**	**8.72**	**4.84**		**1.73**
1. Direct Soil Emissions	0.43	4.80			1.73
2. Animal Production	IE	0.69			IE
3. Indirect Emissions	IE	3.23			IE
4. Other *(please specify)*	0.00	0.00			0.00
E. Prescribed Burning of Savannas	**NO**	**NO**	**NO**	**NO**	**NO**
F. Field Burning of Agricultural Residues	**0.07**	**0.00**	**0.01**	**1.72**	**0.22**
1 . Cereals	0.05	0.00	0.01	1.50	0.16
2. Pulse	NO	NO	NO	NO	NO
3 . Tuber and Root	NO	NO	NO	NO	NO
4 . Sugar Cane	NO	NO	NO	NO	NO
5 . Other *(please specify)*	0.02	0.00	0.00	0.22	0.05
Vine	0.02	0.00	0.00	0.22	0.05
G. Other *(please specify)*	NO	NO	NO	NO	NO

[(1)] 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 category of the sector Agriculture should indicate the amount [Gg] of these emissions or removals in the documentation box to Table 4.D. Additional information (activity data, implied emissions factors) should also be provided using the relevant documentation box to Table 4.D. This table is not modified for reporting the CO_2 emissions and removals for the sake of consistency with the IPCC tables (i.e. IPCC Sectoral Report for Agriculture).

Note: The IPCC Guidelines do not provide methodologies for the calculation of CH_4 emissions, CH_4 and N_2O removals from agricultural soils, or CO_2 emissions from savanna burning or agricultural residues burning. If you have reported such data, you should provide additional information (activity data and emission factors) used to make these estimates using the relevant documentation boxes of the Sectoral background data tables.

TABLE 4.A SECTORAL BACKGROUND DATA FOR AGRICULTURE
Enteric Fermentation
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA[1] AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTORS
	Population size [2] (1000 head)	Average daily feed intake (MJ/day)	CH_4 conversion (%)	CH_4 (kg CH_4/head/yr)
1. Cattle	2 067	198.2	6.00	67.06
Dairy Cattle[3]	589	262.9	6.00	103.45
Non-Dairy Cattle	1 478	133.6	6.00	52.57
2. Buffalo	NO	NO	NO	0.00
3. Sheep	304	NE	NE	8.00
4. Goats	58	NE	NE	5.00
5. Camels and Llamas	NO	NO	NO	0.00
6. Horses	85	NE	NE	18.00
7. Mules and Asses	IE	NE	NE	0.00
8. Swine	3 305	NE	NE	1.50
9. Poultry	12 572	NE	NE	0.00
10. Other *(please specify)*				
Deer	38	NE	NE	#WERT!
				0.00

Additional information (for Tier 2)[a]

Disaggregated list of animals [b]		Dairy Cattle	Non-Dairy Cattle	Other *(specify)*	
Indicators:					
Weight	(kg)	600.00	406.46		
Feeding situation [c]		NE	NE		
Milk yield	(kg/day)	15.03	NO		
Work	(hrs/day)	NE	NE		
Pregnant	(%)	NE	NE		
Digestibility of feed	(%)	73.91	71.50		

[a] Compare to 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.

[1] In the documentation boxes to all Sectoral background data tables for Agriculture, Parties should provide information on whether the activity data is one year or a 3-year average.

[2] Parties are encouraged to provide detailed livestock population data by animal type and region in a separate table below the documentation box. This consistent set of animal population statistics should be used to estimate CH_4 emissions from enteric fermentation, CH_4 and N_2O from manure management, N_2O direct emissions from soil and N_2O 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.

[3] Including data on dairy heifers, if available.

Documentation box:
Population statistics are on a yearly basis.
NMVOC emissions of 4 D 2 and 4 D 3 are included in 4 D 1.
Emissions of "4 B 12 Solid Storage and Dry Lot" are included in "4 B 11 Liquid Systems".

TABLE 4.B(a) SECTORAL BACKGROUND DATA FOR AGRICULTURE
CH_4 Emissions from Manure Management
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Population size [1] (1000 head)	Allocation by climate region [2] (%) Cool	Temperate	Warm	Typical animal mass (kg)	VS[3] daily excretion (kg dm/head/yr)	CH_4 producing potential (Bo)[3] (CH_4 m^3/kg VS)	IMPLIED EMISSION FACTORS CH_4 (kg CH_4/head/yr)
1. Cattle	2 067	100.0	0.0	0.0	503.2	1 052.1	0.2	10.47
Dairy Cattle[4]	589	100.0	0.0	0.0	600.0	1 441.2	0.2	19.00
Non-Dairy Cattle	1 478	100.0	0.0	0.0	406.5	663.0	0.2	7.07
2. Buffalo	NO	NO	NO	NO	NO	NO	NO	0.00
3. Sheep	304	100.0	0.0	0.0	43.0	146.0	0.2	0.19
4. Goats	58	100.0	0.0	0.0	30.0	102.2	0.2	0.12
5. Camels and Llamas	NO	NO	NO	NO	0.0	0.0	0.0	0.00
6. Horses	85	100.0	0.0	0.0	238.0	627.8	0.3	1.39
7. Mules and Asses	IE	IE	IE	IE	238.0	627.8	0.3	0.00
8. Swine	3 305	100.0	0.0	0.0	82.0	148.8	0.5	5.81
9. Poultry	12 572	100.0	0.0	0.0	1.1	36.5	0.3	0.08

[1] See footnote 1 to Table 4.A of this common reporting format.

[2] Climate regions are defined in terms of annual average temperature as follows: Cool=less than 15°C; Temperate=15°C to 25°C inclusive; and Warm=greater than 25°C (see Table 4.2 of the IPCC Guidelines (Volume 3, Reference Manual, p. 4.8)).

[3] VS=Volatile Solids; Bo=maximum methane producing capacity for manure IIPCC Guidelines (Volume 3, Reference Manual, p.4.23 and p. 4.15.

[4] Including data on diary heifers, if available.

Documentation Box:
Population statistics are on a yearly basis 4 B 7 Mules and Asses" are included in "4 B 6 Horses"

Additional information (for Tier 2)

Animal category[a]	Indicator	Climate region	Animal waste management system: Anaerobic lagoon	Liquid system	Daily spread	Solid storage and dry lot	Pasture range paddock	Other
Dairy Cattle	Allocation(%)	Cool	0.00	18.95	0.00	70.40	10.65	0.00
		Temperate	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO
	MCF[b]	Cool	90.00	39.00	0.00	1.00	1.00	1.00
		Temperate	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO
Non-Dairy Cattle	Allocation(%)	Cool	0.00	23.93	0.00	66.33	9.74	0.00
		Temperate	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO
	MCF[b]	Cool	90.00	39.00	0.00	1.00	1.00	1.00
		Temperate	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO
Swine	Allocation(%)	Cool	0.00	71.48	0.00	28.52	0.00	0.00
		Temperate	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO
	MCF[b]	Cool	90.00	39.00	0.00	1.00	1.00	1.00
		Temperate	NO	NO	NO	NO	NO	NO
		Warm	NO	NO	NO	NO	NO	NO

[a] Copy the above table as many times as necessary.

[b] MCF = Methane Conversion Factor (IPCC Guidelines, (Volume 3. Reference Manual, p. 4.9)). In the case of use of other climate region categorization, please 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 (1)	Nitrogen excretion	Nitrogen excretion per animal waste management system (kg N/yr)					
	(1000s)	(kg N/head/yr)	Anaerobic lagoon	Liquid system	Daily spread	Solid storage and dry lot	Pasture range and paddock	Other
Non-Dairy Cattle	1 478	34.2	NO	11 808 832.0	0.0	32 391 652.9	6 322 218.1	0.0
Dairy Cattle	589	65.3	NO	7 309 489.2	0.0	27 083 581.0	4 077 925.6	0.0
Sheep	304	20.0	NO	0.0	0.0	121 745.6	5 295 933.6	669 600.8
Swine	3 305	17.7	NO	19 233 408.6	0.0	7 759 241.2	0.0	0.0
Poultry	12 572	0.9	NO	1 411 400.0	0.0	108 569.2	217 138.5	9 119 815.2
Other *(please specify)*								
Goats	58	20.0	NO	0.0	0.0	0.0	1 110 566.4	46 273.6
Horses	85	50.0	NO	0.0	0.0	0.0	4 080 000.0	170 000.0
Deer	38	20.0	NO	0.0	0.0	0.0	738 720.0	30 780.0
Total per AWMS(2)			**0.0**	**39 763 129.8**	**0.0**	**67 464 789.9**	**21 842 502.1**	**10 036 469.6**

IMPLIED EMISSION FACTORS	
Emission factor per animal waste management system ($kg N_2O$-N/kg N)	
Anaerobic lagoon	0.000
Liquid system	0.036
Solid storage and dry lot	0.000
Other	0.000

(1) See footnote 1 to Table 4.A of this common reporting format
(2) AWMS - Animal Waste Management System

Documentation box:
Population statistics are on a yearly basis 4 B 7 Mules and Asses" are included in "4 B 6 Horses"

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			0.00	NO
Intermittently Flooded	Single Aeration	NO			0.00	NO
	Multiple Aeration	NO			0.00	NO
2. Rainfed						NO
Flood Prone		NO			0.00	NO
Drought Prone		NO			0.00	NO
3. Deep Water						NO
Water Depth 50-100 cm		NO			0.00	NO
Water Depth > 100 cm		NO			0.00	NO
4. Other *(please specify)*						NO
		NO			0.00	NO
Upland Rice(4)		NO				
Total (4)		0.00				

(1) The implied emission factor takes account of all relevant corrections for continuously flooded fields without organic amendment plus the correction for the organi amendments, if used, as well as of the effect of different soil characteristics, if taken into account, on methane emissions.

(2) Harvested area is the cultivated area multiplied by the number of cropping seasons per yeaı

(3) Specify dry weight or wet weight for organic amendments

(4) These rows are included to allow comparison with the international statistics. Upland rice emissions are assumed to be zero and are ignored in the emission calculation

Documentation box:
When dissagregating by more than one region within a country, provide additional information in the documentation box. Where available, provide activity data and scaling factors by soil type and rice cultivar.
There is no rice cultivation in Austria

TABLE 4.D SECTORAL BACKGROUND DATA FOR AGRICULTURE

Agricultural Soils[1]

(Sheet 1 of 1)

Austria

2002

Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION Description	Value	IMPLIED EMISSION FACTORS Unit		EMISSIONS ($Gg N_2O$)
Direct Soil Emissions	**N input to soils (kg N/yr)**				**4.80**
Synthetic Fertilizers	Use of synthetic fertilizers (kg N/yr)	104 330 033	(kg N2O-N/kg N)[2]	0.013	2.05
Animal Wastes Applied to Soils	Nitrogen input from manure applied to soils (kg N/yr)	93 580 363	(kg N2O-N/kg N)[2]	0.013	1.84
N-fixing Crops	pulses and soybeans produced (kg N fixed/yr)	19 150 440	(kg N2O-N/kg dry biomass)[2]	0.013	0.38
Crop Residue	N-input from Dry production of other crops (kg N/yr)	27 359 207	(kg N2O-N/kg dry biomass)[2]	0.013	0.54
Cultivation of Histosols	Area of cultivated organic soils (ha)	NO	(kg N2O-N/ha)[2]	0.000	NO
Animal Production	**N excretion on pasture range and paddock (kg N/yr)**	**21 842 502**	**(kg N2O-N/kg N)[2]**	**0.020**	**0.69**
Indirect Emissions					**3.23**
Atmospheric Deposition	Volatized N (NH_3 and NOx) from fertilizers and animal wastes (kg N/yr)	23 232 570	(kg N2O-N/kg N)[2]	0.010	0.37
Nitrogen Leaching and Run-off	N from fertilizers and animal wastes that is lost through leaching and run off (kg N/yr)	72 895 640	(kg N2O-N/kg N)[2]	0.025	2.86
Other *(please specify)*					**0.00**
				0.000	

Additional information

Fraction [a]	Description	Value
$Frac_{BURN}$	Fraction of crop residue burned	0.007
$Frac_{FUEL}$	Fraction of livestock N excretion in excrements burned for fuel	0.000
$Frac_{GASF}$	Fraction of synthetic fertilizer N applied to soils that volatilizes as NH_3 and NOx	0.029
$Frac_{GASM}$	Fraction of livestock N excretion that volatilizes as NH_3 and NOx	0.177
$Frac_{GRAZ}$	Fraction of livestock N excreted and deposited onto soil during grazing	0.161
$Frac_{LEACH}$	Fraction of N input to soils that is lost through leaching and runoff	0.300
$Frac_{NCRBF}$	Fraction of N in non-N-fixing crop	0.005
$Frac_{NCRO}$	Fraction of N in N-fixing crop	0.015
$Frac_R$	Fraction or crop residue removed from the field as crop	0.341

[a] Use the fractions as specified in the IPCC Guidelines (Volume 3. Reference Manual, pp. 4.92 - 4.113).

[1] 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 category should indicate the amount [Gg] of these emissions or removals and relevant additional information (activity data, implied emissions factors) in the documentation box.

[2] To convert from N_2O-N to N_2O emissions, multiply by 44/28.

