umweltbundesamt

# AUSTRIA'S INFORMATIVE INVENTORY REPORT 2004

## Submission under the UNECE Convention on Long-range Transboundary Air Pollution

BERICHTE

BE-257

Vienna, 2004

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**Acknowledgements**

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 Air Emissions Inventory for their contribution to the continuous improvement of the inventory.

The preparation of this report was financially supported by the *Federal Ministry of Agriculture, Forestry, Environment and Water Management*.



**Impressum**

Medieninhaber und Herausgeber (*Editor)* : Umweltbundesamt GmbH
Spittelauer Lände 5, 1090 Wien/Vienna,
Österreich/Austria

Eigenvervielfältigung (*published by Umweltbundesamt*)

Gedruckt auf Recyclingpapier (*Printed on recycling paper*)


ISBN 3-85457-752-4

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EXECUTIVE SUMMARY

This report provides a complete and comprehensive description of the methodologies used for the compilation of Austrian's Air Emission Inventory for $NO_X$, $SO_2$, NMVOC and $NH_3$ as presented in Austria's 2004 submission under the Convention on Long-range Transboundary Air Pollution of the United Nations Economic Commission for Europe (UNECE/LRTAP).

As a party to the Convention Austria is bound to annually report data on emissions of air pollutants covered in the Convention and its Protocols. To be able to meet this reporting requirement Austria compiles an Air Emission Inventory ("Österreichische Luftschadstoffinventur – OLI") which is updated annually.

This report follows the regulations under the UNECE/LRTAP Convention and its Protocols that define standards for national emission inventories. In 2002 the Executive Body adopted guidelines for estimating and reporting of emission data which are necessary to ensure that the transparency, consistency, comparability, completeness and accuracy of reported emissions are adequate for current CLRTAP requirements (EB.AIR/GE.1/2002/7 and its supporting addendum).

The guidelines offer guidance on how to provide supporting documentation within the new reporting format (Nomenclature For Reporting NFR) and give information on the level of required reporting detail and on minimum and additional reporting obligations. Furthermore they ask parties to provide an Informative Inventory Report (IIR) containing detailed and complete information on the compilation of their emission inventories in order to ensure the transparency of the inventory.

This year, Austria provides the Informative Inventory Report at hand for the second time. The structure of this report follows closely the structure of Austria's National Inventory Report (NIR) submitted annually under the United Nations Framework Convention on Climate Change (UNFCCC) which includes a complete and comprehensive description of methodologies used for compilation of Austria's greenhouse gas inventory[1].

The first chapter of this report provides general information on the institutional arrangements for inventory preparation, on the inventory preparation process itself and on QA/QC activities. Chapter 2 gives information on reduction or stabilisation targets as set out in the Protocols to the Convention compared to actual trends. The third chapter presents major changes to the previous submission (emission data report 2003 under the UNECE/LRTAP convention).

Chapters 4 to 8 include detailed information on the methodologies and assumptions used for estimating $NO_X$, $SO_2$, NMVOC and $NH_3$ emissions in Austria's Air Emissions Inventory and contains references and expected future methodological improvements.

The annex presents inter alia emission data for $NO_X$, $SO_2$, NMVOC and $NH_3$ for the year 2002 in the "New Format for Reporting - NFR" as well as trend tables for these gases and for heavy metals, POPs and particulate matter, as included in "Austria's Annual National Air Emissions Inventory 1980-2002. Submission under the Convention on Long-range Transboundary Air Pollution (CLRTAP)".

The preparation and review of Austria's National Air Emission Inventory are the responsibility of the Department of AIR EMISSIONS of the UMWELTBUNDESAMT (federal environment agency Austria).

An electronic version of the IIR 2004 as well as related data may be found on the website of the UMWELTBUNDESAMT (www.umweltbundesamt.at); further copies of this report can be ordered from the website, as well.

[1] UMWELTBUNDESAMT (2004): Austria's National Inventory Report 2004 – Submission under the United Nations Framework Convention on Climate Change; Wien.

Specific responsibilities for the IIR 2004 have been as follows:

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# 1 INTRODUCTION

## 1.1 Institutional Arrangement for Inventory Preparation

The UMWELTBUNDESAMT has a legal responsibility for the preparation of Austrian emission inventories[2]. 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.

An national air emission inventory that identifies and quantifies the main sources of pollutants in a consistent manner provides a common means for comparing the relative contribution of different emission sources and hence serves as an important basis for policies to reduce emissions.

### 1.1.1 Austria's Obligations

Austria has to comply with the following air emission related obligations:

- Austria's obligation under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP): Austria signed the convention in 1979, since its entry into force in 1983 the Convention has been extended by eight protocols which identify specific obligations or measures to be taken by Parties. These are (with their status of ratification)[3]:
    - The 1984 Geneva Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP); 41 Parties. Entered into force 28 January 1988.
    - The 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent; 22 Parties. Entered into force 2 September 1987.
    - The 1988 Sofia Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes; 28 Parties. Entered into force 14 February 1991.
    - The 1991 Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes; 21 Parties. Entered into force 29 September 1997.
    - The 1994 Oslo Protocol on Further Reduction of Sulphur Emissions; 25 Parties. Entered into force 5 August 1998.
    - The 1998 Aarhus Protocol on Heavy Metals; 36 Signatories and 21 ratifications. Entered into force on 29 December 2003.
    - The 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs); 36 Signatories and 20 ratifications. Entered into force on 23 October 2003.
    - The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone; 31 Signatories and 11 ratifications. Not yet in force.

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[2] "Umweltkontrollgesetz" (*environmental surveillance act*): Bundesgesetzblatt (*federal law gazette*) 152/1998.

[3] For information on reduction or stabilization targets as set out in the Protocols to CLRTAP as well as on the status of Austria fulfilling these targets see Chapter 2.1.

- Austria's annual obligations under the Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants (NEC- Directive). The Austrian implementation of the European NEC-Directive[4] also entails the obligation for an national emissions inventory of the covered air pollutants.
- Austria's annual obligations under the European Council Decision 280/2004//EC of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementation of the Kyoto Protocol.
- Austria's obligation under the United Nations Framework Convention on Climate Change (UNFCCC, 1992) and the Kyoto Protocol (1997).
- Obligation under the Austrian "ambient air quality law"[5] 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; see www.umweltbundesamt.at/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.

### 1.1.2 History

As there are 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 measurements for $SO_2$ under EMEP in 1978 (Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe) and joined the UNECE in 1983. At that time Austria reported mainly $SO_2$ emissions.
- 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 $NH_3$.
- As a Party to the Convention, 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 carried out.
- In 1997 emission data were reported for a time period (for each of the years from 1980 to 1995) for the first time.
- In 1998 also emissions of HM, POPs and fluorinated compounds ($SF_6$, PFCs, HFCs) were included in the inventory.
- Inventory data for particulate matter were included in the inventory in 2001.

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[4] „Emissionshöchstmengengesetz- Luft *EG-L*" (*air emissions ceilings law*) Bundesgesetzblatt (*federal law gazette*) I 34/2003

[5] „Immissionsschutzgesetz-Luft *IG-L*" (*ambient air quality law*): Bundesgesetzblatt (*federal law gazette*) I 115/1997.

### 1.1.3 Adaptation of the National Inventory System according to the UNECE/LRTAP Convention and its Protocols

Regulations under the UNECE/LRTAP Convention and its Protocols define standards for the preparation of and reporting on national emission inventories. In 2002, the Executive Body adopted new guidelines for estimating and reporting of emission data to ensure that the transparency, consistency, comparability, completeness and accuracy of reported emissions is adequate for current CLRTAP needs (EB.AIR/GE.1/2002/7 and its supporting addendum).

Under article 8, paragraph (a) of the Convention, Parties shall exchange available information on emissions of agreed upon air pollutants annually. As a minimum requirement, each Party shall report on emissions of the substances relevant to the Protocol to which they are a Party, as required by that Protocol. Since Austria has signed all eight protocols, the annual reporting obligation enfolds 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 the persistent organic pollutants PAH, dioxins and furans and HCB.

Emission estimates should be prepared using the methodologies agreed upon by the Executive Body. This is in particular the EMEP/CORINAIR Guidebook as well as other internationally applied methodologies and guidelines including:

(i) The Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories and the IPCC Good Practice Guidance

(ii) The Integrated Pollution Prevention and Control (IPPC) European Pollutant Emission Register (EPER)

(iii) The IPPC Best Available Techniques Reference Documents

(iv) The Guidelines for Emission Inventory Reporting from the Large Combustion Plant Directive

(v) The Organization for Economic Co-operation and Development (OECD) and Pollution Release and Transfer Register (PRTR) Guidance

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

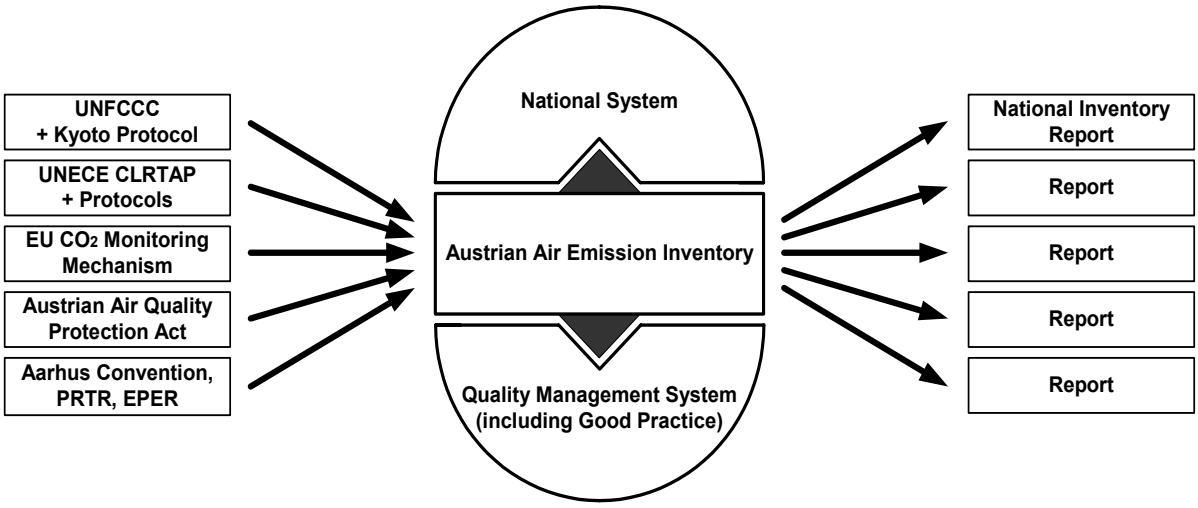


*Figure 1: Structure of the future emission inventory system in Austria (NISA)*

The Austrian Air Emission Inventory comprising all air pollutants stipulated by various national and international obligations will be the centre of NISA. The national system and the quality management system will be 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 obtained in a transparent, consistent, complete, comparable and accurate manner.

The system will include all institutions whose data have a significant impact on emission estimates 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 compiled by the UMWELTBUNDESAMT applying a top down approach using the emissions of the Austrian Air Emission Inventory. One of the next steps will be to further improve the cooperation between these institutions and the UMWELTBUNDESAMT.

## 1.2 Inventory Preparation Process

The present Austrian air pollutant inventory for the period 1990 to 2002 was compiled according to the recommendations for inventories as set out by the Executive Body in the guidelines mentioned above.

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 emissions of air pollutants are estimated together with greenhouse gases 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 NFR 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 into the NFR format to comply with the reporting obligations under UNECE/LRTAP. 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 under the UNECE/LRTAP.

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 1.4) as well as documentation on QA/QC activities.

## 1.3 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 1: 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,<br>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

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 air emissions 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

**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, "Bunde-

slastverteiler" 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 Figure 3.

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[6]. 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[7].

It is covering 50 pollutants including NOx, $SO_2$, NMVOC, $NH_3$, CO, HM, POPs and PM. 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 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.

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[6] "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.

[7] data can be obtained from: http://www.umweltbundesamt.at/eper/

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.

## 1.4 Quality Assurance and Quality Control (QA/QC)

A quality management system (QMS) has been designed to ensure compliance with requirements such as transparency, accuracy, completeness, comparability and consistency.

The QMS was primarily developed to meet the strict requirement for the reporting of GHG emissions under the Kyoto Protocol. For this reason emphasis was placed on GHGs. All air pollutants are comprised by the QMS, however, in the first instance the inspection body is seeking accreditation for GHGs only.

Accreditation of the *Inspection Body for Air Emissions* is scheduled for 2004. The QMS was fully implemented by the end of 2003. The QMS contains all relevant features of the European standard EN 45004:1995 (*General criteria for the operation of various types of bodies performing inspections*) such as strict independence, impartiality and integrity of accredited bodies and in addition complies with the QA/QC requirements of the IPCC-GPG (Good Practice Guidance by the Intergovernmental Panel on Climate Change).

### 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 and EN45004 requirements.

One of the highlights was the re-design of the key management process "Corrective and Preventive Actions" including an efficient process to establish and maintain transparency and completeness in the improvement process, while taking into account all complaints by IPCC Expert Review Teams as well as all other discrepancies discovered during the inventory compilation process.

## 1.5 Completeness

Austria has no territory not covered by the inventory, the geographic coverage is complete.

Regarding emissions, not all sources specified by the NFR format occur in Austria and for some sources emissions have not been estimated so far. To make this transparent, the following notation keys are used in the NFR:

**"NO"** (not occurring) for sources that do not occur in Austria.

**"NA"** (not applicable) for emissions that do not occur for this source category.

**"NE"** (not estimated) for existing emissions that have not been estimated.

**"IE"** (included elsewhere) for emissions that were estimated but included elsewhere in the inventory instead of in the expected source category. Information on where this emissions have been included can be found in this report in the sector specific chapters.

# 2 TREND IN TOTAL EMISSIONS

## 2.1 Emission Targets

Stabilisation or reduction targets for $SO_2$, $NO_X$, NMVOCs, HM and POPs respectively, have been set out in the 1985 Helsinki Protocol, the 1988 Sofia Protocol, the 1991 Geneva Protocol and the 1998 Aarhus Protocols to the UNECE/CLRTAP Convention. Information on these targets as well as on the status of Austria fulfilling these targets is provided below.

### 2.1.1 The 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes

The Protocol to the UNECE/CLRTAP Convention on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent entered into force in 1987. The base year to the protocol was 1984 and the reduction target should have been met by 1993.

Twenty-one ECE countries are Parties to this Protocol, all Parties have reached the reduction target. Taken as a whole, the 21 Parties to the 1985 Sulphur Protocol reduced 1980 sulphur emissions by more than 50% by 1993 (using the latest available figure, where no data were available for 1993).

In Austria $SO_2$ emissions in the base year 1984 amounted to 207 Gg, by the year 1993 emissions were reduced to 59 Gg corresponding to a reduction of 72% .

### 2.1.2 The 1988 Sofia Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes

This Protocol requires to freeze emissions of nitrogen oxides or their transboundary fluxes. The general reference year is 1987 (with the exception of the United States that chose to relate its emission target to 1978).

Taking the sum of emissions of Parties to the $NO_X$ Protocol in 1994 (or a previous year, where no recent data are available) also a reduction of 9% compared to 1987 can be noted. Nineteen of the 25 Parties to the 1988 $NO_X$ Protocol have reached the target and stabilized emissions at 1987 (or in the case of the United States 1978) levels or reduced emissions below that level according to the latest emission data reported.

Austria was successful in fulfilling the stabilisation target set out in the Protocol: $NO_X$ emissions decreased steadily from the base year 1987 until the mid 90ties and remained quite stable with only minor fluctuations until 2000. Since then emissions are increasing again.

Austrian $NO_X$ emissions in the base year to that Protocol amounted to 225 Gg, by the year 1994 emissions were reduced to 194 Gg corresponding to a reduction of 14%. In 2002 $NO_X$ emissions in Austria amounted to 204 Gg, which is 9% below the level of 1987.

### 2.1.3 The 1991 Geneva Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes

In November 1991, the Protocol to the Convention on Long-range Transboundary Air Pollution on the Control of Emissions of Volatile Organic Compounds (other than methane - NMVOCs) or Their Transboundary Fluxes, the second major air pollutant responsible for the formation of ground level ozone, was adopted. The protocol entered into force on 29 September 1997.

This Protocol specifies three options for emission reduction targets that have to be chosen upon signature or upon ratification. Austria opted for reduction of its emissions of non-

methane volatile organic compounds (NMVOCs) by 30% by 1999 using the year 1988 as a basis.

Austria met the reduction target: in the base year NMVOC emissions amounted to 378 Gg, in 1999 emissions were reduced by 50% to 190 Gg.

### 2.1.4 The 1998 Aarhus Protocol on Persistent Organic Pollutants (POPs):

The Executive Body adopted the Protocol on Persistent Organic Pollutants on 24 June 1998 in Aarhus (Denmark). It will entered into force on 23 October 2003. It focuses on a list of 16 substances that have been singled out according to agreed risk criteria. The substances comprise eleven pesticides, two industrial chemicals and three by-products/contaminants. The ultimate objective is to eliminate any discharges, emissions and losses of POPs. The Protocol bans the production and use of some products outright (aldrin, chlordane, chlordecone, dieldrin, endrin, hexabromobiphenyl, mirex and toxaphene). Others are scheduled for elimination at a later stage (DDT, heptachlor, hexaclorobenzene, PCBs). Finally, the Protocol severely restricts the use of DDT, HCH (including lindane) and PCBs. The Protocol includes provisions for dealing with the wastes of products that will be banned.

The Protocol obliges Parties to reduce their emissions of dioxins, furans, PAHs and HCB below their levels in 1990 or an alternative year between 1985 and 1995. It determines specific upper limits for the incineration of municipal, hazardous and medical waste.

Austria has chosen 1985 as a base year and current emissions are well below the level of the base year (see Chapter 2.4).

### 2.1.5 The 1998 Aarhus Protocol on Heavy Metals:

It targets three particularly harmful metals: cadmium, lead and mercury. According to one of the basic obligations, Parties will have to reduce their emissions for these three metals below their levels in 1990 or an alternative year between 1985 and 1995. The Protocol entered into force on 29 December 2003.

Austria has chosen 1985 as a base year and current emissions are well below the level of the base year (see Chapter 2.3).

### 2.1.6 Protocols not yet in Force

The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone "Multi-Effect Protocol" is not yet in force:

> The Protocol sets emission ceilings for 2010 for four pollutants: sulphur, $NO_X$, NMVOCs and ammonia. Parties whose emissions have a severe environmental or health impact and whose emissions are relatively cheap to reduce will have to make the biggest cuts. Once the Protocol is fully implemented, Europe's sulphur emissions should be cut by at least 63%, $NO_X$ emissions by 41%, NMVOC emissions by 40% and ammonia emissions by 17% compared to 1990. The Protocol also sets tight limit values for specific emission sources and requires best available techniques to be used to keep emissions down.

## 2.2 Emission Trends for Air Pollutants covered by the Multi- Effect Protocol and CO

Table 2 and Figure 2 show national total emissions and trends (1990-2002) as well as emission targets[8] for air pollutants covered by the Multi- Effect Protocol.

*Table 2: National total emissions and trends 1990-2002 as well as emission targets for air pollutants covered by the multi- effect protocol and CO*

| Year | Emissions [Gg] | | | | |
|---|---|---|---|---|---|
| | $SO_2$ | $NO_X$ | NMVOC | $NH_3$ | CO |
| 1990 | 79.99 | 212.03 | 298.09 | 57.45 | 1 249 |
| 1991 | 77.10 | 217.27 | 286.22 | 58.58 | 1 253 |
| 1992 | 61.38 | 207.41 | 256.95 | 55.12 | 1 209 |
| 1993 | 58.73 | 198.95 | 250.44 | 57.10 | 1 171 |
| 1994 | 53.08 | 193.70 | 232.76 | 58.71 | 1 118 |
| 1995 | 51.96 | 189.40 | 232.48 | 58.24 | 1 031 |
| 1996 | 49.33 | 193.65 | 225.78 | 56.83 | 1 038 |
| 1997 | 45.44 | 190.08 | 213.13 | 58.06 | 978 |
| 1998 | 40.55 | 194.04 | 201.11 | 57.26 | 938 |
| 1999 | 38.49 | 189.51 | 189.73 | 55.96 | 891 |
| 2000 | 35.39 | 190.28 | 190.30 | 54.13 | 833 |
| 2001 | 37.60 | 196.44 | 195.47 | 54.48 | 837 |
| 2002 | 35.96 | 204.47 | 192.65 | 53.00 | 812 |
| *Trend 1990-2002* | *-55%* | *-4%* | *-35%* | *-8%* | *-35%* |
| **Absolute Emission Target** | **39** | **107** | **159** | **66** | **--** |

[8] For $NO_X$ the National Emission Ceilings Directive (NEC Directive) of the European Union, who also signed the Multi- Effect Protocol, sets a tighter emission target for Austria than the CLRTAP Protocol (103 Gg vs. 107 Gg).

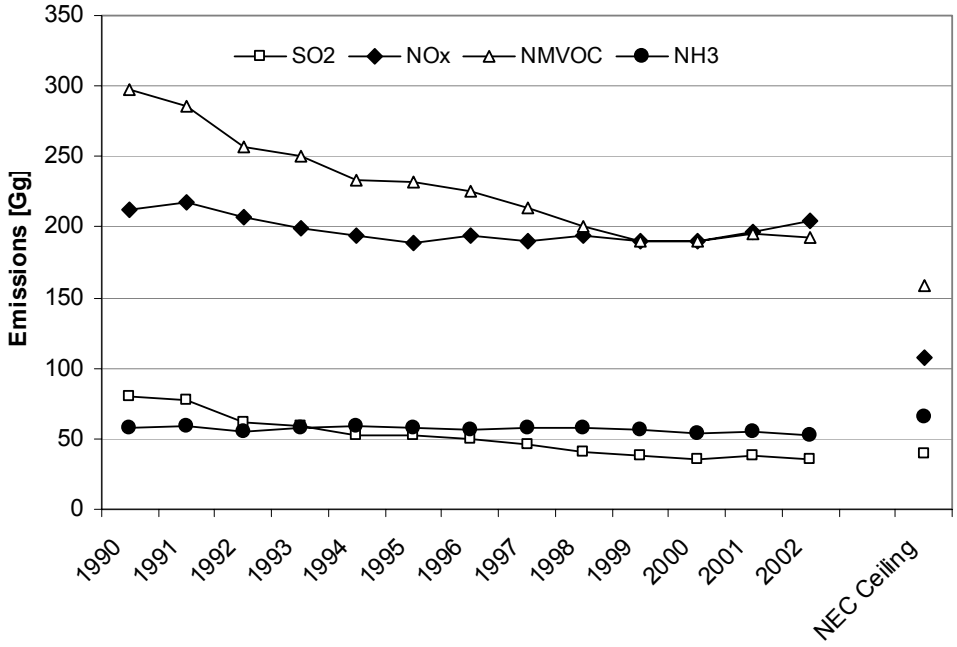



*Figure 2: Emission trends and reduction targets for air pollutants covered under the Multi- Effect Protocol*

## $SO_2$ Emissions

In 1990 national total $SO_2$ Emissions amounted to 80 Gg; emissions decreased steadily since then and by the year 2002 emissions were reduced by 55% mainly due to lower emissions from residential heating, combustion in industries and energy industries.

As can be seen in Table 3, the main source for $SO_2$ emissions in Austria with a share of 93% in 1990 and 89% in 2002 result from fuel combustion activities. Within this source residential heating has the highest contribution to total $SO_2$ emissions.

*Table 3: $SO_2$ emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions*

| NRF Category | $SO_2$ Emissions [Gg] | | Trend 1990-2002 | Share in National Total | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| Energy | 76.58 | 31.97 | *-58%* | *95.7%* | *88.9%* |
| *Fuel Combustion Activities* | 74.58 | 31.83 | *-57%* | *93.2%* | *88.5%* |
| *Fugitive Emissions from Fuels* | 2.00 | 0.14 | *-93%* | *2.5%* | *0.4%* |
| Industrial Processes | 3.34 | 3.93 | *18%* | *4.2%* | *10.9%* |
| Agriculture | 0.00 | 0.00 | *-2%* | *0.0%* | *0.0%* |
| Waste | 0.06 | 0.05 | *-16%* | *0.1%* | *0.2%* |
| **National Total** | **79.99** | **35.96** | ***-55%*** | ***100%*** | ***100%*** |

NOTE: $SO_2$ emissions do not arise from NFR Categories *Solvent and Other Product Use, Land Use Change and Forestry* (LUCF) and *Other*, that's why these categories are not presented in the table.

The 2010 national emission ceiling for $SO_2$ emissions in Austria as set out in Annex II of the Multi- Effects Protocol is 39 Gg, which corresponds to a reduction of 50% based on 1990 emissions. Total emissions of 36 Gg in 2001 emissions are already below the ceiling.

### $NO_X$ Emissions

In 1990 national total $NO_X$ Emissions amounted to 212 Gg; emissions fluctuated since then, and were about 4% below the level of 1990 in 2002.

As can be seen in Table 4, the main source for $NO_X$ emissions in Austria with a share of 95% in 1990 and 97% in 2002 are fuel combustion activities. Within this source road transport has the highest contribution to total $NO_X$ emissions, about 50% of national total emissions arise from this source.

*Table 4: $NO_X$ emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions*

| NRF Category | $NO_X$ Emissions [Gg] | | Trend 1990-2002 | Share in National Total | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| Energy | 201.67 | 197.88 | *-1.9%* | *95.1%* | *96.8%* |
| *Fuel Combustion Activities* | 201.67 | 197.88 | *-1.9%* | *95.1%* | *96.8%* |
| *Fugitive Emissions from Fuels* | IE | IE | -- | -- | -- |
| Industrial Processes | 4.80 | 1.71 | *-64.3%* | *2.3%* | *0.8%* |
| Agriculture | 5.52 | 4.85 | *-12.2%* | *2.6%* | *2.4%* |
| Waste | 0.04 | 0.03 | *-32.6%* | *0.0%* | *0.0%* |
| **National Total** | **212.03** | **204.47** | ***-3.6%*** | ***100%*** | ***100%*** |

NOTE: $NO_X$ emissions do not arise from NFR Categories *Solvent and Other Product Use, Land Use Change and Forestry* (LUCF) and *Other*, that's why these categories are not presented in the table.

The 2010 national emission ceiling for $NO_X$ emissions in Austria as set out in Annex II of the Multi- Effects Protocol is 107 Gg (in the European National Emissions Ceiling Directive it is 103 Gg), which corresponds to a reduction of 50% based on 1990 emissions (49% for the NEC Directive). With 204 Gg in 2002, which is a reduction of 4% compared to 1990 levels, emissions in Austria are at the moment well above this ceiling.

### NMVOC Emissions

In 1990 national total NMVOC Emissions amounted to 298 Gg; emissions decreased steadily since then and by the year 2002 emissions were reduced by 35%.

As can be seen in Table 5, the main source of NMVOC emissions in Austria with a share of 51% in 1990 and 43% in 2001 is *Fuel Combustion Activities*. Another important sector regarding NMVOC emissions is *Solvent and Other Product Use* with a contribution to the national total of 39% in 1990 and 43% in 2002 respectively.

*Table 5: NMVOC emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions*

| NRF Category | NMVOC Emissions [Gg] | | Trend 1990-2002 | Share in National Total | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| Energy | 162.63 | 86.95 | *-47%* | *54.6%* | *45.1%* |
| *Fuel Combustion Activities* | 152.00 | 83.56 | *-45%* | *51.0%* | *43.4%* |
| *Fugitive Emissions from Fuels* | 10.63 | 3.39 | *-68%* | *3.6%* | *1.8%* |
| Industrial Processes | 16.37 | 21.00 | *28%* | *5.5%* | *10.9%* |
| Solvent and Other Product Use | 116.95 | 82.63 | *-29%* | *39.2%* | *42.9%* |
| Agriculture | 1.94 | 1.94 | *0%* | *0.7%* | *1.0%* |
| Waste | 0.19 | 0.13 | *-35%* | *0.1%* | *0.1%* |
| National Total | 298.09 | 192.65 | ***-35%*** | *100%* | *100%* |

The national emission ceiling 2010 for NMVOC emissions in Austria as set out in Annex II of the Multi- Effects Protocol is 159 Gg, which corresponds to a reduction of 54% based on 1990 emissions. Assuming a linear path to the emission target, with a reduction of 35% from 1990-2002 Austria is on its path to meet the target.

### $NH_3$ Emissions

In 1990 national total $NH_3$ Emissions amounted to 53 Gg; emissions fluctuated over the period from 1990 to 2002, in 2002 emissions were 8% below 1990 levels.

As can be seen in Table 6, $NH_3$ emissions in Austria are almost exclusively emitted by the agricultural sector. The share in national total $NH_3$ emissions is about 97%. Within this source manure management has the highest contribution to total $NH_3$ emissions (about 80%).

*Table 6: $NH_3$ emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions*

| NRF Category | $NH_3$ Emissions [Gg] | | Trend 1990-2002 | Share in National Total | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| Energy | 1.35 | 1.48 | *10%* | *2.3%* | *2.8%* |
| *Fuel Combustion Activities* | 1.35 | 1.48 | *10%* | *2.3%* | *2.8%* |
| *Fugitive Emissions from Fuels* | IE | IE | | | |
| Industrial Processes | 0.19 | 0.06 | *-67%* | *0.3%* | *0.1%* |
| Agriculture | 55.54 | 50.84 | *-8%* | *96.7%* | *95.9%* |
| Waste | 0.38 | 0.61 | *62%* | *0.7%* | *1.2%* |
| **National Total** | **57.45** | **53.00** | ***-8%*** | ***100%*** | ***100%*** |

The national emission ceiling 2010 for $NH_3$ emissions in Austria as set out in Annex II of the Multi- Effects Protocol is 66 Gg, which is higher than 1990 emissions, thus the target has already been reached.

## 2.3 Emission Trends for Heavy Metals

Emissions of heavy metals decreased remarkably from 1985 to 2002. Emission trends for heavy metals from 1985 to 2002 are presented in Table 7. Emissions for all three priority heavy metals are well below their 1985 level, which is the obligation for Austria as a Party to the Heavy Metals Protocol.

*Table 7: Emissions and emission trends for heavy metals 1985-2002*

| | Cd [Mg] | Hg [Mg] | Pb [Mg] |
|---|---|---|---|
| **1985** | 3.27 | 3.77 | 327.09 |
| **1986** | 2.89 | 3.34 | 313.39 |
| **1987** | 2.42 | 2.86 | 302.52 |
| **1988** | 2.12 | 2.50 | 273.18 |
| **1989** | 1.95 | 2.28 | 240.28 |
| **1990** | 1.54 | 2.16 | 203.81 |
| **1991** | 1.48 | 2.04 | 168.40 |
| **1992** | 1.25 | 1.65 | 116.68 |
| **1993** | 1.15 | 1.40 | 83.77 |
| **1994** | 1.05 | 1.18 | 58.57 |
| **1995** | 0.95 | 1.21 | 16.22 |
| **1996** | 0.98 | 1.17 | 15.66 |
| **1997** | 0.97 | 1.15 | 14.80 |
| **1998** | 0.91 | 0.96 | 13.18 |
| **1999** | 0.91 | 0.92 | 12.53 |
| **2000** | 0.89 | 0.88 | 11.90 |
| **2001** | 0.97 | 0.95 | 12.61 |
| **2002** | 1.02 | 0.95 | 12.90 |
| Trend 1985- 2002 | -69% | -75% | -96% |

Figure 3 presents emissions of heavy metals relative to 1985 (1985=100).

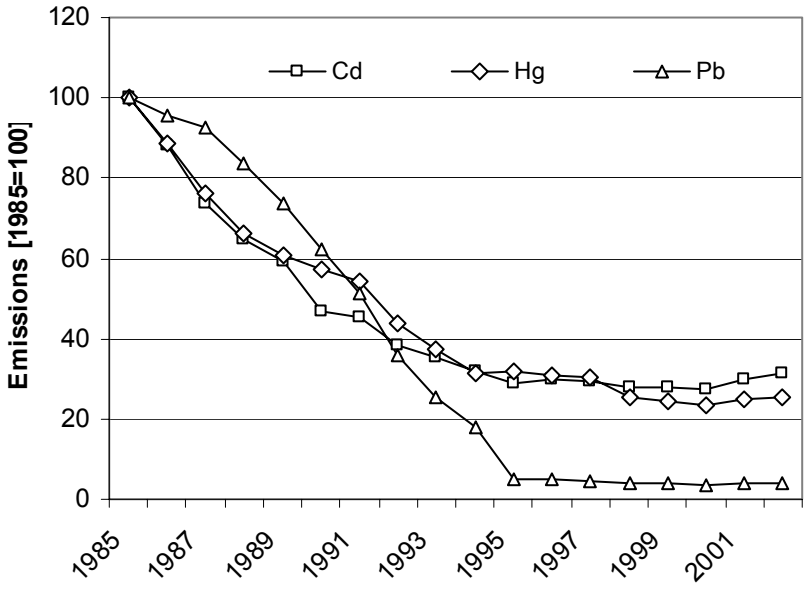



*Figure 3: Emission of heavy metals 1985-2002*

### Cd Emissions

Cd emissions mainly arise from combustion of heavy fuel oil and wood. The sectors with the highest contribution to total emissions are residential heating, industry and energy industries.

In 1985 national total Cd emissions amounted to 3.3 Mg; emissions decreased steadily since then and by the year 2002 emissions were reduced by 69%. This reduction is due to decreasing emissions from industry and residential heating because of a decrease in the use heavy fuel oil and wood as fuel and because of improved dust abatement techniques in industry.

### Hg Emissions

Hg emissions mainly arise from combustion of heavy fuel oil, wood and coal. Like Cd emissions, Hg results from the sectors with the highest contribution to total emissions which are residential heating, industry and energy industries.

In 1985 national total Hg emissions amounted to 3.8 Mg; emissions decreased steadily since then and by the year 2002 emissions were reduced by 75%. This reduction is due to decreasing emissions from industry and residential heating due to a decrease in the use of heavy fuel oil and wood as fuel and due to improved emission abatement techniques in industry.

### Pb Emissions

In 1985 the main emission source for Pb emissions was road transport. From 1990 to 1995 Pb emissions from this sector decreased by 100% due to prohibition of the addition of lead to petrol. National total emissions decreased by 96% from 1985 to 2002. In addition to emission reduction in transport the industry remarkably reduced its emissions due to improved dust abatement technologies.

## 2.4 Emission Trends for POPs

Emissions of Persistent Organic Pollutants "POPs" decreased remarkably from 1985 to 2002. Emission trends for POPs from 1985 to 2002 are presented in Table 8. Emissions for all three POPs are well below their 1985 level, which is the obligation for Austria as a Party to the POPs Protocol (see Chapter 2.1.6).

*Table 8: Emissions and emission trends for POPs 1990-2002*

| | PAH [Mg] | Diox [g] | PCB [kg] |
|---|---|---|---|
| **1985** | **28.5** | **188.4** | **106.7** |
| **1986** | **27.7** | **187.2** | **104.0** |
| **1987** | **27.6** | **188.8** | **106.4** |
| **1988** | **26.3** | **175.7** | **99.8** |
| **1989** | **25.9** | **166.6** | **96.3** |
| **1990** | **17.7** | **160.8** | **92.7** |
| **1991** | **18.2** | **134.9** | **84.6** |
| **1992** | **13.7** | **76.1** | **69.1** |
| **1993** | **10.4** | **67.0** | **64.2** |
| **1994** | **9.5** | **55.9** | **51.5** |
| **1995** | **9.8** | **58.2** | **52.8** |
| **1996** | **10.9** | **59.2** | **55.5** |
| **1997** | **9.5** | **59.5** | **51.8** |
| **1998** | **9.1** | **55.4** | **48.7** |
| **1999** | **8.7** | **51.5** | **45.9** |
| **2000** | **8.2** | **49.6** | **42.3** |
| **2001** | **9.1** | **54.1** | **47.8** |
| **2002** | **8.9** | **52.5** | **44.9** |
| Trend 985- 2002 | **-69%** | **-72%** | **-58%** |

Figure 4 presents emissions of POPs relative to 1985 (1985=100).

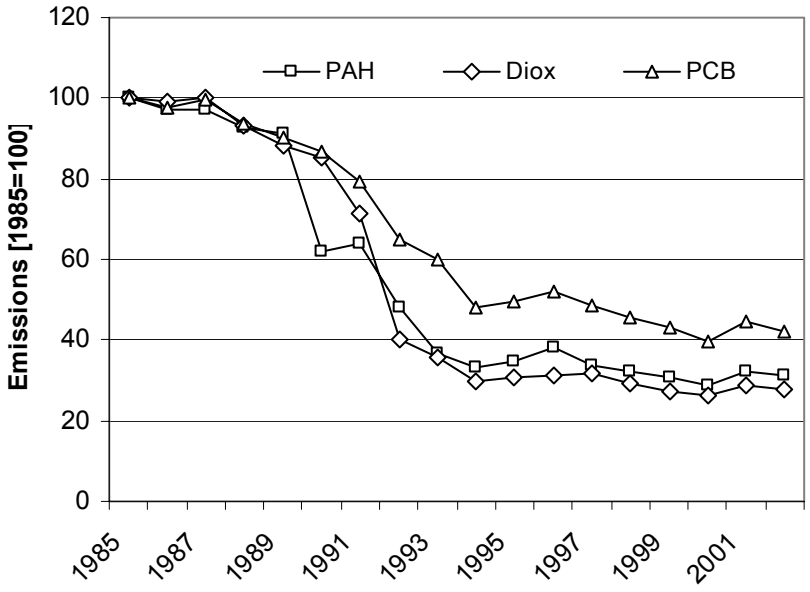



*Figure 4: Emission of Persistent Organic Pollutants 1985-2002*

The most important source for POPs in Austria is residential heating.

In the 80ties industry and waste incineration were still important sources regarding POP emissions. Due to legal regulations concerning air quality emissions from industry and waste incineration decreased remarkably from 1990 to 1993, which is the main reason for the overall decrease in national total POP emissions.

# 3 MAJOR CHANGES

## 3.1 Major Changes by Sector

This chapter gives an overview on methodological changes made to the inventory since the previous submission, detailed information is given in the respective subchapter of this report.

**ENERGY (1A)**

***Update of data:***

*Energy balance*

From 1999 on a new industry inquiry (Gütereinsatzstatistik) of the 2000 most important Austrian companies have been considered.

From 1990 on 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 have been revised [KWK-Statistik].

The revisions above partly affected the final energy consumption of manufacturing industry and the small combustion sector.

*1 A 1 a:* For the year 2001 the emission declarations of combustion plants >= 50 MW have been updated.

*1 A 1, 1 A 2, 1 A 4:* Fuel consumption of stationary sources have been updated according to the revised energy balance.

***Changes in allocation of emissions:***

*1 A 2 a:* Emissions from fuel combustion of two iron and steel plants so far reported under category *2 C 1* are now reported under this category.

*1 A 2 f:* Emissions from fuel combustion in cement industry so far reported under category *2 A 1* are now reported under this category.

*1 A 5 b:* Emissions from military aviation so far reported under *1 A 3 a* are now reported under this category.

*1 A 5 b:* Emissions from military transportation so far reported under *1 A 3 b* are now reported under this category.

***Changes in methodology:***

*1 A 5 b:* The basis of the recalculation of emissions from military aviation is a new study by Kalivoda M., Kudrna M.: "Air Traffic Emission Calculation for Austria 1990-2000"; a study for the UMWELTBUNDESAMT, 2002. Unpublished report.

The emission factors for $SO_2$, NMVOC and $NO_X$ were taken from the emission inventory guidebook. Because of similar conditions in Switzerland, Swiss emission factors were chosen.

**FUGITIVE EMISSIONS (1 B)**

***Addition of source categories:***

*1 B 2 a ii:* NMVOC emissions from oil and gas production

***Update of data:***

NMVOC emissions from 1998 onwards have been updated.

**INDUSTRIAL PROCESSES (2)**

***Changes in allocation of emissions:***

*2 C 1:* All emissions except NMVOC emissions from rolling mills have been allocated to category *1 A 2 a*.

*2 A 1:* Cement Production: emissions are now reported in category *1 A 2 f*.

*2 A 7:* Glass Production: emissions have been allocated to the energy sector.

***Update of data:***

$NO_X$ emissions from inorganic chemical industries have been updated.

$NH_3$ emissions until 1994 from ammonium nitrate production have been recalculated (before these emissions were calculated with the implied emission factor for 1995, now the actual emission value for 1994 has become available and the IEF for 1994 was used for the years before).

**SOLVENT AND OTHER PRODUCT USE (9)**

A new study covering the Solvents sector which combines a top-down with a bottom-up approach has been finished. Results were considered for the inventory.

SCHÖRNER, G. & WINDSPERGER, A. (2004): Studie zur Anpassung der Lösemittelemissionen der österreichischen Luftschadstoff-Inventur (OLI) 1980-2002. Unpublished study commissioned by the UMWELTBUNDESAMT.

**AGRICULTURE (4)**

*4 B 1 a, 4 D:*

The time series of annual milk yields was revised by STATISTIK AUSTRIA. As the methodology for emissions from manure production of dairy cattle is based on milk yield data, this revision resulted in higher emissions from this category.

*4 B 8:*

The age class split for swine categories for the years 1990–1992 were adjusted. There was an inconsistency in the time series in the statistical data set resulting from a changing methodology of the statistical survey in 1992/1993. That's why the time series has been adjusted using the split from 1993.

*4 D:*

Data on synthetic fertiliser use have been updated for the years 2001 and 2002.

**WASTE (6)**

*6 A 1:*

*Residual Waste:* activity data from 1998 to 2002 have been updated on the basis of the Austrian database for solid waste disposals. In the previous submission the amount of waste from administrative facilities of industry was included in the years from 1998 to 2002 but not included in the years before 1998. Therefore the activity data for the time series 1990 to 1997 have been recalculated.

*Non Residual Waste:* previously the amount of non-residual waste has been estimated based on expert judgement, now activity data for the years from 1998 to 2002 is taken from the Austrian database for solid waste disposal sites. No data was available for the years before 1998 from this database, therefore the values of 1998 was also used for the years 1990-1997.