Documentation box:

TABLE 4.E SECTORAL BACKGROUND DATA FOR AGRICULTURE
Prescribed Burning of Savannas
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION					IMPLIED EMISSION FACTORS		EMISSIONS	
	Area of savanna burned (k ha/yr)	Average aboveground biomass density (t dm/ha)	Fraction of savanna burned	Biomass burned (Gg dm)	Nitrogen fraction in biomass	(kg/t dm)		(Gg)	
						CH_4	N_2O	CH_4	N_2O
(specify ecological zone)								NO	NO
	NO					0.00	0.00	NO	NO

Additional information

	Living	Dead
Fraction of aboveground biomass		
Fraction oxidized		
Carbon fraction		

Documentation box:
No occurrance of savannas in Austria

TABLE 4.F SECTORAL BACKGROUND DATA FOR AGRICULTURE
Field Burning of Agricultural Residues
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION						IMPLIED EMISSION FACTORS		EMISSIONS	
	Crop production (t)	Residue/ Crop ratio	Dry matter fraction	Fraction burned in fields	Biomass burned (Gg dm)	Nitrogen fraction in biomass of residues	CH_4 (kg/t dm)	N_2O (kg/t dm)	CH_4 (Gg)	N_2O (Gg)
1. Cereals									**0.05**	**0.00**
Wheat	NA	NA	NA	NA	30.00	NA	1.78	0.12	0.05	0.00
NA	NA	NA	NA	NA	IE	NA	0.00	0.00	IE	IE
Maize	NA	NA	NA	NA	IE	NA	0.00	0.00	IE	IE
Oats	NA	NA	NA	NA	IE	NA	0.00	0.00	IE	IE
Rye	NA	NA	NA	NA	IE	NA	0.00	0.00	IE	IE
Rice	NO	NO	NO	NO	NO	NO	0.00	0.00	NO	NO
Other *(please specify)*									0.00	0.00
							0.00	0.00		
2. Pulse [(1)]									NO	NO
Dry bean	NO	NO	NO	NO	NO	NO	0.00	0.00	NO	NO
Peas	NO	NO	NO	NO	NO	NO	0.00	0.00	NO	NO
Soybeans	NO	NO	NO	NO	NO	NO	0.00	0.00	NO	NO
Other *(please specify)*									0.00	0.00
							0.00	0.00		
3 Tuber and Root									NO	NO
Potatoes	NO	NO	NO	NO	NO	NO	0.00	0.00	NO	NO
Other *(please specify)*									0.00	0.00
							0.00	0.00		
4 Sugar Cane	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**0.00**	**0.00**	**NO**	**NO**
5 Other *(please specify)*									**0.02**	**0.00**
Vine	NE	NE	NE	NE	87.28	NE	0.21	0.00	0.02	0.00

(1) To be used in Table 4.D of this common reporting format.

Documentation Box:
Wheat includes cereals total

TABLE 5 SECTORAL REPORT FOR LAND-USE CHANGE AND FORESTRY
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	Net CO_2 emissions/ removals	CH_4	N_2O	NO_x	CO
	(Gg)						
Total Land-Use Change and Forestry	**22 174.94**	**-29 808.30**	**-7 633.36**	**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks	**22 174.94**	**-29 808.30**	**-7 633.36**				
1. Tropical Forests	NO	NO	0.00				
2. Temperate Forests	22 174.94	-29 808.30	-7 633.36				
3. Boreal Forests	NO	NO	0.00				
4. Grasslands/Tundra	NE	NE	0.00				
5. Other *(please specify)*	0.00	0.00	0.00				
Harvested Wood [(1)]	NE	NE	0.00				
			0.00				
B. Forest and Grassland Conversion [(2)]	IE			NO	NO	NO	NO
1. Tropical Forests	NO			NO	NO	NO	NO
2. Temperate Forests	IE			NO	NO	NO	NO
3. Boreal Forests	NO			NO	NO	NO	NO
4. Grasslands/Tundra	NE			NO	NO	NO	NO
5. Other *(please specify)*	NO			NO	NO	NO	NO
C. Abandonment of Managed Lands	IE	IE	IE				
1. Tropical Forests	NO	NO	0.00				
2. Temperate Forests	IE	IE	0.00				
3. Boreal Forests	NO	NO	0.00				
4. Grasslands/Tundra	NE	NE	0.00				
5. Other *(please specify)*	NO	NO	0.00				
			0.00				
D. CO_2 Emissions and Removals from Soil	NE	NE	NE				
Cultivation of Mineral Soils	NE	NE	0.00				
Cultivation of Organic Soils	NE	NE	0.00				
Liming of Agricultural Soils	NE	NE	0.00				
Forest Soils	NE	NE	0.00				
Other *(please specify)* [(3)]	NO	NO	0.00				
			0.00				
E. Other *(please specify)*	NO	NO	NO	NO	NO	NO	NO
			0.00				

(1) Following the IPCC Guidelines, the harvested wood should be reported under Changes in Forest and Other Woody Biomass Stocks (Volume 3. Reference Manual, p.5.17).

(2) Include only the emissions of CO_2 from Forest and Grassland Conversion. Associated removals should be reported under section D.

(3) Include emissions from soils not reported under sections A, B and C.

Note: See footnote 4 to Summary 1.A of this common reporting format.

TABLE 5.A SECTORAL BACKGROUND DATA FOR LAND-USE CHANGE AND FORESTRY
Changes in Forest and Other Woody Biomass Stocks
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES			ACTIVITY DATA		IMPLIED EMISSION FACTORS	ESTIMATES
			Area of forest/biomass stocks (kha)	Average annual growth rate (t dm/ha)	Implied carbon uptake factor (t C/ha)	Carbon uptake increment (Gg C)
Tropical	Plantations	*Acacia spp.*	NO		0.00	0.00
		Eucalyptus spp.	NO		0.00	0.00
		Tectona grandis	NO		0.00	0.00
		Pinus spp	NO		0.00	0.00
		Pinus caribaea	NO		0.00	0.00
		Mixed Hardwoods	NO		0.00	0.00
		Mixed Fast-Growing Hardwoods	NO		0.00	0.00
		Mixed Softwoods	NO		0.00	0.00
	Other Forests	Moist	NO		0.00	0.00
		Seasonal	NO		0.00	0.00
		Dry	NO		0.00	0.00
	Other *(specify)*		NO		0.00	0.00
			NO		0.00	
Temperate	Plantations		2.00	NE	0.00	NE
			NO		0.00	0.00
	Commercial	Evergreen	2 534.11	4.91	2.41	6 095.19
		Deciduous	817.89	5.15	2.49	2 034.34
	Other *(specify)*		NE		0.00	NE
			NO		0.00	0.00
Boreal			NO		0.00	0.00
			Number of trees (1000s of trees)	Annual growth rate (kt dm/1000 trees)	Carbon uptake factor (t C/tree)	Carbon uptake increment (Gg C)
Non-Forest Trees *(specify type)*						0.00
			NE		0.00	NE
					Total annual growth increment (Gg C)	8 129.54
					Gg CO_2	29 808.30

	Amount of biomass removed (kt dm)	Carbon emission factor (t C/t dm)	Carbon release (Gg C)
Total biomass removed in Commercial Harvest	12 388.62	0.49	6 047.71
Traditional Fuelwood Consumed	IE	0.00	IE
Total Other Wood Use	NE	0.00	NE
		Total Biomass Consumption from Stocks[(1)] (Gg C)	6 047.71
		Other Changes in Carbon Stocks[(2)] (Gg C)	NE
		Gg CO_2	22 174.94

Net annual carbon uptake (+) or release (-) (Gg C)	2 081.82
Net CO_2 emissions (-) or removals (+) (Gg CO_2)	7 633.36

[(1)] Make sure that the quantity of biomass burned off-site is subtracted from this total
[(2)] The net annual carbon uptake/release is determined by comparing the annual biomass growth versus annual harvest, including the decay of forest products and slash left during harvest. The IPCC Guidelines recommend default assumption that all carbon removed in wood and other biomass from forests is oxidized in the year of removal. The emissions from decay could be included under Other Changes in Carbon Stocks.

Note: Sectoral background data tables on Land-Use Change and Forestry should be filled in only by Parties using the IPCC default methodology. Parties that use country specific methods and models should report information on them in a transparent manner, also providing suggestions for a possible sectoral background data table suitable for their calculation method.

Documentation box:

Figures for "Total annual growth increment" include above and belowground biomass and also growth increment resulting from conversion of managed lands to forests (see Table 5.C)

The basis for the estimated figures for "Total biomass removed in Commercial Harvest" are at-site-measured data by the Austrian forest inventory. These data include all possible reasons for biomass losses in the forests. Therefore the figures for "Total biomass removed in Commercial Harvest" include also for instance traditional fuelwood consumption, biomass losses by forest fires (in the 90-ies at areas <135 ha per year) and biomass losses due to other damages

Figures for "Total biomass removed in Commercial Harvest" include the above- and belowground biomass of harvested trees)
Figures for "Total Biomass Consumption from Stocks" include also biomass losses due to forest conversion (see Table 5.B)
Since 1996 no forest inventory was carried out in Austria. Therefore the mean of the inventory results for the period 1992/96 is used for the years after 1996. A data revision for these years will take place when the new data of the presently running forest inventory will be available which will be in 2003.

TABLE 5.B SECTORAL BACKGROUND DATA FOR LAND-USE CHANGE AND FORESTRY
Forest and Grassland Conversion
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA AND OTHER RELATED INFORMATION							IMPLIED EMISSION FACTORS					EMISSIONS				
		On and off site burning				Decay of above-ground biomass[(1)]			Burning				Decay	Burning				Decay
		Area converted annually	Annual net loss of biomass	Quantity of biomass burned		Average area converted	Average annual net loss of biomass	Average quantity of biomass left to decay	On site			Off site		On site			Off site	
				On site	Off site				CO_2	CH_4	N_2O	CO_2	CO_2	CO_2	CH_4	N_2O	CO_2	CO_2
Vegetation types		(kha)	(kt dm)	(kt dm)	(kt dm)	(kha)	(t dm/ha)	(kt dm)	(t/ha)					(Gg)				
Tropical	Wet/Very Moist	NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
	Moist, short dry season	NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
	Moist, long dry season	NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
	Dry	NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
	Montane Moist	NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
	Montane Dry	NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
Tropical Savanna/Grasslands		NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
Temperate	Coniferous	NO				IE			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
	Broadleaf	NO				IE			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
	Mixed Broadleaf/ Coniferous	NO				IE			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
Grasslands		NO				NE			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
Boreal	Mixed Broadleaf/ Coniferous	NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
	Coniferous	NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
	Forest-tundra	NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
Grasslands/Tundra		NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
Other *(please specify)*		NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
		NO				NO			0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO
Total														NO	NO	NO	NO	NO

[(1)] Activity data are for default 10-year average. Specify the average decay time which is appropriate for the local conditions, if other than 10 years.

Emissions/Removals	On site	Off site
Immediate carbon release from burning	NO	NO
Total On site and Off site (Gg C)	NO	
Delayed emissions from decay (Gg C)	NO	
Total annual carbon release (Gg C)	NO	
Total annual CO_2 emissions (Gg CO_2)	NO	

Additional information

Fractions	On site	Off site
Fraction of biomass burned (average)	NO	NO
Fraction which oxidizes during burning (average)	NO	NO
Carbon fraction of aboveground biomass (average)	IE	IE
Fraction left to decay (average)	IE	IE
Nitrogen-carbon ratio	IE	IE

Note: Sectoral background data tables on Land-Use Change and Forestry should be filled in only by Parties using the IPCC default methodology. Parties that use country specific methods and models should report information on them in a transparent manner, also providing suggestions for a possible sectoral background data table suitable for their calculation method.

Documentation box:
Figures for biomass losses due to forest conversion are included in the figures of Table 5.A
A first estimation of CO2 emissions and removals from cropland and grassland management based on the draft IPCC Guidleines for LUCF was made for 1990.
Due to lack on statistical data needed for the IPCC Tier 1 method an estimation cannot be performed seriously for the whole timseries.
The results show that the contribution to total net emissions for 1990 is about 110 Gg CO2 which therefore is not a keysource.

TABLE 5.C SECTORAL BACKGROUND DATA FOR LAND-USE CHANGE AND FORESTRY
Abandonment of Managed Lands
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA AND OTHER RELATED INFORMATION						IMPLIED EMISSION FACTORS		ESTIMATES	
		Total area abandoned and regrowing [(1)]		Annual rate of aboveground biomass growth		Carbon fraction of aboveground biomass		Rate of aboveground biomass carbon uptake		Annual carbon uptake in aboveground biomass	
Original natural ecosystems		first 20 years (kha)	>20 years (kha)	first 20 years (t dm/ha)	>20 years (t dm/ha)	first 20 years	>20 years	first 20 years (t C/ha/yr)	>20 years (t C/ha/yr)	first 20 years (Gg C/yr)	>20 years (Gg C/yr)
Tropical	Wet/Very Moist	NO						0.00	0.00	0.00	0.00
	Moist, short dry season	NO						0.00	0.00	0.00	0.00
	Moist, long dry season	NO						0.00	0.00	0.00	0.00
	Dry	NO						0.00	0.00	0.00	0.00
	Montane Moist	NO						0.00	0.00	0.00	0.00
	Montane Dry	NO						0.00	0.00	0.00	0.00
Tropical Savanna/Grasslands		NO						0.00	0.00	0.00	0.00
Temperate	Mixed Broadleaf/Coniferous	IE						0.00	0.00	IE	IE
	Coniferous	IE						0.00	0.00	IE	IE
	Broadleaf	IE						0.00	0.00	IE	IE
Grasslands		NE						0.00	0.00	NE	NE
Boreal	Mixed Broadleaf/Coniferous	NO						0.00	0.00	0.00	0.00
	Coniferous	NO						0.00	0.00	0.00	0.00
	Forest-tundra	NO						0.00	0.00	0.00	0.00
Grasslands/Tundra		NO						0.00	0.00	0.00	0.00
Other *(please specify)*		NO						0.00	0.00	0.00	0.00
		NO						0.00	0.00	0.00	0.00

Total annual carbon uptake (Gg C)	0.00
Total annual CO_2 removal (Gg CO_2)	0.00

[(1)] If lands are regenerating to grassland, then the default assumption is that no significant changes in above-ground biomass occur.

Note: Sectoral background data tables on Land-use Change and Forestry should be filled in only by Parties using the IPCC default methodology. Parties that use country specific methods and models should report information on them in a transparent manner, also providing suggestions for a possible sectoral background data table suitable for their calculation method.

Documentation box:
Figures for biomass growth increment resulting from conversion of managed lands to forests are included in the figures of Table 5.A

TABLE 5.D SECTORAL BACKGROUND DATA FOR LAND-USE CHANGE AND FORESTRY

CO_2 Emissions and Removals from Soil

(Sheet 1 of 1)

Austria

2002

Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA	IMPLIED EMISSION FACTORS	ESTIMATES
	Land area (Mha)	Average annual rate of soil carbon uptake/removal (Mg C/ha/yr)	Net change in soil carbon in mineral soils (Tg C over 20 yr)
Cultivation of Mineral Soils [1]	**NE**		**0.00**
High Activity Soils	NE	0.00	NE
Low Activity Soils	NE	0.00	NE
Sandy	NE	0.00	NE
Volcanic	NO	0.00	NO
Wetland (Aquic)	NO	0.00	NO
Other *(please specify)*			0.00
		0.00	
	Land area (ha)	**Annual loss rate (Mg C/ha/yr)**	**Carbon emissions from organic soils (Mg C/yr)**
Cultivation of Organic Soils			**0.00**
Cool Temperate			**0.00**
Upland Crops	NE	0.00	NE
Pasture/Forest	NE	0.00	NE
Warm Temperate			**0.00**
Upland Crops	NO	0.00	NO
Pasture/Forest	NO	0.00	NO
Tropical			**0.00**
Upland Crops	NO	0.00	NO
Pasture/Forest	NO	0.00	NO
	Total annual amount of lime (Mg)	**Carbon conversion factor**	**Carbon emissions from liming (Mg C)**
Liming of Agricultural Soils			**0.00**
Limestone $Ca(CO_3)$	NE	0.00	NE
Dolomite $CaMg(CO_3)_2$	NE	0.00	NE

Total annual net carbon emissions from agriculturally impacted soils (Gg C)	0.00
Total annual net CO_2 emissions from agriculturally impacted soils (Gg CO_2)	0.00

Additional information

Year	Climate [a]	land-use/ management system [a]	Soil type: High activity soils	Low activity soils	Sandy	Volcanic	Wetland (Aquic)	Organic soil
			percent distribution (%)					
20 years prior			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE
inventory year			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE
			NE	NE	NE	NE	NE	NE

[a] These should represent the major types of land management systems per climate regions presented in the country as well as ecosystem types which were either converted to agriculture (e.g., forest, savanna, grassland) or have been derived from previous agricultural land-use (e.g., abandoned lands, reforested lands). Systems should also reflect differences in soil carbon stocks that can be related to differences in management (IPCC Guidelines (Volume 2. Workbook, Table 5-9, p. 5.26, and Appendix (pp. 5-31 - 5.38)).

[1] The information to be reported under Culitvation of Mineral Soils aggregates data per soil type over all land-use/management systems. This refers to land area data and to the emission estimates and implied emissions factors according

Note: Sectoral background data tables on Land-Use Change and Forestry should be filled in only by Parties using the IPCC default methodology. Parties that use country specific methods and models should repo information on them in a transparent manner, also providing suggestions for a possible sectoral background data table suitable for their calculation method.

Documentation Box:

TABLE 6 SECTORAL REPORT FOR WASTE
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
	(Gg)						
Total Waste	**11.24**	**135.03**	**0.22**	**0.03**	**9.49**	**0.13**	**0.05**
A. Solid Waste Disposal on Land	**0.00**	**119.75**		**0.00**	**9.48**	**0.13**	
1. Managed Waste Disposal on Land	NA	119.75		NA	9.48	0.13	
2. Unmanaged Waste Disposal Sites	NO	NO		NO	NO	NO	
3. Other *(please specify)*	0.00	0.00		0.00	0.00	0.00	
B. Wastewater Handling		**14.27**	**0.08**	**0.00**	**0.00**	**0.00**	
1. Industrial Wastewater		4.85	0.02	NA	NA	NA	
2. Domestic and Commercial Wastewater		9.41	0.06	NA	NA	NA	
3. Other *(please specify)*		0.00	0.00	0.00	0.00	0.00	
C. Waste Incineration	**11.24**	**0.00**	**0.00**	**0.03**	**0.01**	**0.00**	**0.05**
D. Other *(please specify)*	**0.00**	**1.01**	**0.14**	**0.00**	**0.00**	**0.00**	**0.00**
Compost production	NA	1.01	0.14	NA	NA	NA	NA

(1) Note that CO_2 from Waste Disposal and Incineration source categories should only be included if it stems from non-biological or inorganic waste sources.

TABLE 6.A SECTORAL BACKGROUND DATA FOR WASTE
Solid Waste Disposal
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION				IMPLIED EMISSION FACTOR		EMISSIONS[(1)]	
	Annual MSW at the SWDS (Gg)	MCF	DOC degraded (Gg)	CH_4 recovery [(2)] (Gg)	CH_4 (t /t MSW)	CO_2 (t /t MSW)	CH_4 (Gg)	CO_2 [(3)] (Gg)
1 Managed Waste Disposal on Land	1 815.38	1.00	165.10	21.73	0.07	0.00	119.75	NA
2 Unmanaged Waste Disposal Sites	NO	NO	NO	NO	0.00	0.00	NO	NO
- deep (>5 m)	NO	NO	NO	NO	0.00	0.00	NO	NO
- shallow (<5 m)	NO	NO	NO	NO	0.00	0.00	NO	NO
3 Other *(please specify)*							0.00	0.00
					0.00	0.00		

Additional information

Description	Value
Total population (1000s)[(a)]	8 032.93
Urban population (1000s)[(a)]	5 369.00
Waste generation rate (kg/capita/day)	0.53
Fraction of MSW disposed to SWDS	0.29
Fraction of DOC in MSW	0.12
Fraction of wastes incinerated	0.15
Fraction of wastes recycled	0.34
CH4 oxidation factor (b)	0.20
CH_4 fraction in landfill gas	0.55
Number of SWDS recovering CH_4	54.00
CH_4 generation rate constant (k)[(c)]	NA
Time lag considered (yr)[(c)]	NA
Composition of landfilled waste (%)	
Paper and paperboard	14.00
Food and garden waste	20.40
Plastics	15.00
Glass	3.00
Textiles	4.20
Other *(specify)*	
other - inert	NA
other - organic	NA
other - sanatory products	12.00
other - metals	4.60
other - unspecified	26.80

[(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)] 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 Amount of incinerated wastes (Gg)	IMPLIED EMISSION FACTOR			EMISSIONS		
		CO_2 (kg/t waste)	CH_4 (kg/t waste)	N_2O (kg/t waste)	CO_2 [(3)] (Gg)	CH_4 (Gg)	N_2O (Gg)
Waste Incineration *(please specify)*	3.00				11.24	0.00	0.00
(biogenic)(3)		0.00	0.00	0.00			
(plastics and other non-biogenic waste) (3)		0.00	0.00	0.00			
Incineration of corpses [Number]	8 972.04	0.18	0.00	0.00	1.57	0.00	0.00
municipal solid waste [Gg]	NO	0.00	0.00	0.00	NO	NO	NO
waste oil [Gg]	3.00	3 224.00	0.00	0.02	9.67	0.00	0.00
		0.00	0.00	0.00			
		0.00	0.00	0.00			
		0.00	0.00	0.00			

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)] Actual emissions (after recovery).

[(2)] CH_4 recovered and flared or utilized.

[(3)] Under Waste Disposal, CO_2 emissions should be reported only when the disposed wastes are combusted at the disposal site which might constitute a management practic
CO_2 emissions from non-biogenic wastes are included in the totals, while the CO_2 emissions from biogenic wastes are not included in the totals.

Documentation box:
All relevant information used in calculation should be provided in the additional information box and in the documentation box. Parties that use country specific models should note this with a brief rationale in the documentation box and fill the relevant cells only.
Recycling and treatment of waste from households and similar establishments: 34.3% recycling 15.4% recycling biogenous waste 0.8% treatment in plants for hazardous waste 6.3% mechanic-biological pre-treatment 14.7% thermal treatment (incineration) 28.5% direct depositoion at landfills MSW not considered in category 6A amd 6C but in category 6D - other - compost production: mechanical biological treated residual waste: 265Gg/a composted waste: 1126Gg/a composted sludge: 238Gg/a

TABLE 6.B SECTORAL BACKGROUND DATA FOR WASTE
Wastewater Handling
(Sheet 1 of 1)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND RELATED INFORMATION[1]				IMPLIED EMISSION FACTOR			EMISSIONS[2]		
	Total organic product		CH_4 recovered and/or flared		CH_4		N_2O[3]	CH_4		N_2O[3]
	Wastewater	Sludge	Wastewater	Sludge	Wastewater	Sludge		Wastewater	Sludge	
	(Gg DC[1]/yr)		(Gg)		(kg/kg DC)	(kg/kg DC)	(kg/kg DC)	(Gg)	(Gg)	(Gg)
Industrial Wastewater	NA	NA	NA	NA	0.00	0.00	NA	4.85	IE	0.02
Domestic and Commercial Wastewater	NA	NA	NA	NA	0.00	0.00	NA	9.41	IE	0.00
Other *(please specify)*								0.00	0.00	0.00
					0.00	0.00				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA AND OTHER RELATED INFORMATION			IMPLIED EMISSION FACTOR	EMISSIONS
	Population[4]	Protein consumption	N fraction	N_2O	N_2O
	(1000s)	(protein in kg/person/yr)	(kg N/kg protein)	(kg N_2O-N/kg sewage N produced)	(Gg)
N_2O from human sewage[3]	8 033	38.69	0.16	0.00	0.06

[1] DC - degradable organic component. DC indicators are COD (Chemical Oxygen Demand) for industrial wastewater and BOD (Biochemical Oxygen Demand) for Domestic/Commerc wastewater/sludge (IPCC Guidelines (Volume 3. Reference Manual, pp. 6.14, 6.18)).

[2] Actual emissions (after recovery)

[3] Parties using other methods for estimation of N_2O emissions from human sewage or wastewater treatment should provide corresponding information on methods, activity da and emission factors used in the documentation box. Use the table to provide aggregate data.

[4] Specify whether total or urban population is used in the calculations and the rationale for doing so. Provide explanation in the documentation box.

Documentation box:

N2O from human sewage: 10 g N / person / day is released into wastewater. 75 % of wastewater is treated in sewage plants. 10 % of N is denitrified. 1 % of denitrified N reacts to N2O.
IE: CH4-Emissions from sludge are reported under emissions from wastewater.

Additional information

	Domestic	Industrial
Total wastewater (m^3):	NE	NE
Treated wastewater (%):	NE	NE

Wastewater streams:	Wastewater output (m^3)	DC ($kgCOD/m^3$)
Industrial wastewater	NE	NE
Iron and steel	NE	NE
Non-ferrous	NE	NE
Fertilizers	NE	NE
Food and beverage	NE	NE
Paper and pulp	NE	NE
Organic chemicals	NE	NE
Other *(specify)*	NE	NE
	DC (kg BOD/1000 person/yr)	
Domestic and Commercial	NE	
Other	NE	

Handling systems:	Industrial wastewater treated (%)	Ind. sludge treated (%)	Domestic wastewater treated (%)	Domestic sludge treated (%)
Aerobic	NE	NE	NE	NE
Anaerobic	NE	NE	NE	NE
Other *(specify)*	NE	NE	NE	NE

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 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	**69 671.29**	**-7 633.36**	**355.46**	**18.55**	**5 090.46**	**1 033.25**	**199.00**	**25.16**	**0.38**	**0.03**	**204.47**	**811.85**	**192.65**	**35.96**
1. Energy	**61 981.95**		**29.69**	**3.99**							**197.88**	**748.27**	**86.95**	**31.97**
A. Fuel Combustion — Reference Approach [2]	61 083.01													
Sectoral Approach [2]	61 814.92		15.24	3.99							197.88	748.27	83.56	31.83
1. Energy Industries	15 013.10		0.26	0.20							14.94	4.10	0.58	8.23
2. Manufacturing Industries and Construction	12 504.07		0.37	0.52							34.08	157.11	4.01	11.04
3. Transport	20 606.16		1.56	2.24							109.37	198.79	29.61	2.25
4. Other Sectors	13 650.84		13.04	1.03							39.40	388.04	49.34	10.30
5. Other	40.75		0.00	0.00							0.09	0.24	0.02	0.01
B. Fugitive Emissions from Fuels	167.03		14.45	0.00							0.00	0.00	3.39	0.14
1. Solid Fuels	0.00		0.26	0.00							0.00	0.00	0.00	0.00
2. Oil and Natural Gas	167.03		14.19	0.00							0.00	0.00	3.39	0.14
2. Industrial Processes	**7 484.49**		**0.39**	**2.60**	**5 090.46**	**1 033.25**	**199.00**	**25.16**	**0.38**	**0.03**	**1.71**	**52.36**	**21.00**	**3.93**
A. Mineral Products	2 910.66		0.04	0.00							0.00	10.03	5.41	0.00
B. Chemical Industry	510.25		0.35	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.66	11.10	12.34	3.19
C. Metal Production	4 063.58		0.00	0.00				0.00		0.00	0.23	30.64	0.41	0.75
D. Other Production [3]	NA										0.82	0.60	2.85	0.00
E. Production of Halocarbons and SF_6						NO		NO		NO				
F. Consumption of Halocarbons and SF_6					5 090.46	1 033.25	199.00	25.16	0.38	0.03				
G. Other	NO		NO	NO	NO	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines. A = Actual emissions based on Tier 2 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. Where possible, the calculations using the Sectoral approach should be used for estimating national totals. Do not include the results of both the Reference approach and the Sectoral approach in national totals.
[3] Other Production includes Pulp and Paper and Food and Drink Production.