The operators of landfill sites reported their annual collected landfill gas in the context of an investigation of the UMWELTBUNDESAMT. Emissions have been recalculated on the basis of following study:

> ROLLAND, CH. & OLIVA, J. (2004): Erfassung von Deponiegas. Statusbericht von Österreichischen Deponien. UMWELTBUNDESAMT (Report BE-238).

The Bio-degradable organic carbon content (DOC) has been corrected according to following new study of the UMWELTBUNDESAMT:

> ROLLAND, CH. & SCHEIBENGRAF, M. (2003): Biologisch abbaubarer Kohlenstoff im Restmüll. UMWELTBUNDESAMT (Report BE-236).

## 3.2 Recalculations per Gas

The following tables present the implication on emission trends of the methodological changes made as summarized in Chapter 3.1 and as described in detail in the sector analysis chapters of this report (Chapters 4 to 8). Changes in the use of notation keys are also shown in the tables.

*Table 9: Recalculation difference of $NO_X$ emissions with respect to submission 2003*

| NFR Category | $NO_X$ [Gg]; | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| Total Emissions | 8.14 | 8.11 | 6.95 | 1.97 | 3.07 | 1.25 | -12.98 | -4.63 | -8.96 | -3.04 | -6.10 | -2.95 |
| 1 Energy | 20.43 | 20.78 | 18.91 | 17.11 | 17.94 | 15.52 | 0.84 | 9.09 | 4.36 | 10.28 | 6.82 | 9.84 |
| 1 A Fuel Combustion | 20.43 | 20.78 | 18.91 | 17.11 | 17.94 | 15.52 | 0.84 | 9.09 | 4.36 | 10.28 | 6.82 | 9.84 |
| 1 A 1 Energy Industries | 0.53 | 0.33 | 0.38 | 0.00 | 0.00 | -0.02 | -0.01 | -0.01 | -0.01 | -0.32 | -0.47 | 1.30 |
| 1 A 1 a Public Electricity and Heat Production | 0.31 | 0.15 | 0.38 | -0.01 | -0.01 | -0.02 | -0.01 | -0.01 | -0.01 | -0.32 | -0.47 | -0.33 |
| 1 A 1 b Petroleum refining | 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 A 1 c Manufacture of Solid fuels and Other Energy Industries | 0.22 | 0.19 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.63 |
| 1 A 2 Manufacturing Industries and Construction | 12.68 | 13.77 | 11.93 | 11.78 | 11.77 | 10.10 | 8.70 | 9.34 | 9.18 | 8.86 | 7.62 | 10.10 |
| 1 A 3 Transport | 6.78 | 6.35 | 6.15 | 5.09 | 5.99 | 5.26 | -8.06 | -0.51 | -5.35 | 1.19 | -0.85 | -2.33 |
| 1 A 3 a Civil Aviation | -0.05 | -0.05 | -0.05 | -0.06 | -0.06 | -0.05 | -0.06 | -0.05 | -0.06 | -0.06 | -0.07 | -0.06 |
| 1 A 3 b Road Transportation | 6.68 | 6.29 | 6.14 | 5.14 | 6.05 | 5.30 | -8.01 | -0.46 | -5.28 | 0.99 | -0.78 | -1.89 |
| 1 A 3 c Railways | 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 A 3 d Navigation | 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 A 3 e Other | 0.15 | 0.12 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.26 | 0.00 | -0.38 |
| 1 A 4 Other Sectors | 0.36 | 0.25 | 0.37 | 0.16 | 0.08 | 0.10 | 0.12 | 0.19 | 0.44 | 0.45 | 0.41 | 0.68 |
| 1 A 5 Other | 0.08 | 0.09 | 0.08 | 0.09 | 0.09 | 0.08 | 0.09 | 0.09 | 0.10 | 0.09 | 0.10 | 0.09 |
| 1 B Fugitive Emissions from Fuels | - | - | - | - | - | - | - | - | - | - | - | - |
| 1 B 1 Solid Fuels | - | - | - | - | - | - | - | - | - | - | - | - |
| 1 B 2 Oil and Natural Gas | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 Industrial Processes | -12.61 | -12.99 | -12.28 | -15.14 | -14.93 | -14.33 | -13.88 | -13.77 | -13.37 | -13.35 | -12.94 | -12.94 |
| 2 A Mineral Products | -7.64 | -7.63 | -7.67 | -7.49 | -7.50 | -6.19 | -5.98 | -5.62 | -5.08 | -5.25 | -5.05 | -5.24 |
| 2 A 1 Cement Production | -6.49 | -6.30 | -6.50 | -6.32 | -6.24 | -4.92 | -4.71 | -4.44 | -3.90 | -3.96 | -3.96 | -3.96 |
| 2 A 2 Lime Production | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 A 7 Other | -1.16 | -1.33 | -1.18 | -1.18 | -1.26 | -1.26 | -1.26 | -1.18 | -1.18 | -1.29 | -1.09 | -1.28 |
| 2 B Chemical Industry | 0.00 | -0.42 | -0.47 | -3.16 | -3.25 | -3.71 | -3.71 | -3.72 | -3.74 | -3.73 | -3.72 | -3.74 |
| 2 C Metal Production | -4.97 | -4.94 | -4.14 | -4.50 | -4.18 | -4.44 | -4.20 | -4.43 | -4.55 | -4.37 | -4.18 | -4.04 |
| 2 D Other Production | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 |
| 2 G Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 Solvent and Other Product Use | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 Agriculture | 0.32 | 0.32 | 0.32 | 0.00 | 0.05 | 0.07 | 0.06 | 0.05 | 0.05 | 0.03 | 0.02 | 0.15 |
| 4 B Manure Management | - | - | - | - | - | - | - | - | - | - | - | - |

| NFR Category | $NO_X$ [Gg]; | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| 4 C Rice Cultivation | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 D Agricultural Soils | 0.32 | 0.32 | 0.32 | 0.00 | 0.05 | 0.07 | 0.06 | 0.05 | 0.05 | 0.03 | 0.02 | 0.15 |
| 4 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 |
| 4 G Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 Land-Use Change and Forestry | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 Waste | 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 A Solid Waste Disposal on Land | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 B Waste-water Handling | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 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 |
| 6 D Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 7 Other (please specify) | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | |
| Memo Items: | | | | | | | | | | | | |
| International Bunkers | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Aviation | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Marine | - | - | - | - | - | - | - | - | - | - | - | - |

Positive values indicate that this year's estimate is higher than last year's estimate.

*Table 10: Recalculation difference of $SO_2$ emissions with respect to submission 2003*

| NFR Category | $SO_2$ [Gg]; | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| Total Emissions | 1.31 | 5.42 | 2.29 | 0.82 | 1.45 | -0.05 | -1.84 | -0.33 | -2.45 | -0.50 | -2.66 | 0.93 |
| 1 Energy | 8.46 | 11.24 | 6.57 | 5.23 | 6.33 | 4.42 | 3.60 | 5.40 | 2.42 | 4.20 | 1.58 | 5.63 |
| 1 A Fuel Combustion | 8.46 | 11.24 | 6.57 | 5.23 | 6.33 | 4.42 | 3.60 | 5.40 | 2.42 | 4.20 | 1.58 | 5.63 |
| 1 A 1 Energy Industries | 0.85 | 0.70 | 0.55 | 0.02 | 0.01 | 0.00 | 0.00 | -0.01 | 0.00 | -0.05 | 0.02 | 0.34 |
| 1 A 1 a Public Electricity and Heat Production | 0.17 | 0.11 | 0.55 | -0.01 | -0.01 | -0.01 | 0.00 | -0.01 | 0.00 | -0.05 | 0.02 | 0.34 |
| 1 A 1 b Petroleum refining | 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 A 1 c Manufacture of Solid fuels and Other Energy Industries | 0.68 | 0.58 | 0.00 | 0.03 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1 A 2 Manufacturing Industries and Construction | 6.44 | 9.72 | 4.70 | 4.64 | 6.27 | 4.40 | 3.67 | 5.66 | 2.83 | 4.75 | 2.08 | 5.03 |
| 1 A 3 Transport | -0.02 | -0.02 | -0.02 | -0.02 | -0.07 | -0.09 | -0.14 | -0.33 | -0.54 | -0.73 | -0.69 | -0.92 |
| 1 A 3 a Civil Aviation | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
| 1 A 3 b Road Transportation | -0.01 | -0.01 | -0.01 | -0.01 | -0.06 | -0.08 | -0.13 | -0.32 | -0.53 | -0.72 | -0.67 | -0.91 |
| 1 A 3 c Railways | 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 A 3 d Navigation | 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 A 3 e 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 |
| 1 A 4 Other Sectors | 1.18 | 0.82 | 1.32 | 0.59 | 0.11 | 0.11 | 0.07 | 0.07 | 0.12 | 0.21 | 0.15 | 1.16 |
| 1 A 5 Other | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |

| NFR Category | $SO_2$ [Gg]; | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| 1 B Fugitive Emissions from Fuels | - | - | - | - | - | - | - | - | - | - | - | - |
| 1 B 1 Solid Fuels | - | - | - | - | - | - | - | - | - | - | - | - |
| 1 B 2 Oil and Natural Gas | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 Industrial Processes | -7.15 | -5.81 | -4.28 | -4.41 | -4.88 | -4.47 | -5.44 | -5.73 | -4.87 | -4.70 | -4.24 | -4.71 |
| 2 A Mineral Products | -1.10 | -1.06 | -1.03 | -0.93 | -1.09 | -0.77 | -1.24 | -1.30 | -0.41 | -0.18 | -0.18 | -0.18 |
| 2 A 1 Cement Production | -1.10 | -1.06 | -1.03 | -0.93 | -1.09 | -0.77 | -1.24 | -1.30 | -0.41 | -0.18 | -0.18 | -0.18 |
| 2 A 2 Lime Production | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 A 7 Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 B Chemical Industry | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 C Metal Production | -6.05 | -4.75 | -3.25 | -3.48 | -3.79 | -3.69 | -4.20 | -4.43 | -4.46 | -4.52 | -4.06 | -4.53 |
| 2 D Other Production | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 |
| 2 G Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 Solvent and Other Product Use | - | - | - | - | - | - | - | - | - | - | - | - |
| 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 |
| 4 B Manure Management | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 C Rice Cultivation | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 D Agricultural Soils | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 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 |
| 4 G Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 Land-Use Change and Forestry | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 Waste | 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 A Solid Waste Disposal on Land | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 B Waste-water Handling | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 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 |
| 6 D Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 7 Other (please specify) | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | |
| Memo Items: | | | | | | | | | | | | |
| International Bunkers | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Aviation | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Marine | - | - | - | - | - | - | - | - | - | - | - | - |

Positive values indicate that this year's estimate is higher than last year's estimate.

*Table 11: Recalculation difference of NMVOC emissions with respect to submission 2003*

| NFR Category | NMVOC [Gg]; | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| Total Emissions | -46.70 | -36.50 | -36.22 | -31.58 | -37.21 | -38.65 | -42.91 | -36.73 | -41.38 | -47.13 | -41.21 | -36.78 |
| 1 Energy | 4.41 | 3.80 | 4.18 | 2.14 | 2.02 | 2.02 | 0.98 | 10.82 | 10.34 | 10.20 | 8.36 | 7.31 |
| 1 A Fuel Combustion | 2.56 | 2.05 | 2.59 | 0.85 | 0.98 | 1.02 | 0.00 | 9.83 | 9.09 | 8.80 | 6.95 | 7.66 |
| 1 A 1 Energy Industries | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | -0.04 | -0.08 | -0.19 |
| 1 A 1 a Public Electricity and Heat Production | 0.00 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | -0.04 | -0.08 | -0.19 |
| 1 A 1 b Petroleum refining | - | - | - | - | - | - | - | - | - | - | - | - |
| 1 A 1 c Manufacture of Solid fuels and Other Energy Industries | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| 1 A 2 Manufacturing Industries and Construction | 0.31 | 0.34 | 0.29 | 0.31 | 0.31 | 0.23 | 0.24 | 0.35 | 0.32 | 0.32 | 0.20 | 0.32 |
| 1 A 3 Transport | 0.87 | 0.83 | 0.86 | 0.45 | 0.63 | 0.70 | -0.29 | 0.33 | 0.01 | 0.40 | 0.06 | -0.22 |
| 1 A 3 a Civil Aviation | 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 A 3 b Road Transportation | 0.87 | 0.83 | 0.86 | 0.45 | 0.63 | 0.70 | -0.29 | 0.33 | 0.01 | 0.40 | 0.06 | -0.22 |
| 1 A 3 c Railways | 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 A 3 d Navigation | 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 A 3 e 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 |
| 1 A 4 Other Sectors | 1.36 | 0.85 | 1.40 | 0.06 | 0.02 | 0.06 | 0.04 | 9.13 | 8.74 | 8.11 | 6.75 | 7.73 |
| 1 A 5 Other | 0.01 | 0.02 | 0.01 | 0.02 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| 1 B Fugitive Emissions from Fuels | 1.85 | 1.75 | 1.59 | 1.28 | 1.04 | 1.00 | 0.98 | 0.98 | 1.25 | 1.40 | 1.41 | -0.35 |
| 1 B 1 Solid Fuels | - | - | - | - | - | - | - | - | - | - | - | - |
| 1 B 2 Oil and Natural Gas | 1.85 | 1.75 | 1.59 | 1.28 | 1.04 | 1.00 | 0.98 | 0.98 | 1.25 | 1.40 | 1.41 | -0.35 |
| 2 Industrial Processes | -0.31 | -0.29 | -0.29 | -0.30 | -0.28 | -0.23 | -0.26 | -0.33 | -0.26 | -0.30 | -0.32 | 0.26 |
| 2 A Mineral Products | -0.24 | -0.24 | -0.24 | -0.25 | -0.21 | -0.17 | -0.20 | -0.26 | -0.19 | -0.23 | -0.23 | 0.24 |
| 2 A 1 Cement Production | -0.24 | -0.23 | -0.23 | -0.24 | -0.21 | -0.16 | -0.20 | -0.25 | -0.18 | -0.22 | -0.22 | -0.22 |
| 2 A 2 Lime Production | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 A 7 Other | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
| 2 B Chemical Industry | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 C Metal Production | -0.07 | -0.05 | -0.05 | -0.05 | -0.06 | -0.06 | -0.06 | -0.07 | -0.07 | -0.07 | -0.09 | -0.09 |
| 2 D Other Production | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 |
| 2 G Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 Solvent and Other Product Use | -50.74 | -39.95 | -40.06 | -33.36 | -38.90 | -40.39 | -43.57 | -47.16 | -51.40 | -56.98 | -49.20 | -44.31 |
| 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 |
| 4 B Manure Management | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 C Rice Cultivation | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 D Agricultural Soils | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| 4 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 |
| 4 G Other | - | - | - | - | - | - | - | - | - | - | - | - |

| NFR Category | NMVOC [Gg]; | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| 5 Land-Use Change and Forestry | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 Waste | 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 A Solid Waste Disposal on Land | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 B Waste-water Handling | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 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 |
| 6 D Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 7 Other (please specify) | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | |
| Memo Items: | | | | | | | | | | | | |
| International Bunkers | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Aviation | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Marine | - | - | - | - | - | - | - | - | - | - | - | - |

Positive values indicate that this year's estimate is higher than last year's estimate.

*Table 12: Recalculation difference of $NH_3$ emissions with respect to submission 2003*

| NFR Category | NMVOC [Gg]; | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| Total Emissions | 5.18 | 5.17 | 5.20 | 0.64 | 1.18 | 1.36 | 1.29 | 1.20 | 1.12 | 1.01 | 0.41 | 0.75 |
| 1 Energy | 0.07 | 0.08 | 0.05 | 0.03 | 0.03 | 0.03 | 0.02 | 0.04 | 0.03 | 0.02 | 0.03 | 0.05 |
| 1 A Fuel Combustion | 0.07 | 0.08 | 0.05 | 0.03 | 0.03 | 0.03 | 0.02 | 0.04 | 0.03 | 0.02 | 0.03 | 0.05 |
| 1 A 1 Energy Industries | 0.04 | 0.04 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 |
| 1 A 1 a Public Electricity and Heat Production | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 |
| 1 A 1 b Petroleum refining | 0.04 | 0.04 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 |
| 1 A 1 c Manufacture of Solid fuels and Other Energy Industries | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| 1 A 2 Manufacturing Industries and Construction | 0.03 | 0.04 | 0.03 | 0.02 | 0.02 | 0.01 | 0.00 | 0.01 | 0.01 | -0.01 | 0.00 | 0.02 |
| 1 A 3 Transport | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| 1 A 3 a Civil Aviation | 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 A 3 b Road Transportation | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| 1 A 3 c Railways | 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 A 3 d Navigation | 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 A 3 e 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 |
| 1 A 4 Other Sectors | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1 A 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 |
| 1 B Fugitive Emissions from Fuels | - | - | - | - | - | - | - | - | - | - | - | - |
| 1 B 1 Solid Fuels | - | - | - | - | - | - | - | - | - | - | - | - |
| 1 B 2 Oil and Natural Gas | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 Industrial Processes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| NFR Category | NMVOC [Gg]; | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| 2 A Mineral Products | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 A 1 Cement Production | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 A 2 Lime Production | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 A 7 Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 B Chemical Industry | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 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 |
| 2 D Other Production | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 G 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 |
| 3 Solvent and Other Product Use | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 Agriculture | 4.74 | 4.70 | 4.71 | 0.08 | 0.53 | 0.70 | 0.61 | 0.55 | 0.47 | 0.36 | -0.23 | 0.10 |
| 4 B Manure Management | 4.74 | 4.70 | 4.71 | 0.08 | 0.53 | 0.70 | 0.61 | 0.55 | 0.47 | 0.36 | 0.25 | 0.45 |
| 4 C Rice Cultivation | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 D Agricultural Soils | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.48 | -0.36 |
| 4 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 |
| 4 G Other | - | - | - | - | - | - | - | - | - | - | - | - |
| 5 Land-Use Change and Forestry | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 Waste | 0.37 | 0.38 | 0.44 | 0.53 | 0.62 | 0.64 | 0.66 | 0.61 | 0.61 | 0.63 | 0.61 | 0.61 |
| 6 A Solid Waste Disposal on Land | 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 B Waste-water Handling | - | - | - | - | - | - | - | - | - | - | - | - |
| 6 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 |
| 6 D Other | 0.37 | 0.39 | 0.44 | 0.53 | 0.62 | 0.64 | 0.66 | 0.61 | 0.61 | 0.63 | 0.61 | 0.61 |
| 7 Other (please specify) | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | | | | | | | | | | |
| Memo Items: | | | | | | | | | | | | |
| International Bunkers | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Aviation | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Marine | - | - | - | - | - | - | - | - | - | - | - | - |

Positive values indicate that this year's estimate is higher than last year's estimate.

# 4 ENERGY (NFR SECTOR 1)

Sector *1 Energy* considers emissions originating from fuel combustion activities (Category *1 A 1* to *1 A 5*) as well as fugitive emissions from fuels (Category *1 B 1* to *1 B 2*).

Sector *1 Energy* considers emissions originating from fuel combustion activities (Category *1 A 1* to *1 A 5*) as well as fugitive emissions from fuels (Category *1 B 1* to *1 B 2*).

## 4.1 Fuel Combustion Activities (NFR Source Categories 1 A 1 to 1 A 5)

The category *Fuel Combustion Activities* comprises all emissions arising from stationary fuel combustion in energy industries, manufacturing industries, residential heating, the commercial and agricultural/forestry sector, all kind of mobile sources such as road transport, air traffic, railways, shipping as well as off-road machinery in agriculture, forestry, industry, military and households.

Fuel combustion is the main source for $SO_2$ and $NO_X$ emissions and a minor source for $NH_3$ emissions in Austria. Road transport and biomass combustion in households are important sources for NMVOC emissions. In 2002, the share in national total anthropogenic emissions of this category is 88.5 % for $SO_2$, 96.8% for $NO_X$, 43.3 % for NMVOC and 2.8% for $NH_3$ emissions.

### 4.1.1 Emission Trends

$SO_2$, $NO_X$, NMVOC and $NH_3$ emissions from fuel combustion activities for the period from 1990 to 2002 are presented in Table 13.

*Table 13: Emissions from Fuel Combustion Activities 1A1 to 1A5 and trends 1990-2002*

| Year | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | $SO_2$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 74.58 | 201.67 | 152.00 | 1.35 | 825 |
| 1991 | 72.28 | 206.84 | 154.75 | 1.50 | 886 |
| 1992 | 55.68 | 197.88 | 141.85 | 1.47 | 833 |
| 1993 | 52.72 | 191.59 | 134.14 | 1.56 | 851 |
| 1994 | 47.88 | 185.84 | 124.12 | 1.53 | 853 |
| 1995 | 46.50 | 182.48 | 120.22 | 1.56 | 894 |
| 1996 | 44.23 | 186.95 | 118.14 | 1.64 | 962 |
| 1997 | 41.44 | 182.93 | 101.20 | 1.61 | 946 |
| 1998 | 36.54 | 187.22 | 97.13 | 1.60 | 956 |
| 1999 | 34.39 | 182.80 | 91.78 | 1.54 | 939 |
| 2000 | 31.25 | 183.49 | 84.97 | 1.44 | 931 |
| 2001 | 33.45 | 189.54 | 86.50 | 1.55 | 997 |
| 2002 | 31.83 | 197.88 | 83.56 | 1.48 | 990 |
| *Trend 1990-2002* | *-57%* | *-2%* | *-45%* | *10%* | *20%* |
| *Share in National Total 1990* | *93%* | *95%* | *51%* | *2%* | - |
| *Share in National Total 2002* | *88.5%* | *96.8%* | *43.4%* | *2.8%* | - |

The following Figure 5 shows emission trends 1990-2002 of total fuel combustion activities.

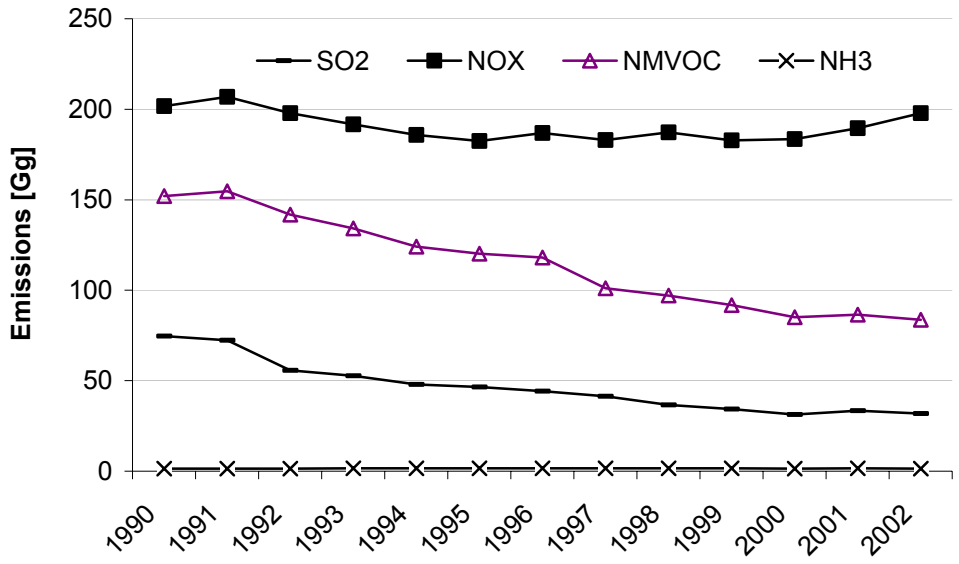



*Figure 5: Emissions from Fuel Combustion Activities 1A1 to 1A5, 1990-2002*

## $SO_2$ Emissions

The main source for $SO_2$ emissions of the fuel combustion sector in 2002 is the sector *1 A 2 Manufacturing Industries and Construction* with a share of 35%, followed by *1 A 4 Other Sectors* with a share of 32%, *1 A 1 Energy Industries* with a share of 26% and *1 A 3 Transport* with a share of 7%.

Total $SO_2$ emissions from fuel combustion activities decreased continuously since 1990. The driving forces for this trend are the desulphurisation of petroleum products and the decreasing usage of coal in residential heating.

Table 14 shows the emission trend of each sub category, comments to notation keys are given in Table 18 and the relevant sub chapters of the methodological description.

*Table 14: $SO_2$ emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions of Fuel Combustion Activities 1A1 to 1A5.*

| NRF Category | $SO_2$ Emissions [Gg] | | Trend 1990-2002 | Share in 1A1 to 1A5 | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| **FUEL COMBUSTION ACTIVITIES** | 74.58 | 31.83 | *-57%* | *100%* | *100%* |
| **1 A 1 Energy Industries** | 14.35 | 8.23 | *-43%* | *19%* | *26%* |
| 1 A 1 a Public Electricity and Heat Production | 11.42 | 4.54 | *-60%* | *15%* | *14%* |
| 1 A 1 b Petroleum refining | 2.25 | 3.69 | *64%* | *3%* | *12%* |
| 1 A 1 c Manufacture of Solid fuels and Other Energy Industries | 0.68 | 0.00 | *-100%* | *1%* | *0%* |
| **1 A 2 Manufacturing Industries and Construction** | 22.09 | 11.04 | *-50%* | *30%* | *35%* |
| 1 A 2 a Iron and Steel | 6.34 | 6.06 | *-4%* | *9%* | *19%* |
| 1 A 2 b Non-ferrous Metals | 0.07 | 0.17 | *129%* | *0%* | *1%* |
| 1 A 2 c Chemicals | 0.99 | 1.19 | *21%* | *1%* | *4%* |
| 1 A 2 d Pulp, Paper and Print | 3.92 | 0.85 | *-78%* | *5%* | *3%* |
| 1 A 2 e Food Processing, Beverages and Tobacco | 1.12 | 0.37 | *-67%* | *2%* | *1%* |
| 1 A 2 f Other | 9.64 | 2.39 | *-75%* | *13%* | *8%* |
| **1 A 3 Transport** | 4.35 | 2.25 | *-48%* | *6%* | *7%* |
| 1 A 3 a Civil Aviation | 0.01 | 0.02 | *159%* | *0%* | *0%* |
| 1 A 3 a 2 Civil Aviation (Domestic) | 0.01 | 0.02 | *159%* | *0%* | *0%* |
| 1 A 3 a 2 i Civil Aviation (Domestic, LTO) | 0.00 | 0.01 | *68%* | *0%* | *0%* |
| 1 A 3 a ii Civil Aviation (Domestic, Cruise) | 0.00 | 0.02 | *244%* | *0%* | *0%* |
| 1 A 3 b Road Transportation | 4.04 | 2.11 | *-48%* | *5%* | *7%* |
| 1 A 3 b i R.T., Passenger cars | 1.83 | 1.20 | *-35%* | *2%* | *4%* |
| 1 A 3 b ii R.T., Light duty vehicles | 0.35 | 0.27 | *-23%* | *0%* | *1%* |
| 1 A 3 b iii R.T., Heavy duty vehicles | 1.86 | 0.64 | *-66%* | *2%* | *2%* |
| 1 A 3 b iv R.T., Mopeds & Motorcycles | 0.01 | 0.00 | *-67%* | *0%* | *0%* |
| 1 A 3 b v R.T., Gasoline evaporation | NA | NA | - | - | - |
| 1 A 3 b vi R.T., Automobile tyre and break wear | NA | NA | - | - | - |
| 1 A 3 b vii R.T., Automobile road abrasion | NA | NA | - | - | - |
| 1 A 3 c Railways | 0.26 | 0.09 | *-64%* | *0%* | *0%* |

| NRF Category | $SO_2$ Emissions [Gg] | | Trend 1990-2002 | Share in 1A1 to 1A5 | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| 1 A 3 d Navigation | 0.04 | 0.02 | *-49%* | *0%* | *0%* |
| 1 A 3 d ii National Navigation | 0.04 | 0.02 | *-49%* | *0%* | *0%* |
| 1 A 3 e Other | NA | NA | - | - | - |
| 1 A 3 e i Pipeline compressors | NA | NA | - | - | - |
| 1 A 3 e ii Other mobile sources and machinery | NO | NO | - | - | - |
| **1 A 4 Other Sectors** | 33.78 | 10.30 | *-70%* | *45%* | *32%* |
| 1 A 4 a Commercial/Institutional | 3.34 | 0.57 | *-83%* | *4%* | *2%* |
| 1 A 4 b Residential | 27.89 | 8.93 | *-68%* | *37%* | *28%* |
| 1 A 4 b i Residential plants | 27.83 | 8.91 | *-68%* | *37%* | *28%* |
| 1 A 4 b ii Houshold and gardening (mobile) | 0.06 | 0.02 | *-67%* | *0%* | *0%* |
| 1 A 4 c Agriculture/Forestry/Fisheries | 2.55 | 0.80 | *-69%* | *3%* | *3%* |
| 1 A 4 c i Stationary | 1.61 | 0.43 | *-73%* | *2%* | *1%* |
| 1 A 4 c ii Off road Vehicles and Other Machinery | 0.94 | 0.37 | *-61%* | *1%* | *1%* |
| 1 A 4 c iii National Fishing | NO | NO | - | - | - |
| **1 A 5 Other** | 0.01 | 0.01 | *5%* | *0%* | *0%* |
| 1 A 5 a Other, Stationary (including Military) | IE | IE | - | - | - |
| 1 A 5 b Other, Mobile (including Military) | 0.01 | 0.01 | *5%* | *0%* | *0%* |
| **Memo items** | | | | | |
| 1 A 3 a i International Aviation | 0.28 | 0.48 | *71%* | *0%* | *2%* |
| 1 A 3 d i International Navigation | NO | NO | - | - | - |

### $NO_X$ Emissions

The main source for $NO_X$ emissions of the fuel combustion sector in 2002 are *1 A 3 Transport* with a share of 55% followed by the sector *1 A 4 Other* (small combustion, mainly households) with a share of 20%, *1 A 2 Manufacturing Industries* with 17% and *1 A 1 Energy Industries* with 8%.

Total $NO_X$ emissions from fuel combustion activities decreased since 1990. The -12% decrease of $NO_X$ emissions from *1 A 1 Energy Industries* and -17% decrease of *1 A 2 Manufacturing Industries* are mainly driven by additionally applied control techniques (Low-$NO_X$ burner, $NO_X$-removal). In the transport sector the -37% decrease of emissions from passenger cars is compensated by the 60% increase of emissions from heavy duty vehicles. The 14% increase of category *1 A 4 Other* is mainly driven by the 36% increase of off-road vehicles in agriculture and forestry.

Table 15 shows the emission trend of each sub category, comments to notation keys are given in Table 18 and the relevant sub chapters of the methodology description.

*Table 15: $NO_X$ emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions of Fuel Combustion Activities 1A1 to 1A5.*

| NRF Category | $NO_X$ Emissions [Gg] | | Trend 1990-2002 | Share in 1A1 to 1A5 | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| **FUEL COMBUSTION ACTIVITIES** | 201.67 | 197.88 | *-2%* | *100%* | *100%* |
| **1 A 1 Energy Industries** | 17.04 | 14.94 | *-12%* | *8%* | *8%* |
| 1 A 1 a Public Electricity and Heat Production | 11.71 | 9.95 | *-15%* | *6%* | *5%* |
| 1 A 1 b Petroleum refining | 4.32 | 3.44 | *-20%* | *2%* | *2%* |
| 1 A 1 c Manufacture of Solid fuels and Other Energy Industries | 1.02 | 1.56 | *53%* | *1%* | *1%* |
| **1 A 2 Manufacturing Industries and Construction** | 41.25 | 34.08 | *-17%* | *20%* | *17%* |
| 1 A 2 a Iron and Steel | 5.15 | 5.63 | *9%* | *3%* | *3%* |
| 1 A 2 b Non-ferrous Metals | 0.22 | 0.17 | *-21%* | *0%* | *0%* |
| 1 A 2 c Chemicals | 1.73 | 1.45 | *-16%* | *1%* | *1%* |
| 1 A 2 d Pulp, Paper and Print | 4.74 | 3.55 | *-25%* | *2%* | *2%* |
| 1 A 2 e Food Processing, Beverages and Tobacco | 1.49 | 0.59 | *-60%* | *1%* | *0%* |
| 1 A 2 f Other | 27.93 | 22.69 | *-19%* | *14%* | *11%* |
| **1 A 3 Transport** | 108.77 | 109.37 | *1%* | *54%* | *55%* |
| 1 A 3 a Civil Aviation | 0.08 | 0.24 | *215%* | *0%* | *0%* |
| 1 A 3 a 2 Civil Aviation (Domestic) | 0.08 | 0.24 | *215%* | *0%* | *0%* |
| 1 A 3 a 2 i Civil Aviation (Domestic, LTO) | 0.04 | 0.06 | *70%* | *0%* | *0%* |
| 1 A 3 a ii Civil Aviation (Domestic, Cruise) | 0.04 | 0.18 | *344%* | *0%* | *0%* |
| 1 A 3 b Road Transportation | 105.62 | 105.91 | *0%* | *52%* | *54%* |
| 1 A 3 b i R.T., Passenger cars | 67.02 | 41.96 | *-37%* | *33%* | *21%* |
| 1 A 3 b ii R.T., Light duty vehicles | 2.86 | 6.39 | *124%* | *1%* | *3%* |
| 1 A 3 b iii R.T., Heavy duty vehicles | 35.56 | 57.02 | *60%* | *18%* | *29%* |
| 1 A 3 b iv R.T., Mopeds & Motorcycles | 0.18 | 0.55 | *198%* | *0%* | *0%* |
| 1 A 3 b v R.T., Gasoline evaporation | NA | NA | - | - | - |

| NRF Category | $NO_X$ Emissions [Gg] | | Trend 1990-2002 | Share in 1A1 to 1A5 | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| 1 A 3 b vi R.T., Automobile tyre and break wear | NA | NA | - | - | - |
| 1 A 3 b vii R.T., Automobile road abrasion | NA | NA | - | - | - |
| 1 A 3 c Railways | 1.95 | 1.66 | *-15%* | *1%* | *1%* |
| 1 A 3 d Navigation | 0.52 | 0.57 | *9%* | *0%* | *0%* |
| 1 A 3 d ii National Navigation | 0.52 | 0.57 | *9%* | *0%* | *0%* |
| 1 A 3 e Other | 0.61 | 0.98 | *62%* | *0%* | *0%* |
| 1 A 3 e i Pipeline compressors | 0.61 | 0.98 | *62%* | *0%* | *0%* |
| 1 A 3 e ii Other mobile sources and machinery | NO | NO | - | - | - |
| **1 A 4 Other Sectors** | 34.52 | 39.40 | *14%* | *17%* | *20%* |
| 1 A 4 a Commercial/Institutional | 2.39 | 1.10 | *-54%* | *1%* | *1%* |
| 1 A 4 b Residential | 14.52 | 15.14 | *4%* | *7%* | *8%* |
| 1 A 4 b i Residential plants | 13.45 | 14.19 | *6%* | *7%* | *7%* |
| 1 A 4 b ii Houshold and gardening (mobile) | 1.07 | 0.95 | *-11%* | *1%* | *0%* |
| 1 A 4 c Agriculture/Forestry/Fisheries | 17.61 | 23.15 | *31%* | *9%* | *12%* |
| 1 A 4 c i Stationary | 1.35 | 1.00 | *-26%* | *1%* | *1%* |
| 1 A 4 c ii Off road Vehicles and Other Machinery | 16.26 | 22.15 | *36%* | *8%* | *11%* |
| 1 A 4 c iii National Fishing | NO | NO | - | - | - |
| **1 A 5 Other** | 0.08 | 0.09 | *5%* | *0%* | *0%* |
| 1 A 5 a Other, Stationary (including Military) | IE | IE | - | - | - |
| 1 A 5 b Other, Mobile (including Military) | 0.08 | 0.09 | *5%* | *0%* | *0%* |
| **Memo items** | | | | | |
| 1 A 3 a i International Aviation | 2.77 | 4.84 | *75%* | *1%* | *2%* |
| 1 A 3 d i International Navigation | NO | NO | - | - | - |

### NMVOC Emissions

The main source for NMVOC emissions of the fuel combustion sector in 2002 is the sector *1 A 4 Other* (small combustion, mainly households) with a share of 59%, followed by *1 A 3 Transport* with a share of 35%. *1 A 2 Manufacturing Industries* with a share of 5% and *1 A 1 Energy Industries* with a share of 1% are minor sources of NMVOC.

Total NMVOC emissions from fuel combustion activities decreased continuously since 1990. The main reasons for this trend are the -71% decrease of combustion related emissions from passenger cars and the -72% decrease of gasoline evaporation of mobile sources. The -27% decrease of *1 A 4 Other* is mainly driven by the improved efficiency of biomass heatings in households.

Table 16 shows the emission trend of each sub category, comments to notation keys are given in Table 18 and the relevant sub chapters of the methodology description.

*Table 16: NMVOC emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions of Fuel Combustion Activities 1A1 to 1A5.*

| NRF Category | NMVOC Emissions [Gg] | | Trend 1990-2002 | Share in 1A1 to 1A5 | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| **FUEL COMBUSTION ACTIVITIES** | 152.00 | 83.56 | *-45%* | *100%* | *100%* |
| **1 A 1 Energy Industries** | 0.42 | 0.58 | *38%* | *0%* | *1%* |
| 1 A 1 a Public Electricity and Heat Production | 0.41 | 0.57 | *41%* | *0%* | *1%* |
| 1 A 1 b Petroleum refining | IE | IE | - | - | - |
| 1 A 1 c Manufacture of Solid fuels and Other Energy Industries | 0.01 | 0.01 | *-50%* | *0%* | *0%* |
| **1 A 2 Manufacturing Industries and Construction** | 3.89 | 4.01 | *3%* | *3%* | *5%* |
| 1 A 2 a Iron and Steel | 0.07 | 0.13 | *91%* | *0%* | *0%* |
| 1 A 2 b Non-ferrous Metals | 0.00 | 0.00 | *151%* | *0%* | *0%* |
| 1 A 2 c Chemicals | 0.13 | 0.23 | *74%* | *0%* | *0%* |
| 1 A 2 d Pulp, Paper and Print | 0.59 | 0.74 | *25%* | *0%* | *1%* |
| 1 A 2 e Food Processing, Beverages and Tobacco | 0.02 | 0.01 | *-27%* | *0%* | *0%* |
| 1 A 2 f Other | 3.08 | 2.89 | *-6%* | *2%* | *3%* |
| **1 A 3 Transport** | 79.96 | 29.61 | *-63%* | *53%* | *35%* |
| 1 A 3 a Civil Aviation | 0.04 | 0.07 | *67%* | *0%* | *0%* |
| 1 A 3 a 2 Civil Aviation (Domestic) | 0.04 | 0.07 | *67%* | *0%* | *0%* |
| 1 A 3 a 2 i Civil Aviation (Domestic, LTO) | 0.02 | 0.05 | *122%* | *0%* | *0%* |
| 1 A 3 a ii Civil Aviation (Domestic, Cruise) | 0.02 | 0.02 | *5%* | *0%* | *0%* |
| 1 A 3 b Road Transportation | 78.89 | 28.64 | *-64%* | *52%* | *34%* |
| 1 A 3 b i R.T., Passenger cars | 47.58 | 13.73 | *-71%* | *31%* | *16%* |
| 1 A 3 b ii R.T., Light duty vehicles | 1.11 | 0.91 | *-18%* | *1%* | *1%* |
| 1 A 3 b iii R.T., Heavy duty vehicles | 3.18 | 3.18 | *0%* | *2%* | *4%* |
| 1 A 3 b iv R.T., Mopeds & Motorcycles | 6.49 | 5.14 | *-21%* | *4%* | *6%* |
| 1 A 3 b v R.T., Gasoline evaporation | 20.53 | 5.69 | *-72%* | *14%* | *7%* |
| 1 A 3 b vi R.T., Automobile tyre and break wear | NA | NA | - | - | - |

| NRF Category | NMVOC Emissions [Gg] | | Trend 1990-2002 | Share in 1A1 to 1A5 | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| 1 A 3 b vii R.T., Automobile road abrasion | NA | NA | - | - | - |
| 1 A 3 c Railways | 0.31 | 0.23 | *-25%* | *0%* | *0%* |
| 1 A 3 d Navigation | 0.73 | 0.67 | *-8%* | *0%* | *1%* |
| 1 A 3 d ii National Navigation | 0.73 | 0.67 | *-8%* | *0%* | *1%* |
| 1 A 3 e Other | 0.00 | 0.00 | *62%* | *0%* | *0%* |
| 1 A 3 e i Pipeline compressors | 0.00 | 0.00 | *62%* | *0%* | *0%* |
| 1 A 3 e ii Other mobile sources and machinery | NO | NO | - | - | - |
| **1 A 4 Other Sectors** | 67.71 | 49.34 | *-27%* | *45%* | *59%* |
| 1 A 4 a Commercial/Institutional | 0.62 | 0.67 | *9%* | *0%* | *1%* |
| 1 A 4 b Residential | 58.77 | 38.41 | *-35%* | *39%* | *46%* |
| 1 A 4 b i Residential plants | 52.40 | 33.89 | *-35%* | *34%* | *41%* |
| 1 A 4 b ii Houshold and gardening (mobile) | 6.37 | 4.52 | *-29%* | *4%* | *5%* |
| 1 A 4 c Agriculture/Forestry/Fisheries | 8.32 | 10.26 | *23%* | *5%* | *12%* |
| 1 A 4 c i Stationary | 0.39 | 2.51 | *552%* | *0%* | *3%* |
| 1 A 4 c ii Off road Vehicles and Other Machinery | 7.94 | 7.74 | *-2%* | *5%* | *9%* |
| 1 A 4 c iii National Fishing | NO | NO | - | - | - |
| **1 A 5 Other** | 0.01 | 0.02 | *4%* | *0%* | *0%* |
| 1 A 5 a Other, Stationary (including Military) | IE | IE | - | - | - |
| 1 A 5 b Other, Mobile (including Military) | 0.01 | 0.02 | *4%* | *0%* | *0%* |
| **Memo items** | | | | | |
| 1 A 3 a i International Aviation | 0.30 | 0.60 | *102%* | *0%* | *1%* |
| 1 A 3 d i International Navigation | NO | NO | - | - | - |

## $NH_3$ Emissions

The main source for $NH_3$ emissions of the fuel combustion sector in 2002 is the small combustion sector *1 A 4* with a share of 46%, followed by *1 A 3 Transport* with a share of 22%, *1 A 1 Energy Industries* with a share of 19% and *1 A 2 Manufacturing Industries* with 13%.