Note: The numbering of footnotes to all tables containing more than one sheet continue to the next sheet. Common footnotes are given only once at the first point of reference.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 2 of 3)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 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	**193.60**			**0.75**							0.00	0.00	82.63	0.00
4. Agriculture	**0.00**	**0.00**	**190.35**	**10.98**							4.85	1.72	1.94	0.00
A. Enteric Fermentation			147.83											
B. Manure Management			42.02	2.26									NE	
C. Rice Cultivation			NO										NO	
D. Agricultural Soils	(4) 0.00	(4) 0.00	0.43	8.72							4.84		1.73	
E. Prescribed Burning of Savannas			NO	NO							NO	NO	NO	
F. Field Burning of Agricultural Residues			0.07	0.00							0.01	1.72	0.22	0.00
G. Other			NO	NO							NO	NO	NO	0.00
5. Land-Use Change and Forestry	(5) **0.00**	(5) **-7 633.36**	**0.00**	**0.00**							**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks	(5) 0.00	(5) -7 633.36												
B. Forest and Grassland Conversion	IE		NO	NO							NO	NO	NO	
C. Abandonment of Managed Lands	(5) IE	(5) IE												
D. CO_2 Emissions and Removals from Soil	(5) NE	(5) NE												
E. Other	(5) NO	(5) NO	NO	NO							NO	NO	NO	NO
6. Waste	**11.24**		**135.03**	**0.22**							**0.03**	**9.49**	**0.13**	**0.05**
A. Solid Waste Disposal on Land	(6) 0.00		119.75									9.48	0.13	
B. Wastewater Handling			14.27	0.08							0.00	0.00	0.00	
C. Waste Incineration	(6) 11.24		0.00	0.00							0.03	0.01	0.00	0.05
D. Other	0.00		1.01	0.14							0.00	0.00	0.00	0.00
7. Other *(please specify)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

[4] According to the IPCC Guidelines (Volume 3. Reference Manual, pp. 4.2, 4.87), CO_2 emissions from agricultural soils are to be included under Land-Use Change and Forestry (LUCF). At the same time, the Summary Report 7A (Volume 1. Reporting Instructions, Tables.27) allows for reporting CO_2 emissions or removals from agricultural soils, either in the Agriculture sector, under D. Agricultural Soils or in the Land-Use Change and Forestry sector under D. Emissions and Removals from Soil. Parties may choose either way to report emissions or removals from this source in the common reporting format, but the way they have chosen to report should be clearly indicated, by inserting explanatory comments to the corresponding cells of Summary 1.A and Summary 1.B. Double-counting of these emissions or removals should be avoided. Parties should include these emissions or removals consistently in Table8(a) (Recalculation - Recalculated data) and Table10 (Emission trends).

[5] Please do not provide an estimate of both CO_2 emissions and CO_2 removals. "Net" emissions (emissions - removals) of CO_2 should be estimated and a single number placed in either the CO_2 emissions or CO_2 removals column, as appropriate. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

[6] Note that CO_2 from Waste Disposal and Incineration source categories should only be included if it stems from non-biogenic or inorganic waste streams.

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7A)
(Sheet 3 of 3)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 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: [7]														
International Bunkers	**1 512.24**		**0.03**	**0.05**							**4.84**	**1.49**	**0.60**	**0.48**
Aviation	1 512.24		0.03	0.05							4.84	1.49	0.60	0.48
Marine	NO		NO	NO							NO	NO	NO	NO
Multilateral Operations	**IE**		**IE**	**IE**							**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass	**13 562.05**													

[7] Memo Items are not included in the national totals.

SUMMARY 1.B SHORT SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 7B)
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 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	**69 671.29**	**-7 633.36**	**355.46**	**18.55**	**5 090.46**	**1 033.25**	**199.00**	**25.16**	**0.38**	**0.03**	**204.47**	**811.85**	**192.65**	**35.96**
1. Energy	**61 981.95**		**29.69**	**3.99**							**197.88**	**748.27**	**86.95**	**31.97**
A. Fuel Combustion — Reference Approach[2]	61 083.01													
Sectoral Approach[2]	61 814.92		15.24	3.99							197.88	748.27	83.56	31.83
B. Fugitive Emissions from Fuels	167.03		14.45	0.00							0.00	0.00	3.39	0.14
2. Industrial Processes	**7 484.49**		**0.39**	**2.60**	**5 090.46**	**1 033.25**	**199.00**	**25.16**	**0.38**	**0.03**	**1.71**	**52.36**	**21.00**	**3.93**
3. Solvent and Other Product Use	**193.60**			**0.75**							**0.00**	**0.00**	**82.63**	**0.00**
4. Agriculture [3]	**0.00**	**0.00**	**190.35**	**10.98**							**4.85**	**1.72**	**1.94**	**0.00**
5. Land-Use Change and Forestry	(4) **0.00**	(4) **-7 633.36**	**0.00**	**0.00**							**0.00**	**0.00**	**0.00**	**0.00**
6. Waste	**11.24**		**135.03**	**0.22**							**0.03**	**9.49**	**0.13**	**0.05**
7. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items:														
International Bunkers	**1 512.24**		**0.03**	**0.05**							**4.84**	**1.49**	**0.60**	**0.48**
Aviation	1 512.24		0.03	0.05							4.84	1.49	0.60	0.48
Marine	NO		NO	NO							NO	NO	NO	NO
Multilateral Operations	**IE**		**IE**	**IE**							**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass	**13 562.05**													

P = Potential emissions based on Tier 1 approach of the IPCC Guidelines.

A = Actual emissions based on Tier 2 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 document box of Table1.A(c) Where possible, the calculations using the Sectoral approach should be used for estimating national totals. Do not include the results of both the Reference approach and the Sectoral approach in national totals.

(3) See footnote 4 to Summary 1.A.

(4) Please do not provide an estimate of both CO_2 emissions and CO_2 removals. "Net" emissions (emissions - removals) of CO_2 should be estimated and a single number placed in either the CO_2 emissions or CO_2 removals column, as appropriate. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [(1)]	CH_4	N_2O	HFCs	PFCs	SF_6	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [(1)]	**62 037.93**	**7 464.64**	**5 749.51**	**1 033.25**	**25.16**	**676.95**	**76 987.44**
1. Energy	**61 981.95**	**623.40**	**1 237.16**				**63 842.51**
A. Fuel Combustion (Sectoral Approach)	61 814.92	319.94	1 237.16				63 372.02
1. Energy Industries	15 013.10	5.52	61.58				15 080.20
2. Manufacturing Industries and Construction	12 504.07	7.79	161.97				12 673.84
3. Transport	20 606.16	32.82	694.14				21 333.12
4. Other Sectors	13 650.84	273.78	318.46				14 243.08
5. Other	40.75	0.03	1.00				41.78
B. Fugitive Emissions from Fuels	167.03	303.46	0.00				470.49
1. Solid Fuels	0.00	5.53	0.00				5.53
2. Oil and Natural Gas	167.03	297.93	0.00				464.97
2. Industrial Processes	**7 484.49**	**8.25**	**807.21**	**1 033.25**	**25.16**	**676.95**	**10 035.31**
A. Mineral Products	2 910.66	0.78	0.00				2 911.45
B. Chemical Industry	510.25	7.40	807.21	0.00	0.00	0.00	1 324.86
C. Metal Production	4 063.58	0.07	0.00		0.00	7.65	4 071.30
D. Other Production	NA						0.00
E. Production of Halocarbons and SF_6				NO	NO	NO	0.00
F. Consumption of Halocarbons and SF_6				1 033.25	25.16	669.30	1 727.71
G. Other	NO	NO	NO	NO	NO	NO	0.00
3. Solvent and Other Product Use	**193.60**		**232.50**				**426.10**
4. Agriculture	**0.00**	**3 997.44**	**3 404.37**				**7 401.81**
A. Enteric Fermentation		3 104.43					3 104.43
B. Manure Management		882.41	701.12				1 583.53
C. Rice Cultivation		0.00					0.00
D. Agricultural Soils[(2)]		9.09	2 702.09				2 711.18
E. Prescribed Burning of Savannas		0.00	0.00				0.00
F. Field Burning of Agricultural Residues		1.51	1.17				2.68
G. Other		0.00	0.00				0.00
5. Land-Use Change and Forestry[(1)]	**-7 633.36**	**0.00**	**0.00**				**-7 633.36**
6. Waste	**11.24**	**2 835.55**	**68.26**				2 915.06
A. Solid Waste Disposal on Land	0.00	2 514.85					2 514.85
B. Wastewater Handling		299.60	23.62				323.21
C. Waste Incineration	11.24	0.00	0.02				11.26
D. Other	0.00	21.11	44.62				65.73
7. Other *(please specify)*	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
							0.00
Memo Items:							
International Bunkers	**1 512.24**	**0.55**	**16.80**				**1 529.58**
Aviation	1 512.24	0.55	16.80				1 529.58
Marine	NO	NO	NO				0.00
Multilateral Operations	**IE**	**IE**	**IE**				**0.00**
CO_2 Emissions from Biomass	**13 562.05**						**13 562.05**

[(1)] For CO_2 emissions from Land-Use Change and Forestry the net emissions are to be reported. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).
[(2)] See footnote 4 to Summary 1.A of this common reporting format.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 emissions	CO_2 removals	Net CO_2 emissions / removals	CH_4	N_2O	Total emissions
Land-Use Change and Forestry	CO_2 equivalent (Gg)					
A. Changes in Forest and Other Woody Biomass Stocks	22 174.94	-29 808.30	-7 633.36			-7 633.36
B. Forest and Grassland Conversion	IE		IE	NO	NO	0.00
C. Abandonment of Managed Lands	IE	IE	IE			0.00
D. CO_2 Emissions and Removals from Soil	NE	NE	NE			0.00
E. Other	NO	NO	NO	NO	NO	0.00
Total CO_2 Equivalent Emissions from Land-Use Change and Forestry	22 174.94	-29 808.30	-7 633.36	0.00	0.00	-7 633.36

Total CO_2 Equivalent Emissions without Land-Use Change and Forestry[(a)]	84 620.79
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry[(a)]	76 987.44

[(a)] The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report emissions and removals from Land-Use Change and Forestry.

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 [1]	Emission factor [2]	Method applied [1]	Emission factor [2]	Method applied [1]	Emission factor [2]	Method applied [1]	Emission factor [2]	Method applied [1]	Emission factor [2]	Method applied [1]	Emission factor [2]
1. Energy												
A. Fuel Combustion												
1. Energy Industries	C	CS	C	CS	C	CS						
2. Manufacturing Industries and Construction	C	CS	C	CS	C	CS						
3. Transport	M, CS	CS	M, T1	CS	M, T1	CS						
4. Other Sectors	C	CS	C	CS	C	CS						
5. Other	M, CS	CS	M, T1	CS	M, T1	CS						
B. Fugitive Emissions from Fuels												
1. Solid Fuels			T1	D								
2. Oil and Natural Gas	T1, CS	D, CS, PS	T1, CS	D	C	CS						
2. Industrial Processes												
A. Mineral Products	D, CS	D, CS	C	CS								
B. Chemical Industry	PS	PS	PS	PS	PS	PS						
C. Metal Production	T2	CS, PS	C	CS								
D. Other Production												
E. Production of Halocarbons and SF_6												
F. Consumption of Halocarbons and SF_6							CS	CS	CS	CS	CS	CS
G. Other												

(1) Use the following notation keys to specify the method applied: D (IPCC default), RA (Reference Approach), T1 (IPCC Tier 1), T1a, T1b, T1c (IPCC Tier 1a, Tier 1b and Tier 1c, respectively), T2 (IPCC Tier 2, T3 (IPCC Tier 3), C (CORINAIR), CS (Country Specific), M (Model). If using more than one method, enumerate the relevant methods. Explanations of any modifications to the default IPCC methods, as well as information on the proper use of methods per source category where more than one method is indicated, and explanations on the country specific methods, should be provided in the documentation box of the relevant Sectoral background data table.

(2) Use the following notation keys to specify the emission factor used: D (IPCC default), C (CORINAIR), CS (Country Specific), PS (Plant Specific), M (Model). Where a mix of emission factors has been usec use different notations in one and the same cells with further explanation in the documentation box of the relevant Sectoral background data table.

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED
(Sheet 2 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)	Method applied (1)	Emission factor (2)
3. Solvent and Other Product Use	**C, CS**	**CS**			**CS**	**CS**						
4. Agriculture												
A. Enteric Fermentation			T1, T2	D, CS								
B. Manure Management			T1, T2	D, CS								
C. Rice Cultivation												
D. Agricultural Soils					T1	D						
E. Prescribed Burning of Savannas												
F. Field Burning of Agricultural Residues			CS	CS	CS	CS						
G. Other												
5. Land-Use Change and Forestry												
A. Changes in Forest and Other Woody Biomass Stocks	D	CS										
B. Forest and Grassland Conversion												
C. Abandonment of Managed Lands												
D. CO_2 Emissions and Removals from Soil												
E. Other												
6. Waste												
A. Solid Waste Disposal on Land			CS	CS								
B. Wastewater Handling			C	CS	T1	D, CS						
C. Waste Incineration	C	CS	C	CS	C	CS						
D. Other			C, CS	CS								
7. Other *(please specify)*												

TABLE 7 OVERVIEW TABLE[(1)] FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 8A)
(Sheet 1 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6		NO_x		CO		NMVOC		SO_2	
	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality
Total National Emissions and Removals																				
1 Energy																				
A. Fuel Combustion Activities																				
Reference Approach	ALL	H																		
Sectoral Approach	ALL	H	ALL	L	ALL	M							ALL	L	ALL	L	ALL	L	ALL	M
1. Energy Industries	ALL	H	ALL	L	ALL	L							ALL	M	ALL	M	ALL	L	ALL	H
2. Manufacturing Industries and Construction	ALL	H	ALL	L	ALL	L							ALL	L	ALL	L	ALL	L	ALL	H
3. Transport	ALL	H	ALL	M	ALL	M							ALL	M	ALL	M	ALL	M	ALL	H
4. Other Sectors	ALL	H	ALL	L	ALL	L							ALL	L	ALL	L	ALL	L	ALL	M
5. Other	ALL	H	ALL	M	ALL	M							ALL	M	ALL	M	ALL	M	ALL	H
B. Fugitive Emissions from Fuels																				
1. Solid Fuels	NA	NA	ALL	L	NA	NA														
2. Oil and Natural Gas	PART	L	PART	L	PART	L							PART	L	PART	L	PART	L	PART	L
2 Industrial Processes																				
A. Mineral Products	PART	M	ALL	L	NA	NA							ALL	M	PART	M	ALL	M	ALL	M
B. Chemical Industry	ALL	H	PART	H	ALL	H	NA	NA	NA	NA			ALL	M	PART	M	ALL	M	ALL	M
C. Metal Production	PART	M	PART	L	NA	NA			NA	NA	ALL	M	ALL	M	PART	M	ALL	M	ALL	M
D. Other Production	NO	NO											ALL	M	ALL	M	ALL	M	NE	NE
E. Production of Halocarbons and SF_6							NO	NO	NO	NO	NO	NO								

(1) This table is intended to be used by Parties to summarize their own assessment of completeness (e.g. partial, full estimate, not estimated) and quality (high, medium, low) of major source/sin inventory estimates. The latter could be understood as a quality assessment of the uncertainty of the estimates. This table might change once the IPCC completes its work on managing uncertainties of GHG inventories. The title of the table was kept for consistency with the current table in the IPCC Guidelines.

Note: To fill in the table use the notation key as given in the IPCC Guidelines (Volume 1. Reporting Instructions, Tables. 37)

TABLE 7 OVERVIEW TABLE FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 8A)
(Sheet 2 of 3)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6		NO_x		CO		NMVOC		SO_2	
	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality
2 Industrial Processes (continued)																				
F. Consumption of Halocarbons and SF_6																				
Potential (2)							ALL	M	ALL	M	ALL	M								
Actual (3)							ALL	M	ALL	M	ALL	M								
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3 Solvent and Other Product Use	**ALL**	**M**			**ALL**	**L**							**NA**	**NA**	**NA**	**NA**	**ALL**	**M**	**NA**	**NA**
4 Agriculture																				
A. Enteric Fermentation			ALL	M																
B. Manure Management			ALL	M	ALL	M											NE	NE		
C. Rice Cultivation			NO	NO													NO	NO		
D. Agricultural Soils	NE	NE	ALL	M	ALL	M											ALL	L		
E. Prescribed Burning of Savannas			NO	NO	NO	NO							NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues			ALL	L	ALL	L							ALL	L	ALL	L	ALL	L	ALL	L
G. Other			NO	NO	NO	NO							NO	NO	NO	NO	NO	NO	NO	NO
5 Land-Use Change and Forestry	**PART**	**H**	**NE**	**NE**	**NE**	**NE**														
A. Changes in Forest and Other Woody Biomass Stocks	PART	H																		
B. Forest and Grassland Conversion	IE	IE	NO	NO	NO	NO							NO	NO	NO	NO	NO	NO		

(2) Potential emissions based on Tier 1 approach of the IPCC Guidelines.
(3) Actual emissions based on Tier 2 approach of the IPCC Guidelines.

TABLE 7 OVERVIEW TABLE FOR NATIONAL GREENHOUSE GAS INVENTORIES (IPCC TABLE 8A)
(Sheet 3 of 3)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6		NO_x		CO		NMVOC		SO_2	
	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality
5 Land-Use Change and Forestry (continued)																				
C. Abandonment of Managed Lands	IE	IE																		
D. CO_2 Emissions and Removals from Soil	NE	NE																		
E. Other	NO	NO	NO	NO	NO	NO							NO	NO	NO	NO	NO	NO	NO	NO
6 Waste																				
A. Solid Waste Disposal on Land	NE	NE	ALL	L											ALL	M	ALL	L		
B. Wastewater Handling			ALL	L	ALL	L							NE	NE	NE	NE	NE	NE		
C. Waste Incineration	ALL	L	ALL	M	ALL	L							ALL	M	ALL	M	ALL	L	ALL	H
D. Other	NE	NE	ALL	M	NE	NE							NE	NE	NE	NE	NE	NE	NE	NE
7 Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items:																				
International Bunkers	**ALL**	**H**	**ALL**	**M**	**ALL**	**M**							**ALL**	**M**	**ALL**	**M**	**ALL**	**M**	**ALL**	**H**
Aviation	ALL	H	ALL	M	ALL	M							ALL	M	ALL	M	ALL	M	ALL	H
Marine	NO	NO	NO	NO	NO	NO							NO	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**							**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass	**ALL**	**L**																		

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 2002

(Sheet 1 of 2)

Austria

2002

Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		Previous submission	Latest submission	Difference[1]	Previous submission	Latest submission	Difference[1]	Previous submission	Latest submission	Difference[1]
		CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
Total National Emissions and Removals			**69 671.29**	**0.00**		**7 464.64**	**0.00**		**5 749.51**	**0.00**
1. Energy			**61 981.95**	**0.00**		**623.40**	**0.00**		**1 237.16**	**0.00**
1.A.	Fuel Combustion Activities		61 814.92	0.00		319.94	0.00		1 237.16	0.00
1.A.1.	Energy Industries		15 013.10	0.00		5.52	0.00		61.58	0.00
1.A.2.	Manufacturing Industries and Construction		12 504.07	0.00		7.79	0.00		161.97	0.00
1.A.3.	Transport		20 606.16	0.00		32.82	0.00		694.14	0.00
1.A.4.	Other Sectors		13 650.84	0.00		273.78	0.00		318.46	0.00
1.A.5.	Other		40.75	0.00		0.03	0.00		1.00	0.00
1.B.	Fugitive Emissions from Fuels		167.03	0.00		303.46	0.00		IE	0.00
1.B.1.	Solid fuel		IE	0.00		5.53	0.00		IE	0.00
1.B.2.	Oil and Natural Gas		167.03	0.00		297.93	0.00		IE	0.00
2. Industrial Processes			**7 484.49**	**0.00**		**8.25**	**0.00**		**807.21**	**0.00**
2.A.	Mineral Products		2 910.66	0.00		0.78	0.00		NA	0.00
2.B.	Chemical Industry		510.25	0.00		7.40	0.00		807.21	0.00
2.C.	Metal Production		4 063.58	0.00		0.07	0.00		0.00	0.00
2.D.	Other Production		NA	0.00						
2.G.	Other		NO	0.00		NO	0.00		NO	0.00
3. Solvent and Other Product Use			**193.60**	**0.00**					**232.50**	**0.00**
4. Agriculture			**NA**	**0.00**		**3 997.44**	**0.00**		**3 404.37**	**0.00**
4.A.	Enteric Fermentation		NA			3 104.43	0.00			
4.B.	Manure Management		NA			882.41	0.00		701.12	0.00
4.C.	Rice Cultivation		NO			NO	0.00			
4.D.	Agricultural Soils [2]		NA	0.00		9.09	0.00		2 702.09	0.00
4.E.	Prescribed Burning of Savannas		NO			NO	0.00		NO	0.00
4.F.	Field Burning of Agricultural Residues		NA			1.51	0.00		1.17	0.00
4.G.	Other		NO			NO	0.00		NO	0.00
5. Land-Use Change and Forestry (net)			**-7 633.36**	**0.00**		**NA**	**0.00**		**NA**	**0.00**
5.A.	Changes in Forest and Other Woody Biomass Stocks		-7 633.36	0.00						
5.B.	Forest and Grassland Conversion		IE	0.00		NE	0.00		NE	0.00
5.C.	Abandonment of Managed Lands		IE	0.00						
5.D.	CO_2 Emissions and Removals from Soil		NE	0.00						
5.E.	Other		NO	0.00		NO	0.00		NO	0.00

[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) of this common reporting format.
[2] See footnote 4 to Summary 1.A of this common reporting format.

TABLE 8(a) RECALCULATION - RECALCULATED DATA

Recalculated year: 2002

(Sheet 2 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2			CH_4			N_2O		
		Previous submission	Latest submission	Difference(1)	Previous submission	Latest submission	Difference(1)	Previous submission	Latest submission	Difference(1)
		CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
6. Waste			**11.24**	**0.00**		**2 835.55**	**0.00**		**68.26**	**0.00**
6.A.	Solid Waste Disposal on Land		NA	0.00		2 514.85	0.00			
6.B.	Wastewater Handling					299.60	0.00		23.62	0.00
6.C.	Waste Incineration		11.24	0.00		0.00	0.00		0.02	0.00
6.D.	Other		NA	0.00		21.11	0.00		44.62	0.00
7. Other *(please specify)*			**NE**	**0.00**		**NE**	**0.00**		**NE**	**0.00**
				0.00			0.00			0.00
Memo Items:										
International Bunkers			**1 512.24**	**0.00**		**0.55**	**0.00**		**16.80**	**0.00**
Multilateral Operations			**IE**	**0.00**		**IE**	**0.00**		**IE**	**0.00**
CO_2 Emissions from Biomass			**14 379.68**	**0.00**						

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs			PFCs			SF_6		
		Previous submission	Latest submission	Difference(1)	Previous submission	Latest submission	Difference(1)	Previous submission	Latest submission	Difference(1)
		CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)	CO_2 equivalent (Gg)		(%)
Total Actual Emissions			**1 033.25**	**0.00**		**25.16**	**0.00**		**676.95**	**0.00**
2.C.3.	Aluminium Production					NE	0.00		NE	0.00
2.E.	Production of Halocarbons and SF_6		NE	0.00		NE	0.00		NE	0.00
2.F.	Consumption of Halocarbons and SF_6		1 033.25	0.00		25.16	0.00		676.95	0.00
	Other		NE	0.00		NE	0.00		NE	0.00
Potential Emissions from Consumption of HFCs/PFCs and SF_6			**5 090.46**			**199.00**			**9 184.46**	

	Previous submission	Latest submission	Difference(1)
	CO_2 equivalent (Gg)		(%)
Total CO_2 Equivalent Emissions with Land-Use Change and Forestry(3)	0.00	76 987.44	0.00
Total CO_2 Equivalent Emissions without Land-Use Change and Forestry(3)	0.00	84 620.79	0.00

(3) The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report emissions and removals from Land-Use Change and Forestry.

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/ replacement of source/sink categories
			Methods [2]	Emission factors [2]	Activity data [2]	
1 A 1 a	Public electricity and heat production	CO2, CH4, N2O			Energy statistics is revised by STATISTIK AUSTRIA. Details are provided in the NIR Annex 2. Activity data reported due to emission declarations for plants > 5(MWth are completed for the year 2001.	
1 A 1 c	Combustion of natural gas for Oil/Gas extraction	CO2, CH4, N2O			2001: Energy statistics is revised by STATISTIK AUSTRIA. Details are provided in the NIR Annex 2.	
1 A 2	Fuel combustion in industry	CO2, CH4, N2O			Energy statistics is revised by STATISTIK AUSTRIA. Details are provided in the NIR Annex 2.	
1 A 2 a	Fuel combustion in iron and steel plants	CO2				reallocation: CO2 emissions due to fuel combustion in iron & steel plants so far reported under category 2 C 1 are reported here.
1 A 2 a	Fuel combustion in iron and steel plants	CH4, N2O				addition: CH4 and N2O emissions of iron & steel plants.
1 A 2 f	Fuel combustion in cement industry	CO2				reallocation: CO2 emissions due to fuel combustion in cement industry so far reported under category 2 A 1 are reported here.
1 A 2 f	Fuel combustion in cement industry	CH4				addition: CH4 emissions of fuel combustion in cement industry.
1 A 2 f	Fuel combustion in cement industry	N2O				addition: N2O emissions of fuel combustion in cement industry.
1 A 2 f	Mobile sources in industry	CH4		Error correction		
1 A 3	Transport	CH4		Error correction		
1 A 3 a	Civil aviation	CO2, CH4, N2O				reallocation: Emissions form military aviation are shifted into category 1 A 5.
1 A 3 b	Road transport	CO2, CH4, N2O				reallocation: Emissions form military road transport are shifted into category 1 A 5.
1 A 3 e	Pipeline compressors	CO2, CH4, N2O			Energy statistics is revised by STATISTIK AUSTRIA. Details are provided in the NIR Annex 2.	
1 A 4	Combustion of solid biomass and coal in stoves and heatings.	CH4		1997-2001: VOC emission factors are corrected and imply higher CH4 emission factors.		
1 A 4	Fuel combustion in stoves and heatings.	CO2, CH4, N2O			Energy statistics is revised by STATISTIK AUSTRIA. Details are provided in the NIR Annex 2.	
1 A 4	Mobile sources in households, agriculture and forestry	CH4		Error correction		
1 A 5	Military aviation and road transport	CO2, CH4, N2O				reallocation: Emissions form military road transport so far reported under category 1 A 3 b are reported here. Emissions from military aviation so far reported under category 1 A 3 a are reported here.
1 B 2 b ii	1 B 2 b ii gas transmission in pipelines	CH4				addition
1 B 2 b ii	1 B 2 b ii gas transmission in pipelines	CO2				addition
1 B 2 b ii	1 B 2 b ii gas storage	CH4				addition
1 B 2 a ii	1 B 2 a ii oil and gas production	CH4				addition
1 B 2 b ii	1 B 2 b ii Distribution	CO2				removal: the time series for CO2 emissions from gas distribution was deleted, according to the emis-sion factor of the GPG (emission factor is zero).
1 B 1 a ii	1 B 1 a ii Coal Mining/ Surface Mines:	CH4		now the IPCC default emission factor is used, which is higher than the country specific emission factor used before.		
2 A 3	2 A 3 Limestone and Dolomite Use	CO2				addition
2 A 4	2 A 4 Soda Ash Use	CO2				addition
2 B 4	2 B 4 Calcium Carbide Production	CO2				addition
2 A 7	2 A 7 Bricks Production	CO2				addition
2 C 3	2 C 3 Aluminium Production	CO2				addition
2 C 1	2 C 1 electric arc furnaces	CO2				addition
2 B 5	2 B 5 production of fertilizers	CH4				addition
2 D 2	2 D 2 Food and Drink Production	CO2				removal (as CO2 emissions from this source are of biogenic origin)
2 C 1	2 C 1 Iron and Steel Production	CO2				reallocation: now only CO2 process emissions from iron and steel production (both from steel production in basic oxygen furnaces and from electric furnaces) as well as CH4 emissions from rolling mills are reported in this category. In the previous submission also emissions due to combustion were included in this category, they are now reported in category 1 A 2 a.
2 A 1	2 A 1 Cement Production	CO2				reallocation: emissions due to combustion are now reported in category 1 A 2 f.