Total $NH_3$ emissions from fuel combustion activities are slightly fluctuating over time depending on the yearly changing fuel consumption mix. The main sources of NH3 from fuel combustion activities are biomass and gas oil heatings in households.

Table 17 shows the emission trend of each sub category, comments to notation keys are given in Table 18 and the relevant sub chapters of the methodology description.

*Table 17: $NH_3$ emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions of Fuel Combustion Activities 1A1 to 1A5.*

| NRF Category | $NH_3$ Emissions [Gg] | | Trend 1990-2002 | Share in 1A1 to 1A5 | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| **FUEL COMBUSTION ACTIVITIES** | 1.348 | 1.480 | *10%* | *100%* | *100%* |
| **1 A 1 Energy Industries** | 0.226 | 0.277 | *22%* | *17%* | *19%* |
| 1 A 1 a Public Electricity and Heat Production | 0.118 | 0.181 | *53%* | *9%* | *12%* |
| 1 A 1 b Petroleum refining | 0.103 | 0.085 | *-17%* | *8%* | *6%* |
| 1 A 1 c Manufacture of Solid fuels and Other Energy Industries | 0.005 | 0.010 | *94%* | *0%* | *1%* |
| **1 A 2 Manufacturing Industries and Construction** | 0.220 | 0.192 | *-13%* | *16%* | *13%* |
| 1 A 2 a Iron and Steel | 0.021 | 0.049 | *136%* | *2%* | *3%* |
| 1 A 2 b Non-ferrous Metals | 0.002 | 0.003 | *38%* | *0%* | *0%* |
| 1 A 2 c Chemicals | 0.025 | 0.018 | *-28%* | *2%* | *1%* |
| 1 A 2 d Pulp, Paper and Print | 0.045 | 0.031 | *-31%* | *3%* | *2%* |
| 1 A 2 e Food Processing, Beverages and Tobacco | 0.018 | 0.012 | *-33%* | *1%* | *1%* |
| 1 A 2 f Other | 0.110 | 0.079 | *-28%* | *8%* | *5%* |
| **1 A 3 Transport** | 0.278 | 0.332 | *19%* | *21%* | *22%* |
| 1 A 3 a Civil Aviation | 0.000 | 0.000 | *65%* | *0%* | *0%* |
| 1 A 3 a 2 Civil Aviation (Domestic) | 0.000 | 0.000 | *65%* | *0%* | *0%* |
| 1 A 3 a 2 i Civil Aviation (Domestic, LTO) | 0.000 | 0.000 | *9%* | *0%* | *0%* |
| 1 A 3 a ii Civil Aviation (Domestic, Cruise) | 0.000 | 0.000 | *241%* | *0%* | *0%* |
| 1 A 3 b Road Transportation | 0.272 | 0.323 | *19%* | *20%* | *22%* |
| 1 A 3 b i R.T., Passenger cars | 0.226 | 0.266 | *17%* | *17%* | *18%* |
| 1 A 3 b ii R.T., Light duty vehicles | 0.005 | 0.007 | *39%* | *0%* | *0%* |
| 1 A 3 b iii R.T., Heavy duty vehicles | 0.023 | 0.022 | *0%* | *2%* | *2%* |
| 1 A 3 b iv R.T., Mopeds & Motorcycles | 0.018 | 0.028 | *60%* | *1%* | *2%* |
| 1 A 3 b v R.T., Gasoline evaporation | NA | NA | - | - | - |
| 1 A 3 b vi R.T., Automobile tyre and break wear | NA | NA | - | - | - |
| 1 A 3 b vii R.T., Automobile road abrasion | NA | NA | - | - | - |
| 1 A 3 c Railways | 0.002 | 0.002 | *-25%* | *0%* | *0%* |

| NRF Category | $NH_3$ Emissions [Gg] | | Trend 1990-2002 | Share in 1A1 to 1A5 | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| 1 A 3 d Navigation | 0.000 | 0.000 | *-2%* | *0%* | *0%* |
| 1 A 3 d ii National Navigation | 0.000 | 0.000 | *-2%* | *0%* | *0%* |
| 1 A 3 e Other | 0.004 | 0.007 | *62%* | *0%* | *0%* |
| 1 A 3 e i Pipeline compressors | 0.004 | 0.007 | *62%* | *0%* | *0%* |
| 1 A 3 e ii Other mobile sources and machinery | NO | NO | - | - | - |
| **1 A 4 Other Sectors** | 0.623 | 0.679 | *9%* | *46%* | *46%* |
| 1 A 4 a Commercial/Institutional | 0.059 | 0.033 | *-45%* | *4%* | *2%* |
| 1 A 4 b Residential | 0.515 | 0.600 | *17%* | *38%* | *41%* |
| 1 A 4 b i Residential plants | 0.515 | 0.600 | *17%* | *38%* | *41%* |
| 1 A 4 b ii Houshold and gardening (mobile) | 0.000 | 0.000 | *-14%* | *0%* | *0%* |
| 1 A 4 c Agriculture/Forestry/Fisheries | 0.049 | 0.046 | *-6%* | *4%* | *3%* |
| 1 A 4 c i Stationary | 0.042 | 0.037 | *-10%* | *3%* | *3%* |
| 1 A 4 c ii Off road Vehicles and Other Machinery | 0.007 | 0.009 | *18%* | *1%* | *1%* |
| 1 A 4 c iii National Fishing | NO | NO | - | - | - |
| **1 A 5 Other** | 0.000 | 0.000 | *15%* | *0%* | *0%* |
| 1 A 5 a Other, Stationary (including Military) | IE | IE | - | - | - |
| 1 A 5 b Other, Mobile (including Military) | 0.000 | 0.000 | *15%* | *0%* | *0%* |
| **Memo items** | | | | | |
| 1 A 3 a i International Aviation | 0.002 | 0.003 | *70%* | *0%* | *0%* |
| 1 A 3 d i International Navigation | NO | NO | - | - | - |

### 4.1.2 General Methodology for stationary sources of NFR categories 1 A 1 to 1 A 5

CORINAIR methodology is applied: emissions from area sources are estimated by multiplying the fuel consumption of each subcategory with a fuel and technology dependent emission factor for $NO_X$, $SO_2$, NMVOC and $NH_3$. Emission factors for $NO_X$, $SO_2$ and NMVOC are generally based on country specific measurements and published in national studies. $NO_X$, $SO_2$ and NMVOC emission measurements from large point sources are considered in categories *1 A 1 a*, *1 A 1 b*, *1 A 2 a* and *1 A 2 f* (cement industry).

#### Emission factors

Emission factors are expressed as: kg released pollutant per TJ of burned fuel [kg/TJ].

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.
- The mix of fuels of a 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. If emission factors are in the unit kg/t the transformation to kg/TJ induces a different emission factor due to varying net calorific values.
- The technology of a combustion plant changes over time.

Stationary sources

Country specific emission factors taken from national studies [BMWA-EB, 1990], [BMWA-EB, 1996] and [UMWELTBUNDESAMT, 2001] are used. In these studies emission factors are provided for the years 1987, 1995 and 1996 which are determined by measurements in Austrian plants. $NH_3$ emission factors are taken from a national study [UMWELTBUNDESAMT, 1990] and the CORINAIR Guidebook B112. Details are included in the relevant chapters.

**$NH_3$**

Emission factors are constant for the whole time series.

**$SO_2$, $NO_X$, NMVOC**

For the years 1990 to 1994 emission factors are linearly interpolated by using the emission factors from 1987 and 1995 taken from the studies mentioned above. From 1997 onwards the emission factors of 1996 are used.

In the national studies only emission factors for VOC are cited. NMVOC emissions are calculated by subtracting $CH_4$ emissions from VOC emissions.

#### Activity data

If the energy balance is based on mass or volume units the fuel quantities must be converted into energy units [TJ] by multiplying with the corresponding net calorific value (NCV), which is provided by STATISTIK AUSTRIA along with the energy balance (see Annex 1). The fuel quantities of each subcategory are taken from the energy balance as presented in Annex 1. Detailed activity data used for calculation of emission data (in more detail than energy balance data) is presented in Chapter 4.7.

Not all categories of the gross inland fuel consumption are combusted or relevant for the inventory:

- emissions from international bunker fuels are not included in the National Total but reported separately as *Memo Item*.

- 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) is not considered for calculation of emissions.
- non-energy use is also not considered for calculation of emissions in Sector *1 A Energy*. However, from these fuels fugitive emissions might occur, these emissions are considered in Sector 3 *Solvents*. Emissions from fuel used as a feedstock are considered in Sector 2 *Industrial Processes*.

### 4.1.3 Recalculations

Recalculations are mainly driven by the revision of the energy balance as described in chapter 3 *Major Changes*. More detailed information on changes made with respect to last year's submission is provided in the corresponding subchapters.

### 4.1.4 Completeness

Table 18 gives an overview of the NFR 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 18: Overview of subcategories of Category 1 A Fuel Combustion: transformation into SNAP Codes and status of estimation*

| NFR Category | SNAP | Status | | | |
|---|---|---|---|---|---|
| | | $NO_X$ | $SO_2$ | NMVOC | $NH_3$ |
| **1 A 1 Energy Industries** | | | | | |
| 1 A 1 a Public Electricity and Heat Production | 0101 Public power<br>0102 District heating plants | ✓ | ✓ | ✓ | ✓ |
| 1 A 1 b Petroleum refining | 0103 Petroleum refining plants | ✓ | ✓ | IE(1) | ✓ |
| 1 A 1 c Manufacture of Solid fuels and Other Energy Industries | 010503 Oil/Gas Extraction plants | ✓ | ✓ | ✓ | ✓ |
| **1 A 2 Manufacturing Industries** | | | | | |
| 1 A 2 a Iron and Steel | 0301 Comb. In boilers, gas turbines and stationary engines (Iron and Steel Industry)<br>030301 Sinter and palletising plants<br>030326 Processes with Contact-Other(Iron and Steel Industry) | ✓ | ✓ | ✓ | ✓ |
| 1 A 2 b Non-ferrous Metals | 0301 Comb. In boilers, gas turbines and stationary engines(Non-ferrous Metals Industry) | ✓ | ✓ | ✓ | ✓ |
| 1 A 2 c Chemicals | 0301 Comb. in boilers, gas turbines and stationary engines (Chemical Industry) | ✓ | ✓ | ✓ | ✓ |
| 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 e Food Processing, Beverages and Tobacco | 0301 Comb. in boilers, gas turbines and stationary engines (Food Processing, Beverages and Tobacco Industry) | ✓ | ✓ | ✓ | ✓ |

| NFR Category | SNAP | Status | | | |
|---|---|---|---|---|---|
| | | $NO_X$ | $SO_2$ | NMVOC | $NH_3$ |
| 1 A 2 f Other | 0301 Comb. in boilers, gas turbines and stationary engines (Other Industry+ Electricity and Heat Production in Industry)<br>030311 Cement Industry<br>030317 Other Glass<br>030319 Bricks and Tiles<br>0808 Other Mobile Sources and Machinery-Industry | ✓ | ✓ | ✓ | ✓ |
| **1 A 3 Transport** | | | | | |
| 1 A 3 a ii Civil Aviation (Domestic) | 080501 Domestic airport traffic (LTO cycles - <1000 m)<br>080503 Domestic cruise traffic (>1000 m) | ✓ | ✓ | ✓ | ✓ |
| 1 A 3 b Road Transportation | 0701 Passenger cars<br>0702 Light duty vehicles < 3.5 t<br>0703 Heavy duty vehicles > 3.5 t and buses<br>0704 Mopeds and Motorcycles < 50 cm3<br>0705 Motorcycles > 50 cm3<br>0706 Gasoline evaporation from vehicles<br>0801 Other Mobile Sources and Machinery-Military | ✓ | ✓ | ✓ | ✓ |
| 1 A 3 c Railways | 0802 Other Mobile Sources and Machinery-Railways | ✓ | ✓ | ✓ | ✓ |
| 1 A 3 d ii National Navigation | 0803 Other Mobile Sources and Machinery-Inland waterways | ✓ | ✓ | ✓ | ✓ |
| 1 A 4 e Other | | | | | |
| 1 A 3 e i Pipeline Compressors | 010506 Pipeline Compressors | ✓ | ✓ | ✓ | ✓ |
| 1 A 3 e ii Other mobile sources and machinery | 0810 Other Mobile Sources and Machinery-Other off-road | NO | NO | NO | NO |
| **1 A 4 Other Sectors** | | | | | |
| 1 A 4 a Commercial/Institutional | 0201 Commercial and institutional plants | ✓ | ✓ | ✓ | ✓ |
| 1 A 4 b Residential | | | | | |
| 1 A 4 b i Residential Plants | 0202 Residential plants | ✓ | ✓ | ✓ | ✓ |
| 1 A 4 b ii Houshold and gardening (mobile) | 0809 Other Mobile Sources and Machinery-Household and gardening | ✓ | ✓ | ✓ | ✓ |
| 1 A 4 c Agriculture/Forestry/Fisheries | | | | | |
| 1 A 4 c i Stationary | 0203 Plants in agriculture, forestry and aquaculture | ✓ | ✓ | ✓ | ✓ |
| 1 A 4 c ii Off-road Vehicles and Other Machinery | 0806 Other Mobile Sources and Machinery-Agriculture<br>0807 Other Mobile Sources and Machinery-Forestry | ✓ | ✓ | ✓ | ✓ |
| 1A 4 c iii National Fishing | 080403 National fishing | NO | NO | NO | NO |
| **1 A 5 Other** | | | | | |
| 1 A 5 a Other, Stationary | | IE[2] | IE[2] | IE[2] | IE[2] |
| 1 A 5 b Other, Mobile (Including military) | 0801 Military | ✓<br>IE[3] | ✓<br>IE[3] | ✓<br>IE[3] | ✓<br>IE[3] |
| **Memo Items** | | | | | |
| 1 A 3 a i International Aviation | 080502 International airport traffic (LTO cycles - <1000 m)<br>080504 International cruise traffic (>1000 m) | ✓ | ✓ | ✓ | ✓ |

| NFR Category | SNAP | Status | | | |
|---|---|---|---|---|---|
| | | $NO_X$ | $SO_2$ | NMVOC | $NH_3$ |
| 1 A 3 d i International Navigation | 080404 International sea traffic (international bunkers) | NO | NO | NO | NO |

(1) NMVOC emissions from petroleum refinery are included in category 1 B 2 a iv Oil Refining/ Storage.

(2) Emissions from stationary combustion in military installations are included in 1 A 4 Other Sectors.

(3) Emissions from Military Aviation are included in 1 A 3 a Civil Aviation.

## 4.2 Energy Industries (NFR Source Category 1 A 1)

### 4.2.1 Public Electricity and Heat Production (1 A 1 a)

#### 4.2.1.1 Source Category Description

Category *1 A 1 a Public Electricity and Heat Production* comprises emissions from fuel combustion in public power and heat plants. Emissions from waste incineration plants which produce public district heating and/or power are also considered in this source category. Emissions from industrial autoproducers are included in category *1 A 2 f*.

While total fuel consumption increased from 144 PJ in 1990 to 180 PJ in 2002, $SO_2$ and $NO_X$ emissions decreased due to fuel switches and the implementation of abatement techniques. Since 2000 $SO_2$ emissions increased due to rising coal consumption of public power plants. The increase of $NO_X$ emissions from 2000 onwards is mainly driven by the increase of coal, biomass and natural gas consumption.

*Table 19: Emission trends of category 1 A 1 a Energy Industries*

| Year | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 11.4 | 11.7 | 0.41 | 0.12 | 144 |
| 1991 | 10.6 | 9.4 | 0.47 | 0.13 | 151 |
| 1992 | 5.7 | 9.3 | 0.43 | 0.12 | 119 |
| 1993 | 6.6 | 7.9 | 0.44 | 0.14 | 120 |
| 1994 | 4.7 | 6.8 | 0.41 | 0.14 | 125 |
| 1995 | 5.9 | 8.0 | 0.41 | 0.14 | 139 |
| 1996 | 4.3 | 7.3 | 0.44 | 0.16 | 158 |
| 1997 | 5.4 | 7.9 | 0.45 | 0.16 | 155 |
| 1998 | 3.6 | 6.8 | 0.45 | 0.18 | 149 |
| 1999 | 3.9 | 7.1 | 0.38 | 0.18 | 149 |
| 2000 | 3.7 | 7.5 | 0.41 | 0.15 | 144 |
| 2001 | 4.5 | 8.9 | 0.50 | 0.17 | 160 |
| 2002 | 4.5 | 9.9 | 0.57 | 0.18 | 180 |
| *Trend* | *-60%* | *-15%* | *41%* | *53%* | *25%* |

#### 4.2.1.2 Methodological Issues

In a first step large point sources are considered. The UMWELTBUNDESAMT is operating a database to store plant specific data, called "*Dampfkesseldatenbank"* (DKDB) which includes data on fuel consumption, $NO_X$, $SO_X$, CO and PM emissions from boilers with a thermal capacity greater than 3 MW for all years from 1990 onwards. These data are used to generate a sectoral split of the categories *Public Power* and *District Heating*, with further distinction between the two categories ≥ *300 MW* and ≥ *50 MW to 300 MW* of thermal capacity. Currently 42 plants are considered with this approach. Table 20 shows the trends of the reported $NO_X$ and $SO_2$ emissions and fuel consumption.

*Table 20: Trends of reported emissions and fuel consumption of 1 A 1 a point sources.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|
| 1990 | 10.85 | 10.46 | 133 |
| 1991 | 9.56 | 8.00 | 140 |
| 1992 | 4.83 | 7.79 | 107 |
| 1993 | 4.38 | 5.18 | 100 |
| 1994 | 2.71 | 4.52 | 107 |
| 1995 | 3.03 | 5.20 | 116 |
| 1996 | 3.50 | 4.84 | 117 |
| 1997 | 4.26 | 5.00 | 101 |
| 1998 | 2.83 | 4.64 | 109 |
| 1999 | 3.31 | 4.84 | 109 |
| 2000 | 3.20 | 5.18 | 109 |
| 2001 | 3.61 | 6.18 | 122 |
| 2002 | 3.66 | 6.21 | 117 |
| *Trend* | *-66%* | *-41%* | *-12%* |

The fuel consumption of all considered point sources is subtracted from the total consumption of this category which is taken from the energy balance. The rest is considered as area source.

Emissions of plants < 50 MW are calculated by multiplying emission factors with the corresponding activity data (see Chapter 4.1.2).

For point sources >= 50 MW plant specific emission and activity data was used.

### Emission factors

Emission factors are summarized in Chapter 4.7.

$NH_3$

For $NH_3$ emission factors from [UMWELTBUNDESAMT, 1990] are used.

NMVOC

Sources of VOC emission factors are cited in chapter 4.1.2 General Methodology.

VOC emission factors are divided into NMVOC and $CH_4$ emission factors as shown in Table 21. The split follows closely [STANZEL et. al, 1995].

*Table 21: Share of NMVOC emissions in VOC emissions for 1 A 1 a.*

| | Solid Fossile | Liquid Fossile | Natural Gas | Biomass |
|---|---|---|---|---|
| Electricity plants | 90% | 80% | 25% | 75% |
| District Heating plants | Hard coal 70%<br>Brown Coal 80% | 80% | 30% | 75% |

$NO_X$ and $SO_2$

For plants < 50 MW emission factors of the studies cited in Chapter 4.1.2 are used.

Plants >= 50 MW are considered as point sources. These are grouped according to the four SNAP categories:

- SNAP 010101 Public Power >= 300 MW thermal capacity.
- SNAP 010102 Public Power >= 50 MW < 300 MW thermal capacity.
- SNAP 010201 District Heating >= 300 MW thermal capacity.
- SNAP 010202 District Heating >= 50 MW < 300 MW thermal capacity.

For each group implied emission factors (IEF) from plant specific emission data as obtained from plant operators were calculated. The implied emission factors are used to report emissions per fuel group as needed for the CRF-format of the UNFCCC that has to be consistent with the UNECE/CLRTAP submission. Implied emission factors are in addition used to trace control efficiency over time series and to compare different inventories.

**Activity data**

Detailed activity data is provided in Chapter 4.7.

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.

Fuel consumption is taken from the energy balance prepared by STATISTIK AUSTRIA (see Annex 1). Total fuel consumption minus consumption of point sources >= 50 MW is taken as activity data for plants smaller than 50 MW.

Solid Fossil Fuels

In this category solid fossil fuels are combusted by public power and district heating plants with a thermal capacity greater than 50 MW. From 1990 onwards emissions from all point sources >=50 MW were reported annually and are therefore considered in the inventory. There are, however, two reasons why not all emissions of solid fuels are reported as point sources in this category:

- Fuel consumption of the energy balance for this category is greater than the sum of all point sources.
- Point source data is not complete.

If any of the two cases occur the distribution of the remaining solid fuels to one of the area source categories is done using information of previous years.

#### 4.2.1.3 Recalculation

Recalculation is mainly driven by the revision of the energy balance as cited in chapter 3 *Major Changes*. Table 22 shows the change of emissions due to recalculation.

*Table 22: Recalculation difference with respect to previous submission for 1 A 1 a Energy Industries.*

| | $SO_2$* [Gg] | $NO_X$* [Gg] | NMVOC* [Gg] | $NH_3$* [Gg] |
|---|---|---|---|---|
| 1990 | 0.17 | 0.31 | 0.00 | 0.00 |
| 1991 | 0.11 | 0.15 | 0.01 | 0.00 |
| 1992 | 0.55 | 0.38 | 0.02 | 0.01 |
| 1993 | -0.01 | -0.01 | 0.01 | 0.00 |
| 1994 | -0.01 | -0.01 | 0.01 | 0.00 |
| 1995 | -0.01 | -0.02 | 0.01 | 0.00 |
| 1996 | 0.00 | -0.01 | 0.00 | 0.00 |
| 1997 | -0.01 | -0.01 | 0.00 | 0.00 |
| 1998 | 0.00 | -0.01 | 0.00 | 0.00 |
| 1999 | -0.05 | -0.32 | -0.04 | 0.00 |
| 2000 | 0.34 | -0.33 | -0.19 | 0.01 |
| 2001 | 0.17 | 0.31 | 0.00 | 0.00 |

* Negative numbers indicate less emissions compared to previous submission

### 4.2.2 Petroleum Refining (1 A 1 b)

#### 4.2.2.1 Source Category Description

Category *1 A 1 b Petroleum Refining* enfolds $SO_2$, $NO_X$ and $NH_3$ emissions from fuel combustion of one petroleum refining plant. NMVOC emissions from fuel combustion are included in category *1 B 2 a iv Oil Refining/ Storage* together with fugitive NMVOC emissions.

$SO_2$ emissions increased since 1990 due to higher fuel consumption; $NO_X$ emissions decreased.

*Table 23: Emission trends of category 1 A 1 b Petroleum Refining*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 2.25 | 4.32 | IE | 0.10 | 44 |
| 1991 | 2.11 | 4.32 | IE | 0.10 | 43 |
| 1992 | 2.85 | 4.19 | IE | 0.10 | 42 |
| 1993 | 3.42 | 3.40 | IE | 0.11 | 45 |
| 1994 | 3.03 | 3.41 | IE | 0.11 | 46 |
| 1995 | 2.98 | 3.38 | IE | 0.11 | 45 |
| 1996 | 3.49 | 3.48 | IE | 0.12 | 49 |
| 1997 | 3.66 | 3.47 | IE | 0.12 | 48 |
| 1998 | 3.80 | 3.36 | IE | 0.11 | 47 |
| 1999 | 3.55 | 3.25 | IE | 0.10 | 41 |
| 2000 | 3.44 | 3.07 | IE | 0.09 | 39 |
| 2001 | 3.62 | 3.30 | IE | 0.10 | 40 |
| 2002 | 3.69 | 3.44 | IE | 0.09 | 37 |
| *Trend* | *64%* | *-20%* | - | *-17%* | *-16%* |

#### 4.2.2.2 Methodological Issues

Since 1994 the refinery plant directly reports $NO_X$ and $SO_2$ emissions to UMWELTBUNDESAMT. For the years 1990 to 1993 emission values are taken from the DKDB. $NH_3$ emissions for each fuel type are calculated by multiplying fuel consumption with an emission factor. As NMVOC emissions of the refinery are mainly fugitive emissions, emissions are included in category *1 B*.

**Emission factors**

$NH_3$ emission factors are taken from [UMWELTBUNDESAMT, 1990].

**Activity data**

Fuel consumption of refinery is reported in the energy balance as *Inputs to Oil Refineries* and *Refinery Fuel* respectively.

#### 4.2.2.3 Recalculation

Recalculation is mainly driven by revision of the energy balance as cited in chapter 3 *Major Changes*. Table 22 shows the change of $NH_3$ emissions due to recalculation.

*Table 24: Recalculation difference with respect to previous submission for 1 A 1 b Petroleum Refining.*

| | $NH_3$* [Gg] |
|---|---|
| 1990 | 0.04 |
| 1991 | 0.04 |
| 1992 | 0.01 |
| 1993 | 0.01 |
| 1994 | 0.01 |
| 1995 | 0.01 |
| 1996 | 0.02 |
| 1997 | 0.02 |
| 1998 | 0.02 |
| 1999 | 0.01 |
| 2000 | 0.01 |
| 2001 | 0.04 |

* Negative numbers indicate less emissions compared to previous submission

### 4.2.3 Manufacture of Solid Fuels and Other Energy Industries (1 A 1 c)

#### 4.2.3.1 Source Category Description

Category *1 A 1 c Manufacture of Solid Fuels and Other Energy Industries* enfolds emissions from natural gas combustion in the oil and gas extraction sector as well as emissions from gas works.

*Table 25: Emission trends of category 1 A 1 c Manufacture of Solid Fuels and Other Energy Industries*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 0.68 | 1.02 | 0.01 | 0.01 | 6 |
| 1991 | 0.58 | 1.00 | 0.01 | 0.01 | 6 |
| 1992 | 0.00 | 0.75 | 0.00 | 0.01 | 5 |
| 1993 | 0.03 | 0.80 | 0.00 | 0.01 | 5 |
| 1994 | 0.02 | 0.79 | 0.00 | 0.01 | 5 |
| 1995 | 0.01 | 0.86 | 0.00 | 0.01 | 6 |
| 1996 | 0.00 | 0.45 | 0.00 | 0.00 | 3 |
| 1997 | 0.00 | 0.56 | 0.00 | 0.00 | 4 |
| 1998 | 0.00 | 0.45 | 0.00 | 0.00 | 3 |
| 1999 | 0.00 | 0.45 | 0.00 | 0.00 | 3 |
| 2000 | 0.00 | 0.40 | 0.00 | 0.00 | 3 |
| 2001 | 0.00 | 2.09 | 0.01 | 0.01 | 14 |
| 2002 | 0.00 | 1.56 | 0.01 | 0.01 | 10 |
| *Trend* | *-100%* | *53%* | *-50%* | *94%* | *66%* |

#### 4.2.3.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

**Emission factors**

Emission factors are provided in Chapter 4.7 *Activity Data and Emissions Factors.* Unabated emission factors of industrial boilers were applied. Sources of emission factors are cited in chapter 4.1.2.

**Activity data**

Fuel consumption is reported in the energy balance as *Oil and Gas Extraction* and *Gasworks.*

#### 4.2.3.3 Recalculation

From 1990 to 1995 emissions from gas works are now estimated by means of the fuel consumption reported in the energy balance.

*Table 26: Recalculation difference with respect to previous submission for 1 A 1 c Manufacture of Solid Fuels and Other Energy Industries.*

| | $SO_2$* [Gg] | $NO_X$* [Gg] | NMVOC* [Gg] | $NH_3$* [Gg] |
|---|---|---|---|---|
| 1990 | 0.68 | 0.22 | 0.01 | 0.00 |
| 1991 | 0.58 | 0.19 | 0.01 | 0.00 |
| 1992 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1993 | 0.03 | 0.01 | 0.00 | 0.00 |
| 1994 | 0.02 | 0.01 | 0.00 | 0.00 |
| 1995 | 0.01 | 0.00 | 0.00 | 0.00 |
| 1996 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1997 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1998 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1999 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2000 | 0.00 | 1.63 | 0.01 | 0.01 |
| 2001 | 0.68 | 0.22 | 0.01 | 0.00 |

* Negative numbers indicate less emissions compared to previous submission

## 4.3 Manufacturing Industries and Construction (NFR Source Category 1 A 2)

Category *1 A 2 Manufacturing Industries and Construction* comprises emissions from stationary fuel combustion as well as from off-road activities in industry. NOX and $SO_2$ emissions decreased from 1990 on due to less use of coal and the implementation of measures while total fuel consumption is at the level of 1990.

*Table 27: Emission trends of category 1 A 2 Manufacturing Industries and Construction.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 22.1 | 41.2 | 3.89 | 0.22 | 209 |
| 1991 | 24.0 | 42.6 | 4.08 | 0.23 | 217 |
| 1992 | 16.0 | 40.3 | 4.14 | 0.22 | 208 |
| 1993 | 14.3 | 39.9 | 4.06 | 0.25 | 218 |
| 1994 | 14.8 | 40.0 | 4.14 | 0.26 | 232 |
| 1995 | 13.5 | 37.4 | 4.11 | 0.25 | 235 |
| 1996 | 14.2 | 36.6 | 4.10 | 0.24 | 233 |
| 1997 | 16.8 | 40.0 | 4.29 | 0.29 | 258 |
| 1998 | 14.2 | 39.0 | 4.20 | 0.25 | 248 |
| 1999 | 12.7 | 37.0 | 4.19 | 0.24 | 240 |
| 2000 | 11.2 | 36.1 | 4.08 | 0.23 | 242 |
| 2001 | 11.2 | 34.9 | 3.96 | 0.23 | 234 |
| 2002 | 11.0 | 34.1 | 4.01 | 0.19 | 208 |
| *Trend* | *-50%* | *-17%* | *3%* | *-13%* | *0%* |

### 4.3.1 Iron and Steel (1 A 2 a)

#### 4.3.1.1 Source Category Description

Category *1 A 2 a Iron and Steel* comprises emissions from iron and steel industry.

*Table 28: Emission trends of category 1 A 2 a Iron and Steel.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 6.3 | 5.1 | 0.07 | 0.02 | 53 |
| 1991 | 5.1 | 5.1 | 0.06 | 0.02 | 51 |
| 1992 | 3.4 | 4.3 | 0.05 | 0.02 | 45 |
| 1993 | 3.8 | 4.7 | 0.06 | 0.02 | 47 |
| 1994 | 4.1 | 4.4 | 0.07 | 0.02 | 50 |
| 1995 | 3.9 | 4.6 | 0.07 | 0.03 | 55 |
| 1996 | 4.5 | 4.4 | 0.07 | 0.02 | 53 |
| 1997 | 5.7 | 5.3 | 0.10 | 0.05 | 66 |
| 1998 | 5.6 | 5.3 | 0.09 | 0.04 | 64 |
| 1999 | 4.8 | 4.5 | 0.07 | 0.04 | 61 |
| 2000 | 4.4 | 4.4 | 0.10 | 0.04 | 65 |
| 2001 | 4.9 | 4.3 | 0.10 | 0.05 | 67 |
| 2002 | 6.1 | 5.6 | 0.13 | 0.05 | 65 |
| *Trend* | *-4%* | *9%* | *91%* | *136%* | *22%* |

#### 4.3.1.2 Methodological Issues

The two main iron and steel production sites (the only ones operating blast furnaces in Austria) are considered as point sources. $SO_2$, $NO_X$, VOC 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 all pollutants of area sources and $NH_3$ the CORINAIR simple methodology was applied.

**Emission factors**

Emission factors are provided in Chapter 4.7 *Activity Data and Emission Factors*. For area sources emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

**Activity data**

To avoid double counting of emissions the fuel consumption of the two iron & steel sites is subtracted from total fuel consumption for this category taken from the energy balance (see Annex 1).

Activity data of the two iron and steel sites is not reported for the whole time series. The data gaps are filled by means of a model and additional information from STATISTIK AUSTRIA.

**Recalculation**

In the previous submission emissions from the two iron and steel sites were reported under category *2 C 1 Metal Production.*

$NH_3$ emissions of the two iron and steel sites are now estimated.

### 4.3.2 Non-Ferrous Metals (1 A 2 b)

#### 4.3.2.1 Source Category Description

Category *1 A 2 b Non-Ferrous Metals* comprises emissions from fuel combustion in non ferrous metal industry.

The increase of emissions is driven by the increase of fuel consumption.

*Table 29: Emission trends of category 1 A 2 b Non-Ferrous Metals.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 0.07 | 0.22 | 0.002 | 0.002 | 1.9 |
| 1991 | 0.15 | 0.21 | 0.003 | 0.002 | 1.9 |
| 1992 | 0.17 | 0.24 | 0.004 | 0.002 | 2.3 |
| 1993 | 0.11 | 0.21 | 0.003 | 0.003 | 2.5 |
| 1994 | 0.19 | 0.22 | 0.004 | 0.003 | 2.8 |
| 1995 | 0.10 | 0.16 | 0.003 | 0.003 | 2.8 |
| 1996 | 0.11 | 0.16 | 0.003 | 0.003 | 2.7 |
| 1997 | 0.17 | 0.21 | 0.004 | 0.004 | 3.2 |
| 1998 | 0.14 | 0.19 | 0.003 | 0.004 | 3.2 |
| 1999 | 0.18 | 0.21 | 0.005 | 0.004 | 3.3 |
| 2000 | 0.16 | 0.20 | 0.004 | 0.004 | 3.2 |
| 2001 | 0.28 | 0.25 | 0.006 | 0.004 | 3.5 |
| 2002 | 0.17 | 0.17 | 0.004 | 0.003 | 2.6 |
| *Trend* | *129%* | *-21%* | *151%* | *38%* | *36%* |

#### 4.3.2.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

**Emission factors**

Emission factors are provided in Chapter 4.7 *Activity Data and Emission Factors,* emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

**Activity data**

Fuel consumption is taken from the energy balance (see Annex 1).

### 4.3.3 Chemicals (1 A 2 c)

#### 4.3.3.1 Source Category Description

Category *1 A 2 c Chemicals* enfolds emissions from fuel combustion in chemical industry.

$SO_2$ and NMVOC emissions increased due to the increase of coal and biomass consumption.

*Table 30: Emission trends of category 1 A 2 c Chemicals.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 1.0 | 1.7 | 0.13 | 0.02 | 14 |
| 1991 | 1.2 | 1.6 | 0.13 | 0.02 | 14 |
| 1992 | 1.3 | 1.7 | 0.13 | 0.03 | 15 |
| 1993 | 1.3 | 1.4 | 0.09 | 0.02 | 13 |
| 1994 | 1.6 | 1.4 | 0.10 | 0.02 | 14 |
| 1995 | 1.4 | 1.3 | 0.11 | 0.02 | 14 |
| 1996 | 1.4 | 1.3 | 0.10 | 0.02 | 14 |
| 1997 | 2.0 | 1.7 | 0.13 | 0.03 | 18 |
| 1998 | 1.8 | 1.5 | 0.13 | 0.02 | 17 |
| 1999 | 1.9 | 1.4 | 0.14 | 0.01 | 16 |
| 2000 | 1.4 | 1.3 | 0.14 | 0.02 | 16 |
| 2001 | 1.7 | 1.5 | 0.17 | 0.02 | 15 |
| 2002 | 1.2 | 1.4 | 0.23 | 0.02 | 16 |
| *Trend* | *21%* | *-16%* | *74%* | *-28%* | *10%* |

#### 4.3.3.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

**Emission factors**

Emission factors are provided in Chapter 4.7 *Activity Data and Emission Factors*, emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

**Activity data**

Fuel consumption is taken from the energy balance (see Annex 1).

### 4.3.4 Pulp, Paper and Print (1 A 2 d)

#### 4.3.4.1 Source Category Description

Category *1 A 2 d Pulp, Paper and Print* comprises emissions from fuel combustion in pulp, paper and print industry. Emissions from combustion of black liquor for autoproduction of heat and electricity are reported in category *1 A 2 f Other.*

While fuel consumption in 2002 is on the level of 1990, $NO_X$ and $SO_2$ emissions decreased due to the implementation of measures and fuel switches.

*Table 31: Emission trends of category 1 A 2 d Pulp, Paper and Print.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 3.9 | 4.7 | 0.59 | 0.05 | 36 |
| 1991 | 4.5 | 4.7 | 0.59 | 0.04 | 36 |
| 1992 | 2.2 | 4.3 | 0.56 | 0.04 | 35 |
| 1993 | 1.9 | 4.4 | 0.57 | 0.05 | 35 |
| 1994 | 1.8 | 4.0 | 0.53 | 0.04 | 32 |
| 1995 | 1.6 | 3.6 | 0.57 | 0.04 | 32 |
| 1996 | 1.5 | 3.2 | 0.52 | 0.03 | 30 |
| 1997 | 1.7 | 4.2 | 0.61 | 0.04 | 40 |
| 1998 | 1.3 | 4.4 | 0.56 | 0.06 | 41 |
| 1999 | 1.0 | 3.8 | 0.61 | 0.04 | 39 |
| 2000 | 1.0 | 4.2 | 0.74 | 0.04 | 43 |
| 2001 | 0.9 | 4.1 | 0.70 | 0.04 | 43 |
| 2002 | 0.9 | 3.6 | 0.74 | 0.03 | 37 |
| *Trend* | *-78%* | *-25%* | *25%* | *-31%* | *1%* |

#### 4.3.4.2 Methodological Issues

$NO_X$, NMVOC and $NH_3$

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

$SO_2$

$SO_2$ emissions for the year 1990 are taken from [UMWELTBUNDESAMT, 1993], for the year 1993 from [WINDSPERGER et al., 1997], for the year 1999 personal information from Austropapier (the Austrian Association of Paper Industry) was provided, for the years 2000 and 2001 emissions were taken from [Austropapier, 2002]. Emissions for the years in between were linearly interpolated. Emissions for the year 2002 are estimated by means of 2001 data.

From the reported emission data and the activity data of the energy balance implied emission factors were calculated.

As total emissions are reported, these also include emissions from auto production of electricity in pulp and paper industry. Following the allocation of the energy balance, the share of emissions from combustion of black liquor that corresponds to production of electricity is reported under category *1 A 2 f Other.*

**Emission factors**

Emission factors are provided in chapter 4.7 *Activity Data and Emission Factors*, emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

**Activity data**

Fuel consumption is taken from the energy balance (see Annex 1).

### 4.3.5 Food Processing, Beverages and Tobacco (1 A 2 e)

#### 4.3.5.1 Source Category Description

Category *1 A 2 e Food Processing, Beverages and Tobacco* comprises emissions from fuel combustion in food processing, beverages and tobacco industry.

While fuel consumption is quite stable emissions decreased due to a decrease of liquid fuel consumption and the implementation of measures.

*Table 32: Emission trends of category 1 A 2 e Food Processing, Beverages and Tobacco.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 1.1 | 1.5 | 0.02 | 0.02 | 12 |
| 1991 | 1.4 | 1.5 | 0.02 | 0.02 | 13 |
| 1992 | 0.9 | 1.3 | 0.02 | 0.02 | 12 |
| 1993 | 0.7 | 1.1 | 0.02 | 0.02 | 12 |
| 1994 | 1.2 | 1.2 | 0.03 | 0.02 | 13 |
| 1995 | 0.7 | 0.9 | 0.02 | 0.02 | 13 |
| 1996 | 0.4 | 0.7 | 0.01 | 0.02 | 11 |
| 1997 | 0.4 | 0.7 | 0.01 | 0.02 | 12 |
| 1998 | 0.3 | 0.7 | 0.01 | 0.02 | 12 |
| 1999 | 0.3 | 0.6 | 0.01 | 0.01 | 11 |
| 2000 | 0.4 | 0.8 | 0.01 | 0.02 | 15 |
| 2001 | 0.4 | 0.8 | 0.02 | 0.02 | 15 |
| 2002 | 0.4 | 0.6 | 0.01 | 0.01 | 11 |
| *Trend* | -67% | -60% | -27% | -33% | -14% |

#### 4.3.5.2 Methodological Issues

CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

**Emission factors**

Emission factors are provided in chapter 4.7 *Activity Data and Emission factors*, emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

**Activity data**

Fuel consumption is taken from the energy balance (see Annex 1).

### 4.3.6 Manufacturing Industries and Construction – Other (1 A 2 f)

#### 4.3.6.1 Source Category Description

Category *1 A 2 f Other* comprises 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 off-road machinery of total industry.

*Table 33: Emission trends of category 1 A 2 f Other.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] |
|---|---|---|---|---|
| 1990 | 9.6 | 27.9 | 3.1 | 0.11 |
| 1991 | 11.7 | 29.4 | 3.3 | 0.13 |
| 1992 | 8.0 | 28.6 | 3.4 | 0.11 |
| 1993 | 6.4 | 28.0 | 3.3 | 0.14 |
| 1994 | 5.9 | 28.8 | 3.4 | 0.15 |
| 1995 | 5.8 | 26.9 | 3.3 | 0.14 |
| 1996 | 6.3 | 26.9 | 3.4 | 0.14 |
| 1997 | 6.8 | 27.9 | 3.4 | 0.16 |
| 1998 | 4.9 | 26.9 | 3.4 | 0.11 |
| 1999 | 4.5 | 26.4 | 3.4 | 0.12 |
| 2000 | 3.8 | 25.3 | 3.1 | 0.11 |
| 2001 | 3.1 | 24.1 | 3.0 | 0.10 |
| 2002 | 2.4 | 22.7 | 2.9 | 0.08 |
| *Trend* | *-75%* | *-19%* | *-6%* | *-28%* |

#### 4.3.6.2 1 A 2 f Manufacturing Industries and Construction - Other - stationary sources

Table 34 shows emission trends of stationary sources of category *1 A 2 f Other-stationary sources.*

*Table 34: Emission trends of category 1 A 2 f Other-Stationary Sources.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 9.0 | 16.1 | 0.7 | 0.1 | 79 |
| 1991 | 11.0 | 16.9 | 0.7 | 0.1 | 89 |
| 1992 | 7.3 | 15.7 | 0.7 | 0.1 | 87 |
| 1993 | 5.7 | 15.3 | 0.7 | 0.1 | 96 |
| 1994 | 5.3 | 15.1 | 0.7 | 0.1 | 108 |
| 1995 | 5.5 | 13.1 | 0.7 | 0.1 | 106 |
| 1996 | 6.1 | 13.1 | 0.8 | 0.1 | 108 |
| 1997 | 6.5 | 13.2 | 0.8 | 0.2 | 106 |
| 1998 | 4.7 | 11.4 | 0.8 | 0.1 | 98 |
| 1999 | 4.2 | 11.5 | 0.9 | 0.1 | 97 |
| 2000 | 3.6 | 10.6 | 0.7 | 0.1 | 86 |
| 2001 | 2.8 | 9.8 | 0.6 | 0.1 | 76 |
| 2002 | 2.1 | 8.8 | 0.6 | 0.1 | 63 |
| *Trend* | *-76%* | *-45%* | *-5%* | *-29%* | *-21%* |

**Methodology**

Cement Industry

For 1990 to 1999 activity data, $NO_X$, NMVOC and $SO_2$ emissions are taken from studies [HACKEL et al., 1995/1997/2001]. They are based upon information from companies and thus represent plant specific data.