2 A 7	2 A 7 Glass Production	CO2				reallocation: process specific CO2 emissions (decarbonising) have been recalculated based on information from industry, they have been split into the categories Limestone and Dolomite Use and Soda Ash Use. All other emissions have been allocated to the energy sector, as they are mainly emissions due to combustion and difficult to separate.
2 A 7	2 A 7 Magnesite Sinter Plants	CO2		the timeseries has been updated with emission data provided by industry.		
2 A 2	2 A 2 Lime Production	CO2			the timeseries has been updated with emission data provided by associations of industries.	
2 A 5	2 A 5 Asphalt Roofing	CH4			activity data for 2001 has been updated using statistical data.	
2 B 2	2 B 2 Nitric Acid Production	N2O			emission and activity data have been corrected as indicated in the NIR 2003.	
2 C 1	2 C 1 Iron and Steel Production	CH4			activity data have been harmonized with those used for calculating CO2 emissions from this source.	
3	SOLVENT AND OTHER PRODUCT USE	CO2	Data were recalculated and updated according to new national studies.			
4 A 1 a	Enteric Fermentation - Dairy cows	CH4		1990-2001: Milk yield update.		
4 B 1 a	Manure Management - Dairy Cows	CH4, N2O		1990-2001: Milk yield update.		
4 B 8	Manure Management - Swine	CH4, N2O			1990 - 1992: adjustment of age class split for swine following the recommendations of the centralized review 2003.	
4 D 1	Agricultural soils - direct soil emissions from animal wastes	CH4		1990-2001: Milk yield of dairy ows updated.	1990 - 1992: adjustment of age class split for swine following the recommendations of the centralized review 2003.	
4 D 1	Agricultural soils - direct soil emissions from synthetic fertilizer use	CH4			2001: Update of synthetic fertilizer use.	
4 D 1	Agricultural Soils - sewage sludge spreading	CH4				reallocation: emissions from sewage sludge spreading previously reported under 6 D are now reported in this category.
4 D	Agricultural Soils	N2O		1990-2001: Milk yield update.	1990 - 1992: adjustment of age class split for swine following the recommendations of the centralized review 2003. 2001: Update of synthetic fertilizer use.	
6 A 1	Managed Waste disposal	CH4	The DOC has been corrected according to a new study		update of disposed waste from new database.	
6 C	Incineration of corpses	CO2			2001: upate according to new statistics	
6 D	OTHER WASTE - sewage sludge spreading	CH4				reallocation: emissions from sewage sludge spreading are shifted into category 4 D.
6 D	OTHER WASTE - compost production	CH4, N2O	New national study uses updated emission factors and activity data.			reallocation: emissions from sewage sludge spreading are shifted into category 4 D.
	International bunkers- aviation	CH4		Error correction.		

(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 (see 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 relevant changes in the assumptions and coefficients under the "Methods" column.

Documentation box: Use the documentation box to report the justifications of the changes as to improvements in the accuracy, completeness and consistency of the invento

TABLE 9 COMPLETENESS
(Sheet 1 of 2)

Sources and sinks not reported (NE)(1)			
GHG	**Sector(2)**	**Source/sink category (2)**	**Explanation**
CO_2			
	1 B 2 a	Transport and Distribution of Oil Products	CO2 emissions are assumed to be neglible. Only NMVOC Emissions
	5 A 2 c	5 A 2 c Plantations	The Austrian area of temperate forest plantations is very small (<2000 ha). Therefore the C stock changes at these plantations are negligible.
	5 A 2 d	5 A 2 d Other	There are not sufficient data which would allow to estimate accurately the emissions and removals from other wooded land like vineyards, orchards, parks, forest nurseries and christmas tree cultures.
	5 A 2 d	5 A 2 d Harvested Wood	Estimates on this sector will be made in the near future.
	5 A 4	5 A 4 Emissions and removals from grasslands	There are not sufficient data which would allow to estimate accurately the emissions and removals from grasslands. However, it is assumed that figures for this category are of minor relevance for the Austrian GHG balance.
	5 B 4	5 B 4 Emissions from grassland conversion	There are not sufficient data which would allow to estimate accurately the emissions from grassland conversion.
	5 B 5	5 B 5 Other	There are not sufficient data which would allow to estimate accurately the emissions from conversion of other wooded land like vineyards, orchards, parks, forest nurseries and christmas tree cultures.
	5 C 4	5 C 4 Removals by abondonment of managed land and regrowth by grasslands	There are not sufficient data which would allow to estimate accurately the removals from abandonment of managed land and regrowth by grasslands (biomass). However, it is assumed that figures for this category are of minor relevance for the Austrian GHG balance.
	5 D	5 D CO2 emissions and removals from soil	Up to now there were no reassessments of the soil inventories in Austria. Therefore it is not possible to give estimates on the C stock changes in the soils which are based on measured data. It is planned to carry out such reassessments in the near future which will allow to provide figures for this sector.
	5 E	5 E Other	There are not sufficient data which would allow estimates for this sector.
CH_4			
	1 B 2 a	Transport and Distribution of Oil Products	CH4 emissions are assumed to be neglible. Only NMVOC Emissions are estimated from this source.
	2 B 5	Carbon Black/Methanol/Ethylene	CH4 emissions from that source are included in the NMVOC estimate. The share of CH4 in these emissions is not known.
	2 B 4	Carbide Production	CH4 emissions were not estimated because there is no default emission factor and until this submission no information on country specific emission factors was available.
	4 A 9	Poultry	The IPCC guidelines do not provide a methodology. Presently there is no national methodology avaliable.
	4 A 10	Deer	The IPCC guidelines do not provide a methodology. Presently there is no national methodology avaliable.
N_2O			
HFCs			
PFCs			
SF_6			

Sources and sinks reported elsewhere (IE)(3)				
GHG	**Source/sink category**	**Allocation as per IPCC Guidelines**	**Allocation used by the Party**	**Explanation**
CO_2				
	Oil Exploration, Gas Exploration, Gas Production/Processing	1 B 2 a i, 1 B 2 b Exploration, 1 B 2 b i	1 B 2 a iI Oil Production	As all oil fields are combined oil and gas production fields, total emissions together with emissions from gas production fields are reported here (total figures are reported from the Association of Oil Industry).
	Refining/Storage	1 B 2 b iv	1 A 1 b Petroleum Refining	The emission declaration of the refinery includes all emissions from the plant.
	Venting and Flaring	1 B 2 c	1 A 1 b Petroleum Refining	The emission declaration of the refinery includes all emissions from the plant.
	Multilateral Operations	Memo Item: Multilateral Operations	1 A 4 Other Sectors	No explicit information in the national energy statistics about multilateral operations. Since the emissions of this sector are very low they are included in the residential/commercial sector.
	CO2 emissions of Changes in Forest and Other Woody Biomass Stocks	5 A CO2 emissions of Changes in Forest and Other Woody Biomass Stocks	5 A CO2 Removals of Changes in Forest and Other Woody Biomass Stocks	The national method provides only total CO2 emissions/removals.

	Biomass increment by abandonment of managed land and regrowth by forests	5 C 2 Abandonment of managed lands and regrowth by temperate forests	5 A 2 a,b Total biomass increment in Commercial Harvest	The basis for the estimated figures for "Total annual growth increment in Commercial Harvest" are at-site-measured data by the Austrian forest inventory. These data include all possible reasons for biomass increments in the forests. Therefore the figures for "Total biomass increment in Commercial Harvest" include also the biomass increments due to abandonment of managed land and regrowth by forests
	Biomass losses by forest conversion	5 B 2 a,b Biomass losses by forest conversion	5 A 2 a,b Total biomass removed in Commercial Harvest	The basis for the estimated figures for "Total biomass removed in Commercial Harvest" are at-site-measured data by the Austrian fores inventory. These data include all possible reasons for biomass losses in the forests. Therefore the figures for "Total biomass removed in Commercial Harvest" include also the biomass losses due to forest conversion
	Traditional Fuelwood Consumed	5 A 2 a,b Traditional Fuelwood Consumed	5 A 2 a,b Total biomass removed in Commercial Harvest	The basis for the estimated figures for "Total biomass removed in Commercial Harvest" are at-site-measured data by the Austrian fores inventory. These data include all possible reasons for biomass losses in the forests. Therefore the figures for "Total biomass removed in Commercial Harvest" include also for instance traditional fuelwood consumption, biomass losses by forest fires (in the 90-ies at areas <135 ha per year) and biomass losses due to other damages
CH_4				
	Oil Exploration, Gas Exploration, Production/Processing	1 B 2 a i, 1 B 2 b Exploration, 1 B 2 b i	1 B 2 a iI Oil Production	As all oil fields are combined oil and gas production fields, total emissions together with emissions from gas production fields are reported here (total figures are reported from the Association of Oil Industry).
	Venting and Flaring	1 B 2 c	1 B 2 b iv Refining Storage	The emission declaration of the refinery includes all emissions from the plant.
	Multilateral Operations	Memo Item: Multilateral Operations	1 A 4 Other Sectors	see explanation for CO2.
	Enteric Fermentation - Mules and Asses	4 A 7 Enteric Fermentation - Mules and Asses	4 A 6 Enteric Fermentation - Horses	In the national statistics mules, asses and horses are published together.
	Manure Managment - Mules and Asses	4 B 7 Manure Managment - Mules and Asses	4 B 6 Manure Managment - Horses	In the national statistics mules, asses and horses are published together.
	Emissions from sewage sludge	6 B 1, 6 B 2 emissions from sludge, Table 6.B	6 B 1, 6 B 2 emissions from wastewater, Table 6.B	Emissions from sewage sludge are included in emissions from wastewater handling. The country specific method does not separate between the two emission sources.
N_2O				
	Multilateral Operations	Memo Item: Multilateral Operations	1 A 4 Other Sectors	see explanation for CO2.
	Venting and Flaring	1 B 2 c	1 A 1 b Petroleum Refining	see explanation for CO2.
HFCs				
HFCs	Consumption of HFCs - Potential Emissions By Sectors	2 F 1 to 2 F 8	2 F Consumption of Halocarbons and SF6	No detailed information about potential emissions of HFCs.
HFCs	Potential Emissions of HFCs - Import in Products	2 F(p) Import in Products	2 F(p) Import in Bulk	No detailed information about import of HFCs in bulk.
PFCs				
PFCs	Consumption of PFCs - Potential Emissions By Sectors	2 F 1 to 2 F 8	2 F Consumption of Halocarbons and SF6	see explanation for HFCs.
PFCs	Potential Emissions of PFCs - Import in Products	2 F(p) Import in Products	2 F(p) Import in Bulk	see explanation for HFCs.
SF_6				
	Consumption of SF6 - Potential Emissions By Sectors	2 F 1 to 2 F 8	2 F Consumption of Halocarbons and SF6	see explanation for HFCs.
	Potential Emissions of SF6 - Import in Products	2 F(p) Import in Products	2 F(p) Import in Bulk	see explanation for HFCs.

(1) Please, 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 category for which the indicator "NE" is entered in the sectoral tables.
(2) Indicate omitted source/sink following the IPCC source/sink category structure (e.g. sector: Waste, source category: Wastewater Handling).
(3) Please 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 the reason for reporting these sources and sinks in a different sector. An entry should be made for each source/sink for which the indicator "IE" is used in the sectoral tables.

TABLE 9 COMPLETENESS
(Sheet 2 of 2)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

Additional GHG emissions reported[4]						
GHG	Source category	Emissions (Gg)	Estimated GWP value (100-year horizon)	Emissions CO_2 equivalent (Gg)	Reference to the data source of GWP value	Explanation

[4] Parties are encouraged to provide information on emissions of greenhouse gases whose GWP values have not yet been agreed upon by the COP. Please include such gases in this table if they are considered in the submitted inventory. Provide additional information on the estimation methods used.

TABLE 10 EMISSIONS TRENDS (CO_2)
(Sheet 1 of 5)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[(1)]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(Gg)													
1. Energy	**53 218.87**	**53 218.87**	**57 000.48**	**52 143.61**	**52 422.39**	**52 498.90**	**54 992.95**	**59 023.90**	**57 983.84**	**58 414.13**	**57 098.19**	**57 306.43**	**61 188.51**	**61 981.95**
A. Fuel Combustion (Sectoral Approach)	53 116.84	53 116.84	56 889.46	52 023.59	52 310.37	52 371.37	54 865.92	58 952.87	57 863.33	58 272.30	56 927.65	57 141.90	61 005.77	61 814.92
1. Energy Industries	13 475.12	13 475.12	14 266.95	11 144.54	10 924.98	11 279.13	12 438.20	13 695.83	13 675.08	12 847.42	12 796.98	12 500.81	14 511.94	15 013.10
2. Manufacturing Industries and Construction	13 032.63	13 032.63	13 388.43	12 397.28	13 012.32	13 754.15	13 805.30	13 524.42	15 011.66	14 161.59	13 318.76	13 706.53	12 920.20	12 504.07
3. Transport	12 759.20	12 759.20	14 171.78	14 098.33	14 224.80	14 327.52	14 418.49	16 063.85	15 013.44	17 093.93	16 551.64	17 437.19	18 705.54	20 606.16
4. Other Sectors	13 814.87	13 814.87	15 025.19	14 349.74	14 108.84	12 968.97	14 171.35	15 629.83	14 126.02	14 126.92	14 218.65	13 452.42	14 824.69	13 650.84
5. Other	35.02	35.02	37.11	33.70	39.43	41.60	32.59	38.94	37.13	42.45	41.62	44.95	43.40	40.75
B. Fugitive Emissions from Fuels	102.03	102.03	111.03	120.03	112.03	127.53	127.03	71.03	120.51	141.83	170.53	164.53	182.73	167.03
1. Solid Fuels	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
2. Oil and Natural Gas	102.03	102.03	111.03	120.03	112.03	127.53	127.03	71.03	120.51	141.83	170.53	164.53	182.73	167.03
2. Industrial Processes	**7 377.00**	**7 377.00**	**7 279.71**	**6 741.16**	**6 691.50**	**7 023.45**	**7 281.47**	**6 939.93**	**7 528.79**	**7 210.70**	**7 068.33**	**7 565.32**	**7 643.77**	**7 484.49**
A. Mineral Products	3 242.73	3 242.73	3 100.60	3 118.54	3 052.83	3 166.86	2 825.81	2 738.24	2 938.01	2 765.73	2 750.73	2 804.29	2 814.17	2 910.66
B. Chemical Industry	461.34	461.34	468.81	436.16	460.89	431.15	514.86	516.90	507.83	555.63	524.86	532.29	509.05	510.25
C. Metal Production	3 672.92	3 672.92	3 710.30	3 186.46	3 177.78	3 425.44	3 940.79	3 684.79	4 082.95	3 889.34	3 792.74	4 228.74	4 320.56	4 063.58
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF_6														
F. Consumption of Halocarbons and SF_6													NE	NE
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**282.67**	**282.67**	**236.77**	**187.74**	**187.35**	**171.54**	**189.88**	**172.81**	**190.09**	**172.24**	**158.37**	**181.02**	**193.60**	**193.60**
4. Agriculture	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils [(2)]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land-Use Change and Forestry [(3)]	**-9 214.81**	**-9 214.81**	**-13 503.89**	**-8 656.47**	**-8 982.36**	**-7 861.58**	**-7 254.00**	**-5 385.22**	**-7 633.36**	**-7 633.36**	**-7 633.36**	**-7 633.36**	**-7 633.36**	**-7 633.36**
A. Changes in Forest and Other Woody Biomass Stocks	-9 214.81	-9 214.81	-13 503.89	-8 656.47	-8 982.36	-7 861.58	-7 254.00	-5 385.22	-7 633.36	-7 633.36	-7 633.36	-7 633.36	-7 633.36	-7 633.36
B. Forest and Grassland Conversion	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
C. Abandonment of Managed Lands	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
D. CO_2 Emissions and Removals from Soil	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**20.70**	**20.70**	**18.45**	**7.55**	**8.50**	**9.75**	**10.09**	**10.40**	**10.70**	**10.99**	**11.31**	**11.28**	**11.24**	**11.24**
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Waste-water Handling	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Waste Incineration	20.70	20.70	18.45	7.55	8.50	9.75	10.09	10.40	10.70	10.99	11.31	11.28	11.24	11.24
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other *(please specify)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total Emissions/Removals with LUCF [(4)]	**51 684.42**	**51 684.42**	**51 031.53**	**50 423.60**	**50 327.39**	**51 842.06**	**55 220.38**	**60 761.82**	**58 080.06**	**58 174.72**	**56 702.84**	**57 430.70**	**61 403.76**	**62 037.93**
Total Emissions without LUCF[(4)]	**60 899.24**	**60 899.24**	**64 535.42**	**59 080.06**	**59 309.75**	**59 703.64**	**62 474.38**	**66 147.04**	**65 713.42**	**65 808.07**	**64 336.20**	**65 064.05**	**69 037.12**	**69 671.29**
Memo Items:														
International Bunkers	**885.97**	**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**	**1 674.93**	**1 614.75**	**1 512.24**
Aviation	885.97	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	1 674.93	1 614.75	1 512.24
Marine	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass	**9 750.24**	**9 750.24**	**10 612.42**	**10 401.32**	**10 963.02**	**10 591.10**	**11 254.16**	**11 973.05**	**12 058.41**	**11 474.32**	**11 960.24**	**11 691.36**	**13 112.68**	**13 562.05**

[(1)] Fill in the base year adopted by the Party under the Convention, if different from 1990.
[(2)] See footnote 4 to Summary 1.A of this common reporting format.
[(3)] Take the net emissions as reported in Summary 1.A of this common reporting format. Please note that for the purposes of reporting, the signs for uptake are always (-) and for emissions (+).
[(4)] The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report CO_2 emissions and removals from Land-Use Change and Forestry.

TABLE 10 EMISSIONS TRENDS (CH_4)
(Sheet 2 of 5)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(Gg)													
Total Emissions	**446.39**	**446.39**	**444.74**	**431.01**	**429.01**	**422.49**	**417.78**	**409.69**	**397.00**	**391.25**	**382.26**	**370.98**	**364.56**	**355.46**
1. Energy	**35.46**	**35.46**	**37.15**	**35.09**	**34.85**	**32.71**	**33.74**	**35.56**	**31.06**	**30.47**	**30.38**	**28.93**	**30.60**	**29.69**
A. Fuel Combustion (Sectoral Approach)	22.24	22.24	23.75	21.77	21.17	19.29	19.78	20.63	16.23	15.66	15.35	14.34	15.83	15.24
1. Energy Industries	0.15	0.15	0.17	0.16	0.16	0.16	0.16	0.18	0.20	0.18	0.17	0.17	0.20	0.26
2. Manufacturing Industries and Construction	0.41	0.41	0.43	0.42	0.41	0.44	0.43	0.44	0.48	0.44	0.46	0.44	0.43	0.37
3. Transport	2.86	2.86	2.96	2.77	2.62	2.50	2.29	2.08	1.91	1.91	1.72	1.61	1.54	1.56
4. Other Sectors	18.82	18.82	20.19	18.43	17.98	16.19	16.89	17.93	13.65	13.12	13.00	12.11	13.65	13.04
5. Other	0.00	0.00	0.00	0.00	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	13.22	13.22	13.40	13.32	13.67	13.42	13.96	14.93	14.83	14.81	15.02	14.60	14.77	14.45
1. Solid Fuels	0.52	0.52	0.45	0.37	0.36	0.29	0.28	0.24	0.24	0.24	0.24	0.27	0.26	0.26
2. Oil and Natural Gas	12.70	12.70	12.96	12.94	13.31	13.13	13.68	14.69	14.59	14.57	14.78	14.33	14.51	14.19
2. Industrial Processes	**0.33**	**0.33**	**0.31**	**0.29**	**0.32**	**0.32**	**0.28**	**0.28**	**0.30**	**0.32**	**0.27**	**0.27**	**0.25**	**0.39**
A. Mineral Products	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.04
B. Chemical Industry	0.29	0.29	0.28	0.25	0.27	0.28	0.24	0.24	0.26	0.29	0.23	0.23	0.21	0.35
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production	NA	NA	NA	NA	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	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
4. Agriculture	**218.67**	**218.67**	**215.69**	**207.67**	**207.66**	**210.15**	**211.28**	**207.96**	**205.48**	**204.94**	**200.69**	**197.13**	**194.76**	**190.35**
A. Enteric Fermentation	169.68	169.68	167.37	160.06	160.08	162.26	163.51	161.10	158.61	157.56	155.78	153.54	150.83	147.83
B. Manure Management	48.59	48.59	47.92	47.22	47.04	47.42	47.25	46.34	46.35	46.86	44.39	43.07	43.42	42.02
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	0.33	0.33	0.33	0.31	0.47	0.40	0.44	0.45	0.45	0.45	0.45	0.45	0.43	0.43
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land-Use Change and Forestry	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Forest and Grassland Conversion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. CO_2 Emissions and Removals from Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	**191.93**	**191.93**	**191.58**	**187.95**	**186.19**	**179.31**	**172.48**	**165.89**	**160.16**	**155.52**	**150.93**	**144.65**	**138.95**	**135.03**
A. Solid Waste Disposal on Land	177.69	177.69	177.16	173.25	171.18	164.07	157.15	150.48	144.81	140.15	135.51	129.24	123.68	119.75
B. Waste-water Handling	13.73	13.73	13.88	14.06	14.19	14.26	14.29	14.31	14.34	14.35	14.37	14.40	14.27	14.27
C. Waste Incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other	0.52	0.52	0.54	0.65	0.82	0.98	1.04	1.09	1.01	1.02	1.05	1.01	1.01	1.01
7. Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items:														
International Bunkers	**0.01**	**0.01**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**
Aviation	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
Marine	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
CO_2 Emissions from Biomass														

TABLE 10 EMISSIONS TRENDS (N_2O)
(Sheet 3 of 5)

Austria

2002

Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(Gg)													
Total Emissions	**19.32**	**19.32**	**21.34**	**18.37**	**20.03**	**21.94**	**20.55**	**19.80**	**20.66**	**19.95**	**19.66**	**19.52**	**19.26**	**18.55**
1. Energy	**3.05**	**3.05**	**3.69**	**3.94**	**4.22**	**4.38**	**4.36**	**4.29**	**4.13**	**4.24**	**4.00**	**3.88**	**3.90**	**3.99**
A. Fuel Combustion (Sectoral Approach)	3.05	3.05	3.69	3.94	4.22	4.38	4.36	4.29	4.13	4.24	4.00	3.88	3.90	3.99
1. Energy Industries	0.15	0.15	0.17	0.14	0.14	0.15	0.16	0.16	0.15	0.17	0.17	0.17	0.20	0.20
2. Manufacturing Industries and Construction	0.44	0.44	0.47	0.47	0.48	0.50	0.50	0.50	0.55	0.55	0.54	0.54	0.54	0.52
3. Transport	1.57	1.57	2.10	2.40	2.65	2.81	2.72	2.59	2.40	2.48	2.24	2.14	2.08	2.24
4. Other Sectors	0.89	0.89	0.95	0.93	0.94	0.92	0.97	1.04	1.03	1.04	1.05	1.02	1.07	1.03
5. Other	0.00	0.00	0.00	0.00	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	0.00	0.00	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. Solid Fuels	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
2. Oil and Natural Gas	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
2. Industrial Processes	**2.94**	**2.94**	**2.99**	**2.70**	**2.83**	**2.66**	**2.77**	**2.82**	**2.78**	**2.89**	**2.98**	**3.07**	**2.54**	**2.60**
A. Mineral Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Chemical Industry	2.94	2.94	2.99	2.70	2.83	2.66	2.77	2.82	2.78	2.89	2.98	3.07	2.54	2.60
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production	NA	NA	NA	NA	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	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
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**	**0.75**	**0.75**	**0.75**	**0.75**
4. Agriculture	**12.42**	**12.42**	**13.76**	**10.80**	**12.04**	**13.93**	**12.46**	**11.71**	**12.78**	**11.84**	**11.70**	**11.60**	**11.85**	**10.98**
A. Enteric Fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Manure Management	2.54	2.54	2.51	2.41	2.43	2.46	2.50	2.45	2.43	2.42	2.38	2.34	2.31	2.26
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	9.88	9.88	11.25	8.39	9.60	11.46	9.96	9.25	10.34	9.41	9.32	9.26	9.54	8.72
E. Prescribed Burning of Savannas	NO	NO	NO	NO	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	0.00	0.00	0.00	0.00
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land-Use Change and Forestry	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
A. Changes in Forest and Other Woody Biomass Stocks	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Forest and Grassland Conversion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C. Abandonment of Managed Lands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. CO_2 Emissions and Removals from Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	**0.15**	**0.15**	**0.15**	**0.17**	**0.19**	**0.22**	**0.23**	**0.23**	**0.22**	**0.22**	**0.23**	**0.22**	**0.22**	**0.22**
A. Solid Waste Disposal on Land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Waste-water Handling	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
C. Waste Incineration	0.00	0.00	0.00	0.00	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	0.08	0.10	0.12	0.14	0.15	0.16	0.14	0.15	0.15	0.14	0.14	0.14
7. Other *(please specify)*	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items:														
International Bunkers	**0.03**	**0.03**	**0.03**	**0.04**	**0.04**	**0.04**	**0.05**	**0.05**	**0.05**	**0.06**	**0.05**	**0.06**	**0.06**	**0.05**
Aviation	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.06	0.05	0.06	0.06	0.05
Marine	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass														

TABLE 10 EMISSION TRENDS (HFCs, PFCs and SF_6)
(Sheet 4 of 5)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(Gg)													
Emissions of HFCs(5) - CO_2 equivalent (Gg)	546.07	3.69	5.85	8.54	12.15	16.89	546.07	624.83	718.02	815.61	870.46	1 033.25	1 033.25	1 033.25
HFC-23	0.0002	0.0002	0.0003	0.0004	0.0005	0.0007	0.0002	0.0003	0.0003	0.0004	0.0005	0.0006	0.0006	0.0006
HFC-32	0.0001	NO	NO	NO	NO	0.0000	0.0001	0.0002	0.0004	0.0006	0.0009	0.0017	0.0017	0.0017
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-125	0.0014	NO	NO	NO	NO	0.0000	0.0014	0.0057	0.0110	0.0148	0.0162	0.0219	0.0219	0.0219
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	0.4143	0.0014	0.0021	0.0032	0.0046	0.0067	0.4143	0.4578	0.5089	0.5677	0.6020	0.6531	0.6531	0.6531
HFC-152a	0.0001	NO	NO	NO	NO	NO	0.0001	0.0003	0.0006	0.0008	0.0007	0.4522	0.4522	0.4522
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	0.0004	NO	NO	NO	NO	NO	0.0004	0.0025	0.0056	0.0081	0.0095	0.0136	0.0136	0.0136
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	0.0000	0.0000	0.0001	0.0001	0.0002	0.0002	0.0002
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of PFCs(5) - CO_2 equivalent (Gg)	15.62	963.17	974.33	576.19	48.13	53.63	15.62	14.79	18.26	20.85	25.32	25.16	25.16	25.16
CF_4	0.0008	0.1328	0.1338	0.0793	0.0048	0.0050	0.0008	0.0007	0.0009	0.0009	0.0015	0.0015	0.0015	0.0015
C_2F_6	0.0011	0.0109	0.0114	0.0066	0.0018	0.0023	0.0011	0.0011	0.0014	0.0016	0.0017	0.0017	0.0017	0.0017
C_3F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
$c-C_4F_8$	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Emissions of SF_6(5) - CO_2 equivalent (Gg)	1 174.74	517.74	682.90	725.40	822.84	1 032.81	1 174.74	1 246.13	1 148.06	954.90	729.90	676.95	676.95	676.95
SF_6	0.05	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.04	0.03	0.03	0.03	0.03

Chemical	GWP
HFCs	
HFC-23	11700
HFC-32	650
HFC-41	150
HFC-43-10mee	1300
HFC-125	2800
HFC-134	1000
HFC-134a	1300
HFC-152a	140
HFC-143	300
HFC-143a	3800
HFC-227ea	2900
HFC-236fa	6300
HFC-245ca	560
PFCs	
CF_4	6500
C_2F_6	9200
C_3F_8	7000
C_4F_{10}	7000
$c-C_4F_8$	8700
C_5F_{12}	7500
C_6F_{14}	7400
SF_6	23900

(5) Enter information on the actual emissions. Where estimates are only available for the potential emissions, specify this in a comment to the corresponding cell. Only in this row the emissions are expressed as CO_2 equivalent emissions in order to facilitate data flow among spreadsheets.