For the period 2000 to 2002 the following methodology is applied:

- Fuels of minor importance the value of 1999 is used.
- For *Hard Coal, Brown Coal*, *Industrial Waste* and *Other Petroleum Products* total fuel consumption of energy balance sector *Non Metallic Mineral Products* is taken.
- *Natural Gas* consumption of 1999 is extrapolated.
- For *Fuel Oil* consumption 50% of energy balance sector *Non Metallic Mineral Products* is taken.
- $SO_2$ emissions are calculated using the implied emission factors for the year 1999. For $NO_X$ and NMVOC emissions the values of 1999 are used.

$NH_3$ emissions are calculated with the simple CORINAIR methodology.

Glas Industry

For the years 1997 and 2002 $NO_X$ and $SO_2$ emissions are based on an industry inquiry performed by the *Association of Glass Industry* which covers 95% of the total Austrian glass production capacity. For 1990 to 1996 the implied emissions factors of 1997 were used. From 1998 to 2001 emissions are interpolated. NMVOC and $NH_3$ are calculated with the simple CORINAIR methodology.

Bricks and Tiles and Other Industry

CORINAIR simple methodology is applied. Fuel consumption is multiplied with fuel dependant emission factors.

**Emission factors**

Emission factors used for simple CORINAIR methodology are provided in Chapter 4.7 *Activity Data and Emissions Factors.* Emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

**Activity data**

Cement Industry

See chapter methodology.

Glass Industry

For 1990 to 1996 statistical data of fuel consumption is available. For 1997 and 2000 to 2002 data is based upon information from the *Association of Glass Industry*. Gap filling is performed by interpolation.

Bricks and Tiles Industry

For 1990 to 1995 fuel consumption is reported by the *Association of Bricks and Precast Concrete Part Industry.* From 1996 on data from 1995 is extrapolated.

Other Industry

This group includes emissions from industrial fuel combustion not considered elsewhere. Total industrial autoproduction of electricity and heat for which a sectoral split is not available yet is included here.

Total fuel consumption for category *1 A 2 f* is taken from the energy balance (see Annex 1).

**Recalculation**

In the previous submission emissions from cement industry were reported under *2 A 1 Cement Production.* In this submission $NH_3$ emissions from cement industry were estimated. $NO_X$ and $SO_2$ emissions from glass industry were updated for the whole time series.

#### 4.3.6.3 1 A 2 f Manufacturing Industries and Construction - Other - mobile sources

Most mobile sources of the industry are among the building industry. Within the industry sector there are different vehicles, which can be summarized to the following groups:

- vehicles with diesel engine > 80 kW
- vehicles with diesel engine < 80 kW
- vehicles with 4-stroke-petrol engine
- vehicles with 2-stroke-petrol engine

Emissions from this category are presented in the following table.

*Table 35: Emissions from off-road – Industry 1990-2002 [Gg]*

| | NOx [Gg] | $SO_2$ [Gg] | $NH_3$ [Gg] | NMVOC [Gg] |
|---|---|---|---|---|
| 1990 | 11.80 | 0.66 | 0.003 | 2.36 |
| 1991 | 12.52 | 0.70 | 0.004 | 2.50 |
| 1992 | 12.92 | 0.73 | 0.004 | 2.59 |
| 1993 | 12.76 | 0.72 | 0.004 | 2.56 |
| 1994 | 13.74 | 0.64 | 0.004 | 2.60 |
| 1995 | 13.75 | 0.23 | 0.004 | 2.57 |
| 1996 | 13.80 | 0.23 | 0.004 | 2.52 |
| 1997 | 14.67 | 0.24 | 0.004 | 2.54 |
| 1998 | 15.46 | 0.25 | 0.004 | 2.57 |
| 1999 | 14.89 | 0.23 | 0.004 | 2.43 |
| 2000 | 14.66 | 0.23 | 0.004 | 2.37 |
| 2001 | 14.25 | 0.24 | 0.004 | 2.28 |
| 2002 | 13.89 | 0.24 | 0.004 | 2.20 |
| *Trend 1990 - 2002* | *18%* | *-63%* | *6%* | *-6%* |

$NO_x$-emission increased slightly due to an increase of traffic in this category. However, the implied emission factor decreased. For NMVOC, $NH_3$ and especially $SO_2$ the downward trend was stronger resulting in an overall decreasing trend.

**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 c Railways
- 1 A 3 d Navigation
- 1 A 4 b Household and Gardening
- 1 A 4 c Agriculture and Forestry
- 1 A 5 Other: Military Activities

Depending on the engine's fuel consumption 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

Emission factors for $NO_x$, NMVOC and $NH_3$ were defined for four categories of engine type depending on the year of construction. They are listed in Table 36 to Table 39. 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 bottom-up method national total fuel consumption and total emissions are calculated. 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 5-20%. To be consistent with the national energy balance, activity data in the bottom-up approaches for both road transport and off- road traffic is adjusted so that finally the calculated total fuel consumption equals to the figure of fuel sold in the national energy balance.

*Table 36: Emission Factors for diesel engines > 80 kW [g/kWh]*

| Year | Fuel | $NO_x$ | $NH_3$ | NMVOC |
|---|---|---|---|---|
| | [g/kWh] | | | |
| 1993 | 282 | 13.0 | 0.00300 | 1.95 |
| 1997 | 273 | 14.4 | 0.00240 | 1.56 |
| 2000 | 265 | 9.2 | 0.00195 | 1.27 |

*Table 37: Emission Factors for diesel engines < 80 kW [g/kWh]*

| Year | Fuel | $NO_x$ | $NH_3$ | NMVOC |
|---|---|---|---|---|
| | [g/kWh] | | | |
| 1993 | 296 | 13.0 | 0.00600 | 3.90 |
| 1997 | 287 | 14.4 | 0.00450 | 2.93 |
| 2000 | 278 | 9.2 | 0.00390 | 2.54 |

*Table 38: Emission Factors for 4-stroke-petrol engines [g/kWh]*

| Year | Fuel | $NO_x$ | $NH_3$ | NMVOC |
|---|---|---|---|---|
| | [g/kWh] | | | |
| 1993 | 550 | 5.0 | 0.00194 | 42.84 |
| 1997 | 520 | 5.5 | 0.00172 | 38.08 |
| 2000 | 500 | 5.5 | 0.00159 | 35.22 |

*Table 39: Emission Factors for 2-stroke-petrol engines [g/kWh]*

| Year | Fuel | $NO_x$ | $NH_3$ | NMVOC |
|---|---|---|---|---|
| | [g/kWh] | | | |
| 1993 | 700 | 1.5 | 0.00168 | 297.0 |
| 1997 | 675 | 1.5 | 0.00151 | 267.3 |
| 2000 | 655 | 1.5 | 0.00134 | 237.6 |

Emission factors for $SO_2$ are based on the "Handbook of Emission Factors" [HAUSBERGER & KELLER, 1998]. They take into account analysis about the sulphur content of the fuel, which has been part of the inquiry of the yearly fuel quality monitory system.

### 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 as well as the implied emission factors (national total emissions divided by total fuel consumption in GWh) for mobile sources of *1 A 2 f Manufacturing Industries and Construction* (off-road transport in industry) are presented in the following table.

*Table 40: Implied emission factors and activities for off-road transport in industry (Category 1 A 2 f Manufacturing Industries and Construction – mobile 1990-2002*

| | Activity | Implied Emission Factors | | | |
|---|---|---|---|---|---|
| | | NOx | $SO_2$ | $NH_3$ | NMVOC |
| | [GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] |
| 1990 | 3 086 | 3 822.5 | 214.8 | 1.1 | 763.3 |
| 1991 | 3 276 | 3 822.2 | 214.8 | 1.1 | 764.0 |
| 1992 | 3 380 | 3 821.5 | 214.8 | 1.1 | 765.8 |
| 1993 | 3 341 | 3 820.6 | 214.8 | 1.1 | 766.5 |
| 1994 | 3 501 | 3 925.3 | 182.1 | 1.1 | 741.4 |
| 1995 | 3 499 | 3 931.0 | 67.1 | 1.1 | 733.8 |
| 1996 | 3 478 | 3 969.0 | 67.1 | 1.0 | 723.6 |
| 1997 | 3 614 | 4 058.7 | 67.1 | 1.0 | 701.8 |
| 1998 | 3 748 | 4 124.9 | 67.1 | 1.0 | 684.7 |
| 1999 | 3 866 | 3 851.2 | 58.6 | 0.9 | 629.0 |
| 2000 | 4 003 | 3 663.0 | 58.6 | 0.9 | 592.0 |
| 2001 | 4 074 | 3 496.5 | 58.6 | 0.9 | 559.6 |
| 2002 | 4 151 | 3 347.0 | 58.6 | 0.9 | 530.8 |

## 4.4 Transport (NFR Source Category 1 A 3)

### 4.4.1 1 A 3 a Civil Aviation

As can be seen in Table 41, emissions from NFR Category Civil Aviation more than doubled within the period from 1990-2002 due to an increase in civil aviation by 170%, $NO_x$-emissions even tripled. However, emission factors decreased over this period.

*Table 41: Emissions from 1 A 3 a Civil Aviation 1990-2002*

| | NOx | | $SO_2$ | | $NH_3$ | | NMVOC | |
|---|---|---|---|---|---|---|---|---|
| | LTO | cruise | LTO | cruise | LTO | cruise | LTO | cruise |
| | [Mg] | [Mg] | [Mg] | [Mg] | [Mg] | [Mg] | [Mg] | [Mg] |
| 1990 | 36.13 | 40.53 | 4.20 | 4.5 | 0.10 | 0.03 | 20.63 | 18.25 |
| 1991 | 38.72 | 59.07 | 4.50 | 5.9 | 0.10 | 0.04 | 19.95 | 15.90 |
| 1992 | 41.32 | 77.60 | 4.78 | 7.4 | 0.10 | 0.05 | 19.28 | 13.55 |
| 1993 | 43.94 | 96.13 | 5.06 | 8.8 | 0.11 | 0.06 | 18.61 | 11.20 |
| 1994 | 46.55 | 114.67 | 5.36 | 10.2 | 0.11 | 0.07 | 17.94 | 8.85 |
| 1995 | 47.14 | 133.20 | 5.37 | 11.6 | 0.10 | 0.08 | 17.27 | 6.50 |
| 1996 | 53.36 | 149.63 | 6.03 | 12.9 | 0.10 | 0.09 | 27.12 | 10.93 |
| 1997 | 60.69 | 166.07 | 6.85 | 14.1 | 0.11 | 0.10 | 36.97 | 15.37 |
| 1998 | 67.77 | 182.50 | 7.62 | 15.4 | 0.12 | 0.11 | 46.83 | 19.80 |
| 1999 | 69.05 | 190.80 | 7.86 | 16.3 | 0.13 | 0.11 | 48.82 | 20.55 |
| 2000 | 67.50 | 199.10 | 7.73 | 17.2 | 0.11 | 0.12 | 50.80 | 21.30 |
| 2001 | 65.31 | 191.95 | 7.48 | 16.5 | 0.11 | 0.11 | 48.97 | 20.53 |
| 2002 | 61.57 | 179.76 | 7.06 | 15.5 | 0.10 | 0.11 | 45.87 | 19.23 |
| *Trend 1990-2002* | *70%* | *344%* | *68%* | *244%* | *0%* | *267%* | *122%* | *5%* |

#### 4.4.1.1 Methodological Issues

Emission estimates for **$NO_x$ and $SO_2$** were taken from a study commissioned by the UMWELTBUNDESAMT that was finished in 2002 [KALIVODA et. al, 2002]. Emissions for the years 2001 and 2002 have been calculated using implied emission factors and fuel allocation obtained from the values for the year 2000.

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

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

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

sales figures from the energy balance. The reason for choosing IFR international cruise for this adjustment is that this mode is assumed to hold the highest uncertainty.

Only IFR national LTO and IFR national cruise is considered in *1 A 3 a Civil Aviation*, IFR international LTO and IFR international cruise is considered in *I B Av International Bunkers Aviation*.

For calculation of $NO_x$ and $SO_2$ emissions VFR flights were considered as well.

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.

**NMVOC**
VOC emissions for IFR have been calculated like $NO_x$ and $SO_2$. According to the CORINAIR guidebook 90.4% of VOC emissions of the LTO-IFR are assumed to be NMVOC.

**$NH_3$** emissions were calculated using the fuel consumptions as obtained in the study.

Emission factors are taken from the ICAO Engine Exhaust Emissions Databank [BALASHOW & SMITH, 1995].

Fuel consumptions for *1 A 3 a Civil Aviation* as obtained from the MEET model (or from the energy balance for VFR) presented in Table 42.

*Table 42: Fuel consumptions for 1 A 3 a Civil Aviation 1990-2002*

| | LTO | | Cruise |
|---|---|---|---|
| | Kerosene | Gasoline | Kerosene |
| | [Mg] | [Mg] | [Mg] |
| 1990 | 3 164 | 2 487 | 4 508 |
| 1991 | 3 417 | 2 563 | 5 929 |
| 1992 | 3 670 | 2 641 | 7 351 |
| 1993 | 3 924 | 2 722 | 8 773 |
| 1994 | 4 177 | 2 805 | 10 195 |
| 1995 | 4 430 | 2 241 | 11 616 |
| 1996 | 5 128 | 2 153 | 12 877 |
| 1997 | 5 827 | 2 417 | 14 137 |
| 1998 | 6 525 | 2 602 | 15 398 |
| 1999 | 6 697 | 2 771 | 16 279 |
| 2000 | 6 868 | 2 039 | 17 161 |
| 2001 | 6 621 | 2 039 | 16 544 |
| 2002 | 6 201 | 2 039 | 15 494 |
| *Trend 1990-2002* | *96%* | *-18%* | *244%* |

*Table 43: Implied emission factors and activities for Civil Aviation (LTO+cruise) 1990-2002*

| | Activity | IEF NOx | IEF $SO_2$ | IEF $NH_3$ | IEF NMVOC |
|---|---|---|---|---|---|
| | [GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] |
| 1990 | 121.66 | 630.14 | 71.63 | 1.04 | 319.58 |
| 1991 | 142.82 | 684.70 | 73.01 | 0.99 | 251.02 |
| 1992 | 164.01 | 725.11 | 73.96 | 0.94 | 200.17 |
| 1993 | 185.90 | 753.44 | 74.41 | 0.92 | 160.35 |
| 1994 | 207.17 | 778.20 | 75.05 | 0.89 | 129.32 |
| 1995 | 219.46 | 821.74 | 77.42 | 0.81 | 108.31 |
| 1996 | 242.41 | 837.38 | 78.03 | 0.78 | 156.96 |
| 1997 | 269.24 | 842.21 | 77.94 | 0.78 | 194.40 |
| 1998 | 295.08 | 848.15 | 78.02 | 0.78 | 225.80 |
| 1999 | 309.12 | 840.62 | 78.11 | 0.78 | 224.41 |
| 2000 | 313.10 | 851.50 | 79.48 | 0.72 | 230.28 |
| 2001 | 302.71 | 849.83 | 79.36 | 0.73 | 229.62 |
| 2002 | 285.02 | 846.71 | 79.13 | 0.74 | 228.39 |

#### 4.4.1.2 Recalculation

For calculation of $NO_x$ and $SO_2$ emissions military flights were considered as well, they were reallocated to *1 A 5 Other* (in the submission 2003 the civil aviation contained military aviation as well).

### 4.4.2 1 A 3 b Road Transport

*Road Transport* is the main emission source for $NO_x$, $SO_2$, NMVOC and $NH_3$ emissions of the transport sector: about 94 to 97% of these emissions of the transport sector originate from that source. Total *Road Transport* activity increased by 63% from 1990 to 2002. However, due to decreasing emission factors $SO_2$, NMVOC and $NO_X$ emissions were below 1990 levels in 2002.

The sector includes emissions from passenger cars, light duty vehicles, heavy duty vehicles and busses, mopeds and motorcycles as well as gasoline evaporation from vehicles and automobile tyre and brake wear.

Technical improvements and a stricter legislation led to a reduction of emissions per vehicles or per mileage, respectively. On the other hand a steady increase of transport activity is observed.

The road transport sector is one of the main sources of $NO_X$ emissions in Austria. Around 52% of national total $NO_X$ emissions are caused by road transport. $NO_X$ emissions from road transport are dominated by road freight transport with heavy duty vehicles (with a share of about 53% in total road transport emissions) and passenger car transport (about 40% from total road transport emissions).

*Table 44: $NO_x$ emissions from Road Transport 1990-2002 [Gg]*

| | Passenger Cars | Light Duty Vehicle | Heavy Duty Vehicle | Mopeds & Motorcycles | **Total** |
|---|---|---|---|---|---|
| 1990 | 67.02 | 2.86 | 35.56 | 0.18 | **105.62** |
| 1991 | 69.93 | 3.05 | 37.12 | 0.21 | **110.32** |
| 1992 | 63.06 | 3.15 | 38.27 | 0.22 | **104.71** |
| 1993 | 58.28 | 3.37 | 39.57 | 0.23 | **101.45** |
| 1994 | 54.46 | 3.37 | 39.40 | 0.25 | **97.47** |
| 1995 | 48.85 | 3.58 | 40.76 | 0.27 | **93.45** |
| 1996 | 46.98 | 5.10 | 45.16 | 0.31 | **97.55** |
| 1997 | 41.64 | 4.17 | 42.55 | 0.33 | **88.70** |
| 1998 | 44.02 | 4.90 | 45.01 | 0.42 | **94.35** |
| 1999 | 38.25 | 4.76 | 47.13 | 0.42 | **90.55** |
| 2000 | 37.74 | 5.38 | 49.08 | 0.47 | **92.67** |
| 2001 | 38.87 | 5.66 | 50.18 | 0.54 | **95.25** |
| 2002 | 41.96 | 6.38 | 57.02 | 0.55 | **105.91** |
| *Trend 1990-2002* | *-37%* | *124%* | *60%* | *198%* | ***0%*** |

For $SO_2$, NMVOC and $NH_3$ emissions passenger cars are the main source.

$SO_2$ and $NH_3$ emissions reached a maximum in 1994 and have steadily decreased since then: $SO_2$ emissions in 2002 were 48% below 1990 levels whereas $NH_3$ emissions were still 19% above emissions in 1990.

NMVOC emissions have constantly decreased since 1990, in 2002 emissions were 61% below the 1990 level.

*Table 45: $SO_2$ emissions from road transport 1990-2002 [Gg]*

| | Passenger Cars | Light Duty Vehicle | Heavy Duty Vehicle | Mopeds & Motorcycles | **Total** |
|---|---|---|---|---|---|
| 1990 | 1.83 | 0.35 | 1.86 | 0.01 | **4.04** |
| 1991 | 2.23 | 0.42 | 1.97 | 0.01 | **4.61** |
| 1992 | 2.31 | 0.46 | 2.06 | 0.01 | **4.84** |
| 1993 | 2.51 | 0.53 | 2.15 | 0.01 | **5.20** |
| 1994 | 2.59 | 0.56 | 2.20 | 0.01 | **5.36** |
| 1995 | 2.34 | 0.54 | 1.98 | 0.01 | **4.86** |
| 1996 | 1.38 | 0.32 | 0.81 | 0.01 | **2.51** |
| 1997 | 1.18 | 0.24 | 0.71 | 0.01 | **2.13** |
| 1998 | 1.38 | 0.27 | 0.71 | 0.01 | **2.36** |
| 1999 | 1.14 | 0.24 | 0.67 | 0.00 | **2.06** |
| 2000 | 1.15 | 0.25 | 0.64 | 0.00 | **2.04** |
| 2001 | 1.21 | 0.26 | 0.62 | 0.00 | **2.09** |
| 2002 | 1.20 | 0.27 | 0.64 | 0.00 | **2.11** |
| *Trend 1990-2002* | *-35%* | *-23%* | *-66%* | *-67%* | ***-48%*** |

*Table 46: $NH_3$ emissions from road transport 1990-2002 [Gg]*

| | Passenger Cars | Light Duty Vehicle | Heavy Duty Vehicle | Mopeds & Motorcycles | **Total** |
|---|---|---|---|---|---|
| 1990 | 0.23 | 0.01 | 0.02 | 0.02 | **0.27** |
| 1991 | 0.29 | 0.01 | 0.02 | 0.02 | **0.33** |
| 1992 | 0.31 | 0.01 | 0.02 | 0.02 | **0.36** |
| 1993 | 0.34 | 0.01 | 0.02 | 0.02 | **0.38** |
| 1994 | 0.35 | 0.01 | 0.02 | 0.02 | **0.40** |
| 1995 | 0.34 | 0.01 | 0.02 | 0.02 | **0.39** |
| 1996 | 0.32 | 0.01 | 0.02 | 0.02 | **0.37** |
| 1997 | 0.30 | 0.01 | 0.02 | 0.02 | **0.35** |
| 1998 | 0.31 | 0.01 | 0.02 | 0.03 | **0.36** |
| 1999 | 0.28 | 0.01 | 0.02 | 0.03 | **0.33** |
| 2000 | 0.26 | 0.01 | 0.02 | 0.03 | **0.32** |
| 2001 | 0.25 | 0.01 | 0.02 | 0.03 | **0.31** |
| 2002 | 0.27 | 0.01 | 0.02 | 0.03 | **0.32** |
| *Trend 1990-2002* | *17%* | *37%* | *0%* | *60%* | ***19%*** |

*Table 47: NMVOC emissions from road transport 1990-2002 [Gg]*

| | Passenger Cars | Light Duty Vehicle | Heavy Duty Vehicle | Mopeds & Motorcycles | **Total** |
|---|---|---|---|---|---|
| 1990 | 45.28 | 1.08 | 3.10 | 6.06 | **55.53** |
| 1991 | 44.39 | 1.08 | 3.10 | 6.37 | **54.94** |
| 1992 | 38.63 | 1.04 | 3.09 | 5.72 | **48.49** |
| 1993 | 34.08 | 1.03 | 3.12 | 5.29 | **43.52** |
| 1994 | 30.51 | 0.96 | 3.08 | 4.99 | **39.55** |
| 1995 | 26.56 | 0.95 | 3.17 | 4.66 | **35.34** |
| 1996 | 22.49 | 1.17 | 3.32 | 4.73 | **31.71** |
| 1997 | 19.80 | 0.91 | 2.91 | 4.46 | **28.08** |
| 1998 | 18.36 | 0.96 | 2.87 | 5.01 | **27.20** |
| 1999 | 15.93 | 0.83 | 2.80 | 4.52 | **24.09** |
| 2000 | 13.95 | 0.85 | 2.76 | 4.66 | **22.22** |
| 2001 | 12.60 | 0.83 | 2.77 | 4.93 | **21.14** |
| 2002 | 12.64 | 0.88 | 3.10 | 4.79 | **21.42** |
| *Trend 1990-2002* | *-72%* | *-19%* | *0%* | *-21%* | *-61%* |

#### 4.4.2.1 Methodological Issues

Mobile combustion is differentiated into the categories Passenger Cars, Light Duty Vehicles, Heavy Duty Vehicles and Buses, Mopeds and Motorcycles. Calculations 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). Emission factors are based on the "Handbook of Emission Factors" [HAUSBERGER, KELLER, 1998]. The emissions from cold starts are calculated separately – taking into account temperature, interception periods and driving distances.

**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.

Different road performance for different street categories depending on the engine type, vehicle size and vehicle age is taken into account. 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 5-20%. 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.

*Table 48: Implied emission factors and activities for 1 A 3 b Road Transport 1990-2002*

| | Activity [GWh] | IEF NOx [kg/GWh] | IEF $SO_2$ [kg/GWh] | IEF $NH_3$ [kg/GWh] | IEF NMVOC [kg/GWh] |
|---|---|---|---|---|---|
| 1990 | 46 080.35 | 2 292.06 | 87.76 | 5.90 | 1 205.03 |
| 1991 | 51 356.18 | 2 148.12 | 89.84 | 6.50 | 1 069.83 |
| 1992 | 51 094.14 | 2 049.28 | 94.73 | 7.06 | 948.98 |
| 1993 | 51 596.82 | 1 966.23 | 100.78 | 7.42 | 843.56 |
| 1994 | 51 946.23 | 1 876.40 | 103.09 | 7.66 | 761.28 |
| 1995 | 52 270.75 | 1 787.88 | 92.96 | 7.38 | 676.04 |
| 1996 | 58 502.15 | 1 667.39 | 42.97 | 6.35 | 542.09 |
| 1997 | 54 502.79 | 1 627.37 | 39.03 | 6.36 | 515.23 |
| 1998 | 61 874.71 | 1 524.81 | 38.09 | 5.86 | 439.57 |
| 1999 | 59 029.63 | 1 534.03 | 34.97 | 5.63 | 408.17 |
| 2000 | 62 353.84 | 1 486.16 | 32.76 | 5.07 | 356.27 |
| 2001 | 67 298.75 | 1 415.26 | 31.01 | 4.56 | 314.15 |
| 2002 | 75 000.95 | 1 412.16 | 28.16 | 4.31 | 285.60 |
| *Trend 1990-2002* | *63%* | *-38%* | *-68%* | *-27%* | *-76%* |

#### 4.4.2.2 Recalculations

Measurements in a new study, which is part of the continuation and update of the manual for road-transport emission factors [UMWELTBUNDESAMT, 2003], showed that NOx emissions of heavy duty vehicles in real driving situations are higher than on the test bench. Though the updated handbook was not published these results were incorporated in the inventory. Therefore the NOx-emissions of duty vehicles are higher than in the last submission. Additionally, new emission factors for passenger cars (EURO2 and EUR3) have been used.

#### 4.4.2.3 Planned Improvements

For the category 1 A 3 b it is planned to use the whole updated emission factor data set which has been published in the springtime 2004.

### 4.4.3 1 A 3 c Railways

Only diesel and coal engines are taken into account, emissions driven by power plants due to production of electricity for electric engines are not included to avoid double counting of emissions.

*Table 49: Emissions from railways 1990-2002 [Gg]*

| | NOx [Gg] | $SO_2$ [Gg] | $NH_3$ [Gg] | NMVOC [Gg] |
|---|---|---|---|---|
| 1990 | 1.95 | 0.26 | 0.002 | 0.30 |
| 1991 | 2.03 | 0.25 | 0.002 | 0.30 |
| 1992 | 1.99 | 0.26 | 0.002 | 0.30 |
| 1993 | 1.92 | 0.24 | 0.002 | 0.28 |

| | | | | |
|---|---|---|---|---|
| 1994 | 1.90 | 0.24 | 0.002 | 0.28 |
| 1995 | 1.75 | 0.22 | 0.002 | 0.25 |
| 1996 | 1.55 | 0.15 | 0.002 | 0.23 |
| 1997 | 1.53 | 0.11 | 0.002 | 0.22 |
| 1998 | 1.49 | 0.10 | 0.002 | 0.21 |
| 1999 | 1.81 | 0.11 | 0.002 | 0.25 |
| 2000 | 1.77 | 0.10 | 0.002 | 0.24 |
| 2001 | 1.65 | 0.10 | 0.002 | 0.22 |
| 2002 | 1.61 | 0.09 | 0.002 | 0.21 |
| *Trend 1990 - 2002* | *-17%* | *-64%* | *-28%* | *-28%* |

Emissions from Railways fluctuated over the period from 1990-2002. They reached a maximum in 1992; afterwards the trend was decreasing until 2002. In the year 2002 all emissions were below 1990 levels. In contrast to the other transport sectors the activity of railways is decreasing constantly within the last four years.

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 4.3.6.3). Activities used for estimating the emissions and implied emission factors are presented in the following table.

*Table 50: Emission factors and activities for railways 1990-2002*

| | Activity | IEF NOx | IEF $SO_2$ | IEF $NH_3$ | IEF NMVOC |
|---|---|---|---|---|---|
| | [GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] |
| 1990 | 647 | 3 005.8 | 402.2 | 3.3 | 460.4 |
| 1991 | 671 | 3 022.8 | 379.3 | 3.3 | 453.4 |
| 1992 | 670 | 2 976.3 | 386.9 | 3.2 | 443.7 |
| 1993 | 653 | 2 933.1 | 374.4 | 3.1 | 432.4 |
| 1994 | 659 | 2 889.3 | 370.4 | 3.1 | 422.1 |
| 1995 | 616 | 2 837.5 | 354.7 | 3.0 | 413.1 |
| 1996 | 557 | 2 793.1 | 276.7 | 2.9 | 405.4 |
| 1997 | 555 | 2 758.6 | 194.0 | 2.8 | 388.2 |
| 1998 | 547 | 2 717.7 | 183.6 | 2.8 | 378.1 |
| 1999 | 676 | 2 673.4 | 162.0 | 2.7 | 366.5 |
| 2000 | 674 | 2 632.0 | 152.0 | 2.6 | 356.6 |
| 2001 | 636 | 2 591.9 | 150.6 | 2.5 | 348.0 |
| 2002 | 629 | 2 553.0 | 149.3 | 2.5 | 339.7 |

### 4.4.4 1 A 3 d Navigation

Navigation is mainly freight traffic. $NO_X$ and $SO_2$ emissions from this category fluctuated over the period from 1990 to 1997, since 1997 emissions are quite stable.

$NH_3$ and NMVOC emissions were constant with only minor fluctuations over the period from 1990 to 2002.

*Table 51: Emissions from navigation 1990-2002 [Gg]*

| | NOx [Gg] | $SO_2$ [Gg] | $NH_3$ [Gg] | NMVOC [Gg] |
|---|---|---|---|---|
| 1990 | 0.52 | 0.04 | 0.00008 | 0.72 |
| 1991 | 0.47 | 0.03 | 0.00007 | 0.71 |
| 1992 | 0.45 | 0.03 | 0.00007 | 0.71 |
| 1993 | 0.45 | 0.03 | 0.00007 | 0.71 |
| 1994 | 0.54 | 0.04 | 0.00008 | 0.72 |
| 1995 | 0.52 | 0.03 | 0.00008 | 0.71 |
| 1996 | 0.51 | 0.01 | 0.00008 | 0.70 |
| 1997 | 0.59 | 0.02 | 0.00008 | 0.71 |
| 1998 | 0.58 | 0.02 | 0.00008 | 0.70 |
| 1999 | 0.58 | 0.02 | 0.00008 | 0.69 |
| 2000 | 0.58 | 0.02 | 0.00008 | 0.68 |
| 2001 | 0.57 | 0.02 | 0.00008 | 0.67 |
| 2002 | 0.57 | 0.02 | 0.00008 | 0.66 |
| *Trend 1990 - 2002* | *9%* | *-49%* | *-2%* | *-8%* |

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 4.3.6.3). Activities used for estimating the emissions and the implied emission factors are presented in the following table.

*Table 52: Emission factors and activities for navigation 1990-2002*

| | Activity | IEF NOx | IEF $SO_2$ | IEF $NH_3$ | IEF NMVOC |
|---|---|---|---|---|---|
| | [GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] |
| 1990 | 194.6 | 2 688.6 | 182.7 | 0.4 | 3 684.5 |
| 1991 | 176.6 | 2 658.0 | 179.3 | 0.4 | 4 027.8 |
| 1992 | 172.9 | 2 610.1 | 178.5 | 0.4 | 4 102.4 |
| 1993 | 175.0 | 2 565.1 | 178.0 | 0.4 | 4 050.7 |
| 1994 | 208.4 | 2 600.0 | 183.2 | 0.4 | 3 430.9 |
| 1995 | 202.6 | 2 548.4 | 151.5 | 0.4 | 3 494.8 |
| 1996 | 202.9 | 2 514.1 | 72.6 | 0.4 | 3 464.9 |
| 1997 | 232.3 | 2 523.3 | 74.1 | 0.4 | 3 034.9 |
| 1998 | 234.7 | 2 489.7 | 74.2 | 0.4 | 2 976.2 |
| 1999 | 236.9 | 2 451.5 | 74.0 | 0.3 | 2 910.3 |
| 2000 | 238.6 | 2 418.6 | 74.1 | 0.3 | 2 851.5 |
| 2001 | 240.3 | 2 384.4 | 74.3 | 0.3 | 2 791.9 |
| 2002 | 242.0 | 2 351.4 | 74.4 | 0.3 | 2 732.3 |

### 4.4.5 Other Transportation (1 A 3 e)

#### 4.4.5.1 Source Category Description

Category *1 A 3 e Other Transportation* comprises emissions from pipeline transport (compressors). Fuel consumption and emissions increased by 62% since 1990.

*Table 53: Emission trends of category 1 A 3 e Other Transportation.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | NO | 0.6 | 0.002 | 0.004 | 4 |
| 1991 | NO | 0.6 | 0.002 | 0.004 | 4 |
| 1992 | NO | 0.6 | 0.002 | 0.004 | 4 |
| 1993 | NO | 0.6 | 0.002 | 0.004 | 4 |
| 1994 | NO | 0.6 | 0.002 | 0.004 | 4 |
| 1995 | NO | 0.6 | 0.002 | 0.004 | 4 |
| 1996 | NO | 0.6 | 0.002 | 0.004 | 4 |
| 1997 | NO | 0.6 | 0.002 | 0.004 | 4 |
| 1998 | NO | 1.0 | 0.003 | 0.006 | 6 |
| 1999 | NO | 1.4 | 0.005 | 0.010 | 10 |
| 2000 | NO | 1.4 | 0.005 | 0.010 | 10 |
| 2001 | NO | 1.4 | 0.005 | 0.009 | 9 |
| 2002 | NO | 1.0 | 0.003 | 0.007 | 7 |
| *Trend* | - | *62%* | *62%* | *62%* | *62%* |

#### 4.4.5.2 Methodological Issues

Simple CORINAIR methodology is applied: fuel consumption is multiplied with a fuel and technology dependant emission factor.

Emission factors are provided in Chapter 4.7. Unabated emission factors of industrial boilers were applied. Sources of emission factors are cited in Chapter 4.1.2.

Fuel consumption is taken from the energy balance (see Annex 1).

## 4.5 Other Sectors (NFR Source Category 1 A 4)

Category *1 A 4 Other sectors* comprises emissions from 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 mobile sources in agriculture and forestry.

*Table 54: Emission trends of category 1 A 4 Other Sectors.*

| | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] | Fuel Consumption [PJ] |
|---|---|---|---|---|---|
| 1990 | 34 | 35 | 68 | 0.62 | 251 |
| 1991 | 30 | 36 | 72 | 0.69 | 278 |
| 1992 | 26 | 35 | 67 | 0.65 | 268 |
| 1993 | 23 | 35 | 65 | 0.66 | 268 |
| 1994 | 20 | 34 | 61 | 0.61 | 248 |
| 1995 | 19 | 36 | 63 | 0.67 | 272 |
| 1996 | 19 | 39 | 66 | 0.75 | 300 |
| 1997 | 13 | 39 | 54 | 0.69 | 276 |
| 1998 | 12 | 40 | 52 | 0.68 | 275 |
| 1999 | 12 | 40 | 52 | 0.68 | 277 |
| 2000 | 11 | 40 | 48 | 0.63 | 264 |
| 2001 | 12 | 41 | 52 | 0.72 | 292 |
| 2002 | 10 | 39 | 49 | 0.68 | 273 |
| *Trend* | *-70%* | *14%* | *-27%* | *9%* | *9%* |

### 4.5.1 Other Sectors - Stationary Combustion (1 A 4 a, 1 A 4 b i and 1 A 4 c i)

#### 4.5.1.1 Source Category Description

Categories *1 A 4 a Commercial / Institutional, 1 A 4 b i Residential plants* and *1 A 4 c i Agriculture / Forestry / Fishing-Stationary* enfold emissions from stationary fuel combustion in the small combustion sector.

Since 1990 fuel consumption of the small combustion sector increased by 6%.

*Table 55: Fuel consumption trends of 1 A 4 Other Sectors - Stationary Combustion.*

| | 1 A 4 Stationary [PJ] | 1 A 4 a Commercial [PJ] | 1 A 4 b i Residential [PJ] | 1 A 4 c i Agriculture [PJ] |
|---|---|---|---|---|
| 1990 | 233 | 28 | 192 | 13 |
| 1991 | 259 | 33 | 213 | 13 |
| 1992 | 249 | 39 | 198 | 12 |
| 1993 | 249 | 38 | 201 | 10 |
| 1994 | 228 | 34 | 186 | 8 |
| 1995 | 251 | 43 | 200 | 9 |
| 1996 | 278 | 49 | 220 | 10 |

| | | | | |
|---|---|---|---|---|
| 1997 | 254 | 36 | 209 | 8 |
| 1998 | 252 | 36 | 207 | 9 |
| 1999 | 254 | 34 | 210 | 9 |
| 2000 | 239 | 29 | 201 | 9 |
| 2001 | 268 | 33 | 225 | 10 |
| 2002 | 248 | 21 | 217 | 10 |
| *Trend* | *6%* | *-22%* | *13%* | *-25%* |

$NO_X$ emissions of the commercial sector decreased due to a fuel switch from liquid fuels to natural gas and due to the decrease of coal consumption. Total $NO_X$ emissions of the residential sector increased mainly due to the increase of biomass and natural gas consumption although $NO_X$ emissions from coal combustion and liquid fuels decreased strongly. In the agricultural sector $NO_X$ emissions from combustion of liquid and solid fuels decreased while $NO_X$ emissions from natural gas and biomass combustion increased.

*Table 56: $NO_X$ emission trends of 1 A 4 Stationary Combustion.*

| $NO_X$ [Gg] | 1 A 4 Stationary | 1 A 4 a Commercial | 1 A 4 b i Residential | 1 A 4 c i Agriculture |
|---|---|---|---|---|
| 1990 | 17.19 | 2.39 | 13.45 | 1.35 |
| 1991 | 18.19 | 2.42 | 14.48 | 1.29 |
| 1992 | 16.97 | 2.55 | 13.25 | 1.17 |
| 1993 | 16.07 | 2.39 | 12.74 | 0.94 |
| 1994 | 14.49 | 2.19 | 11.54 | 0.76 |
| 1995 | 15.83 | 2.68 | 12.31 | 0.83 |
| 1996 | 17.24 | 2.97 | 13.35 | 0.92 |
| 1997 | 16.73 | 1.91 | 13.97 | 0.86 |
| 1998 | 16.46 | 1.87 | 13.72 | 0.88 |
| 1999 | 16.59 | 1.65 | 13.96 | 0.98 |
| 2000 | 15.68 | 1.47 | 13.24 | 0.97 |
| 2001 | 17.45 | 1.62 | 14.79 | 1.04 |
| 2002 | 16.29 | 1.10 | 14.19 | 1.00 |
| *Trend* | *-5%* | *-54%* | *6%* | *-26%* |

$SO_2$ emissions of all sectors decreased due to a strong decrease of coal combustion and the decreased sulphur content of gas oil.

*Table 57: $SO_2$ emission trends of 1 A 4 Stationary Combustion.*

| $SO_2$ [Gg] | 1 A 4 Stationary | 1 A 4 a Commercial | 1 A 4 b i Residential | 1 A 4 c i Agriculture |
|---|---|---|---|---|
| 1990 | 32.78 | 3.34 | 27.83 | 1.61 |
| 1991 | 29.01 | 2.78 | 25.14 | 1.09 |
| 1992 | 24.88 | 2.34 | 21.58 | 0.96 |
| 1993 | 21.78 | 2.10 | 18.94 | 0.73 |
| 1994 | 18.67 | 1.82 | 16.28 | 0.57 |
| 1995 | 18.62 | 1.67 | 16.35 | 0.60 |
| 1996 | 19.10 | 1.91 | 16.56 | 0.63 |
| 1997 | 12.95 | 1.40 | 11.11 | 0.44 |
| 1998 | 12.06 | 1.33 | 10.30 | 0.43 |
| 1999 | 11.62 | 1.16 | 9.99 | 0.48 |
| 2000 | 10.28 | 0.79 | 9.02 | 0.47 |
| 2001 | 11.41 | 0.98 | 9.96 | 0.47 |
| 2002 | 9.91 | 0.57 | 8.91 | 0.43 |
| *Trend* | *-70%* | *-83%* | *-68%* | *-73%* |

NMVOC emissions decreased due to the decrease of coal consumption and due to the switch of combustion of biomass in stoves and apartment heatings to central heatings. The dip of total NMVOC emissions from 1996 to 1997 results from the use of more actual emission factors.