TABLE 10 EMISSION TRENDS (SUMMARY)
(Sheet 5 of 5)

Austria
2002
Umweltbundesamt, UNFCCC submission 2004

GREENHOUSE GAS EMISSIONS	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	CO_2 equivalent (Gg)													
Net CO_2 emissions/removals	51 684.42	51 684.42	51 031.53	50 423.60	50 327.39	51 842.06	55 220.38	60 761.82	58 080.06	58 174.72	56 702.84	57 430.70	61 403.76	62 037.93
CO_2 emissions (without LUCF)[6]	60 899.24	60 899.24	64 535.42	59 080.06	59 309.75	59 703.64	62 474.38	66 147.04	65 713.42	65 808.07	64 336.20	65 064.05	69 037.12	69 671.29
CH_4	9 374.18	9 374.18	9 339.51	9 051.14	9 009.30	8 872.32	8 773.33	8 603.59	8 336.93	8 216.35	8 027.55	7 790.64	7 655.84	7 464.64
N_2O	5 988.22	5 988.22	6 616.07	5 693.93	6 210.62	6 801.08	6 371.54	6 139.55	6 405.61	6 184.16	6 093.28	6 050.15	5 970.07	5 749.51
HFCs	546.07	3.69	5.85	8.54	12.15	16.89	546.07	624.83	718.02	815.61	870.46	1 033.25	1 033.25	1 033.25
PFCs	15.62	963.17	974.33	576.19	48.13	53.63	15.62	14.79	18.26	20.85	25.32	25.16	25.16	25.16
SF_6	1 174.74	517.74	682.90	725.40	822.84	1 032.81	1 174.74	1 246.13	1 148.06	954.90	729.90	676.95	676.95	676.95
Total (with net CO_2 emissions/removals)	**68 783.27**	**68 531.43**	**68 650.18**	**66 478.80**	**66 430.42**	**68 618.79**	**72 101.70**	**77 390.71**	**74 706.95**	**74 366.59**	**72 449.36**	**73 006.84**	**76 765.04**	**76 987.44**
Total (without CO_2 from LUCF)[6]	**77 998.09**	**77 746.24**	**82 154.07**	**75 135.27**	**75 412.78**	**76 480.37**	**79 355.70**	**82 775.93**	**82 340.31**	**81 999.95**	**80 082.72**	**80 640.20**	**84 398.39**	**84 620.79**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	CO_2 equivalent (Gg)													
1. Energy	54 909.71	54 909.71	58 924.48	54 102.71	54 461.92	54 543.91	57 052.33	61 101.33	59 917.21	60 367.98	58 975.68	59 115.76	63 039.50	63 842.51
2. Industrial Processes	10 032.32	9 780.47	9 876.67	8 894.94	8 460.02	8 958.72	9 881.01	9 705.85	10 281.98	9 905.60	9 623.08	10 257.87	10 170.88	10 035.32
3. Solvent and Other Product Use	515.17	515.17	469.27	420.24	419.85	404.04	422.38	405.31	422.59	404.74	390.87	413.52	426.10	426.10
4. Agriculture	8 443.72	8 443.72	8 794.67	7 710.33	8 092.87	8 731.55	8 298.04	7 997.19	8 275.98	7 975.18	7 842.11	7 735.56	7 764.41	7 401.81
5. Land-Use Change and Forestry[7]	-9 214.81	-9 214.81	-13 503.89	-8 656.47	-8 982.36	-7 861.58	-7 254.00	-5 385.22	-7 633.36	-7 633.36	-7 633.36	-7 633.36	-7 633.36	-7 633.36
6. Waste	4 097.17	4 097.17	4 088.99	4 007.05	3 978.12	3 842.15	3 701.94	3 566.25	3 442.55	3 346.44	3 250.98	3 117.49	2 997.50	2 915.06
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

[6] The information in these rows is requested to facilitate comparison of data, since Parties differ in the way they report CO_2 emissions and removals from Land-Use Change and Forestry.
[7] Net emissions.

TABLE 11 CHECK LIST OF REPORTED INVENTORY INFORMATION [(1)]

Party: Austria **Year:** 2002

Contact info:

Focal point for national GHG inventories:	Manfred Ritter				
Address:	Spittelauer Lände 5, A-1090 Vienna, Austria				
Telephone:	++43+1-31304-5951	Fax:	++43+1-31304-5959	E-mail:	manfred.ritter@umweltbundesamt.at
Main institution preparing the inventory:	Umweltbundesamt GmbH				

General info:

Date of submission:	15.03.2004		
Base years:	1990	PFCs, HFCs, SF_6:	1995
Year covered in the submission:	2002		
Gases covered:	CO2, CH4, N2O, PFCs, HFCs, SF6, NOX, CO, NMVOC, SO2		
Omissions in geographic coverage:	None		

Tables:

	Energy	Ind. Processes	Solvent Use	LUCF	Agriculture	Waste
Sectoral report tables:	☑	☑	☑	☑	☑	☑
Sectoral background data tables:	☑	☑	☑	☑	☑	☑
Summary 1 (IPCC Summary tables):	IPCC Table 7A:		☑	IPCC Table 7B:		☑
Summary 2 (CO_2 equivalent emissions):			☑			
Summary 3 (Methods/Emission factors):			☑			
Uncertainty:	IPCC Table 8A:		☑	National information:		☑
Recalculation tables:			☑			
Completeness table:			☑			
Trend table:			☑			

CO_2

	Worksheet 1-1	Percentage of difference	Explanation of differences
Comparison of CO_2 from fuel combustion:	☑	-1.18	☑

Recalculation:

	Energy	Ind.Processes	Solvent Use	LUCF	Agriculture	Waste
CO_2	☑	☑	☐	☐	☐	☑
CH_4	☑	☑	☐	☐	☑	☑
N_2O	☑	☑	☐	☐	☑	☑
HFCs, PFCs, SF_6		☐				
Explanations:	☑	☑	☐	☐	☑	☑
Recalculation tables for all recalculated years			☑			
Full CRF for the recalculated base year			☑			

HFCs, PFCs, SF_6:

	HFCs		PFCs		SF_6	
Disaggregation by species:	☑		☑			
Production of Halocarbons/SF_6:	☑		☑		☑	
Consumption of Halocarbons/SF_6:	Actual	Potential	Actual	Potential	Actual	Potential
	☑	☑	☑	☑	☑	☑
Potential/Actual emission ratio:	2.69		7.91		1.58	

Reference to National Inventory Report and/or national inventory web site:	Umweltbundesamt, OLI 2003 http://www.umweltbundesamt.at

CRF - Common Reporting Format.
LUCF - Land-Use Change and Forestry.

[(1)] For each omission, give an explanation for the reasons by inserting a comment to the corresponding cell.

ANNEX 6: EXTRACTS FROM AUSTRIAN LEGISLATION

Extracts from Austrian legislation, which regulate monitoring, reporting and verification of emissions at plant level

Cement production

BGBl 1993/ 63 Verordnung für Anlagen zur Zementerzeugung

§ 5. Der Betriebsanlageninhaber hat

1. kontinuierliche Messungen der Emissionskonzentrationen an Gesamtstaub, SO_2 und Stickstoffoxiden (berechnet als NO_2) der Ofenanlage entsprechend der Z 1 der Anlage zu dieser Verordnung durchzuführen ...

Zur Durchführung der Messungen gemäß Z 2 und 3 sind Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, welcher

1. bei Messungen gemäß § 5 Z 1 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes und die gemäß § 4 Abs. 1 zu führenden Aufzeichnungen über Grenzwertüberschreitungen,

zu enthalten hat. Der Messbericht ist mindestens fünf Jahre in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage

(§ 5)

Emissionsmessungen

1. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Registrierende Emissionsmessgeräte sind im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 5 letzter Satz angeführten Personenkreis zu kalibrieren.

c) Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige aus dem im § 5 letzter Satz angeführten Personenkreis vorzunehmen.

Foundries

BGBl 1994/ 447 Verordnung für Gießereien

§ 5 (1) Der Betriebsanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 angeführten Stoffe entsprechend der Z 1 lit. A bis c der Anlage 2 dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen durchführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebsanlageninhaber hat kontinuierliche Messungen der Emissionskonzentrationen ... entsprechend der Z2 der Anlage 2 zu dieser Verordnung durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, oder akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992) heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, welcher

1. bei Messungen gemäß § 5 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff, Rohmaterial und Zuschlagstoffen),

2. bei Messungen gemäß § 5 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes und die gemäß § 4 Abs. 2 zu führenden Aufzeichnungen über Grenzwertüberschreitungen, zu enthalten hat. Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 5 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

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.

<u>Sinter plants</u>

<u>BGBl II 1997/ 163 Verordnung für Anlagen zum Sintern von Eisenerzen</u>

§ 5 (1) Der Betriebanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 Z 2 lit. a und b und Z 3 angeführten Stoffe entsprechend der Z 1 in der Anlage zu dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen, durchzuführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebanlageninhaber hat kontinuierliche Messungen der Emissionskonzentrationen von Staub, Stickstoffoxiden und Schwefeldioxid entsprechend der Z 2 der Anlage dieser Verordnung durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind akkreditierte Stellen im

Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992), Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, der zu enthalten hat:

1. bei Messungen gemäß § 5 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff und Einsatzmaterial),

2. bei Messungen gemäß § 5 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes.

Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 5 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

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

BGBl II 1997/ 331 Feuerungsanlagen-Verordnung

Emissionsmessungen

§ 4 (1) Der Betriebsanlageninhaber hat Emissionsmessungen sowie die Bestimmung des Abgasverlustes entsprechend der Anlage 1 zu dieser Verordnung durchzuführen bzw. durchführen zu lassen.

(2) Zur Durchführung der Emissionseinzelmessungen sowie zur Bestimmung des Abgasverlustes ist ein Sachverständiger aus dem im § 2 Abs. 2 zweiter Satz genannten Personenkreis heranzuziehen.

§ 5 (1) Der Betriebsanlageninhaber hat, sofern in dieser Verordnung nicht anderes bestimmt ist,

1. kontinuierliche Messungen der Emissionskonzentrationen, abhängig von der jeweiligen Brennstoffwärmeleistung und dem eingesetzten Brennstoff, entsprechende der folgenden Tabelle durchzuführen

Brennstoff	Staub	CO	SO_2	NO_x	
fest	> 10	> 10	> 30	> 30	MW
flüssig	> 10	> 10	> 50	> 30	MW
gasförmig	-	> 10	-	> 30	MW

Prüfungen

Erstmalige Prüfung

§ 23 (1) Feuerungsanlagen sind anlässlich ihrer Inbetriebnahme einer erstmaligen Prüfung zu unterziehen.

(2) Die erstmalige Prüfung hat in der Erbringung des Nachweises zu bestehen, dass die Feuerungsanlage den Anforderungen dieser Verordnung entspricht.

Wiederkehrende Prüfungen

§ 25 (1) Feuerungsanlagen sind jährlich zu prüfen. Bei dieser jährlichen Prüfung sind die Feuerungsanlagen hinsichtlich jener Anlagenteile, die für die Emissionen oder deren Begrenzung von Bedeutung sind, zu besichtigen und auf etwaige Mängel zu kontrollieren... Weiters sind jährlich die Ergebnisse der gemäß § 5 durchgeführten kontinuierlichen Messungen zu beurteilen.

Prüfbescheinigung

§ 27 Das Ergebnis jeder Prüfung muss in einer Prüfbescheinigung festgehalten sein, die insbesondere festgestellte Mängel sowie Vorschläge zu deren Behebung zu enthalten hat. Die Prüfbescheinigung ist im Original in der Betriebsanlage zumindest fünf Jahre so aufzubewahren, dass sie den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

Anlage 1

(§§ 4 und 25)

Emissionsmessungen

1. Die Messungen sind

1.3 für gasförmige Emissionen nach den Regeln der Technik, oder nach einem diesen Verfahren gleichwertigen Verfahren durchzuführen.

2. Die Messstellen sind so festzulegen, dass eine repräsentative und messtechnisch einwandfreie Emissionsmessung gewährleistet ist.

3. Einzelmessungen

3.2 Die Einzelmessungen sind an einer repräsentativen Entnahmestelle im Kanalquerschnitt vorzunehmen. Es sind innerhalb eines Zeitraumes von drei Stunden drei messwerte als Halbstundenmittelwerte zu bilden.

4. Kontinuierliche Messungen

4.1 Die Datenaufzeichnung hat durch automatisch registrierende Messgeräte in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90 % zu betragen. Als Bezugszeitraum gilt ein Monat. Die Messergebnisse müssen mit dem einzuhaltenden Grenzwert vergleichbar sein.

4.2 Registrierende Emissionsmessgeräte sind im Abnahmeversuch und mindestens alle drei Jahre durch einen Sachverständigen aus dem im § 2 Abs. 2 zweiter Satz angeführten Personenkreis zu kalibrieren. Die Kalibrierung hat nach den Regeln der Technik (z.B. nach den vom Verein Deutscher Ingenieure herausgegebenen und beim Österreichischen Normungsinstitut, Heinestraße 38, 1021 Wien, erhältlichen Richtlinien VDI 2066, Blatt 4 und Blatt 6, und VDI 3950, Blatt 1E) zu erfolgen.

4.3 Jährlich ist eine Funktionskontrolle an registrierenden Emissionsmessgeräten durch Sachverständige aus dem im § 2 Abs. 2 zweiter Satz angeführten Personenkreis vorzunehmen.

Non-ferrous metal production

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.