*Table 58: NMVOC emission trends of 1 A 4 Stationary Combustion.*

| NMVOC [Gg] | 1 A 4 Stationary | 1 A 4 a Commercial | 1 A 4 b i Residential | 1 A 4 c i Agriculture |
|---|---|---|---|---|
| 1990 | 53.41 | 0.62 | 52.40 | 0.39 |
| 1991 | 57.19 | 0.72 | 56.05 | 0.42 |
| 1992 | 51.90 | 0.50 | 51.01 | 0.39 |
| 1993 | 50.64 | 0.51 | 49.74 | 0.38 |
| 1994 | 45.62 | 0.47 | 44.80 | 0.34 |
| 1995 | 47.73 | 0.42 | 46.93 | 0.37 |
| 1996 | 50.75 | 0.42 | 49.93 | 0.40 |
| 1997 | 38.86 | 1.43 | 35.26 | 2.17 |
| 1998 | 37.26 | 1.18 | 33.91 | 2.17 |
| 1999 | 36.92 | 0.81 | 33.80 | 2.31 |
| 2000 | 34.33 | 0.72 | 31.36 | 2.25 |
| 2001 | 38.84 | 0.82 | 35.45 | 2.58 |
| 2002 | 37.08 | 0.67 | 33.89 | 2.51 |
| *Trend* | *-31%* | *9%* | *-35%* | *552%* |

$NH_3$ emissions of the commercial and agricultural sector decreased due to the decrease of liquid fuel and coal consumption. $NH_3$ emissions of the residential sector increased due to the increase of biomass, natural gas and liquid fuel consumption.

*Table 59: $NH_3$ emission trends of 1 A 4 Stationary Combustion.*

| $NH_3$ [Gg] | 1 A 4 Stationary | 1 A 4 a Commercial | 1 A 4 b i Residential | 1 A 4 c i Agriculture |
|---|---|---|---|---|
| 1990 | 0.62 | 0.06 | 0.51 | 0.04 |
| 1991 | 0.68 | 0.06 | 0.57 | 0.04 |
| 1992 | 0.64 | 0.07 | 0.54 | 0.04 |
| 1993 | 0.65 | 0.07 | 0.55 | 0.03 |
| 1994 | 0.60 | 0.06 | 0.51 | 0.03 |
| 1995 | 0.66 | 0.07 | 0.56 | 0.03 |
| 1996 | 0.74 | 0.09 | 0.61 | 0.04 |
| 1997 | 0.68 | 0.06 | 0.58 | 0.03 |
| 1998 | 0.67 | 0.07 | 0.57 | 0.03 |
| 1999 | 0.67 | 0.06 | 0.58 | 0.04 |
| 2000 | 0.63 | 0.04 | 0.55 | 0.04 |
| 2001 | 0.71 | 0.05 | 0.62 | 0.04 |
| 2002 | 0.67 | 0.03 | 0.60 | 0.04 |
| *Trend* | *9%* | *-45%* | *17%* | *-10%* |

#### 4.5.1.2 Methodological Issues

CORINAIR simple methodology was applied.

Three technology-dependent subcategories (heating types) were considered in this category:

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

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

There is no information on the kind of devices within this categories, it is assumed that devices similar to central heatings are used (thus emission factors for central heatings were applied).

1 A 4 b i Residential

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

*Table 60: Split of heating types of category 1 A 4 b i Residential.*

| | Natural Gas | | | Fuel Oil, LPG | Gas oil | | | Hard Coal (+ Briquettes) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CH | AH | ST | CH | CH | AH | ST | CH | AH | ST |
| 1990 | 22.6% | 38.4% | 39.1% | 100% | 75.0% | 10.0% | 15.0% | 60.6% | 9.4% | 30.0% |
| 1991 | 26.0% | 36.4% | 37.6% | 100% | 75.0% | 10.0% | 15.0% | 62.3% | 8.8% | 29.0% |
| 1992 | 28.6% | 37.8% | 33.5% | 100% | 76.2% | 9.4% | 14.4% | 62.0% | 8.8% | 29.3% |
| 1993 | 31.3% | 39.2% | 29.5% | 100% | 77.3% | 8.9% | 13.8% | 61.6% | 8.7% | 29.6% |
| 1994 | 33.9% | 40.6% | 25.4% | 100% | 78.5% | 8.3% | 13.3% | 61.3% | 8.7% | 30.0% |
| 1995 | 36.6% | 42.1% | 21.4% | 100% | 79.6% | 7.7% | 12.7% | 61.0% | 8.7% | 30.3% |
| 1996 | 39.2% | 43.5% | 17.3% | 100% | 80.8% | 7.2% | 12.1% | 60.7% | 8.7% | 30.6% |
| 1997 | 41.9% | 44.9% | 13.2% | 100% | 81.9% | 6.6% | 11.5% | 60.4% | 8.7% | 30.9% |
| 1998 | 44.5% | 46.3% | 9.2% | 100% | 83.1% | 6.0% | 10.9% | 60.0% | 8.7% | 31.3% |
| 1999 | 47.1% | 47.7% | 5.1% | 100% | 84.2% | 5.4% | 10.4% | 59.7% | 8.7% | 31.6% |
| 2000 | 47.1% | 47.7% | 5.1% | 100% | 84.2% | 5.4% | 10.4% | 59.7% | 8.7% | 31.6% |
| 2001 | 47.1% | 47.7% | 5.1% | 100% | 84.2% | 5.4% | 10.4% | 59.7% | 8.7% | 31.6% |
| 2002 | 47.1% | 47.7% | 5.1% | 100% | 84.2% | 5.4% | 10.4% | 59.7% | 8.7% | 31.6% |

*Table 61: Split of heating types of category 1 A 4 b i Residential.*

| | Brown Coal | | | Brown Coal Briquettes | | | Coke | | |
|---|---|---|---|---|---|---|---|---|---|
| | CH | AH | ST | CH | AH | ST | CH | AH | ST |
| 1990 | 60.6% | 9.4% | 30.0% | 60.6% | 9.4% | 30.0% | 60.6% | 9.4% | 30.0% |
| 1991 | 62.3% | 8.8% | 29.0% | 62.3% | 8.8% | 29.0% | 62.3% | 8.8% | 29.0% |
| 1992 | 60.4% | 10.0% | 29.6% | 57.8% | 8.9% | 33.3% | 63.9% | 8.6% | 27.5% |
| 1993 | 58.5% | 11.3% | 30.2% | 53.3% | 9.1% | 37.6% | 65.6% | 8.5% | 26.0% |
| 1994 | 56.6% | 12.5% | 30.9% | 48.7% | 9.3% | 42.0% | 67.3% | 8.3% | 24.5% |
| 1995 | 54.7% | 13.7% | 31.5% | 44.2% | 9.4% | 46.3% | 68.9% | 8.1% | 22.9% |
| 1996 | 52.8% | 15.0% | 32.2% | 39.7% | 9.6% | 50.7% | 70.6% | 8.0% | 21.4% |
| 1997 | 51.0% | 16.2% | 32.8% | 35.2% | 9.8% | 55.0% | 72.2% | 7.8% | 19.9% |
| 1998 | 49.1% | 17.5% | 33.4% | 30.7% | 10.0% | 59.3% | 73.9% | 7.7% | 18.4% |
| 1999 | 47.2% | 18.7% | 34.1% | 26.2% | 10.1% | 63.7% | 75.6% | 7.5% | 16.9% |
| 2000 | 47.2% | 18.7% | 34.1% | 26.2% | 10.1% | 63.7% | 75.6% | 7.5% | 16.9% |
| 2001 | 47.2% | 18.7% | 34.1% | 26.2% | 10.1% | 63.7% | 75.6% | 7.5% | 16.9% |
| 2002 | 47.2% | 18.7% | 34.1% | 26.2% | 10.1% | 63.7% | 75.6% | 7.5% | 16.9% |

*Table 62: Split of heating types of category 1 A 4 b i Residential.*

| | Fuel Wood | | | Wood Wastes | | |
|---|---|---|---|---|---|---|
| | CH | AH | ST | CH | AH | ST |
| 1990 | 61.3% | 7.3% | 31.4% | 61.3% | 7.3% | 31.4% |
| 1991 | 62.9% | 6.1% | 31.0% | 62.9% | 6.1% | 31.0% |
| 1992 | 63.5% | 6.4% | 30.1% | 66.2% | 5.8% | 28.0% |
| 1993 | 64.1% | 6.6% | 29.3% | 69.5% | 5.4% | 25.1% |
| 1994 | 64.7% | 6.8% | 28.5% | 72.8% | 5.1% | 22.1% |
| 1995 | 65.3% | 7.1% | 27.6% | 76.1% | 4.7% | 19.1% |
| 1996 | 65.9% | 7.3% | 26.8% | 79.4% | 4.4% | 16.2% |
| 1997 | 66.5% | 7.5% | 26.0% | 82.8% | 4.0% | 13.2% |
| 1998 | 67.1% | 7.8% | 25.1% | 86.1% | 3.7% | 10.3% |
| 1999 | 67.7% | 8.0% | 24.3% | 89.4% | 3.3% | 7.3% |
| 2000 | 67.7% | 8.0% | 24.3% | 89.4% | 3.3% | 7.3% |
| 2001 | 67.7% | 8.0% | 24.3% | 89.4% | 3.3% | 7.3% |
| 2002 | 67.7% | 8.0% | 24.3% | 89.4% | 3.3% | 7.3% |

**Emission factors**

Country specific emission factors taken from the national studies [BMWA-EB, 1990] and [BMWA-EB, 1996] and [UMWELTBUNDESAMT, 2001] were applied. In these studies emission factors are provided for the years 1987, and 1995 and 1996 which were determined by measurements of emissions of typical Austrian small combustion devices. For the years 1990 to 1994 emission factors were interpolated using the values of 1987 and 1995. From 1997 onwards the emission factors from 1996 were applied.

Emission factors are provided in Chapter 4.7.

In some cases only VOC emission factors are provided in the studies, NMVOC emission factors are determined assuming that a certain percentage of VOC emissions is methane as listed in Table 63. The split follows closely [STANZEL et. al, 1995].

*Table 63: Share of $CH_4$ and NMVOC in 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% |

**Activity data**

Fuel consumption is taken from the energy balance (see Annex 1).

#### 4.5.1.3 Recalculation

Activity data changed due to a revision of the energy balance (see Chapter 3 Major Changes).

For 1996 to 2001 NMVOC emission factors of coal and biomass were adjusted (previously the value for TOC emissions was used, now VOC emissions were calculated by multiplying with a factor of 1.3).

#### 4.5.1.4 Planned Improvements

It is planned to consider new technologies like pellet heatings and condensing boilers ("Brennwert-Technologie") in the calculation model and to obtain more specific information about the heating devices and fuel consumption of the commercial/institutional and agricultural sector.

### 4.5.2 1 A 4 b Household and gardening – mobile sources

In addition to vehicles used in household and gardening this category contains ski slope machineries and snow vehicles.

$NH_3$ and NMVOC emissions from this category slightly decreased over the period from 1990 to 2002, NOx and especially $SO_2$ emissions decreased to a greater extend due to decreasing emission factors.

*Table 64: Emissions from off-road – household and gardening 1990-2002*

| | NOx | SO2 | NH3 | NMVOC |
|---|---|---|---|---|
| | [Gg] | [Gg] | [Gg] | [Gg] |
| 1990 | 1.07 | 0.06 | 0.00 | 6.27 |
| 1991 | 1.07 | 0.06 | 0.00 | 6.29 |
| 1992 | 1.09 | 0.06 | 0.00 | 6.33 |
| 1993 | 1.10 | 0.06 | 0.00 | 6.34 |
| 1994 | 1.13 | 0.05 | 0.00 | 6.32 |
| 1995 | 1.16 | 0.02 | 0.00 | 6.25 |
| 1996 | 1.15 | 0.02 | 0.00 | 6.18 |
| 1997 | 1.15 | 0.02 | 0.00 | 6.11 |
| 1998 | 1.15 | 0.02 | 0.00 | 6.03 |
| 1999 | 1.00 | 0.02 | 0.00 | 5.84 |
| 2000 | 0.98 | 0.02 | 0.00 | 5.35 |
| 2001 | 0.97 | 0.02 | 0.00 | 4.89 |
| 2002 | 0.95 | 0.02 | 0.00 | 4.45 |
| *Trend 1990 - 2002* | *-11%* | *-67%* | *-14%* | *-29%* |

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 4.3.6.3).

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

*Table 65: Emission factors and activities for off-road – household and gardening 1990-2002*

| | Activity | IEF NOx | IEF $SO_2$ | IEF $NH_3$ | IEF NMVOC |
|---|---|---|---|---|---|
| | [GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] |
| 1990 | 525.3 | 2 040.2 | 108.1 | 0.5 | 11 929.5 |
| 1991 | 526.9 | 2 038.7 | 108.0 | 0.5 | 11 939.2 |
| 1992 | 532.1 | 2 047.1 | 108.5 | 0.5 | 11 888.8 |
| 1993 | 541.7 | 2 029.9 | 107.6 | 0.5 | 11 712.3 |
| 1994 | 537.8 | 2 096.5 | 92.0 | 0.5 | 11 758.0 |
| 1995 | 541.3 | 2 149.8 | 39.9 | 0.5 | 11 551.8 |
| 1996 | 537.7 | 2 143.3 | 39.9 | 0.5 | 11 498.1 |
| 1997 | 533.9 | 2 156.0 | 39.8 | 0.5 | 11 441.3 |
| 1998 | 530.6 | 2 170.5 | 39.7 | 0.5 | 11 372.1 |
| 1999 | 528.2 | 1 902.3 | 35.7 | 0.5 | 11 065.6 |
| 2000 | 527.5 | 1 863.8 | 35.7 | 0.5 | 10 144.1 |
| 2001 | 527.5 | 1 833.1 | 35.7 | 0.5 | 9 264.0 |
| 2002 | 527.6 | 1 801.2 | 35.7 | 0.5 | 8 438.3 |

### 4.5.3 1 A 4 c Agriculture and forestry – mobile sources

$NO_X$ emissions from this category increased following the increase in activity data. $SO_2$ emissions decreased by about 60% in the period from 1990 to 2002 due to decreasing emission factors. $NH_3$ and NMVOC emissions remained quite constant with only minor fluctuations over this period.

*Table 66: Emissions from off-road – agriculture and forestry 1990-2002*

| | Agriculture | | | | Forestry | | | |
|---|---|---|---|---|---|---|---|---|
| | NOx [Gg] | $SO_2$ [Gg] | $NH_3$ [Gg] | NMVOC [Gg] | NOx [Gg] | $SO_2$ [Gg] | $NH_3$ [Gg] | NMVOC [Gg] |
| 1990 | 11.12 | 0.64 | 0.005 | 1.13 | 5.14 | 0.30 | 0.002 | 3.35 |
| 1991 | 11.39 | 0.66 | 0.005 | 1.22 | 5.28 | 0.31 | 0.002 | 3.35 |
| 1992 | 11.79 | 0.68 | 0.005 | 1.22 | 5.48 | 0.32 | 0.003 | 3.48 |
| 1993 | 12.15 | 0.70 | 0.005 | 1.42 | 5.66 | 0.33 | 0.003 | 3.39 |
| 1994 | 12.56 | 0.61 | 0.006 | 1.17 | 5.87 | 0.29 | 0.003 | 3.70 |
| 1995 | 13.05 | 0.23 | 0.006 | 1.28 | 6.11 | 0.11 | 0.003 | 3.62 |
| 1996 | 13.83 | 0.24 | 0.006 | 1.20 | 6.41 | 0.11 | 0.003 | 3.79 |
| 1997 | 14.65 | 0.26 | 0.006 | 1.32 | 6.73 | 0.12 | 0.003 | 3.76 |
| 1998 | 15.22 | 0.27 | 0.006 | 1.42 | 7.03 | 0.12 | 0.003 | 3.67 |
| 1999 | 15.47 | 0.24 | 0.006 | 1.38 | 7.18 | 0.11 | 0.003 | 3.60 |
| 2000 | 15.64 | 0.25 | 0.006 | 1.42 | 7.22 | 0.11 | 0.003 | 3.45 |
| 2001 | 15.49 | 0.25 | 0.006 | 1.43 | 7.12 | 0.11 | 0.003 | 3.28 |
| 2002 | 15.12 | 0.26 | 0.006 | 1.41 | 7.04 | 0.11 | 0.003 | 3.11 |
| *Trend 1990 - 2002* | *36%* | *-60%* | *19%* | *24%* | *37%* | *-62%* | *16%* | *-7%* |

The applied methodology is described in the subchapter on mobile sources of *1 A 2 f* (see Chapter 4.3.6.3).

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

*Table 67: Emission factors and activities for off-road – agriculture and forestry 1990-2001*

| | Agriculture | | | | | Forestry | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Activity | IEF NOx | IEF $SO_2$ | IEF $NH_3$ | IEF NMVOC | Activity | IEF NOx | IEF $SO_2$ | IEF $NH_3$ | IEF NMVOC |
| | [GWh] | [kg/GWh] | | | | [GWh] | [kg/GWh] | | | |
| 1990 | 3 078.4 | 3 611.1 | 209.4 | 1.6 | 367.9 | 1 433.5 | 3 587.3 | 209.5 | 1.7 | 2 333.9 |
| 1991 | 3 152.0 | 3 613.1 | 209.5 | 1.6 | 387.8 | 1 469.0 | 3 592.7 | 209.8 | 1.7 | 2 279.7 |
| 1992 | 3 260.6 | 3 616.1 | 209.7 | 1.6 | 372.6 | 1 524.9 | 3 592.6 | 209.8 | 1.7 | 2 282.7 |
| 1993 | 3 360.4 | 3 616.2 | 209.8 | 1.6 | 423.0 | 1 569.7 | 3 602.6 | 210.3 | 1.7 | 2 157.8 |
| 1994 | 3 453.5 | 3 637.6 | 178.0 | 1.6 | 340.1 | 1 624.4 | 3 613.6 | 177.7 | 1.6 | 2 280.3 |
| 1995 | 3 551.1 | 3 676.0 | 65.9 | 1.6 | 360.0 | 1 670.6 | 3 656.7 | 65.8 | 1.6 | 2 168.0 |
| 1996 | 3 712.5 | 3 725.4 | 65.9 | 1.6 | 323.2 | 1 735.2 | 3 696.4 | 65.8 | 1.6 | 2 184.9 |
| 1997 | 3 879.6 | 3 776.1 | 66.0 | 1.5 | 341.5 | 1 795.4 | 3 746.9 | 65.9 | 1.5 | 2 092.4 |
| 1998 | 4 034.9 | 3 771.2 | 66.0 | 1.5 | 352.5 | 1 851.1 | 3 795.5 | 66.0 | 1.5 | 1 981.5 |
| 1999 | 4 189.7 | 3 692.7 | 57.8 | 1.4 | 330.3 | 1 910.3 | 3 759.8 | 57.7 | 1.5 | 1 887.0 |
| 2000 | 4 323.8 | 3 618.0 | 57.8 | 1.4 | 328.0 | 1 956.7 | 3 688.3 | 57.7 | 1.4 | 1 765.1 |
| 2001 | 4 391.3 | 3 527.7 | 57.8 | 1.4 | 324.9 | 1 965.5 | 3 624.7 | 57.8 | 1.4 | 1 667.8 |
| 2002 | 4 429.8 | 3 412.2 | 57.8 | 1.3 | 317.3 | 1 974.9 | 3 563.5 | 57.8 | 1.4 | 1 577.3 |

### 4.5.3.1 Recalculations

An error regarding NMVOC 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).

## 4.6 Other (NFR Source Category 1 A 5): Military

In this category military off-road transport and military aviation are considered.

### 4.6.1 Military off road transport

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 was 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 36; for these vehicles a power of 300 kW was assumed). The yearly road performance for such vehicles was estimated to be 30 h/year (as a lot of vehicles are old and many are assumed not to be in actual use anymore).

*Table 68: Emissions from military off road transport 1990-2002*

| | NOx [Gg] | $SO_2$ [Gg] | $NH_3$ [Gg] | NMVOC [Gg] |
|---|---|---|---|---|
| 1990 | 0.03120 | 0.00173 | 0.00001 | 0.00468 |
| 1991 | 0.03120 | 0.00173 | 0.00001 | 0.00468 |
| 1992 | 0.03120 | 0.00173 | 0.00001 | 0.00468 |
| 1993 | 0.03120 | 0.00173 | 0.00001 | 0.00468 |
| 1994 | 0.03123 | 0.00147 | 0.00001 | 0.00468 |
| 1995 | 0.03170 | 0.00054 | 0.00001 | 0.00455 |
| 1996 | 0.03213 | 0.00054 | 0.00001 | 0.00442 |
| 1997 | 0.03255 | 0.00053 | 0.00001 | 0.00431 |
| 1998 | 0.03288 | 0.00053 | 0.00001 | 0.00419 |
| 1999 | 0.03179 | 0.00046 | 0.00001 | 0.00399 |
| 2000 | 0.03054 | 0.00046 | 0.00001 | 0.00384 |
| 2001 | 0.02909 | 0.00046 | 0.00001 | 0.00370 |
| 2002 | 0.02643 | 0.00045 | 0.00001 | 0.00348 |
| *Trend 1990 - 2002* | *-15%* | *-74%* | *0%* | *-26%* |

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

*Table 69: Emission factors and activities for military off road transport 1990-2002*

| | Actlivity | IEF NOx | IEF $SO_2$ | IEF $NH_3$ | IEF NMVOC |
|---|---|---|---|---|---|
| | [GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] | [kg/GWh] |
| 1990 | 8.0 | 3 892.32 | 215.82 | 1.25 | 583.85 |
| 1991 | 8.0 | 3 892.32 | 215.82 | 1.25 | 583.85 |
| 1992 | 8.0 | 3 892.32 | 215.82 | 1.25 | 583.85 |
| 1993 | 8.0 | 3 892.32 | 215.82 | 1.25 | 583.85 |
| 1994 | 8.0 | 3 897.16 | 183.44 | 1.25 | 584.01 |

| | | | | | |
|---|---|---|---|---|---|
| 1995 | 8.0 | 3 964.58 | 67.54 | 1.25 | 569.05 |
| 1996 | 8.0 | 4 034.87 | 67.81 | 1.26 | 555.06 |
| 1997 | 7.9 | 4 104.24 | 66.83 | 1.26 | 543.45 |
| 1998 | 7.9 | 4 163.98 | 67.12 | 1.27 | 530.63 |
| 1999 | 7.9 | 4 046.62 | 58.55 | 1.27 | 507.90 |
| 2000 | 7.8 | 3 912.07 | 58.92 | 1.28 | 491.89 |
| 2001 | 7.8 | 3 748.60 | 59.28 | 1.29 | 476.79 |
| 2002 | 7.7 | 3 446.75 | 58.68 | 1.30 | 453.83 |

### 4.6.2 Military aviation

Emissions of military aviation were calculated following [KALIVODA et al, 2002]. 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.

*Table 70: Emissions and activities from military aviation 1990-2002*

| | NOx | SO2 | NH3 | NMVOC | Activity |
|---|---|---|---|---|---|
| | [Gg] | [Gg] | [Gg] | [Gg] | [GWh] |
| 1990 | 50.66 | 10.49 | 0.00007 | 10.16 | 4.20 |
| 1991 | 53.87 | 11.16 | 0.00008 | 10.80 | 4.80 |
| 1992 | 48.62 | 10.07 | 0.00007 | 9.75 | 5.39 |
| 1993 | 57.45 | 11.90 | 0.00008 | 11.53 | 5.99 |
| 1994 | 60.79 | 12.59 | 0.00009 | 12.19 | 6.59 |
| 1995 | 46.93 | 9.72 | 0.00007 | 9.41 | 7.08 |
| 1996 | 56.72 | 11.75 | 0.00008 | 11.38 | 7.60 |
| 1997 | 53.95 | 11.17 | 0.00008 | 10.82 | 8.09 |
| 1998 | 62.15 | 12.87 | 0.00009 | 12.47 | 8.58 |
| 1999 | 60.90 | 12.61 | 0.00009 | 12.21 | 8.73 |
| 2000 | 66.05 | 13.68 | 0.00009 | 13.25 | 8.92 |
| 2001 | 63.68 | 13.19 | 0.00009 | 12.77 | 8.60 |
| 2002 | 59.63 | 12.35 | 0.00008 | 11.96 | 8.05 |

### 4.6.3 Recalculation

Emissions from military activities have been allocated to category 1 A 5 Other, last year emissions were included in NFR Category 1 A 3 Transport.

## 4.7 Activity Data and Emission Factors

Activity Data is taken from the National Energy Balance, which is presented in Annex 1.

### The National Energy Balance

The new time series is consistent to the IEA-questionnaire format and has been submitted to the IEA in January 2004. There are four different IEA questionnaires for each of: oil, natural gas, coal and renewable fuels. Table 71 shows the unified categories of the IEA questionnaires and the corresponding NFR categories to which the fuel consumption is assigned to.

*Table 71: IEA-Questionnaires and their correspondence to NFR categories.*

| IEA-Category and ISIC Codes* | Comments | SNAP | NFR-Category |
|---|---|---|---|
| Production | | | IPCC Reference Approach: Production |
| Imports | | | IPCC Reference Approach: Import |
| Exports | | | IPCC Reference Approach: Export |
| Bunkers | No consumption (1) | | |
| Stock Changes | | | IPCC 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<br>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 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 |

| IEA-Category and ISIC Codes* | Comments | SNAP | NFR-Category |
|---|---|---|---|
| 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 | Division to SNAP categories is performed by means of studies. | 07<br>08<br>0201 | 1 A 2 f Manuf. Ind. and Constr. -Other<br>1 A 3 Transport<br>1 A 4 b Residential<br>1 A 4 c Agriculture/ Forestry/ Fisheries |
| Road | | | |
| Rail | | | |
| Inland Waterways | | | |
| 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<br>(ISIC 271, 2731) | | 0301<br>030301 | 1 A 2 a Iron and Steel |
| Chemical incl.Petro-Chemical<br>(ISIC 24) | | 0301 | 1 A 2 c Chemicals |
| Non ferrous Metals<br>(ISIC 272, 2732) | | 0301 | 1 A 2 b Non-ferrous Metals |
| Non metallic Mineral Products<br>(ISIC 26) | | 0301<br>030311<br>030317<br>030319 | 1 A 2 f Manuf. Ind. and Constr. -Other |
| Transportation Equipment<br>(ISIC 34, 35) | | 0301 | 1 A 2 f Manuf. Ind. and Constr. -Other |
| Machinery<br>(ISIC 28, 29, 30, 31, 32) | | 0301 | 1 A 2 f Manuf. Ind. and Constr. -Other |
| Mining and Quarrying<br>(ISIC 13, 14) | | 0301 | 1 A 2 f Manuf. Ind. and Constr. -Other |
| Food, Beverages and Tobacco<br>(ISIC 15, 16) | | 0301 | 1 A 2 e Food Processing, Beverages and Tobacco |
| Pulp, Paper and Printing<br>(ISIC 21, 22) | | 0301 | 1 A 2 d Pulp, Paper and Print |
| Wood and Wood Products<br>(ISIC 20) | | 0301 | 1 A 2 f Manuf. Ind. and Constr. -Other |
| Construction<br>(ISIC 45) | | 0301 | 1 A 2 f Manuf. Ind. and Constr. -Other |
| Textiles and Leather<br>(ISIC 17, 18, 19) | | 0301 | 1 A 2 f Manuf. Ind. and Constr. -Other |
| Non Specified<br>(ISIC 25, 33, 36, 37) | | 0301 | 1 A 2 f Manuf. Ind. and Constr. -Other |
| **Total Other sectors, of which:** | | | |
| Commercial and Public Services<br>(ISIC 41, 50, 51, 52, 55, 63, 64, 65, 66, 67, 70, 71, 72, 73, 74, 75, 80, 85, 90, 91, 92, 93, | | 0201 | 1 A 4 a Commercial/ Institutional |

| IEA-Category and ISIC Codes* | Comments | SNAP | NFR-Category |
|---|---|---|---|
| 99) | | | |
| 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 72.

*Table 72: 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 Anthra-cite | 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 |
| 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* | 14.35 | Biomass |

| Inventory Fuel Category | | IEA Fuel Category | | IPCC Fuel Category [3] |
|---|---|---|---|---|
| Code [1] | Category | Category | Average Net Calorific Value[2] | |
| | | *Solid Wastes, of which:* Wood | | |
| 116 A | Wood Wastes | *Wood/Wood wastes/Other Solid Wastes, of which:* Other vegetal materials and waste (including straw, saw-dust, 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.

The following tables provide detailed activity data and emission factors for stationary fuel combustion. Descriptions of SNAP codes are given in chapter 4.1.4 Completeness.

*Table 73: Activity data [TJ]*

| Fuel | SNAP | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| 1 A 1 a Public Electricity and Heat Production - Point Sources | | | | | | | |
| Light Fuel Oil | 010101 | 2 | 10 | 0 | 0 | 0 | 0 |
| Light Fuel Oil | 010102 | 0 | 0 | 1 | 1 | 0 | 0 |
| Light Fuel Oil | 010201 | 1 | 5 | 0 | 0 | 9 | 4 |
| Light Fuel Oil | 010202 | 0 | 0 | 4 | 243 | 0 | 0 |
| Medium Fuel Oil | 010202 | 291 | 113 | 86 | 0 | 0 | 0 |
| Heavy Fuel Oil | 010101 | 7 428 | 5 887 | 12 451 | 5 864 | 5 777 | 4 513 |
| Heavy Fuel Oil | 010102 | 1 252 | 524 | 257 | 66 | 67 | 69 |
| Heavy Fuel Oil | 010201 | 237 | 60 | 75 | 70 | 106 | 84 |
| Heavy Fuel Oil | 010202 | 6 595 | 5 961 | 4 427 | 5 271 | 3 199 | 2 064 |
| Gasoil | 010201 | 0 | 0 | 7 | 2 | 1 | 5 |
| Hard Coal | 010101 | 28 041 | 18 690 | 13 488 | 23 252 | 27 844 | 28 945 |
| Hard Coal | 010102 | 735 | 1 941 | 2 844 | 5 673 | 8 322 | 7 189 |
| Hard Coal | 010201 | 9 229 | 8 798 | 7 574 | 9 983 | 10 440 | 10 208 |
| Hard Coal | 010202 | 64 | 21 | 0 | 0 | 0 | 0 |
| Lignite and brown coal | 010101 | 16 676 | 12 709 | 13 883 | 11 165 | 13 371 | 12 947 |
| Lignite and brown coal | 010102 | 5 399 | 2 302 | 0 | 0 | 0 | 0 |
| Lignite and brown coal | 010202 | 725 | 16 | 6 | 0 | 0 | 0 |
| Brown Coal Briquettes | 010202 | 93 | 0 | 0 | 0 | 0 | 0 |
| Natural Gas | 010101 | 42 323 | 42 000 | 41 896 | 34 556 | 38 926 | 37 121 |
| Natural Gas | 010102 | 9 544 | 2 906 | 526 | 319 | 665 | 516 |
| Natural Gas | 010201 | 542 | 1 013 | 903 | 623 | 627 | 516 |
| Natural Gas | 010202 | 1 672 | 7 746 | 6 335 | 6 111 | 7 028 | 7 109 |
| Municipal Solid Waste | 010202 | 2 414 | 3 911 | 4 006 | 3 925 | 4 014 | 4 248 |
| Hazardous Waste | 010101 | 0 | 0 | 0 | 3 | 70 | 71 |
| Hazardous Waste | 010102 | 0 | 0 | 0 | 45 | 327 | 346 |
| Hazardous Waste | 010201 | 0 | 0 | 0 | 0 | 11 | 0 |
| Hazardous Waste | 010202 | 0 | 656 | 187 | 613 | 664 | 799 |
| Fuel Wood | 010101 | 0 | 0 | 20 | 17 | 40 | 0 |
| Fuel Wood | 010102 | 0 | 0 | 0 | 23 | 33 | 21 |
| Sewage Sludge | 010202 | 0 | 558 | 149 | 700 | 654 | 519 |
| 1 A 1 a Public Electricity and Heat Production - Area Sources | | | | | | | |
| Light Fuel Oil | 010103 | 113 | 153 | 223 | 116 | 152 | 94 |
| Light Fuel Oil | 010203 | 1 495 | 1 223 | 1 121 | 1 465 | 1 872 | 496 |
| Heavy Fuel Oil | 010103 | 0 | 5 256 | 6 368 | 2 187 | 7 993 | 3 093 |
| Gasoil | 010103 | 4 | 82 | 16 | 1 | 789 | 82 |
| Diesel | 010105 | 0 | 214 | 87 | 0 | 0 | 11 |

| Fuel | SNAP | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Diesel | 010205 | 0 | 43 | 0 | 0 | 0 | 0 |
| Liquified Petroleum Gas | 010203 | 51 | 161 | 33 | 0 | 0 | 29 |
| Hard Coal | 010103 | 376 | 458 | 234 | 206 | 0 | 0 |
| Lignite and brown coal | 010103 | 0 | 468 | 0 | 239 | 591 | 506 |
| Lignite and brown coal | 010203 | 0 | 86 | 0 | 0 | 0 | 0 |
| Brown Coal Briquettes | 010103 | 131 | 0 | 0 | 351 | 563 | 0 |
| Brown Coal Briquettes | 010203 | 2 | 0 | 0 | 0 | 0 | 0 |
| Natural Gas | 010101 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural Gas | 010102 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural Gas | 010103 | 71 | 8 231 | 24 208 | 19 060 | 13 830 | 41 236 |
| Natural Gas | 010201 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural Gas | 010202 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural Gas | 010203 | 6 081 | 2 754 | 217 | 2 241 | 0 | 593 |
| Wood Waste | 010103 | 0 | 0 | 98 | 139 | 814 | 1 277 |
| Wood Waste | 010203 | 2 045 | 4 332 | 6 886 | 8 165 | 10 235 | 11 670 |
| Biogas | 010103 | 0 | 0 | 13 | 20 | 20 | 0 |
| Sewage Sludge Gas | 010103 | 0 | 10 | 17 | 49 | 52 | 57 |
| Landfill Gas | 010103 | 0 | 29 | 25 | 58 | 67 | 58 |
| Municipal Solid Waste | 010203 | 0 | 0 | 513 | 595 | 595 | 667 |
| Industrial Waste | 010203 | 0 | 0 | 133 | 134 | 134 | 3 084 |
| 1 A 1 b Petroleum Refining | | | | | | | |
| Heavy Fuel Oil | 010301 | 5 368 | 9 401 | 7 183 | 5 574 | 4 837 | 289 |
| Gasoil | 010301 | 0 | 10 | 269 | 3 | 3 | 5 |
| Diesel | 010301 | 0 | 41 | 12 | 11 | 12 | 17 |
| Other Petroleum Products | 010301 | 11 655 | 11 633 | 12 112 | 11 780 | 12 825 | 14 700 |
| Liquified Petroleum Gas | 010301 | 360 | 901 | 170 | 939 | 0 | 98 |
| Refinery Gas | 010301 | 18 276 | 14 938 | 14 386 | 14 348 | 15 076 | 14 070 |
| Natural Gas | 010301 | 8 045 | 7 606 | 7 339 | 6 356 | 7 380 | 7 356 |
| 1 A 1 c Manufacture of Solid Fuels and Other Energy Industries | | | | | | | |
| Other Petroleum Products | 010503 | 923 | 9 | 0 | 0 | 0 | 0 |
| Natural Gas | 010503 | 5 339 | 5 746 | 3 017 | 2 665 | 13 949 | 10 381 |
| 1 A 2 a Iron and Steel - Point Sources | | | | | | | |
| Heavy Fuel Oil | 030326 | 3 265 | 5 165 | 7 917 | 10 362 | 10 855 | 7 818 |
| Coke | 030326 | 26 079 | 26 669 | 26 129 | 29 630 | 30 686 | 27 750 |
| Coke Oven Gas | 030326 | 13 117 | 10 906 | 12 220 | 10 466 | 9 776 | 9 742 |
| Natural Gas | 030326 | 9 871 | 10 519 | 13 271 | 11 693 | 12 199 | 12 560 |
| 1 A 2 a Iron and Steel - Area Sources | | | | | | | |
| Heavy Fuel Oil | 030103 | 363 | 574 | 235 | 211 | 150 | 4 885 |
| Petroleum | 030103 | 0 | 0 | 0 | 0 | 0 | 2 |
| Liquified Petroleum Gas | 030103 | 202 | 155 | 50 | 61 | 21 | 29 |

| Fuel | SNAP | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Coke | 030103 | 15 | 0 | 360 | 526 | 526 | 526 |
| Natural Gas | 030103 | 585 | 623 | 331 | 1 790 | 3 050 | 1 723 |
| 1 A 2 b Non Ferrous Metals | | | | | | | |
| Light Fuel Oil | 030103 | 91 | 155 | 177 | 303 | 131 | 39 |
| Medium Fuel Oil | 030103 | 15 | 24 | 70 | 45 | 49 | 83 |
| Heavy Fuel Oil | 030103 | 42 | 83 | 102 | 12 | 118 | 157 |
| Gasoil | 030103 | 1 | 2 | 96 | 2 | 5 | 2 |
| Petroleum | 030103 | 0 | 0 | 1 | 1 | 2 | 9 |
| Liquified Petroleum Gas | 030103 | 364 | 272 | 433 | 245 | 202 | 272 |
| Coke | 030103 | 39 | 93 | 200 | 229 | 402 | 148 |
| Natural Gas | 030103 | 1 343 | 2 134 | 2 195 | 2 362 | 2 580 | 1 861 |
| 1 A 2 c Chemicals | | | | | | | |
| Light Fuel Oil | 030103 | 574 | 563 | 395 | 506 | 105 | 21 |
| Medium Fuel Oil | 030103 | 92 | 88 | 157 | 75 | 40 | 44 |
| Heavy Fuel Oil | 030103 | 265 | 300 | 228 | 20 | 95 | 83 |
| Gasoil | 030103 | 1 | 5 | 10 | 4 | 10 | 3 |
| Liquified Petroleum Gas | 030103 | 0 | 0 | 5 | 5 | 5 | 6 |
| Hard Coal | 030103 | 160 | 1 251 | 2 304 | 1 549 | 1 745 | 1 217 |
| Coke | 030103 | 72 | 170 | 26 | 0 | 0 | 0 |
| Natural Gas | 030103 | 7 661 | 8 176 | 9 384 | 10 100 | 7 485 | 7 261 |
| Wood Waste | 030103 | 2 898 | 1 722 | 639 | 726 | 2 282 | 1 982 |
| Black Liquor | 030103 | 0 | 0 | 0 | 0 | 0 | 3 482 |
| Biogas | 030103 | 0 | 0 | 211 | 138 | 91 | 185 |
| Industrial Waste | 030103 | 2 763 | 1 933 | 2 350 | 2 737 | 3 426 | 1 593 |
| 1 A 2 d Pulp, Paper and Print | | | | | | | |
| Light Fuel Oil | 030103 | 151 | 116 | 68 | 62 | 52 | 32 |
| Heavy Fuel Oil | 030103 | 4 898 | 3 754 | 2 203 | 1 994 | 1 692 | 1 039 |
| Gasoil | 030103 | 0 | 2 | 4 | 1 | 3 | 1 |
| Liquified Petroleum Gas | 030103 | 40 | 39 | 58 | 71 | 50 | 67 |
| Hard Coal | 030103 | 36 | 1 193 | 1 983 | 2 641 | 2 280 | 1 839 |
| Lignite and brown coal | 030103 | 1 442 | 1 213 | 779 | 749 | 761 | 690 |
| Brown Coal Briquettes | 030103 | 833 | 267 | 1 | 0 | 1 | 0 |
| Natural Gas | 030103 | 12 780 | 9 695 | 15 636 | 16 828 | 17 205 | 12 406 |
| Fuel Wood | 030103 | 9 | 0 | 0 | 0 | 1 | 1 |
| Wood Waste | 030103 | 3 660 | 3 901 | 4 376 | 3 589 | 4 483 | 3 069 |
| Black Liquor | 030103 | 12 540 | 12 125 | 13 616 | 16 864 | 15 992 | 17 582 |
| Biogas | 030103 | 0 | 0 | 17 | 41 | 56 | 103 |
| Industrial Waste | 030103 | 0 | 0 | 14 | 17 | 21 | 10 |
| 1 A 2 e Food Processing, Beverages and Tobacco | | | | | | | |
| Light Fuel Oil | 030103 | 1 934 | 1 884 | 621 | 1 263 | 501 | 128 |

| Fuel | SNAP | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Medium Fuel Oil | 030103 | 310 | 295 | 247 | 187 | 190 | 274 |
| Heavy Fuel Oil | 030103 | 893 | 1 002 | 358 | 49 | 454 | 517 |
| Gasoil | 030103 | 6 | 22 | 67 | 19 | 46 | 16 |
| Petroleum | 030103 | 0 | 0 | 77 | 0 | 0 | 0 |
| Liquified Petroleum Gas | 030103 | 162 | 116 | 220 | 161 | 219 | 295 |
| Lignite and brown coal | 030103 | 17 | 0 | 0 | 0 | 0 | 0 |
| Brown Coal Briquettes | 030103 | 13 | 0 | 1 | 0 | 0 | 0 |
| Coke | 030103 | 26 | 62 | 75 | 382 | 304 | 143 |
| Natural Gas | 030103 | 8 822 | 9 333 | 8 937 | 12 814 | 12 769 | 9 208 |
| Fuel Wood | 030103 | 121 | 93 | 8 | 7 | 9 | 8 |
| Wood Waste | 030103 | 10 | 9 | 1 | 0 | 6 | 3 |
| Biogas | 030103 | 0 | 0 | 15 | 8 | 8 | 3 |
| Industrial Waste | 030103 | 0 | 0 | 6 | 7 | 9 | 4 |
| 1 A 2 f Industry - Electricity and Heat Autoproducers | | | | | | | |
| Light Fuel Oil | 030103 | 1 821 | 1 985 | 546 | 443 | 526 | 328 |
| Heavy Fuel Oil | 030103 | 3 620 | 1 985 | 546 | 443 | 526 | 328 |
| Gasoil | 030103 | 0 | 0 | 14 | 7 | 11 | 3 |
| Diesel | 030105 | 8 | 28 | 41 | 38 | 0 | 0 |
| Hard Coal | 030103 | 1 335 | 402 | 903 | 1 391 | 600 | 450 |
| Lignite and brown coal | 030103 | 513 | 1 036 | 0 | 224 | 211 | 298 |
| Natural Gas | 030103 | 14 504 | 31 817 | 29 548 | 21 617 | 19 178 | 18 338 |
| Wood Waste | 030103 | 407 | 4 542 | 4 426 | 4 840 | 2 752 | 3 691 |
| Black Liquor | 030103 | 5 260 | 9 267 | 10 003 | 7 197 | 7 247 | 9 994 |
| Biogas | 030103 | 0 | 35 | 114 | 159 | 122 | 98 |
| Sewage Sludge Gas | 030103 | 0 | 609 | 696 | 742 | 760 | 756 |
| Landfill Gas | 030103 | 0 | 117 | 499 | 399 | 1 315 | 324 |
| Industrial Waste | 030103 | 2 542 | 714 | 3 144 | 472 | 42 | 262 |
| 1 A 2 f Industry - Other | | | | | | | |
| Light Fuel Oil | 030103 | 4 182 | 3 816 | 2 154 | 3 519 | 1 322 | 225 |
| Medium Fuel Oil | 030103 | 598 | 530 | 754 | 494 | 476 | 533 |
| Heavy Fuel Oil | 030103 | 830 | 2 301 | 1 639 | 912 | 1 013 | 295 |
| Gasoil | 030103 | 49 | 174 | 330 | 155 | 372 | 127 |
| Petroleum | 030103 | 0 | 0 | 44 | 14 | 5 | 21 |
| Liquified Petroleum Gas | 030103 | 2 077 | 2 207 | 1 645 | 1 953 | 1 874 | 2 625 |
| Hard Coal | 030103 | 0 | 0 | 2 | 4 | 6 | 3 |
| Lignite and brown coal | 030103 | 25 | 0 | 1 | 0 | 0 | 0 |
| Brown Coal Briquettes | 030103 | 0 | 0 | 0 | 0 | 0 | 0 |
| Coke | 030103 | 156 | 170 | 1 089 | 376 | 254 | 2 |
| Natural Gas | 030103 | 21 481 | 25 772 | 20 527 | 22 367 | 17 716 | 7 858 |
| Fuel Wood | 030103 | 530 | 981 | 940 | 87 | 122 | 159 |

| Fuel | SNAP | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Wood Waste | 030103 | 2 676 | 1 067 | 2 253 | 2 398 | 3 851 | 2 269 |
| Black Liquor | 030103 | 0 | 0 | 46 | 61 | 61 | 57 |
| Industrial Waste | 030103 | 46 | 598 | 510 | 722 | 736 | 342 |
| 1 A 2 f Cement Industry | | | | | | | |
| Light Fuel Oil | 030311 | 17 | 15 | 18 | 18 | 18 | 18 |
| Medium Fuel Oil | 030311 | 8 | 1 | 1 | 1 | 1 | 1 |
| Heavy Fuel Oil | 030311 | 3 946 | 3 218 | 1 739 | 711 | 665 | 430 |
| Other Petroleum Products | 030311 | 590 | 192 | 1 185 | 813 | 667 | 2 222 |
| Hard Coal | 030311 | 4 055 | 4 567 | 3 483 | 4 752 | 4 245 | 2 144 |
| Lignite and brown coal | 030311 | 117 | 39 | 135 | 374 | 429 | 583 |
| Natural Gas | 030311 | 824 | 357 | 444 | 444 | 444 | 444 |
| Industrial Waste | 030311 | 230 | 423 | 754 | 904 | 1 314 | 611 |
| 1 A 2 f Glass Industry | | | | | | | |
| Heavy Fuel Oil | 030317 | 268 | 40 | 29 | 53 | 69 | 82 |
| Liquified Petroleum Gas | 030317 | 148 | 84 | 84 | 84 | 84 | 16 |
| Natural Gas | 030317 | 2 973 | 2 894 | 2 869 | 2 869 | 2 869 | 2 650 |
| 1 A 2 f Bricks and Tiles Industry | | | | | | | |
| Light Fuel Oil | 030319 | 41 | 50 | 50 | 50 | 50 | 50 |
| Heavy Fuel Oil | 030319 | 870 | 588 | 588 | 588 | 588 | 588 |
| Natural Gas | 030319 | 2 242 | 3 317 | 3 317 | 3 317 | 3 317 | 3 317 |
| 1 A 3 e Other Transportation - Pipeline Compressors | | | | | | | |
| Natural Gas | 010506 | 4 050 | 4 092 | 9 570 | 9 650 | 9 090 | 6 555 |
| 1 A 4 a Commercial/Institutional | | | | | | | |
| Light Fuel Oil | 020103 | 9 113 | 7 014 | 101 | 550 | 418 | 158 |
| Medium Fuel Oil | 020103 | 3 571 | 1 512 | 1 144 | 801 | 756 | 935 |
| Gasoil | 020103 | 1 110 | 3 938 | 9 297 | 3 520 | 8 440 | 2 881 |
| Petroleum | 020103 | 766 | 246 | 576 | 245 | 37 | 162 |
| Liquified Petroleum Gas | 020103 | 1 901 | 3 342 | 2 042 | 2 090 | 1 634 | 2 003 |
| Hard Coal | 020103 | 449 | 232 | 208 | 187 | 199 | 91 |
| Hard Coal Briquettes | 020103 | 0 | 0 | 25 | 23 | 3 | 4 |
| Lignite and brown coal | 020103 | 100 | 51 | 40 | 54 | 50 | 68 |
| Brown Coal Briquettes | 020103 | 108 | 119 | 206 | 122 | 79 | 55 |
| Coke | 020103 | 378 | 237 | 154 | 134 | 151 | 58 |
| Natural Gas | 020103 | 7 664 | 23 148 | 17 859 | 19 640 | 18 491 | 13 334 |
| Fuel Wood | 020103 | 1 332 | 1 168 | 477 | 434 | 506 | 469 |
| Wood Waste | 020103 | 844 | 930 | 865 | 797 | 941 | 840 |
| Landfill Gas | 020103 | 0 | 49 | 0 | 0 | 0 | 0 |
| Industrial Waste | 020103 | 230 | 650 | 631 | 734 | 919 | 428 |
| 1 A 4 b i Residential - Central Heatings | | | | | | | |
| Light Fuel Oil | 020202 | 19 291 | 7 846 | 7 904 | 8 077 | 8 048 | 7 619 |
| Gasoil | 020202 | 38 842 | 52 947 | 58 487 | 54 415 | 62 550 | 60 221 |

| Fuel | SNAP | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Liquified Petroleum Gas | 020202 | 756 | 1 208 | 1 999 | 2 032 | 2 299 | 2 215 |
| Hard Coal | 020202 | 3 840 | 2 336 | 1 465 | 1 294 | 1 482 | 1 425 |
| Hard Coal Briquettes | 020202 | 0 | 0 | 59 | 54 | 7 | 10 |
| Lignite and brown coal | 020202 | 1 372 | 593 | 230 | 194 | 180 | 174 |
| Brown Coal Briquettes | 020202 | 2 745 | 1 244 | 462 | 397 | 363 | 303 |
| Coke | 020202 | 9 990 | 7 127 | 4 839 | 4 184 | 4 742 | 3 667 |
| Natural Gas | 020202 | 7 410 | 16 114 | 26 772 | 27 029 | 29 607 | 29 069 |
| Fuel Wood | 020202 | 35 258 | 39 995 | 40 506 | 37 477 | 42 355 | 40 882 |
| Wood Waste | 020202 | 338 | 866 | 2 843 | 3 186 | 3 893 | 3 921 |
| 1 A 4 b i Residential - Apartment Heatings | | | | | | | |
| Gasoil | 020202 | 5 179 | 5 135 | 3 779 | 3 516 | 4 042 | 3 892 |
| Hard Coal | 020202 | 595 | 334 | 213 | 188 | 215 | 207 |
| Hard Coal Briquettes | 020202 | 0 | 0 | 9 | 8 | 1 | 1 |
| Lignite and brown coal | 020202 | 213 | 149 | 91 | 77 | 71 | 69 |
| Brown Coal Briquettes | 020202 | 425 | 266 | 179 | 154 | 140 | 117 |
| Coke | 020202 | 1 547 | 842 | 482 | 416 | 472 | 365 |
| Natural Gas | 020202 | 12 591 | 18 537 | 27 110 | 27 370 | 29 980 | 29 435 |
| Fuel Wood | 020202 | 4 201 | 4 327 | 4 793 | 4 435 | 5 012 | 4 838 |
| Wood Waste | 020202 | 40 | 54 | 105 | 118 | 144 | 145 |
| 1 A 4 b i Residential - Stoves | | | | | | | |
| Gasoil | 020205 | 7 768 | 8 432 | 7 192 | 6 692 | 7 692 | 7 406 |
| Hard Coal | 020205 | 1 903 | 1 160 | 775 | 684 | 784 | 754 |
| Hard Coal Briquettes | 020205 | 0 | 0 | 31 | 29 | 3 | 5 |
| Lignite and brown coal | 020205 | 680 | 342 | 166 | 140 | 130 | 125 |
| Brown Coal Briquettes | 020205 | 1 360 | 1 303 | 1 122 | 965 | 881 | 737 |
| Coke | 020205 | 4 950 | 2 373 | 1 084 | 938 | 1 063 | 822 |
| Peat | 020205 | 9 | 9 | 9 | 9 | 9 | 9 |
| Natural Gas | 020205 | 12 827 | 9 415 | 2 914 | 2 942 | 3 223 | 3 164 |
| Fuel Wood | 020205 | 18 041 | 16 929 | 14 554 | 13 466 | 15 218 | 14 689 |
| Wood Waste | 020205 | 173 | 218 | 233 | 262 | 320 | 322 |
| 1 A 4 c i Agriculture/Forestry/Fisheries | | | | | | | |
| Light Fuel Oil | 020302 | 7 839 | 3 188 | 3 212 | 3 282 | 3 139 | 2 972 |
| Gasoil | 020302 | 38 | 50 | 50 | 46 | 62 | 53 |
| Liquified Petroleum Gas | 020302 | 77 | 124 | 205 | 208 | 188 | 181 |
| Hard Coal | 020302 | 81 | 58 | 33 | 27 | 31 | 29 |
| Brown Coal Briquettes | 020302 | 200 | 124 | 78 | 67 | 61 | 51 |
| Coke | 020302 | 335 | 210 | 130 | 113 | 128 | 99 |
| Natural Gas | 020302 | 355 | 476 | 614 | 620 | 679 | 667 |
| Fuel Wood | 020302 | 3 625 | 3 861 | 3 773 | 3 491 | 3 945 | 3 808 |
| Wood Waste | 020302 | 371 | 624 | 1 397 | 1 566 | 1 871 | 1 879 |

*Table 74: $NO_X$ emission factors [kg/TJ]*

| SNAP | All years | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Hard Coal, Hard Coal Briquettes | | | | | | | |
| 010101, 10102 | | 58.88 | 52.00 | 50.00 | 50.00 | 50.00 | 50.00 |
| 010103 | | 170.00 | 170.00 | 50.00 | 50.00 | 50.00 | 50.00 |
| 010201, 10202 | | 108.75 | 190.00 | 62.00 | 62.00 | 62.00 | 62.00 |
| 010503, 030103 | 250.00 | | | | | | |
| 02 xx xx Apartment and Central Heatings | | 190.00 | 190.00 | 78.00 | 78.00 | 78.00 | 78.00 |
| 02 xx xx Stoves | | 110.00 | 110.00 | 132.00 | 132.00 | 132.00 | 132.00 |
| Brown Coal | | | | | | | |
| 010101, 010102 | | 162.00 | 82.00 | 77.00 | 77.00 | 77.00 | 77.00 |
| 010103 | | 170.00 | 170.00 | 77.00 | 77.00 | 77.00 | 77.00 |
| 010202 | | 101.25 | 170.00 | 77.00 | 77.00 | 77.00 | 77.00 |
| 010203 | 170.00 | | | | | | |
| 02 xx xx Central Heatings | | 170.00 | 170.00 | 78.00 | 78.00 | 78.00 | 78.00 |
| 02 xx xx Apartment Heatings | | 80.00 | 80.00 | 78.00 | 78.00 | 78.00 | 78.00 |
| 02 xx xx Stoves | | 70.00 | 70.00 | 132.00 | 132.00 | 132.00 | 132.00 |
| 030103 | 170.00 | | | | | | |
| Brown Coal Briquettes | | | | | | | |
| 010103 | | 170.00 | 170.00 | 77.00 | 77.00 | 77.00 | 77.00 |
| 010202 | | 101.25 | 170.00 | 77.00 | 77.00 | 77.00 | 77.00 |
| 010203 | 170.00 | | | | | | |
| 02 xx xx Apartment and Central Heatings | | 140.00 | 140.00 | 78.00 | 78.00 | 78.00 | 78.00 |
| 02 xx xx Stoves | | 30.00 | 30.00 | 132.00 | 132.00 | 132.00 | 132.00 |
| 030103 | 170.00 | | | | | | |
| Coke Oven Coke | | | | | | | |
| 02 xx xx Apartment and Central Heatings | | 140.00 | 140.00 | 78.00 | 78.00 | 78.00 | 78.00 |
| 02 xx xx Stoves | | 110.00 | 110.00 | 132.00 | 132.00 | 132.00 | 132.00 |
| 030103 | 220.00 | | | | | | |
| Fuel Wood | | | | | | | |
| 010101, 010102, 010203 | 85.00 | | | | | | |
| 02 xx xx Central Heatings | | 85.00 | 85.00 | 107.00 | 107.00 | 107.00 | 107.00 |
| 02 xx xx Apartment Heatings | | 40.00 | 40.00 | 107.00 | 107.00 | 107.00 | 107.00 |
| 02 xx xx Stoves | | 40.00 | 40.00 | 106.00 | 106.00 | 106.00 | 106.00 |
| 030103 | 110.00 | | | | | | |
| Peat | | | | | | | |
| 020205 | 70.00 | | | | | | |
| Municipal Solid Waste, Hazardous Waste, Industrial Waste, Sewage Sludge, Black Liquor | | | | | | | |
| 010101 | 100.00 | | | | | | |
| 010202, 010203 | 100.00 | | | | | | |

| SNAP | All years | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| 020103 | 100.00 | | | | | | |
| 030103 | 100.00 | | | | | | |
| Wood Waste | | | | | | | |
| 010103, 010203 | 143.00 | | | | | | |
| 02 xx xx Central Heatings | | 85.00 | 85.00 | 107.00 | 107.00 | 107.00 | 107.00 |
| 02 xx xx Apart-ment Heatings | | 40.00 | 40.00 | 107.00 | 107.00 | 107.00 | 107.00 |
| 02 xx xx Stoves | | 40.00 | 40.00 | 106.00 | 106.00 | 106.00 | 106.00 |
| 030103 | 143.00 | | | | | | |
| Light Fuel Oil | | | | | | | |
| 010101. 010201. 010202 | | 98.75 | 130.00 | 42.00 | 42.00 | 42.00 | 42.00 |
| 010103. 010203 | | 118.00 | 118.00 | 159.40 | 159.40 | 159.40 | 159.40 |
| 02 xx xx | 115.00 | | | | | | |
| 030103. 030319 | 118.00 | | | | | | |
| Medium Fuel Oil | | | | | | | |
| 010101, 010202 | | 133.75 | 140.00 | 76.00 | 76.00 | 76.00 | 76.00 |
| 010203 | | 138.00 | 118.00 | 159.40 | 159.40 | 159.40 | 159.40 |
| 020103 | | 138.00 | 118.00 | 118.00 | 118.00 | 118.00 | 118.00 |
| 030103 | | 138.00 | 118.00 | 118.00 | 118.00 | 118.00 | 118.00 |
| Heavy Fuel Oil | | | | | | | |
| 010101, 010102 | | 85.50 | 28.00 | 26.00 | 26.00 | 26.00 | 26.00 |
| 010103 | | 235.00 | 235.00 | 26.00 | 26.00 | 26.00 | 26.00 |
| 010201, 010202 | | 156.25 | 200.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| 010203 | | 235.00 | 235.00 | 317.40 | 317.40 | 317.40 | 317.40 |
| 010301(1) | | 96.45 | 83.20 | 86.31 | 86.04 | 91.64 | 107.55 |
| 030103, 030319 | 235.00 | | | | | | |
| 030317 (1) | | 427.87 | 427.87 | 376.42 | 350.69 | 324.97 | 299.24 |
| Gas oil | | | | | | | |
| 010103, 010201, 010203 | 65.00 | | | | | | |
| 010301(1) | | 96.45 | 83.20 | 86.31 | 86.04 | 91.64 | 107.55 |
| 02 xx xx Apart-ment and Central Heatings | 42.00 | | | | | | |
| 02 xx xx Stoves | 19.00 | | | | | | |
| 030103 | 65.00 | | | | | | |
| Diesel | | | | | | | |
| 010105, 010205, 030105 | 700.00 | | | | | | |
| Petroleum, Jet Gasoline | | | | | | | |
| 020103 | 42.00 | | | | | | |
| 030103 | 118.00 | | | | | | |
| Other Petroleum Products | | | | | | | |
| 010301 | | 96.45 | 83.20 | 86.31 | 86.04 | 91.64 | 107.55 |
| Natural Gas | | | | | | | |
| 010101, 010102 | | 57.50 | 35.00 | 30.00 | 30.00 | 30.00 | 30.00 |
| 010103 | | 109.13 | 41.00 | 30.00 | 30.00 | 30.00 | 30.00 |

| SNAP | All years | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| 010201, 010202 | | 43.75 | 50.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| 010203, 010301 | | 109.13 | 41.00 | 41.00 | 41.00 | 41.00 | 41.00 |
| 010503, 010506 | 150.00 | | | | | | |
| 02 xx xx Central Heatings | | 41.50 | 44.00 | 42.00 | 42.00 | 42.00 | 42.00 |
| 02 xx xx Apartment Heatings | | 38.75 | 45.00 | 43.00 | 43.00 | 43.00 | 43.00 |
| 02 xx xx Stoves | | 37.88 | 51.00 | 51.00 | 51.00 | 51.00 | 51.00 |
| 030103, 030319 | | 109.13 | 41.00 | 41.00 | 41.00 | 41.00 | 41.00 |
| 030317 (1) | | 427.87 | 427.87 | 376.42 | 350.69 | 324.97 | 299.24 |
| Liquefied Petroleum Gas | | | | | | | |
| 010203 | | 109.13 | 41.00 | 41.00 | 41.00 | 41.00 | 41.00 |
| 010301(1) | | 96.45 | 83.20 | 86.31 | 86.04 | 91.64 | 107.55 |
| 02 xx xx | | 41.50 | 44.00 | 42.00 | 42.00 | 42.00 | 42.00 |
| 030103 | | 109.13 | 41.00 | 41.00 | 41.00 | 41.00 | 41.00 |
| 030317 (1) | | 427.87 | 427.87 | 376.42 | 350.69 | 324.97 | 299.24 |
| Refinery Gas | | | | | | | |
| 010301(1) | | 96.45 | 83.20 | 86.31 | 86.04 | 91.64 | 107.55 |
| Biogas, Sewage Sludge Gas, Landfill Gas | | | | | | | |
| 010103, 010203 | 150.00 | | | | | | |
| 020103 | 150.00 | | | | | | |
| 030103 | 150.00 | | | | | | |

(1) Implied emissions factors.

*Table 75: $SO_2$ emission factors [kg/TJ]*

| SNAP | All years | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Hard Coal, Hard Coal Briquettes | | | | | | | |
| 010101, 10102 | | 52.38 | 48.00 | 57.00 | 57.00 | 57.00 | 57.00 |
| 010103 | | 600.00 | 600.00 | 57.00 | 57.00 | 57.00 | 57.00 |
| 010201, 10202 | | 640.00 | 640.00 | 40.00 | 40.00 | 40.00 | 40.00 |
| 010503, 030103 | 600.00 | | | | | | |
| 02 xx xx Apartment and Central Heatings | | 640.00 | 640.00 | 543.00 | 543.00 | 543.00 | 543.00 |
| 02 xx xx Stoves | | 640.00 | 640.00 | 340.00 | 340.00 | 340.00 | 340.00 |
| Brown Coal | | | | | | | |
| 010101, 010102 | | 114.88 | 73.00 | 89.00 | 89.00 | 89.00 | 89.00 |
| 010103, 010203 | | 630.00 | 630.00 | 89.00 | 89.00 | 89.00 | 89.00 |
| 010202 | | 530.00 | 530.00 | 89.00 | 89.00 | 89.00 | 89.00 |
| 02 xx xx Central and Apartment Heatings | | 530.00 | 530.00 | 543.00 | 543.00 | 543.00 | 543.00 |
| 02 xx xx Stoves | | 530.00 | 530.00 | 340.00 | 340.00 | 340.00 | 340.00 |
| 030103 | 630.00 | | | | | | |
| 030103 Paper and Pulp Industry (1) | | 297.35 | 172.17 | 116.31 | 103.41 | 100.21 | 102.03 |
| Brown Coal Briquettes | | | | | | | |
| 010103 | | 630.00 | 630.00 | 89.00 | 89.00 | 89.00 | 89.00 |
| 010202, 010203 | | 630.00 | 630.00 | 89.00 | 89.00 | 89.00 | 89.00 |
| 02 xx xx Apartment and Central Heatings | | 600.00 | 600.00 | 543.00 | 543.00 | 543.00 | 543.00 |
| 02 xx xx Stoves | | 600.00 | 600.00 | 340.00 | 340.00 | 340.00 | 340.00 |
| 030103 | 630.00 | | | | | | |
| 030103 Paper and Pulp Industry (1) | | 297.35 | 172.17 | 116.31 | 103.41 | 100.21 | 102.03 |
| Coke Oven Coke | | | | | | | |
| 02 xx xx Apartment and Central Heatings | | 700.00 | 700.00 | 543.00 | 543.00 | 543.00 | 543.00 |
| 02 xx xx Stoves | | 700.00 | 700.00 | 340.00 | 340.00 | 340.00 | 340.00 |
| 030103 | 500.00 | | | | | | |
| 030103 Paper and Pulp Industry (1) | | 392.72 | 227.39 | 153.62 | 136.58 | 132.35 | 134.76 |
| Fuel Wood | | | | | | | |
| 010101, 010102, 010203 | 11.00 | | | | | | |
| 02 xx xx | 11.00 | | | | | | |
| 030103 Paper and Pulp Industry (1) | | 33.66 | 19.49 | 13.17 | 11.71 | 11.34 | 11.55 |
| 030103 | 11.00 | | | | | | |

| SNAP | All years | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Peat | | | | | | | |
| 020205 | 530.00 | | | | | | |
| Municipal Solid Waste. Hazardous Waste. Industrial Waste. Sewage Sludge. Black Liquor | | | | | | | |
| 010101 | 130.00 | | | | | | |
| 0102 xx | 130.00 | | | | | | |
| 020103 | | | | | | | |
| 030103 Paper and Pulp Industry (1) | | 72.93 | 42.23 | 28.53 | 25.36 | 24.58 | 25.03 |
| 030103 | 130.00 | | | | | | |
| Wood Waste | | | | | | | |
| 010103, 010203 | 11.00 | | | | | | |
| 02 xx xx | 11.00 | | | | | | |
| 030103 Paper and Pulp Industry (1) | | 33.66 | 19.49 | 13.17 | 11.71 | 11.34 | 11.55 |
| 030103 | 60.00 | | | | | | |
| Light Fuel Oil | | | | | | | |
| 010101, 010201, 010202 | | 147.00 | 90.00 | 92.00 | 92.00 | 92.00 | 92.00 |
| 010103, 010203 | | 150.00 | 92.00 | 92.00 | 92.00 | 92.00 | 92.00 |
| 02 xx xx | | 147.00 | 90.00 | 90.00 | 90.00 | 90.00 | 90.00 |
| 030103, 030319 | | 150.00 | 92.00 | 92.00 | 92.00 | 92.00 | 92.00 |
| 030103 Paper and Pulp Industry (1) | | 84.16 | 29.89 | 20.19 | 17.95 | 17.39 | 17.71 |
| Medium Fuel Oil | | | | | | | |
| 010101, 010202, 010203 | | 235.20 | 180.00 | 196.00 | 196.00 | 196.00 | 196.00 |
| 020103 | | 294.00 | 196.00 | 196.00 | 196.00 | 196.00 | 196.00 |
| 030103 | | 294.00 | 293.00 | 293.00 | 293.00 | 293.00 | 293.00 |
| Heavy Fuel Oil | | | | | | | |
| 010101, 010102 | | 237.60 | 42.00 | 50.00 | 50.00 | 50.00 | 50.00 |
| 010103 | | 792.00 | 398.00 | 50.00 | 50.00 | 50.00 | 50.00 |
| 010201, 010202 | | 792.00 | 450.00 | 127.00 | 127.00 | 127.00 | 127.00 |
| 010203 | | 792.00 | 398.00 | 398.00 | 398.00 | 398.00 | 398.00 |
| 010301(1) | | 63.16 | 80.82 | 104.04 | 105.38 | 110.43 | 126.49 |
| 030103, 030319 | | 792.00 | 398.00 | 398.00 | 398.00 | 398.00 | 398.00 |
| 030103 Paper and Pulp Industry (1) | | 444.34 | 129.29 | 87.34 | 77.65 | 75.25 | 76.62 |
| 030317 (1) | | 858.21 | 464.21 | 455.18 | 447.50 | 440.94 | 433.69 |
| Gas oil | | | | | | | |
| 010103, 010201, 010203 | | 93.33 | 45.00 | 45.00 | 45.00 | 45.00 | 45.00 |
| 010301(1) | | 63.16 | 80.82 | 104.04 | 105.38 | 110.43 | 126.49 |
| 02 xx xx | | 93.33 | 45.00 | 45.00 | 45.00 | 45.00 | 45.00 |

| SNAP | All years | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| 030103 | | 93.33 | 45.00 | 45.00 | 45.00 | 45.00 | 45.00 |
| Diesel | | | | | | | |
| 010105, 010205, 030105 | | 58.72 | 60.65 | 18.76 | 18.76 | 18.76 | 18.76 |
| Petroleum. Jet Gasoline | | | | | | | |
| 020103 | | 147.00 | 90.00 | 90.00 | 90.00 | 90.00 | 90.00 |
| 030103 | | 150.00 | 92.00 | 92.00 | 92.00 | 92.00 | 92.00 |
| Other Petroleum Products | | | | | | | |
| 010301(1) | | 63.16 | 80.82 | 104.04 | 105.38 | 110.43 | 126.49 |
| Natural Gas | | | | | | | |
| 01, 02, 0301 | 0.00 | | | | | | |
| 030317 (1) | | 66.21 | 66.21 | 57.18 | 49.50 | 42.94 | 35.69 |
| Liquefied Petroleum Gas | | | | | | | |
| 010203 | 6.00 | | | | | | |
| 02 xx xx | 6.00 | | | | | | |
| 030103 | 6.00 | | | | | | |
| 030317 (1) | | 66.21 | 66.21 | 57.18 | 49.50 | 42.94 | 35.69 |
| Refinery Gas | | | | | | | |
| 010301 | | 63.16 | 80.82 | 104.04 | 105.38 | 110.43 | 126.49 |
| Biogas. Sewage Sludge Gas. Landfill Gas | | | | | | | |
| All SNAPs | 0.00 | | | | | | |

(1) Implied emissions factors.

*Table 76: NMVOC emission factors [kg/TJ]*

| SNAP | All years | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| Hard Coal, Hard Coal Briquettes | | | | | | | |
| 010101. 10102. 010103 | 0.90 | | | | | | |
| 010201. 10202 | | 15.25 | 5.00 | 0.70 | 0.70 | 0.70 | 0.70 |
| 010503. 030103 | 15.00 | | | | | | |
| 02 xx xx Apart-ment and Central Heatings | | 700.00 | 700.00 | 284.40 | 284.40 | 284.40 | 284.40 |
| 02 xx xx Stoves | | 1 100.00 | 1 100.00 | 333.30 | 333.30 | 333.30 | 333.30 |
| Brown Coal | | | | | | | |
| 010101. 010102 | | 1.46 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| 010103 | 23.00 | | | | | | |
| 010202 | | 26.13 | 19.00 | 0.80 | 0.80 | 0.80 | 0.80 |
| 010203 | 23.00 | | | | | | |
| 02 xx xx Central and Apartment Heatings | | 830.00 | 830.00 | 284.40 | 284.40 | 284.40 | 284.40 |
| 02 xx xx Stoves | | 900.00 | 900.00 | 333.30 | 333.30 | 333.30 | 333.30 |
| 030103 | 23.00 | | | | | | |
| Brown Coal Briquettes | | | | | | | |

| SNAP | All years | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| 010103 | 23.00 | | | | | | |
| 010202 | | 26.13 | 19.00 | 0.80 | 0.80 | 0.80 | 0.80 |
| 010203 | 23.00 | | | | | | |
| 02 xx xx Apartment and Central Heatings | | 300.00 | 300.00 | 284.40 | 284.40 | 284.40 | 284.40 |
| 02 xx xx Stoves | | 530.00 | 530.00 | 333.30 | 333.30 | 333.30 | 333.30 |
| 030103 | 23.00 | | | | | | |
| Coke Oven Coke | | | | | | | |
| 02 xx xx Apartment and Central Heatings | | 49.00 | 49.00 | 284.40 | 284.40 | 284.40 | 284.40 |
| 02 xx xx Stoves | | 83.00 | 83.00 | 333.30 | 333.30 | 333.30 | 333.30 |
| 030103 | 8.00 | | | | | | |
| Fuel Wood | | | | | | | |
| 010101. 010102. 010203 | 64.00 | | | | | | |
| 02 xx xx Apartment and Central Heatings | | 980.00 | 980.00 | 423.40 | 423.40 | 423.40 | 423.40 |
| 02 xx xx Stoves | | 2 000.00 | 2 000.00 | 643.00 | 643.00 | 643.00 | 643.00 |
| 030103 | 5.00 | | | | | | |
| Peat | | | | | | | |
| 020205 | 900.00 | | | | | | |
| Municipal Solid Waste, Hazardous Waste, Industrial Waste, Sewage Sludge. Black Liquor | | | | | | | |
| All SNAPs | 38.00 | | | | | | |
| Wood Waste | | | | | | | |
| 010103. 010203 | 5.00 | | | | | | |
| 02 xx xx Central Heatings | | 64.00 | 64.00 | 423.40 | 423.40 | 423.40 | 423.40 |
| 02 xx xx Apartment Heatings | | 980.00 | 980.00 | 423.40 | 423.40 | 423.40 | 423.40 |
| 02 xx xx Stoves | | 2 000.00 | 2 000.00 | 643.00 | 643.00 | 643.00 | 643.00 |
| 030103 | 5.00 | | | | | | |
| Light Fuel Oil | | | | | | | |
| 010101. 010201. 010202 | | 7.08 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| 010103. 010203 | 0.80 | | | | | | |
| 02 xx xx | 0.75 | | | | | | |
| 030103. 030319 | 0.80 | | | | | | |
| Medium Fuel Oil | | | | | | | |
| 010101. 010202 | | 7.08 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| 010203 | 8.00 | | | | | | |
| 020103 | 8.00 | | | | | | |
| 030103 | 8.00 | | | | | | |
| Heavy Fuel Oil | | | | | | | |
| 010101. 010102 | 2.40 | | | | | | |
| 010103 | 8.00 | | | | | | |
| 010201. 010202 | | 7.08 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |

| SNAP | All years | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| 010203 | 8.00 | | | | | | |
| 010301 | IE | | | | | | |
| 030103. 030317. 030319 | 8.00 | | | | | | |
| Gas oil | | | | | | | |
| 010103. 010201. 010203 | 4.80 | | | | | | |
| 010301 | IE | | | | | | |
| 02 xx xx Apart-ment and Central Heatings | 0.80 | | | | | | |
| 02 xx xx Stoves | 1.50 | | | | | | |
| 030103 | 4.80 | | | | | | |
| Diesel | | | | | | | |
| 010105. 010205. 030105 | 0.80 | | | | | | |
| Petroleum. Jet Gasoline | | | | | | | |
| 010301 | IE | | | | | | |
| 020103 | 4.80 | | | | | | |
| 030103 | 4.80 | | | | | | |
| Other Petroleum Products | | | | | | | |
| 010301 | IE | | | | | | |
| Natural Gas | | | | | | | |
| 010101. 010102 | 0.06 | | | | | | |
| 010103 | 0.50 | | | | | | |
| 010201. 010202 | | 0.98 | 0.40 | 0.50 | 0.50 | 0.50 | 0.50 |
| 010203 | 0.50 | | | | | | |
| 010301 | IE | | | | | | |
| 010503. 010506 | 0.50 | | | | | | |
| 02 xx xx Apart-ment and Central Heatings | | 0.70 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| 02 xx xx Stoves | | 1.33 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| 030103. 030317. 030319 | 0.50 | | | | | | |
| Liquefied Petroleum Gas | | | | | | | |
| 010203 | 0.50 | | | | | | |
| 010301 | IE | | | | | | |
| 02 xx xx | 0.50 | | | | | | |
| 030103 | 0.50 | | | | | | |
| Coke Oven Gas. Blast Furnace Gas | | | | | | | |
| 030103 | IE | | | | | | |
| Refinery Gas | | | | | | | |
| 010301 | IE | | | | | | |
| Biogas. Sewage Sludge Gas. Landfill Gas | | | | | | | |
| 010103. 010203 | 0.50 | | | | | | |
| 020103 | 0.50 | | | | | | |
| 030103 | 0.50 | | | | | | |

(1) Implied emissions factors.

*Table 77: $NH_3$ emission factors (applied for the years 1990-2001, all sectors) [kg/TJ]*

| Fuel | Emission Factor |
|---|---|
| Hard Coal and Hard Coal Briquettes | 0.01 |
| Brown Coal | 0.02 |
| Brown Coal Briquettes | 0.02 |
| Coke Oven Coke | 0.02 |
| Fuel Wood | 5.00 |
| Peat | 0.02 |
| Municipal Solid Waste. Hazardous Waste. Industrial Waste. Sewage Sludge. Black Liquor | 0.02 |
| Wood Waste | 5.00 |
| Light Fuel Oil | 2.68 |
| Medium Fuel Oil | 2.68 |
| Heavy Fuel Oil | 2.68 |
| Gas Oil | 2.68 |
| Diesel | 2.68 |
| Petroleum. Jet Gasoline | 2.68 |
| Other Petroleum Products | 2.68 |
| Natural Gas | 1.00 |
| Liquefied Petroleum Gas | 1.00 |
| Coke Oven Gas. Blast Furnace Gas | IE |
| Refinery Gas | 2.68 |
| Biogas. Sewage Sludge Gas. Landfill Gas | 1.00 |

## 4.8 Fugitive Emissions (NFR Source Category 1 B)

NMVOC emissions from this category are only a minor source of NMVOC emissions in Austria: in 1990 the contribution to national total emissions was 1.8%, in the year 2002 it was 3.6%. Fugitive NMVOC emissions decreased: in 2002, they were 68% below 1990 levels.

This category is also a minor source regarding $SO_2$ emissions, which originate from the first treatment of sour gas. The contribution in the year 1990 was 0.4%, in 2002 these emissions contributed 2.5% to national total $SO_2$ emissions. $SO_2$ emissions from NFR Category 1 B decreased by 93% between 1990 and 2002.

### 4.8.1 Completeness

Table 78 gives an overview of the NFR 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 78: Overview of subcategories of Category 1 B Fugitive Emissions: transformation into SNAP codes and status of estimation*

| NFR Category | SNAP | Status | | | |
|---|---|---|---|---|---|
| | | $NO_X$ | $SO_2$ | $NH_3$ | NMVOC |
| **1 B 1 a Coal Mining and Handling** | 050102 Underground mining<br>050101 Open cast mining | NO | | | NE |
| **1 B 2 a Oil** | | | | | |
| i Exploration | 0502 Extraction, 1st treatment and loading of liquid fossil fuels | NO | | | NE |
| ii Production | | | | | |
| iii Transport | 050502 Transports and Depots | NO | | | ✓ |
| vi Refining/ Storage | 0401 Processes in Petroleum Industries<br>050501 Refinery Dispatch Station | NO | | | ✓ |
| v Distribution of oil products | 0504 Liquid fuel distribution (Except Petrol distribution) | NO | | | NE |
| | 050503 Petrol distribution – Service Stations | NO | | | ✓ |
| **1 B 2 b Natural Gas** | 0503 Extraction, 1st treatment and loading of gaseous fossil fuels<br>050602 Distribution Networks | NO | ✓ | NO | ✓ |
| **1 B 2 c Venting/Flaring** | | NE | NO | NO | NE |

### 4.8.2 Methodological issues

#### 4.8.2.1 1 B 2 a Oil

In this category NMVOC emissions of transport and distribution of oil products as well as from oil refining are considered. The most important sources of this sector are gas refining with a contribution of 28% to total NMVOC emissions of NFR Category *1 B Fugitive Emissions* and the refinery dispatch station with a contribution of 18% in 2002.

Emissions from depots and from refuelling of cars decreased remarkably (78% and 69% respectively) due to installation of gas recovery units.

Emissions were reported directly from "Fachverband Mineralöl" (Austrian association of oil industry). Activity data were taken from national statistics. From emission and activity data an implied emission factor was calculated.

Emissions, activity data and implied emission factors are presented in Table 79 and Table 80.

*Table 79: Emissions, activity data and implied emission factors for emissions from NFR Category 1 B 2 a Fugitive Emissions from Oil – Transport and Depots and Distribution*

| Year | Refinery Dispatch Station | | Transport and Depots | | Service Stations | | Petrol |
|---|---|---|---|---|---|---|---|
| | NMVOC [Gg] | IEF [g/Mg] | NMVOC [Gg] | IEF [g/Mg] | NMVOC [Gg] | IEF [g/Mg] | Activity [Gg] |
| 1990 | 1.06 | 413 | 2.20 | 861 | 1.63 | 637 | 2 554 |
| 1991 | 1.19 | 427 | 2.49 | 889 | 1.84 | 658 | 2 796 |
| 1992 | 1.17 | 438 | 2.44 | 912 | 1.81 | 675 | 2 676 |
| 1993 | 1.18 | 460 | 2.46 | 958 | 1.82 | 709 | 2 568 |
| 1994 | 1.20 | 478 | 2.50 | 995 | 1.85 | 736 | 2 513 |
| 1995 | 0.82 | 341 | 2.37 | 986 | 1.59 | 662 | 2 402 |
| 1996 | 0.81 | 365 | 1.82 | 819 | 1.26 | 567 | 2 218 |
| 1997 | 0.80 | 381 | 1.79 | 851 | 0.76 | 362 | 2 105 |
| 1998 | 2.25 | 1021 | 0.41 | 185 | 0.54 | 244 | 2 204 |
| 1999 | 1.61 | 785 | 0.43 | 210 | 0.55 | 270 | 2 047 |
| 2000 | 1.61 | 811 | 0.48 | 241 | 0.54 | 270 | 1 980 |
| 2001 | 0.59 | 296 | 0.48 | 238 | 0.54 | 269 | 1 994 |
| 2002 | 0.60 | 281 | 0.57 | 264 | 0.58 | 269 | 2 142 |
| *Trend 1990-2002* | *-43%* | *-32%* | *-74%* | *-70%* | *-64%* | *-58%* | *-16%* |

*Table 80: Emissions, activity data and implied emission factors for emissions from NFR Category 1 B 2 a Fugitive Emissions – Oil Refining*

| Year | NMVOC Emissions [Gg] | IEF [g/Mg] | Crude Oil Refined [Gg] |
|---|---|---|---|
| 1990 | 3.78 | 472 | 7 993 |
| 1991 | 4.00 | 472 | 8 463 |
| 1992 | 4.18 | 472 | 8 856 |
| 1993 | 4.09 | 472 | 8 659 |
| 1994 | 1.50 | 167 | 8 957 |
| 1995 | 1.50 | 172 | 8 721 |
| 1996 | 1.50 | 165 | 9 100 |
| 1997 | 1.50 | 155 | 9 656 |
| 1998 | 1.50 | 155 | 9 707 |
| 1999 | 1.39 | 152 | 9 123 |

| Year | NMVOC Emissions [Gg] | IEF [g/Mg] | Crude Oil Refined [Gg] |
|---|---|---|---|
| 2000 | 1.39 | 159 | 8 720 |
| 2001 | 0.54 | 61 | 8 855 |
| 2002 | 0.55 | 61 | 9 020 |
| *Trend 1990-2002* | *-85%* | *-87%* | *+13%* |

#### 4.8.2.2 1 B 2 b Natural Gas

In this category $SO_2$ and NMVOC emissions from the first treatment of sour gas and NMVOC emissions from gas distribution networks are considered.

$SO_2$ emissions from the 1st treatment of sour gas are reported directly by the operator of the only sour gas treatment plant in Austria. NMVOC emissions were reported for the years 1992 onwards, for the years before the emission value of 1992 was used.

NMVOC emissions from gas distribution networks were calculated by applying an emission factor of 19 656 g/ m³ gas distributed [ORTHOFER, R. 1991]. Gas consumption figures were taken from national statistics.

*Table 81: Emissions, activity data and implied emission factors for emissions from NFR Category 1 B 2 b Fugitive Emissions – Natural Gas*

| Year | Gas Distribution | | Gas Extraction/ 1st treatment | | | | |
|---|---|---|---|---|---|---|---|
| | Gas consumption [Mm³] | NMVOC Emissions [Gg] | NMVOC Emissions [Gg] | IEF [g/Mg] | SO2 Emissions [Gg] | IEF [g/Mg] | Natural Gas [1000m³] |
| 1990 | 6 090 | 0.12 | 1.093 | 849 | 2.00 | 8 062 | 248 090 |
| 1991 | 6 439 | 0.13 | 1.093 | 824 | 1.30 | 4 547 | 285 901 |
| 1992 | 6 323 | 0.12 | 1.093 | 761 | 2.00 | 5 600 | 357 135 |
| 1993 | 6 668 | 0.13 | 1.076 | 723 | 2.10 | 6 529 | 321 653 |
| 1994 | 6 859 | 0.13 | 1.035 | 764 | 1.28 | 3 521 | 363 582 |
| 1995 | 7 488 | 0.15 | 1.002 | 676 | 1.53 | 3 772 | 405 638 |
| 1996 | 7 971 | 0.16 | 0.983 | 659 | 1.20 | 8 776 | 136 737 |
| 1997 | 7 682 | 0.15 | 0.984 | 689 | 0.07 | 165 | 406 177 |
| 1998 | 7 887 | 0.16 | 0.963 | 614 | 0.04 | 114 | 367 195 |
| 1999 | 8 059 | 0.16 | 0.953 | 547 | 0.14 | 406 | 352 318 |
| 2000 | 7 791 | 0.15 | 0.948 | 525 | 0.15 | 405 | 358 357 |
| 2001 | 8 200 | 0.16 | 0.948 | 485 | 0.16 | 402 | 393 492 |
| 2002 | 7 799 | 0.15 | 0.943 | 468 | 0.14 | 397 | 347 513 |
| *Trend 1990-2001* | *+28%* | *+28%* | *-14%* | *-14%* | *-93%* | *-95%* | *+40%* |

# 5 INDUSTRIAL PROCESSES (NFR SECTOR 2)

This chapter includes details on methodologies used for estimating emissions of $SO_2$, $NO_X$, $NH_3$ and NMVOCs as well as references for activity data and emission factors reported under NFR Category *2 Industrial Processes* for the period from 1990 to 2002 in the NFR.

Emissions from this category comprise emissions from the following sub categories: *Mineral Products*, *Chemical Industry*, *Metal Production* and *Other Production* (*Chipboard* and *Food and Drink)*.

Only process related emissions are considered in this Sector, emissions due to fuel combustion in manufacturing industries are allocated in NFR Category *1 A 2 Fuel Combustion - Manufacturing Industries and Construction* (see Chapter 3).

Some categories in this sector are not occurring (NO) for Austria as there is no such production. For some categories emissions have not been estimated (NE) or are included elsewhere (IE). A summary of these categories is given in Table 87.

## 5.1 Sector Overview

### 5.1.1 Emission Trends

$SO_2$, $NO_X$, NMVOC and $NH_3$ emissions from NFR Category *2 Industrial Processes* for the period from 1990 to 2002 are presented in Table 82 and Figure 6.

*Table 82: Emissions from NFR Category 2 Industrial Processes and trends 1990-2002*

| Year | Emissions [Gg] | | | |
|---|---|---|---|---|
| | $SO_2$ | $NO_X$ | NMVOC | $NH_3$ |
| 1990 | 3.34 | 4.80 | 16.37 | 0.19 |
| 1991 | 3.46 | 4.48 | 17.88 | 0.18 |
| 1992 | 3.67 | 4.55 | 19.40 | 0.16 |
| 1993 | 3.86 | 1.97 | 20.88 | 0.18 |
| 1994 | 3.88 | 1.92 | 21.28 | 0.13 |
| 1995 | 3.88 | 1.47 | 21.01 | 0.10 |
| 1996 | 3.85 | 1.45 | 20.99 | 0.10 |
| 1997 | 3.89 | 1.55 | 20.89 | 0.10 |
| 1998 | 3.91 | 1.53 | 20.54 | 0.10 |
| 1999 | 3.90 | 1.53 | 20.79 | 0.12 |
| 2000 | 3.93 | 1.66 | 20.48 | 0.10 |
| 2001 | 3.94 | 1.71 | 21.01 | 0.08 |
| 2002 | 3.93 | 1.71 | 21.00 | 0.06 |
| *Trend 1990-2002* | *18%* | *-64%* | *28%* | *-67%* |
| *Share in National Total 1990* | *4.2%* | *2.3%* | *5.5%* | *0.3%* |
| *Share in National Total 2002* | *10.9%* | *0.8%* | *10.9%* | *0.1%* |

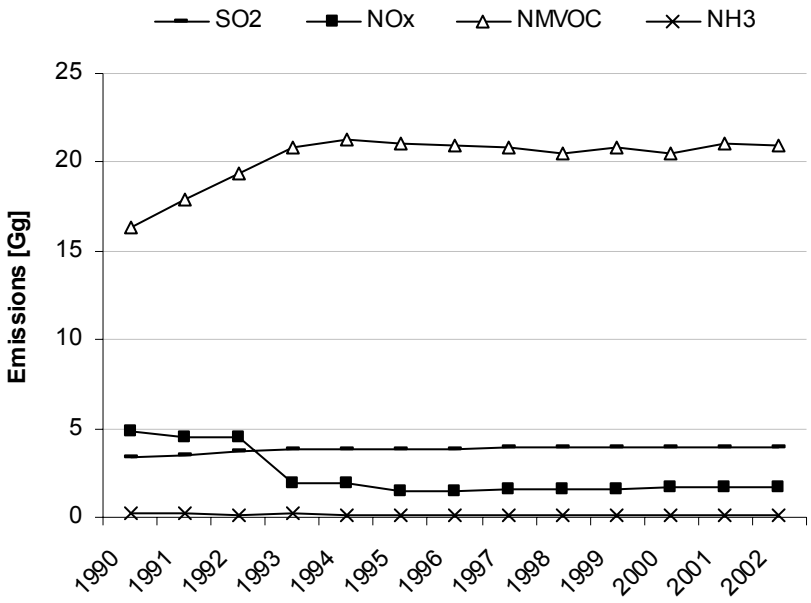



*Figure 6: Emissions from NFR Category 2 Industrial Processes 1990-2002*

## $SO_2$ Emissions

$SO_2$ emissions from NFR Category *2 Industry* fluctuated over the period from 1990 to 2002. As can be seen in Table 3, in 1990 emissions amounted to 11 Gg, in 2001 they were 18% lower (9 Gg). The main source for $SO_2$ emissions in the industrial processes sector is production of chemical products with a contribution of 80%.

The share of $SO_2$ emissions from this sector in national total emissions has increased from about 4% in 1990 to about 11% in 2002 because there was a strong reduction of SO2 emissions from combustion processes whereas emissions from industrial processes remained quite stable.

*Table 83: $SO_2$ emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions of the industry sector.*

| NRF Category | $SO_2$ Emissions [Gg] | | Trend 1990-2001 | Share in *2 Industry* | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2001 |
| **2 Industrial Processes** | 3.34 | 3.93 | ***+18%*** | 100% | 100% |
| 2 B Chemical Products | 2.68 | 3.19 | ***+19%*** | *80%* | *81%* |
| 2 C Metal Production | 0.66 | 0.75 | ***+14%*** | *20%* | *19%* |

## $NO_X$ Emissions

As can be seen in Figure 6, $NO_X$ emissions from the industrial processes sector decreased over the period from 1990 to 2002. In 1990 they amounted to 4 Gg, in the year 2002 they were 64% below 1990 levels (1.7 Gg). The main source for $NO_X$ emissions of NFR Category *2 Industrial Processes* with a contribution of 85% in 1990 is *2 B Chemical Products*. However, emissions from this sector were reduced due to abatement techniques, in 2002 category *2 D Other Production* (Chipboard Production) was the main NOx source from this sector

as emissions increased due to increasing production. Category *2 C Metal Production* is only a minor source within this sector.

*Table 84: $NO_X$ emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions of the industrial processes sector.*

| NRF Category | $NO_X$ Emissions [Gg] | | Trend 1990-2002 | Share in *2 Industry* | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| **2 Industrial Processes** | 4.08 | 1.71 | ***-64%*** | 100% | 100% |
| 2 B Chemical Products | 4.07 | 0.66 | ***-84%*** | 85% | 39% |
| 2 C Metal Production | 0.17 | 0.23 | ***32%*** | 4% | 13% |
| 2 D Other Production | 0.55 | 0.82 | ***49%*** | 12% | 48% |

### NMVOC Emissions

Industrial processes are the third largest sector regarding NMVOC emissions, in 1990 the contribution to national total emissions was 6% compared to 11% in 2002 due to decreasing emissions from the other sectors. The trend regarding NMVOC emissions from *2 Industrial Processes* shows increasing emissions: in the period from 1990 to 2002 emissions increased by 28%, mainly due to increasing emissions from chemical industry, which is the main contributor to NMVOC emissions from industrial processes (see Table 3).

*Table 85: NMVOC emissions per NFR Category 1990 and 2002, their trend 1990-2002 and their share in total emissions of the industry sector.*

| NRF Category | NMVOC Emissions [Gg] | | Trend 1990-2002 | Share in *2 Industry* | |
|---|---|---|---|---|---|
| | 1990 | 2002 | | 1990 | 2002 |
| **2 Industrial Processes** | 16.37 | 21.00 | ***28%*** | 100% | 100% |
| 2 A Mineral Products | 5.27 | 5.41 | ***3%*** | 32% | 26% |
| 2 B Chemical Products | 8.29 | 12.34 | ***49%*** | 51% | 59% |
| 2 C Metal Production | 0.52 | 0.11 | ***-21%*** | 3% | 2% |
| 2 D Other Production | 2.29 | 2.85 | ***24%*** | 14% | 14% |

### $NH_3$ Emissions

$NH_3$ emissions from industrial processes exclusively arise from NFR Category *2 B Chemical Products*. This sector is only a minor source of $NH_3$ emissions with a contribution to national total emissions of 0.3% in 1990 and 0.1% in 2002 respectively.

The trend concerning $NH_3$ emissions from industry is decreasing emissions: in the period from 1990 to 2001 emissions decreased by 67% (see Table 82).

## 5.1.2 Methodology

The general method for estimating emissions for the industrial processes sector involves multiplying production data for each process by an emission factor per unit of production (CORINAIR simple methodology).

In some categories emission and production data were reported directly by industry or associations of industries and thus represent plant specific data.

### 5.1.3 Quality Assurance and Quality Control (QA/QC)

For the Austrian Inventory there is an internal quality management system, 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 86. This legislation also addresses verification. Some plants that are reporting emission data have quality management systems implemented according to the ISO 9000–series or to similar systems.

*Table 86: Austrian legislation with specific regulations concerning measurement and documentation of emission data*

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

Extracts of the applicable paragraphs are provided in Annex 3.

### 5.1.4 Recalculations

Information on changes made with respect to last year's submission is provided in Chapter 3 *Methodological Changes,* details are provided in the corresponding subchapters of this chapter.

### 5.1.5 Completeness

Table 87 gives an overview of the NFR 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 A Fuel Combustion: transformation into SNAP Codes and status of estimation*

| NFR Category | SNAP | Status | | | |
|---|---|---|---|---|---|
| | | $NO_X$ | $SO_2$ | $NH_3$ | NMVOC |
| **2 A Mineral Products** | | | | | |
| 2 A 1 Cement Production | 040612 Cement (decarbonising) | NA | | | |
| 2 A 2 Lime Production | 040614 Lime (decarbonising) | NA | | | |
| 2 A 3 Limestone and Dolomite Use | 040618 Limestone and Dolomite Use | NA | | | |
| 2 A 4 Soda Ash Production and Use | 040619 Soda Ash Production and Use | NA | | | |

| NFR Category | SNAP | Status | | | |
|---|---|---|---|---|---|
| | | $NO_X$ | $SO_2$ | $NH_3$ | NMVOC |
| 2 A 5 Asphalt Roofing | 040610 Roof covering with asphalt materials | NA | | | ✓ |
| 2 A 6 Road Paving with Asphalt | 040611 Road paving with asphalt | NA | | | ✓ |
| 2 A 7 Other | 040613 Glass (decarbonising) | NA | | | |
| **2 B Chemical Industry** | | | | | |
| 2 B 1 Ammonia Production | 040403 Ammonia | ✓ | NA | ✓ | NA |
| 2 B 2 Nitric Acid Production | 040402 Nitric acid | ✓ | NA | ✓ | NA |
| 2 B 3 Adipic Acid Production | 040521 Adipic acid | NO | | | |
| 2 B 4 Carbide Production | 040412 Calcium carbide production | NE | | | |
| 2 B 5 Other | 040405 Ammonium Nitrate | NA | NA | ✓ | NA |
| | 040407 NPK Fertilizers | ✓ | NA | ✓ | NA |
| | 040408 Urea | NA | NA | ✓ | NA |
| | 040416 Processes in Inorganic Chemistry - Other | NA | ✓ | NA | NA |
| | 040527 Processes in Organic Chemistry - Other | NA | NA | NA | ✓ |
| **2 C Metal Production** | 040201 Coke oven<br>040202 Blast furnace charging<br>040203 Pig iron tapping<br>040206 Basic oxygen furnace steel plant<br>040209 Sinter and palletising plants | IE | | | |
| | 040207 Electric furnace steel plant | ✓ | ✓ | NA | ✓ |
| | 040208 Rolling mills | NA | NA | NA | ✓ |
| | 040210 Other processes in ferrous metal industries: Casting<br>040309 Other processes in non-ferrous metal industries: Casting | ✓ | ✓ | NA | ✓ |
| **2 D Other Production** | | | | | |
| 2 D 1 Pulp and Paper | 040601 Chipboard | ✓ | NA | NA | ✓ |
| 2 D 2 Food and Drink | 040605 Bread<br>040606 Wine<br>040607 Beer<br>040608 Spirits | NA | NA | NA | ✓ |
| **2 G Other** | | NE | | | |

## 5.2 Mineral Products (CRF Source Category 2 A)

### 5.2.1 Asphalt Roofing (2 A 5)

#### 5.2.1.1 Source Category Description

In this category NMVOC emissions from the production and laying of asphalt roofing are considered. NMVOC emissions of this category are an important NMVOC source from NFR Category *2 Industry*: in 2002 25% of all industrial process NMVOC emissions, compared to 31% in 1990, originated from this category.

Table 88 presents NMVOC emissions arising from asphalt roofing. As can be seen in the table, NMVOC emissions reached a maximum in 1994. In 2002 emissions from this category were 2.5% above 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.

#### 5.2.1.2 Methodological Issues

NMVOC emissions from asphalt roofing were calculated by multiplying an emission factor of 180 g NMVOC /m² produced asphalt roofing [BUWAL, 1995] with activity data (roofing paper produced). The consumption of bitumen was assumed to be 1.2 kg/m² of asphalt roofing.

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

*Table 88: Activity data (Roofing Paper produced) and NMVOC emissions for Asphalt Roofing 1990-2002*

| Year | Roofing Paper [m²] | NMVOC emissions [Gg] |
|---|---|---|
| 1990 | 27 945 000 | 5.03 |
| 1991 | 28 007 000 | 5.04 |
| 1992 | 29 311 000 | 5.28 |
| 1993 | 30 731 000 | 5.53 |
| 1994 | 31 745 000 | 5.71 |
| 1995 | 31 229 000 | 5.62 |
| 1996 | 31 229 000 | 5.62 |
| 1997 | 29 976 436 | 5.40 |
| 1998 | 27 060 715 | 4.87 |
| 1999 | 26 616 092 | 4.79 |
| 2000 | 26 020 734 | 4.68 |
| 2001 | 28 645 036 | 5.16 |
| 2002 | 28 645 036 | 5.16 |
| *Trend 1990-2002* | *+2.5%* | *+2.5%* |

#### 5.2.1.3 Recalculation

Activity data for the year 2001 was updated using statistical data, for the last submission this value was not available.

### 5.2.2 Road Paving with Asphalt (2 A 6)

#### 5.2.2.1 Source Category Description

In this category NMVOC emissions from road paving with asphalt are considered. This source only contributes 1% to total NMVOC emissions from NFR Category *2 Industry*.

Table 88 presents NMVOC emissions arising from road paving with asphalt. As can be seen in the table, in 2002 emissions from this category were 3.4% above 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.

#### 5.2.2.2 Methodological Issues

Emissions were calculated by applying an emission factor of 600 g NMVOC per t asphalt used for road paving [BUWAL, 1995].

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

Table 88 presents activity data as well as emissions from this category for the period from 1990 to 2002.

*Table 89: Activity data (asphalt used for road paving) and NMVOC emissions for NFR Category 2 A 6 Road Paving with Asphalt 1990-2002*

| Year | Asphalt [t] | NMVOC emissions [Gg] |
|---|---|---|
| 1990 | 402 727 | 0.24 |
| 1991 | 434 305 | 0.26 |
| 1992 | 568 206 | 0.34 |
| 1993 | 490 422 | 0.29 |
| 1994 | 714 808 | 0.43 |
| 1995 | 522 418 | 0.31 |
| 1996 | 522 418 | 0.31 |
| 1997 | 522 943 | 0.31 |
| 1998 | 405 200 | 0.24 |
| 1999 | 969 000 | 0.58 |
| 2000 | 429 292 | 0.26 |
| 2001 | 416 545 | 0.25 |
| 2002 | 416 545 | 0.25 |
| Trend 1990-2002 | *+3.4%* | *+3.4%* |

#### 5.2.2.3 Recalculation

Activity data for the year 2001 was updated using statistical data, for the last submission this value was not available.

## 5.3 Chemical Products (NFR Source Category 2 B)

### 5.3.1 Ammonia and Nitric Acid Production (2 B 1 and 2 B 2)

#### 5.3.1.1 Source Category Description

Ammonia ($NH_3$) is produced by catalytic steam reforming of natural gas or other light hydrocarbons (e.g. liquefied petroleum gas, naphtha). 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 $HNO_3$. Both processes are minor sources of $NH_3$ emissions.

$NH_3$ emissions from the production of ammonia contributed 4% to total $NH_3$ emissions from industrial processes in 1990 and 18% in 2002, respectively. The contribution of emissions from nitric acid production was only about 1%.

In Austria there is only one producer of ammonia and nitric acid.

#### 5.3.1.2 Methodological Issues

Activity data since 1990 and emission data from 1994 onwards were reported directly to the UMWELTBUNDESAMT by the only producer in Austria and thus represent plant specific data. From emission and activity data an implied emission factor was calculated (see Table 90). The implied emission factor that was calculated from activity and emission data from 1994 was applied to calculate emissions of the year 1993 for NOx emissions and for the years 1990 to 1993 for NH3 emissions, as no emission data was available for these years.

NOx emissions from 1990 to 1993 are reported in category *2 B 5 Other processes in organic chemical industries*.

*Table 90: Activity data, emissions and implied emission factors for NOx and $NH_3$ emissions from Ammonia Production (NFR Category 2 B 1) 1990–2002*

| Year | Production [t] | NOx Emission [Gg] | NOx IEF [g/t] | $NH_3$ Emission [Gg] | $NH_3$ IEF [g/t] |
|---|---|---|---|---|---|
| 1990 | 461 000 | IE | -- | 0.0074 | 16.00 |
| 1991 | 475 000 | IE | -- | 0.0076 | 16.00 |
| 1992 | 432 000 | IE | -- | 0.0069 | 16.00 |
| 1993 | 469 000 | 0.691 | 1346 | 0.0075 | 16.00 |
| 1994 | 444 000 | 0.629 | 1346 | 0.0071 | 16.00 |
| 1995 | 473 000 | 0.346 | 715 | 0.0107 | 22.62 |
| 1996 | 484 772 | 0.359 | 724 | 0.0123 | 25.37 |
| 1997 | 479 698 | 0.343 | 701 | 0.0109 | 22.72 |
| 1998 | 484 449 | 0.363 | 719 | 0.0042 | 8.67 |
| 1999 | 490 493 | 0.370 | 722 | 0.0085 | 17.33 |
| 2000 | 482 333 | 0.407 | 762 | 0.0070 | 14.51 |
| 2001 | 448 176 | 0.379 | 742 | 0.0060 | 13.39 |
| 2002 | 464 028 | 0.366 | 700 | 0.0111 | 23.92 |
| *Trend 1990-2002* | 1% | *-47%** | *-48%** | *+51%* | *+50%* |

* Trend 1993-2002

*Table 91: Activity data, emissions and implied emission factors for NOx and $NH_3$ emissions from Nitric Acid Production (NFR Category 2 B 2) 1990–2002*

| Year | Production [t] | NOx Emission [Gg] | NOx IEF [g/t] | $NH_3$ Emission [Gg] | $NH_3$ IEF [g/t] |
|---|---|---|---|---|---|
| 1990 | 530 000 | IE | IE | 0.0014 | 2.60 |
| 1991 | 535 000 | IE | IE | 0.0014 | 2.60 |
| 1992 | 485 000 | IE | IE | 0.0013 | 2.60 |
| 1993 | 513 000 | 0.471 | 1004 | 0.0013 | 2.60 |
| 1994 | 502 000 | 0.446 | 1004 | 0.0013 | 2.59 |
| 1995 | 484 000 | 0.286 | 604 | 0.0001 | 0.21 |
| 1996 | 495 738 | 0.285 | 587 | 0.0002 | 0.40 |
| 1997 | 489 375 | 0.292 | 609 | 0.0019 | 3.88 |
| 1998 | 504 977 | 0.251 | 517 | 0.0003 | 0.59 |
| 1999 | 512 798 | 0.232 | 473 | 0.0002 | 0.39 |
| 2000 | 533 715 | 0.207 | 428 | 0.0004 | 0.75 |
| 2001 | 510 800 | 0.204 | 455 | 0.0005 | 0.98 |
| 2002 | 522 410 | 0.225 | 484 | 0.0006 | 1.15 |
| *Trend 1990-2002* | *-1%* | *-52%** | *-52%** | *-57%* | -56% |

* Trend 1993-2002

$NH_3$ 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.

#### 5.3.1.3 Recalculations

NOx emissions from this category were previously reported in category *2 B 5 Other processes in organic chemical industries* as a sum, and the value of 1993 was used for all years onwards. Now the emission value for the years after 1993 have been updated and allocated to the respective categories.

### 5.3.2 Chemical Products - Other (2 B 5)

#### 5.3.2.1 Source Category Description

This category includes $NH_3$ emissions from the production of ammonium nitrate, fertilizers and urea as well as $SO_2$ from inorganic chemical processes (reported as a sum) and NMVOC emissions from organic chemical processes (also reported as a sum). $NO_X$ emissions from inorganic chemical processes for the years 1990 to 1993 are also as a sum under this category.

The production of fertilizers is the most important $NH_3$ source of this category as well as of the overall industrial processes sector: in 1990 73% of all emissions from NFR Category *2 Industry* originated from fertilizer production, compared to 36% in 2002.

Processes in inorganic chemical industries are an important $NO_x$ source of the industrial processes sector, in 2002 this category contributed 39% to total emissions from NFR Cate-

gory *2 Industry*. This source is also important regarding $SO_2$ emissions: 81% of the $SO_2$ emissions from the industrial processes sector originated from this source.

In the year 2001 NMVOC emissions from organic chemical industries contributed 59% to total emission from the industrial processes sector.

Emissions from this category are presented in the following table:

*Table 92: Emissions from NFR Category 2 B 5 1990–2002*

| | $NH_3$ Emissions from [Gg] | | | | | $NO_x$ [Gg] | $NO_x$ [Gg] | $SO_2$ [Gg] | NMVOC [Gg] |
|---|---|---|---|---|---|---|---|---|---|
| Year | Ammonium Nitrate Prod. | Fertilizer Prod. | Urea Prod. | use as refrigerant | **Total $NH_3$** | Fertilizer Prod. | Processes in Inorganic Chemical Industries | | Organic Chemistry |
| 1990 | 0.0011 | 0.13 | 0.04 | 0.002 | 0.18 | IE | 4.07 | 2.68 | 8.29 |
| 1991 | 0.0011 | 0.12 | 0.04 | 0.002 | 0.17 | IE | 4.18 | 2.85 | 9.64 |
| 1992 | 0.0011 | 0.11 | 0.04 | 0.002 | 0.15 | IE | 4.29 | 3.02 | 10.99 |
| 1993 | 0.0011 | 0.12 | 0.04 | 0.002 | 0.17 | 0.08 | IE | 3.19 | 12.34 |
| 1994 | 0.0003 | 0.07 | 0.05 | 0.002 | 0.12 | 0.08 | IE | 3.19 | 12.34 |
| 1995 | 0.0009 | 0.04 | 0.05 | 0.002 | 0.09 | 0.06 | IE | 3.19 | 12.34 |
| 1996 | 0.0004 | 0.05 | 0.03 | 0.002 | 0.08 | 0.05 | IE | 3.19 | 12.34 |
| 1997 | 0.0003 | 0.06 | 0.03 | 0.002 | 0.09 | 0.05 | IE | 3.19 | 12.34 |
| 1998 | 0.0003 | 0.06 | 0.04 | 0.002 | 0.10 | 0.05 | IE | 3.19 | 12.34 |
| 1999 | 0.0003 | 0.07 | 0.03 | 0.002 | 0.11 | 0.06 | IE | 3.19 | 12.34 |
| 2000 | 0.0002 | 0.07 | 0.02 | 0.002 | 0.09 | 0.07 | IE | 3.19 | 12.34 |
| 2001 | 0.0003 | 0.06 | 0.01 | 0.002 | 0.07 | 0.07 | IE | 3.19 | 12.34 |
| 2002 | 0.0005 | 0.02 | 0.02 | 0.002 | 0.05 | 0.07 | IE | 3.19 | 12.34 |
| *Trend 90-02* | *-58%* | *-84%* | *-36%* | *--* | ***-72%*** | *--* | *--* | *+19%* | *+49%* |

#### 5.3.2.2 Methodological Issues

**Ammonium nitrate and urea production**

For ammonium nitrate and urea production activity data since 1990 and emission data from 1994 onwards were reported directly to the UMWELTBUNDESAMT by the only producer in Austria and thus represent plant specific data.

An implied emission factor was calculated from emission and activity data (see Table 90). The implied emission factor that was calculated from activity and emission data of 1994 was applied to calculate emissions of the years 1990 to 1993 as no emission data was available for these years.

**Fertilizer production**

For fertilizer production activity data from 1990 to 1994 was taken from national production statistics[10] (STATISTK AUSTRIA), emission and activity data from 1995 onwards was reported by the main producer in Austria. For the years 1990 to 1993 emissions were estimated with information on emissions of the main producer and extrapolation to total production. The emission estimate for 1994 was obtained by applying the average emission factor of 1995-1999.

**Use of $NH_3$ as refrigerant**

The amount of $NH_3$ used as refrigerant was estimated for 1994 (expert judgement), this value was used for the whole time series.

*Table 93: Activity data and implied emission factors for $NH_3$ emissions from ammonia nitrate, fertilizers and urea production (NFR Category 2 B 5) 1990–2002*

| Year | Ammonium Nitrate Prod. | | Fertiliser Production | | | Urea Production | |
|---|---|---|---|---|---|---|---|
| | Production [t] | $NH_3$ IEF [g/t] | Production [t] | $NH_3$ IEF [g/t] | IEF [g/t] | Production [t] | IEF [g/t] |
| 1990 | 15 500 | 72.39 | 1 388 621 | 97.00 | -- | 282 000 | 137.00 |
| 1991 | 15 500 | 72.39 | 1 273 467 | 97.00 | -- | 295 000 | 137.00 |
| 1992 | 15 500 | 72.39 | 1 182 595 | 97.00 | -- | 259 000 | 137.00 |
| 1993 | 15 500 | 72.39 | 1 250 804 | 97.00 | 65.48 | 305 000 | 137.00 |
| 1994 | 15 500 | 19.35 | 1 222 578 | 58.85 | 65.48 | 360 000 | 137.00 |
| 1995 | 12 432 | 72.39 | 916 265 | 40.60 | 65.48 | 393 000 | 121.37 |
| 1996 | 14 457 | 27.67 | 940 313 | 54.88 | 50.09 | 417 705 | 72.78 |
| 1997 | 13 718 | 21.87 | 924 856 | 64.77 | 52.76 | 392 017 | 71.17 |
| 1998 | 13 993 | 21.44 | 977 212 | 58.74 | 48.30 | 395 288 | 98.16 |
| 1999 | 14 514 | 20.67 | 988 662 | 75.25 | 64.03 | 408 386 | 81.05 |
| 2000 | 15 510 | 12.89 | 1 022 983 | 71.56 | 69.80 | 390 185 | 44.59 |
| 2001 | 14 697 | 20.41 | 959 698 | 58.56 | 77.63 | 367 218 | 39.21 |
| 2002 | 16 371 | 29.01 | 1 013 767 | 21.53 | 73.00 | 389 574 | 63.15 |
| *Trend 1990-2002* | *+6%* | *-60%* | *-27%* | *-78%* | *--* | *+38%* | *-54%* |

[10] This results in an inconsistency of the time series, as activity data taken from national statistics represent total production in Austria, whereas the data obtained from the largest Austrian producer covers only the production of this producer. It is planned to prepare a consistent time series.

### Processes in inorganic and organic chemical industries

All $SO_2$, $NO_X$ and NMVOC process emissions from chemical industries (both organic and inorganic) are reported together as a total in category *2 B 5 Other*. For NOx emissions from 1994 onwards emission data has been split and allocated to the respective emitting processes (ammonia production, fertilizer production and nitric acid production).

Activity data until 1992 were taken from STATISTIK AUSTRIA. In the year 1994 a study commissioned by associations of industries was published [WINDSPERGER & TURI, 1997]. The activity figures for the year 1993 included in this study was used for all years afterwards, as no more up to date activity data is available.

Emission data was taken from the same study [WINDSPERGER & TURI,1997], it was obtained from direct inquiries in industry.

From activity and emission data an emission factor was calculated. Both activity data and implied emission factors are presented in Table 94.

*Table 94: Implied emission factors and activity data for process emissions from chemical industries*

| Year | Processes in Organic Chemical Industries | | Processes in Inorganic Chemical Industries | | |
|---|---|---|---|---|---|
| | IEF NMVOC [g/Mg] | Activity [Mg] | IEF $SO_2$ [g/Mg] | IEF $NO_X$ [g/Mg] | Activity [Mg] |
| 1990 | 7 330 | 1 130 265 | 2 784 | 4 225 | 963 824 |
| 1991 | 9 355 | 1 030 030 | 3 206 | 4 701 | 889 430 |
| 1992 | 11 537 | 952 298 | 3 338 | 4 743 | 904 561 |
| 1993 | 13 405 | 920 317 | 3 729 | -- | 854 909 |

## 5.4 Metal Production (NFR Source Category 2 C)

In this category emissions from iron and steel production and casting as well as process emissions from non-ferrous metal production and casting are considered.

The following table presents total emissions from this category. For $SO_2$ emissions the contribution to the sector total is about 20%, emissions mainly arise from non-ferrous metal production. The share in total emissions from category 2 Industrial Processes for NOx emissions from metal production is 13% in 2002. Metal production is only a minor source for NMVOC, only 2% of industrial process emissions arise from this category.

*Table 95: Emissions from NFR Category 2 C Metal Production*

| | Emissions [Gg] | | |
|---|---|---|---|
| Year | $SO_2$ | NOx | NMVOC |
| 1990 | 0.66 | 0.17 | 0.52 |
| 1991 | 0.61 | 0.14 | 0.51 |
| 1992 | 0.65 | 0.17 | 0.50 |
| 1993 | 0.67 | 0.18 | 0.46 |
| 1994 | 0.69 | 0.19 | 0.50 |
| 1995 | 0.69 | 0.19 | 0.38 |
| 1996 | 0.66 | 0.17 | 0.37 |
| 1997 | 0.7 | 0.20 | 0.39 |
| 1998 | 0.72 | 0.22 | 0.43 |
| 1999 | 0.71 | 0.21 | 0.43 |
| 2000 | 0.75 | 0.23 | 0.47 |
| 2001 | 0.75 | 0.23 | 0.42 |
| 2002 | 0.75 | 0.23 | 0.41 |
| *Trend 1990-2002* | *14%* | *32%* | *-21%* |

### 5.4.1 Iron and Steel

In this category $SO_2$ emissions from electric furnace steel plants in Austria, from rolling mills and from iron casting are considered.

#### 5.4.1.1 Electric Furnace Steel Plant

Estimation of emissions from electric furnace steel plants was carried out by multiplying an emission factor with production data.

The emission factors of 590 g $SO_2$ /Mg electric steel produced

330 g $NO_x$ / Mg electric steel produced

60 g NMVOC /Mg electric steel produced

were taken from a study published by the Austrian chamber of commerce, section industry [WINDSPERGER & TURI, 1997]. For NMVOC emissions it was assumed that total VOC emissions as presented in the study are composed of 10% $CH_4$ and 90% NMVOC (expert judgement UMWELTBUNDESAMT).

Activity data were obtained from the *Association of Mining and Steel Industries* and thus represent plant specific data.

Table 96 presents activity data for electric steel production for the period from 1990 to 2002. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in electric steel production. For 2002 the value of 2001 was used.

*Table 96: Activity data and emissions from Electric Steel Production 1990-2002*

| Year | Production [t] | Emissions [Gg] | | |
|---|---|---|---|---|
| | Electric steel | $SO_2$ | $NO_X$ | NMVOC |
| 1990 | 370 107 | 0.22 | 0.12 | 0.02 |
| 1991 | 290 324 | 0.17 | 0.10 | 0.02 |
| 1992 | 360 620 | 0.21 | 0.12 | 0.02 |
| 1993 | 410 769 | 0.24 | 0.14 | 0.02 |
| 1994 | 430 949 | 0.25 | 0.14 | 0.03 |
| 1995 | 453 645 | 0.27 | 0.15 | 0.03 |
| 1996 | 396 200 | 0.23 | 0.13 | 0.02 |
| 1997 | 465 578 | 0.27 | 0.15 | 0.03 |
| 1998 | 502 913 | 0.30 | 0.17 | 0.03 |
| 1999 | 485 929 | 0.29 | 0.16 | 0.03 |
| 2000 | 540 539 | 0.32 | 0.18 | 0.03 |
| 2001 | 545 695 | 0.32 | 0.18 | 0.03 |
| 2002 | 545 695 | 0.32 | 0.18 | 0.03 |
| *Trend 1990-2001* | *47%* | *47%* | *47%* | *47%* |

#### 5.4.1.2 Rolling Mills

The emission factor for VOC emissions from rolling mills 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) resulting in an emission factor of 0.9 g NMVOC/ Mg steel produced.

Steel production data was taken from national production statistics, the amount of electric steel was subtracted.

Table 97 presents activity data (steel produced) as well as NMVOC emissions arising from rolling mills for the period from 1990 to 2002. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of steel.

*Table 97: Activity data and NMVOC emissions from Rolling Mills 1990-2002*

| Year | Steel Produced [t] | NMVOC emissions [Gg] |
|---|---|---|
| 1990 | 3 921 341 | 0.0035 |
| 1991 | 3 896 418 | 0.0035 |
| 1992 | 3 592 487 | 0.0032 |
| 1993 | 3 738 096 | 0.0034 |
| 1994 | 3 967 938 | 0.0036 |
| 1995 | 4 538 355 | 0.0041 |
| 1996 | 4 031 800 | 0.0036 |
| 1997 | 4 718 422 | 0.0042 |
| 1998 | 4 801 087 | 0.0043 |
| 1999 | 4 722 071 | 0.0042 |
| 2000 | 5 183 461 | 0.0047 |
| 2001 | 5 346 305 | 0.0048 |
| 2002 | 5 647 282 | 0.0051 |
| *Trend 1990-2001* | *+44%* | *+44%* |

**Recalculation**

Data on production of steel was adjusted to be fully consistent with national statistics, the difference for most years is negligible, only for 2001 the difference was 4%.

#### 5.4.1.3 Iron Cast

Activity data were obtained from "Fachverband der Gießereiindustrie Österreichs" (association of the Austrian foundry industry). The applied emission factors were taken from a study commissioned by the same association [FACHVERBAND DER GIEßEREIINDUSTRIE].

*Table 98: Emissions, implied emission factors and activity data for cast iron 1990-2002*

| Year | Emissions [Gg] | | | Emission Factors [g/Mg] | | | Activity [Mg] |
|---|---|---|---|---|---|---|---|
| | $SO_2$ | NOx | NMVOC | $SO_2$ | NOx | NMVOC | |
| 1990 | 0.03 | 0.03 | 0.29 | 170 | 170 | 1 450 | 196 844 |
| 1991 | 0.03 | 0.03 | 0.28 | 170 | 170 | 1 450 | 191 401 |
| 1992 | 0.03 | 0.03 | 0.26 | 170 | 170 | 1 450 | 176 643 |
| 1993 | 0.03 | 0.03 | 0.23 | 170 | 170 | 1 450 | 155 186 |
| 1994 | 0.03 | 0.03 | 0.23 | 170 | 170 | 1 450 | 158 102 |
| 1995 | 0.02 | 0.03 | 0.22 | 140 | 160 | 1 260 | 176 486 |
| 1996 | 0.02 | 0.03 | 0.21 | 140 | 160 | 1 260 | 166 659 |
| 1997 | 0.02 | 0.03 | 0.21 | 140 | 160 | 1 260 | 169 957 |
| 1998 | 0.03 | 0.03 | 0.24 | 140 | 160 | 1 260 | 190 045 |
| 1999 | 0.03 | 0.03 | 0.23 | 140 | 160 | 1 260 | 181 701 |
| 2000 | 0.03 | 0.03 | 0.24 | 140 | 160 | 1 260 | 191 420 |
| 2001 | 0.03 | 0.03 | 0.23 | 130 | 151 | 1 180 | 192 386 |
| 2002 | 0.02 | 0.03 | 0.21 | 130 | 151 | 1 180 | 181 232 |
| *Trend 1990-2002* | *-30%* | *-18%* | *-25%* | *-24%* | *-11%* | *-19%* | *-8%* |

### 5.4.2 Non-ferrous Metals

In this category process emissions from non-ferrous metal production as well as from non-ferrous metal cast (light metal cast and heavy metal cast) are considered.

#### 5.4.2.1 Non- ferrous Metals Production

Emission estimates for emissions from Non-ferrous Metal Production were taken from a study [WINDSPERGER & TURI, 1997] and was used for all years: 0.4 Gg $SO_2$ and 0.01 Gg NMVOC.

#### 5.4.2.2 Non- ferrous Metals Casting

Activity data were obtained from "Fachverband der Gießereiindustrie Österreichs" (association of the Austrian foundry industry). The applied emission factors as presented below were taken from a study commissioned by the same association [FACHVERBAND DER GIEßEREIINDUSTRIE].

*Table 99: Emissions, implied emission factors and activity data for light metal cast 1990-2002*

| Year | Emissions [Gg] | | | Emission Factors [g/Mg] | | | Activity [Mg] |
|---|---|---|---|---|---|---|---|
| | $SO_2$ | NOx | NMVOC | $SO_2$ | NOx | NMVOC | |
| 1990 | 0.006 | 0.015 | 0.187 | 120 | 330 | 4 040 | 46 316 |
| 1991 | 0.006 | 0.015 | 0.187 | 120 | 330 | 4 040 | 46 252 |
| 1992 | 0.006 | 0.016 | 0.192 | 120 | 330 | 4 040 | 47 434 |
| 1993 | 0.005 | 0.015 | 0.180 | 120 | 330 | 4 040 | 44 626 |
| 1994 | 0.006 | 0.017 | 0.213 | 120 | 330 | 4 040 | 52 786 |
| 1995 | 0.001 | 0.014 | 0.104 | 10 | 230 | 1 740 | 59 834 |
| 1996 | 0.001 | 0.015 | 0.112 | 10 | 230 | 1 740 | 64 462 |
| 1997 | 0.001 | 0.016 | 0.124 | 10 | 230 | 1 740 | 71 001 |
| 1998 | 0.001 | 0.018 | 0.136 | 10 | 230 | 1 740 | 78 174 |
| 1999 | 0.001 | 0.018 | 0.139 | 10 | 230 | 1 740 | 80 105 |
| 2000 | 0.001 | 0.021 | 0.161 | 10 | 230 | 1 740 | 92 695 |
| 2001 | 0.001 | 0.017 | 0.129 | 10 | 170 | 1 289 | 100 061 |
| 2002 | 0.001 | 0.017 | 0.132 | 10 | 170 | 1 289 | 102 703 |
| *Trend 1990-200* | *-82%* | *+14%* | *-29%* | *-92%* | *-49%* | *-68%* | *+122%* |

*Table 100: Emissions, implied emission factors and activity data for heavy metal cast 1990-2002*

| Year | Emissions [Gg] | | | Emission Factors [g/Mg] | | | Activity [Mg] |
|---|---|---|---|---|---|---|---|
| | $SO_2$ | NOx | NMVOC | $SO_2$ | NOx | NMVOC | |
| 1990 | 0.0009 | 0.0009 | 0.0118 | 100 | 100 | 1 390 | 8 525 |
| 1991 | 0.0009 | 0.0009 | 0.0125 | 100 | 100 | 1 390 | 8 957 |
| 1992 | 0.0010 | 0.0010 | 0.0134 | 100 | 100 | 1 390 | 9 624 |
| 1993 | 0.0010 | 0.0010 | 0.0135 | 100 | 100 | 1 390 | 9 733 |
| 1994 | 0.0011 | 0.0011 | 0.0150 | 100 | 100 | 1 390 | 10 758 |
| 1995 | 0.0008 | 0.0008 | 0.0123 | 80 | 80 | 1 180 | 10 384 |
| 1996 | 0.0009 | 0.0009 | 0.0132 | 80 | 80 | 1 180 | 11 204 |
| 1997 | 0.0010 | 0.0010 | 0.0141 | 80 | 80 | 1 180 | 11 955 |
| 1998 | 0.0010 | 0.0010 | 0.0144 | 80 | 80 | 1 180 | 12 214 |
| 1999 | 0.0010 | 0.0010 | 0.0146 | 80 | 80 | 1 180 | 12 334 |
| 2000 | 0.0011 | 0.0011 | 0.0156 | 80 | 80 | 1 180 | 13 214 |
| 2001 | 0.0011 | 0.0011 | 0.0157 | 80 | 80 | 1 180 | 13 285 |
| 2002 | 0.0011 | 0.0011 | 0.0160 | 80 | 80 | 1 180 | 13 525 |
| *Trend 1990-2002* | *+27%* | *+27%* | *+35%* | *-20%* | *-20%* | *-15%* | *+59%* |

## 5.5 Other Production (NFR Source Category 2 D)

### 5.5.1 Pulp and Paper (2 D 1)

#### 5.5.1.1 Source Category Description

As emissions from pulp and paper production mainly arise from combustion activities, they are included in *1 A 2 Combustion in Manufacturing Industries*.

In this category emissions from chipboard production are considered. $NO_X$ emissions from chipboard production mainly arise from combustion activities. It is also a source for NMVOC emissions.

$NO_X$ emissions from this category amounted to 0.82 Gg in the year 2002, that are 48% of total $NO_X$ emissions from production processes (compared to 12% in 1990). As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of chipboards.

NMVOC emissions from this source contributed 3% to the sectoral total emissions in 2002, compared to 2% in 1990.

#### 5.5.1.2 Methodological Issues

Emissions were calculated by applying a national emission factor on production data (activity data).

Activity data were taken from STATISTIK AUSTRIA. The values of 1995, 1998 and 2001 were also used for the year after because no data is available for these years. The applied emission factors were taken from a study [WURST et al., 1994], the values of 492 g $NO_x$ /Mg product and 361 g NMVOC / Mg chipboard produced is a mean value of values obtained by inquiries of different companies producing chipboards.

*Table 101: Activity data and emissions from Chipboard Production 1990–2002*

| Year | Production [t] | Emissions [Gg] | |
|---|---|---|---|
| | Chipboard | NOx | NMVOC |
| 1990 | 1 121 786 | 0.55 | 0.40 |
| 1991 | 1 182 574 | 0.58 | 0.43 |
| 1992 | 1 152 004 | 0.57 | 0.42 |
| 1993 | 1 115 349 | 0.55 | 0.40 |
| 1994 | 1 167 307 | 0.57 | 0.42 |
| 1995 | 1 194 262 | 0.59 | 0.43 |
| 1996 | 1 194 262 | 0.59 | 0.43 |
| 1997 | 1 353 000 | 0.67 | 0.49 |
| 1998 | 1 332 015 | 0.66 | 0.48 |
| 1999 | 1 332 015 | 0.66 | 0.48 |
| 2000 | 1 509 673 | 0.74 | 0.54 |
| 2001 | 1 670 903 | 0.82 | 0.60 |
| 2002 | 1 670 903 | 0.82 | 0.60 |

| Year | Production [t] | Emissions [Gg] | |
|---|---|---|---|
| | Chipboard | NOx | NMVOC |
| *Trend 1990-2002* | *+49%* | *+49%* | *+49%* |

#### 5.5.1.3 Planned Improvements

In chipboard production gas and wood dust are used as fuels. As wood dust accumulates as waste material during chipboard production it is not reported as a fuel in the energy balance, where fuel gas is reported and included in the fuel input of SNAP Category 03 *Combustion in Production Processes*.

As the used emission factor from SNAP Category 040601 Chipboard Production refers to all emissions from chipboard production but emissions due combustion of fuel gas in chipboard production are also included in SNAP 03, these emissions are counted double. However, it is not possible to separate emissions due to combustion of wood dust from gas as no detailed fuel input figures for chipboard production are available. Further investigation of this subject is planned and if possible the double count will be eliminated.

#### 5.5.1.4 Recalculation

Activity data for the year 2001 was updated using statistical data, for the last submission this value was not available.

### 5.5.2 Food and Drink (2 D 2)

#### 5.5.2.1 Source Category Description

This category includes NMVOC emissions from the production of bread, wine, sprits and beer.

Table 102 presents NMVOC emissions from *Food and Drink Production* for the period from 1990 to 2002. As a constant emission factor was used for estimating these emissions, the emissions followed the changes in production of food and drink.

*Table 102: NMVOC emissions from Food and Drink Production 1990–2002*

| Year | NMVOC Emissions [Gg] | | | | |
|---|---|---|---|---|---|
| | Bread | Wine | Beer | Spirits | Total |
| 1990 | 0.91 | 0.21 | 0.20 | 0.58 | 1.89 |
| 1991 | 0.93 | 0.20 | 0.20 | 0.68 | 2.01 |
| 1992 | 0.97 | 0.17 | 0.20 | 0.55 | 1.89 |
| 1993 | 0.98 | 0.12 | 0.20 | 0.56 | 1.86 |
| 1994 | 1.02 | 0.17 | 0.20 | 0.50 | 1.89 |
| 1995 | 1.01 | 0.14 | 0.19 | 0.58 | 1.93 |
| 1996 | 1.01 | 0.14 | 0.19 | 0.58 | 1.92 |
| 1997 | 1.08 | 0.12 | 0.19 | 0.58 | 1.96 |

| Year | NMVOC Emissions [Gg] | | | | |
|---|---|---|---|---|---|
| | Bread | Wine | Beer | Spirits | Total |
| 1998 | 1.25 | 0.18 | 0.18 | 0.58 | 2.18 |
| 1999 | 1.24 | 0.18 | 0.18 | 0.58 | 2.18 |
| 2000 | 1.28 | 0.15 | 0.17 | 0.58 | 2.19 |
| 2001 | 1.33 | 0.16 | 0.17 | 0.58 | 2.24 |
| 2002 | 1.33 | 0.16 | 0.17 | 0.58 | 2.24 |
| *Trend 1990-2002* | *+47%* | *-20%* | *-13%* | *+0%* | *+19%* |

As can be seen in the table, NMVOC emissions varied during the period, but the overall trend was increasing NMVOC emissions. From 1990 to 2002 NMVOC emissions from this category increased by 19%.

#### 5.5.2.2 Methodological Issues

Emissions were calculated by multiplying the annual production with an emission factor.

The following emission factors were applied:

Bread: 4 200 $kg_{NMVOC}/Mg_{bread}$

Wine: 65 $kg_{NMVOC}/hl_{wine}$

Beer: 20 $kg_{NMVOC}/hl_{beer}$

Spirits: 2 000 $kg_{NMVOC}/hl_{spirit}$

All emission factors were taken from [BUWAL, 1995] because of the very similar structures and standards of industry in Austria and Switzerland.

Activity data was taken from national statistics (STATISTIK AUSTRIA), for the year 2002 no activity data was available, that's why the value of 2001 was also used for 2002. Table 103 presents activity data for bread, wine, beer and spirits production for the period from 1990 to 2002.

*Table 103: Activity data of Food and Drink Production 1990–2002*

| Year | Spirits [hl] | Beer [hl] | Wine [hl] | Bread [t] |
|---|---|---|---|---|
| 1990 | 289 134 | 9 799 090 | 3 166 290 | 215 992 |
| 1991 | 338 189 | 9 971 470 | 3 093 259 | 221 149 |
| 1992 | 274 182 | 10 176 200 | 2 588 215 | 229 858 |
| 1993 | 279 831 | 9 788 520 | 1 865 479 | 233 729 |
| 1994 | 249 777 | 9 934 764 | 2 646 635 | 241 691 |
| 1995 | 289 676 | 9 473 950 | 2 228 969 | 241 601 |
| 1996 | 289 676 | 9 370 693 | 2 110 332 | 241 601 |
| 1997 | 289 676 | 9 303 437 | 1 801 747 | 256 055 |
| 1998 | 289 676 | 8 836 673 | 2 703 170 | 296 695 |
| 1999 | 289 676 | 8 884 269 | 2 803 383 | 294 843 |
| 2000 | 289 676 | 8 725 404 | 2 338 410 | 305 845 |

| Year | Spirits [hl] | Beer [hl] | Wine [hl] | Bread [t] |
|---|---|---|---|---|
| 2001 | 289 676 | 8 527 566 | 2 530 576 | 316 744 |
| 2002 | 289 676 | 8 527 566 | 2 530 576 | 316 744 |

#### 5.5.2.3 Recalculations

Activity data for the year 2001 was updated using statistical data, for the last submission this value was not available.

# 6 SOLVENT AND OTHER PRODUCT USE (NFR SECTOR 3)

## 6.1 Sector Overview

This chapter describes the methodology used for calculating 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 $CO_2$.

### 6.1.1 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 104) due to the positive impact of the enforced laws and regulations in Austria[11] (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 104: Trend in emissions of Category 3 Solvent and Other Product Use 1990 – 2002*

| | NMVOC [Gg] | | | | | $NH_3$ [Gg] |
|---|---|---|---|---|---|---|
| | 3 A | 3 B | 3 C | 3 D | Total | |
| 1990 | 46.31 | 13.90 | 18.76 | 37.99 | 116.95 | 2.00 |
| 1991 | 38.21 | 11.40 | 16.91 | 33.56 | 100.08 | 2.00 |
| 1992 | 29.89 | 8.93 | 15.16 | 28.35 | 82.33 | 2.00 |
| 1993 | 29.17 | 8.82 | 14.24 | 30.20 | 82.43 | 2.00 |
| 1994 | 26.04 | 8.07 | 13.15 | 29.81 | 77.06 | 2.00 |
| 1995 | 26.57 | 8.57 | 12.42 | 34.18 | 81.75 | 2.00 |
| 1996 | 24.54 | 8.40 | 12.11 | 33.02 | 78.07 | 2.00 |
| 1997 | 25.56 | 9.28 | 12.08 | 36.02 | 82.93 | 2.00 |
| 1998 | 22.33 | 8.59 | 11.62 | 33.00 | 75.54 | 2.00 |
| 1999 | 19.84 | 8.10 | 11.22 | 30.81 | 69.96 | 2.00 |
| 2000 | 21.66 | 9.38 | 11.33 | 35.38 | 77.74 | 2.00 |
| 2001 | 23.48 | 9.58 | 11.77 | 37.80 | 82.63 | 2.00 |
| 2002 | 23.48 | 9.58 | 11.77 | 37.80 | 82.63 | 2.00 |
| *Trend 1990 – 2002* | *-49%* | *-31%* | *-37%* | *-1%* | *-29%* | *0.00%* |

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

### 6.1.2 Completeness

Table 105 gives an overview of the NFR 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 105: Overview of subcategories of NFR Category Solvent and Other Product Use: transformation into SNAP Codes and status of estimation*

| NFR Category | SNAP | | NMVOC | $NH_3$ |
|---|---|---|---|---|
| 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 | ✓ |

## 6.2 Methodological Issues

### 6.2.1 Methodology Overview

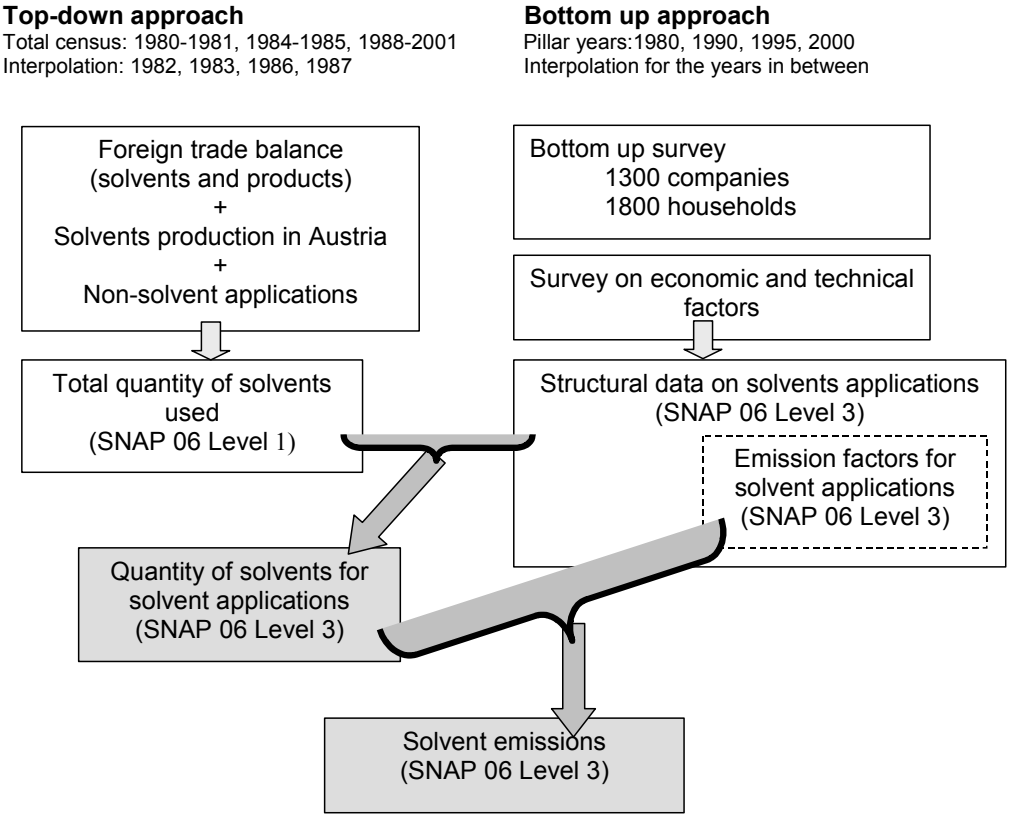
To determine the quantity of solvents used in Austria in the various applications, a bottom up and a top down approach were combined. Figure 7 presents an overview of the methodology.

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 used annually 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 7: Overview of the methodology for solvent emissions*



### 6.2.2 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. ą 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.

### 6.2.3 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 106).

*Table 106: 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 107: 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 108: 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 : con- | ***2000*** | **91%** | **9%** | **19%** | **4%** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | struction and buildings | ***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 109: 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% |

### 6.2.4 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 110). The differences between the quantities of solvents from the top down approach and bottom up approach respectively are lower than 10%. Table 110 shows the range of the differences in the considered pillar years broken down to the 15 substance categories.

*Table 110: 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 111 and Table 112)

*Table 111: Activity data (Use of Solvents) 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 112: 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 |

### 6.2.5 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 113 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% (expert judgement, details see table below). As for the statistical data, the uncertainty is higher in 1990 than in 2000.

*Table 113: Uncertainties of Top down approach*

| | Data source | 1990 | 1995 | 2000 |
|---|---|---|---|---|
| Substances | National statistics STAT.A, foreign trade balance | +2,5 to – 2,5 % | +1,5 to –1,5 % | +0,5 to –0,5 % |
| Products | National statistics STAT.A, foreign trade balance | +10 to –10 % | +5 to –5 % | +2,5 to –2,5 % |
| Solvent Production | National production statistics STAT.A, | 0 | 0 | 0 |
| Non solvent applications | Surveys in relevant companies | +5 to –5 % | +2,5 to –2,5 % | +1,5 to –1,5 % |

Table 114 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 114: Uncertainties of Bottom- up approach*

| | 1990 | 1995 | 2000 |
|---|---|---|---|
| Emissions factor | 86% | 63% | 58% |
| Uncertainty – emissions factor | +10 to –10% | +7 to –7% | +5 to 5% |

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 115.

*Table 115: Uncertainties of Sector 6 Solvent and other product use*

| | 1990 | 1999 | 2000 |
|---|---|---|---|
| Uncertainty solvent emissions | -21 to +24% | -18 to +21% | -13 to +14% |

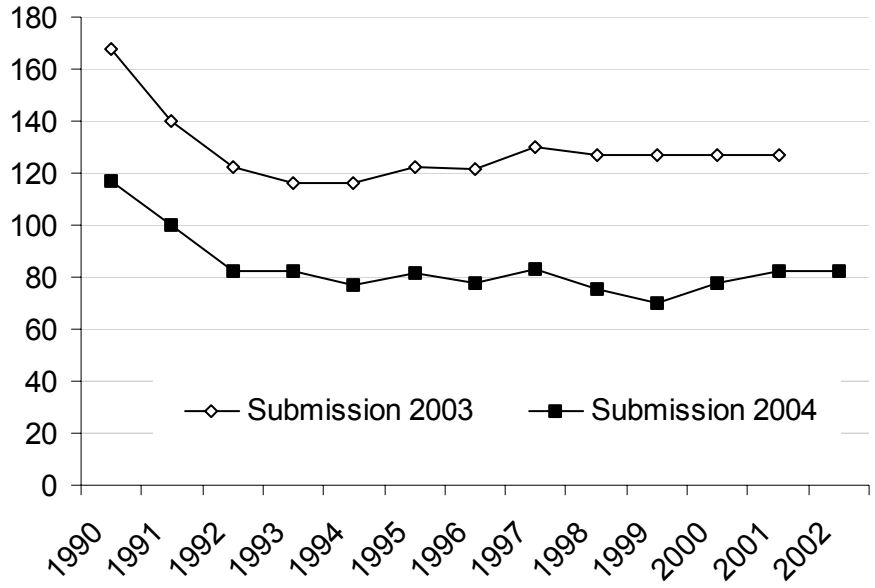
### 6.2.6 Recalculations

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.

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 8: Recalculations of Category 3 Solvent and Other Product Use*



# 7 AGRICULTURE (NFR SECTOR 4)

## 7.1 Sector Overview

This chapter includes information on the estimation of $NH_3$, $NO_X$ and NMVOC emissions of the sector *Agriculture* in Austria corresponding to the data reported in Category 4 of the NFR format. It describes the calculations of source categories *4 B Manure Management, 4 D Agricultural Soils* and *4 F Field Burning of Agricultural Wastes.*

An inventory improvement program has been launched in 2001. Key issues of the implemented improvements of this sector are described in the corresponding *Recalculations* chapters of each subchapter.

To give an overview of Austria's farm structure 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 each. More than 85 000 holdings are classified as situated in less favoured areas. Mountainous areas account for 70% of Austria's federal territory, which is the highest share of all EU countries.

The agricultural area comprises 3.4 million hectares corresponding to ~ 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 a year, litter meadows, rough pastures, Alpine pastures and mountain meadows)
- 2% other types of agricultural land-use (vineyards, orchards, house gardens, vine and tree nurseries)
-

### 7.1.1 Emission Trends

**Emission trends per gas**

In the year 2002 the sector *Agriculture* contributed 95.9% to Austria's $NH_3$ emissions. The trend from 1990 to 2002 shows a decrease of 8.5%. The share of this sector's $NO_X$ emissions in national total emissions is 2.4%. From 1990 to 2002, $NO_X$ emissions from Agriculture decreased by 12.2%.

In 2002, NMVOC emissions contributed 1.0% to Austria's total emissions and increased by 0.3% in the reported period. $SO_2$ emissions of sector *Agriculture* only contribute 0.01% to the Austrian total, and decreased by 1.6% 1990 to 2002.

*Table 116: Emissions and trends from Sector 4 Agriculture 1990-2002*

| Gas | Emissions [Gg] | | | | | | | | | | | | | *Trend 1990-2002* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | |
| $NH_3$ | 55.54 | 56.52 | 53.04 | 54.83 | 56.42 | 55.94 | 54.42 | 55.74 | 54.94 | 53.66 | 51.98 | 52.23 | 50.84 | *-8.5%* |
| $NO_X$ | 5.52 | 5.92 | 4.95 | 5.37 | 5.92 | 5.43 | 5.22 | 5.57 | 5.27 | 5.16 | 5.10 | 5.17 | 4.85 | *-12.2%* |
| NMVOC | 1.94 | 1.93 | 1.87 | 1.84 | 1.90 | 1.91 | 1.89 | 1.97 | 1.93 | 1.97 | 1.87 | 1.95 | 1.94 | *0.3%* |
| $SO_2$ | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | *-1.6%* |

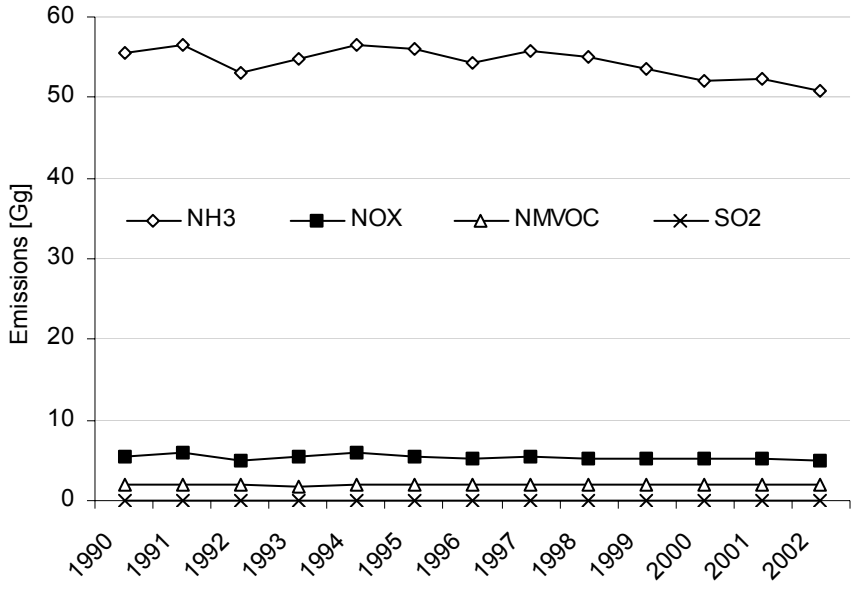



*Figure 9: Emissions from NFR Category 4 Agriculture 1990-2002*

### Emission trends per sector

Table 117 presents emissions and their trends 1990-2002 from sector *Agriculture* by gas and source categories as well as the contribution to the national total emissions.

*Table 117: Emissions and trend 1990-2002 from sector Agriculture by gas and source categories*

| | $NH_3$ | | | $NO_x$ | | | NMVOC | | | $SO_2$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 4 B | 4 D | 4 F | 4 B | 4 D | 4 F | 4 B | 4 D | 4 F | 4 B | 4 D | 4 F |
| 1990 | 47.17 | 8.35 | 0.03 | NA | 5.52 | 0.01 | NA | 1.72 | 0.22 | NA | NA | 0.003 |
| 1991 | 47.15 | 9.34 | 0.03 | NA | 5.91 | 0.01 | NA | 1.71 | 0.22 | NA | NA | 0.003 |
| 1992 | 45.80 | 7.22 | 0.03 | NA | 4.94 | 0.01 | NA | 1.65 | 0.22 | NA | NA | 0.003 |
| 1993 | 46.85 | 7.95 | 0.03 | NA | 5.36 | 0.01 | NA | 1.62 | 0.22 | NA | NA | 0.003 |
| 1994 | 46.92 | 9.48 | 0.03 | NA | 5.91 | 0.01 | NA | 1.68 | 0.22 | NA | NA | 0.003 |
| 1995 | 47.63 | 8.29 | 0.03 | NA | 5.42 | 0.01 | NA | 1.69 | 0.22 | NA | NA | 0.003 |
| 1996 | 46.56 | 7.83 | 0.03 | NA | 5.21 | 0.01 | NA | 1.67 | 0.22 | NA | NA | 0.003 |
| 1997 | 46.82 | 8.89 | 0.03 | NA | 5.57 | 0.01 | NA | 1.75 | 0.22 | NA | NA | 0.003 |
| 1998 | 46.74 | 8.17 | 0.03 | NA | 5.26 | 0.01 | NA | 1.71 | 0.22 | NA | NA | 0.003 |
| 1999 | 45.51 | 8.12 | 0.03 | NA | 5.15 | 0.01 | NA | 1.75 | 0.22 | NA | NA | 0.003 |
| 2000 | 44.14 | 7.81 | 0.03 | NA | 5.09 | 0.01 | NA | 1.66 | 0.22 | NA | NA | 0.003 |
| 2001 | 44.27 | 7.93 | 0.03 | NA | 5.16 | 0.01 | NA | 1.73 | 0.22 | NA | NA | 0.003 |
| 2002 | 43.13 | 7.69 | 0.03 | NA | 4.84 | 0.01 | NA | 1.73 | 0.22 | NA | NA | 0.003 |
| *Trend 1990-2002* | *-8.6%* | *-7.9%* | *-3.9%* | -- | *-12.2%* | *-2.3%* | -- | *0.8%* | *-3.4%* | -- | -- | *-1.6%* |
| *Share in National Total 2002* | *81.4%* | *14.5%* | *0.0%* | -- | *2.4%* | *0.0%* | -- | *0.9%* | *0.1%* | -- | -- | *0.01%* |

As can be seen from the table, $NH_3$ emissions from *Manure Management* are the most important source with regard to the contribution to national total emissions: in 2002 this source had a share of 81.4% in the national total. The second important source with a share of 14.5% in total $NH_3$ emissions and 2.4% in total $NO_X$ emissions is *Enteric Fermentation*. The remaining emissions from agriculture are only minor sources.

### 7.1.2 Methodology

*Source Category 4 B:*

For the calculation of $NH_3$ emissions from cattle and swine the CORINAIR detailed methodology was applied, $NH_3$ emissions from the remaining livestock categories were estimated using the CORINAIR simple methodology.

*Source Category 4 D:*

The CORINAIR detailed method was applied for the estimation of $NH_3$ emissions from synthetic fertilizers as well as from organic fertilizers from the livestock categories cattle and swine. For sheep, horses and poultry the CORINAIR simple methodology was applied.

$NH_3$ emissions from legume cropland were estimated according the CORINAIR detailed methodology, $NH_3$ emissions from grassland and pastures were calculated using the CORINAIR simple method.

For the estimation of $NO_X$ and NMVOC emissions the CORINAIR simple method was used.

*Source Category 4 F:*

CORINAIR simple methodology was used.

Detailed descriptions of the methodologies applied are presented in Chapters 7.2 to 7.4.

### 7.1.3 Uncertainty Assessment

Table 118 presents uncertainties for emissions, for activity data and for emission factors applied. Uncertainties were estimated or provided by the CORINAIR Guidebook (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.

*Table 118: Uncertainties of Emissions and Emission Factors (Agriculture)*

| Categories | | $NH_3$ Emissions | $NO_X$ Emissions | NMVOC Emissions | EF $NH_3$ | EF $NO_X$ | EF NMVOC |
|---|---|---|---|---|---|---|---|
| 4 B 1 a | Dairy Cattle | -- | -- | -- | +/- 30% [2] | -- | -- |
| 4 B 1 b | Non-dairy Cattle | -- | -- | -- | +/- 30% [2] | -- | -- |
| 4 B 8 | Swine | -- | -- | -- | +/- 30% [2] | -- | -- |
| 4 B 3/4/6/9 | Sheep, Goats, Horses, Poultry | -- | -- | -- | +/- 30% [2] | -- | -- |
| 4 D | Agricultural Soils | +/- 25% [3] | +/- 18% [3] | -- | +/- 50% [2a] | -- | -- |
| Activity Data | | | | | | | |
| Animal population | | +/- 10% [1] | | | | | |
| Acricultural used land | | +/- 5% [1] | | | | | |

(1) [WINIWARTER & RYPDAL, 2001]
(2) CORINAIR
(2a) overall uncertainty of CORINAIR emission factors of all fertilizer types
(3) Calculation by expert (Monte Carlo Analysis), DI Gebetsroither (see also below under "Recalculation")

### 7.1.4 Recalculations

*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:*

The age class split for swine categories for the years 1990–1992 was adjusted because there was 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.

### 7.1.5 Completeness

Table 119 gives an overview of the NFR categories included in this chapter and presents the transformation matrix from SNAP categories. It also provides information on the completeness of emission estimates of all subcategories. A "✓" indicates that emissions from this subcategory were estimated.

*Table 119: Overview of subcategories of Category Agriculture: transformation into SNAP Codes and status of estimation*

| NFR Category | | SNAP | | Status | | | |
|---|---|---|---|---|---|---|---|
| | | | | $NO_X$ | $SO_2$ | $NH_3$ | NMVOC |
| **4 B** | **MANURE MANAGEMENT** | **1005** | **MANURE MANAGEMENT REGARDING ORGANIC COMPOUNDS** | ✓ | NA | ✓ | NA |
| | | **1009** | **MANURE MANAGEMENT REGARDING NITROGEN COMPOUNDS** | ✓ | NA | ✓ | NA |
| 4 B 1 | Cattle | -- | -- | NA | NA | ✓ | NA |
| 4 B 1 a | Dairy Cattle | 100501 | Dairy cows | NA | NA | ✓ | NA |
| 4 B 1 b | Non-Dairy Cattle | 100502 | Other cattle | NA | NA | ✓ | NA |
| 4 B 2 | Buffalo | 100514 | Buffalos | NO | NO | NO | NO |
| 4 B 3 | Sheep | 100505 | Ovines | NA | NA | ✓ | NA |
| 4 B 4 | Goats | 100511 | Goats | NA | NA | ✓ | NA |

| NFR Category | | SNAP | | Status | | | |
|---|---|---|---|---|---|---|---|
| | | | | $NO_X$ | $SO_2$ | $NH_3$ | NMVOC |
| 4 B 5 | Camels and Lamas | 100513 | Camels | NO | NO | NO | NO |
| 4 B 6 | Horses | 100506 | Horses | NA | NA | ✓ | NA |
| 4 B 7 | Mules and Asses | 100506 | Mules and asses | IE (1) | IE (1) | IE (1) | IE (1) |
| 4 B 8 | Swine | 100503 | Fattening pigs | NA | NA | ✓ | NA |
| 4 B 9 | Poultry | 100507<br>100509 | Laying hens<br>Other poultry (ducks, gooses,…) | NA | NA | ✓ | NA |
| 4 B 13 | Other | 100915 | Other animals | NO | NO | ✓ | NO |
| **4 C** | **RICE CULTIVATION** | 100103<br>100103 | Rice Field (with fertilizers)<br>Rice Field (without fertil-izers) | NO | NO | NO | NO |
| **4 D** | **AGRICULTURAL SOILS** | **1001**<br>**1002** | **CULTURES WITH FERTILIZERS**<br>**CULTURES WITHOUT FERTILIZERS** | ✓ | NA | ✓ | ✓ |
| 4 D 1 | Direct Soil Emissions | 100205<br>100206 | Grassland<br>Fallows | ✓ | NA | ✓ | ✓ |
| **4 F** | **FIELD BURNING OF AGRICULTURAL WASTE** | **1003** | **ON- FIELD BURNING OF STUBBLE, STRAW, …** | ✓ | ✓ | ✓ | ✓ |

(1) included in *4 B 6 Horses*, SNAP 100506

## 7.2 Manure Management (NFR Category 4 B)

This chapter describes the estimation of $NH_3$ emissions from housing, storage and spreading of animal excreta. In 2002, 84.8% of the agricultural $NH_3$ emissions arose from this category.

### 7.2.1 Source Category Description

From 1990 to 2002, $NH_3$ emissions from *Manure Management* decreased by 8.6% to 43.13 Gg. This is mainly due to the decrease of the livestock. 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 120: $NH_3$ emissions and trend from Manure Management 1990-2002 by subcategories and share in National Total.*

| Year | $NH_3$ Emissions [Gg] Livestock Category | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 4 B | 4 B 1 | 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 |
| | Total | Cattle | Dairy | N. Dairy | Sheep | Goats | Horses | Swine | Poultry | Other |
| 1990 | 47.17 | 28.63 | 12.56 | 16.08 | 0.82 | 0.10 | 0.43 | 11.71 | 5.48 | 0 |
| 1991 | 47.15 | 28.31 | 12.19 | 16.12 | 0.86 | 0.11 | 0.50 | 11.55 | 5.82 | 0 |
| 1992 | 45.80 | 27.02 | 11.75 | 15.28 | 0.83 | 0.10 | 0.53 | 11.81 | 5.50 | 0 |
| 1993 | 46.85 | 27.19 | 11.59 | 15.60 | 0.88 | 0.13 | 0.56 | 12.13 | 5.86 | 0.10 |
| 1994 | 46.92 | 27.53 | 11.81 | 15.72 | 0.90 | 0.13 | 0.58 | 11.93 | 5.74 | 0.10 |
| 1995 | 47.63 | 28.25 | 10.72 | 17.53 | 0.97 | 0.14 | 0.63 | 11.94 | 5.59 | 0.11 |
| 1996 | 46.56 | 27.84 | 10.69 | 17.15 | 1.01 | 0.14 | 0.64 | 11.61 | 5.21 | 0.11 |
| 1997 | 46.82 | 27.32 | 11.15 | 16.17 | 1.01 | 0.15 | 0.64 | 11.64 | 5.90 | 0.15 |
| 1998 | 46.74 | 27.01 | 11.39 | 15.62 | 0.95 | 0.14 | 0.65 | 12.14 | 5.70 | 0.13 |
| 1999 | 45.51 | 26.91 | 11.02 | 15.90 | 0.93 | 0.15 | 0.71 | 10.97 | 5.74 | 0.10 |
| 2000 | 44.14 | 26.89 | 9.90 | 16.99 | 0.90 | 0.15 | 0.72 | 10.64 | 4.74 | 0.10 |
| 2001 | 44.27 | 26.31 | 9.62 | 16.69 | 0.85 | 0.16 | 0.74 | 11.11 | 5.01 | 0.10 |
| 2002 | 43.13 | 25.76 | 9.57 | 16.19 | 0.80 | 0.15 | 0.74 | 10.57 | 5.01 | 0.10 |
| *Trend 1990-2002* | *-8.6%* | *-10.1%* | *-23.8%* | *0.7%* | *-1.8%* | *54.9%* | *72.8%* | *-9.8%* | *-8.6%* | *--* |
| *Share in Austrian Total 2002* | *81.4%* | *48.6%* | *18.1%* | *30.5%* | *1.5%* | *0.3%* | *1.4%* | *19.9%* | *9.4%* | *0.2%* |

### 7.2.2 Methodological Issues

Ammonia emissions from manure management are estimated according to the CORINAIR guidebook. The guidebook outlines a simple and a detailed methodology. Ammonia emissions from cattle and swine are estimated with the detailed methodology, as these are the most important livestock categories. Due to a lack in data availability, $NH_3$ emissions from the remaining livestock categories were estimated with the simple methodology. These livestock categories contribute about 16% to total $NH_3$ emissions from the agricultural sector.

## Activity data

*Livestock Numbers*

Official Austrian statistics [STATISTIK AUSTRIA, 2002] provide 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].

The 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 121: 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 122: 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%* |

*… Due to inconsistences of the statistical data set the age class split for swine categories for the years 1990-1992 was adjusted using the split from 1993.

*Manure Management Systems*

In Austria national statistics on manure management systems are not available. Up to now, a single comprehensive survey has been performed [KONRAD, 1995]. The survey was carried out from 1989 to 1992 and was first published in 1992 (Table 123). According to expert judgements a differentiation between conventional and organic systems would result in very high uncertainties. Thus, Austria's manure management systems distribution is estimated with data collected by [KONRAD, 1995] for the whole period of 1990-2002.

*Table 123: Manure Management System distribution in Austria taken from [KONRAD, 1995]*

| Livestock category | Liquid/Slurry [%] | Solid Storage [%] | Pasture/range/paddock [%] |
|---|---|---|---|
| dairy cattle summer | 16.7 | 62.0 | 21.3 |
| dairy cattle winter | 21.2 | 78.8 | --- |
| Dairy cattle winter/summer | 18.95 | 70.4 | 10.65 |
| suckling cows summer | 16.7 | 62.0 | 21.3 |
| suckling cows winter | 21.2 | 78.8 | --- |
| suckling cows winter/summer | 18.95 | 70.4 | 10.65 |
| cattle 1 –2 years summer | 7.7 | 39.9 | 52.4 |
| cattle 1 –2 years winter | 16.2 | 83.8 | --- |
| cattle 1 –2 years winter/summer | 11.95 | 61.85 | 26.2 |
| cattle < 1 year | 28.75 | 71.25 | --- |
| non dairy cattle > 2 years | 48.6 | 51.4 | --- |
| breeding sows | 70 | 30 | --- |
| fattening pigs | 71.9 | 28.1 | --- |
| nursery and growing pigs | 81.38 | 18.62 | --- |

Manure management systems are distinguished for *Dairy Cattle*, *Suckling Cows* and *Cattle 1–2 years* for summer and winter separetly (Table 123). 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 each last for six months.

Estimation of $NH_3$ emissions includes one additional aspect: the differentiation between tied and loose housing systems for dairy cattle because $NH_3$ emissions from tied systems are much lower than from loose housing systems. In Austria, 98% of the dairy cattle are kept in tied systems (KONRAD 1995). Thus, 98% of N is excreted in tied systems and 2% in loose housing systems. As there are currently no exact data available on manure management systems in Austrian animal husbandry, manure management system distribution within these two systems (solid system, liquid system, grazing) is assumed to be the same.

All other cattle livestock categories are assumed to be housed in loose houses.

#### 7.2.2.1 Cattle (4 B 1) and Swine (4 B 8)

In the detailed methodology, the flow of total ammoniacal nitrogen (TAN or mineral N) is followed through the manure management system. The relative volumes of flow through the different pathways are determined by country-specific information on animal husbandry and manure management systems, while the proportion volatilised as ammonia at each stage in the system is treated as a percentage, based on measured values and expert judgement.

The detailed methodology requires input data of animal numbers, nitrogen excretion and manure management systems.

Total $NH_3$ emissions from Category *4 B 1* and *4 B 8* are calculated as follows:

$$NH_{3\ Total} = NH_{3\ (housing)} + NH_{3\ (storage)} + NH_{3\ (spreading)}$$

**$NH_3$ emissions from housing**

$NH_3$ emissions from dairy cattle are estimated by multiplying N excretion with an emission factor for solid storage and liquid slurry systems, respectively:

| | | | | |
|---|---|---|---|---|
| $NH_3$ (solid storage) | = | Nex (solid storage) | x | EF(ss) |
| $NH_3$ (liquid slurry) | = | Nex (liquid slurry) | x | EF(ls) |

*The sum of both gives $NH_3$ emitted from housing:*

| | | | | |
|---|---|---|---|---|
| $NH_3$ (housing) | = | $NH_3$(solid storage) | + | $NH_3$ (liquid slurry) |

*Emission Factors*

Table 124 gives emission factors for $NH_3$ emissions from animal housing. As far as possible, Swiss default values as given in the CORINAIR guidelines have been chosen to compile the Austrian inventory. Swiss animal husbandry is closest to Austrian animal husbandry. If no CORINAIR emission factors from Switzerland were available, the CORINAIR German default values were used.

*Table 124. Emission factors for $NH_3$ emissions from animal housing used in the Austrian inventory*

| Manure management system | CORINAIR Emission factor [kg $NH_3$ (kg N excreted)$^{-1}$] |
|---|---|
| Dairy cattle, tied systems, liquid slurry system | 0.04[1] |
| Dairy cattle, tied systems, solid storage system | 0.039[1] |
| Diary cattle, loose houses, liquid slurry system | 0.118[1] |
| Diary cattle, loose houses, solid storage system | 0.118[1] |

| | |
|---|---|
| Other cattle, loose houses, liquid slurry system | 0.118[1] |
| Other cattle, loose houses, solid storage system | 0.118[1] |
| Fattening pigs, liquid slurry system | 0.15[2] |
| Fattening pigs, solid storage system | 15 % of total N + 30 % of the remaining TAN[2] |
| Sows plus litter, liquid slurry system | 0.167[1] |
| Sows plus litter, solid storage system | 0.167[1] |

[1]…DÖHLER ET AL., 2001
[2]…EIDGENÖSSISCHE FORSCHUNGSANSTALT, 1997

*N excretion by manure management system*

Country-specific N excretion rates for Austrian cattle and swine were calculated using following formula:

N excretion per animal waste management system:

$$Nex_{(AWMS)} = \sum_{(T)} [N_{(T)} \times Nex_{(T)} \times AWMS_{(T)}]$$

$Nex_{(AWMS)}$ = N excretion per animal waste management system [kg $yr^{-1}$]
$N_{(T)}$ = number of animals of type T in the country (see Table 121)
$Nex_{(T)}$ = N excretion of animals of type T in the country [kg N $animal^{-1}$ $yr^{-1}$] (see Table 125 and Table 126)
$AWMS_{(T)}$ = 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 (see Table 123)
(T) = type of animal category

N excretion from Austrian *Dairy Cattle* was estimated according to [GRUBER & STEINWIDDER, 1996], who intensively reviewed research on N excretion versus annual milk yield (Table 125).

*Table 125: 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 126). 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 126).

*Table 126: N excretion values used for calculation of $NH_3$ emissions from Manure Management*

| Livestock category | Nitrogen excretion [kg per animal per yr] | Livestock category | Nitrogen excretion [kg per animal per yr] |
|---|---|---|---|
| suckling cows[1] | 51.9[2] | Sheep | 20.0[6] |
| cattle 1 – 2 years | 42.2[2] | Goats | 20.0[6] |
| cattle < 1 year | 16.0[3] | Horses | 50.0[7] |
| cattle > 2 years | 60.0[4] | Chicken | 0.8[6] |
| breeding sows[5] | 26.9[2] | Other Poultry | 2.0[7] |
| fattening pigs | 15.0[4] | 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

### $NH_3$ emissions from storage

$NH_3$ emissions from storage are estimated from the amount of N left in the manure when the manure enters the storage. This amount of N is calculated as following:

From total N excretion the N excreted during grazing (see above) and the $NH_3$-N losses from housing (see above) are subtracted. The remaining N enters the store.

*Emission Factors*

During manure storage, $NH_3$ is lost. These losses are estimated with CORINAIR default emission factors given in Table 127.

*Table 127. $NH_3$-emission factors for manure storage*

| Manure storage system | CORINAIR Emission factor [kg $NH_3$ (kg TAN)$^{-1}$] |
|---|---|
| Cattle, liquid slurry system | 0.15[1] |
| Cattle, solid storage system | 0.30[1] |
| Pigs, liquid slurry system | 0.12[1] |
| Pigs, solid storage system | 0.30[1] |

[1]…EIDGENÖSSISCHE FORSCHUNGSANSTALT, 1997

Emission factors only distinguish between cattle and pigs and between liquid slurry systems and solid storage systems (farmyard manure). According to the CORINAIR guidelines, uncertainties in ammonia emission factors are about ± 30%. As there is currently no information on storage systems in Austria, it is not possible to estimate $NH_3$ emissions from manure store more accurately.

*TAN content in excreta*

The detailed method makes use of the total ammoniacal nitrogen (TAN) when calculating

emissions. The initial share of TAN must be known as well as any transformation rates between organic N and TAN. TAN content for Austrian cattle and pig manure is given in [SCHECHTNER, 1991].

*Table 128: TAN content for Austrian cattle and pig manure after SCHECHTNER (1991)*

| Manure | TAN content for Austria [%] |
|---|---|
| cattle – solid storage system | 15.0 |
| cattle – liquid slurry system | 50.0 |
| pig – solid storage system | 19.5 |
| pig – liquid slurry system | 65.0 |

**Land spreading of animal excreta**

Manure application is connected with $NH_3$ and $N_2O$ losses that depend on the amount of manure N. The amount of N left in the manures after housing and storage was calculated as follows:

From total N excretion by Austrian livestock (see Table 125 and Table 126), the following is subtracted:

- $NH_3$-N losses from the housing (see below)
- $NH_3$-N losses during manure storage (see below)
- $N_2O$-N losses from manure management (see NIR 2004)
- N excreted during grazing (see formula N excretion per animal waste management system given in chapter "$NH_3$ emissions from housing")

The remaining N (calculated for each relevant animal category) is spread to agricultural soils ("manure N left for spreading").

*$NH_3$-N losses are calculated as follows:*

$$NH_3\text{-N} = NH_3\text{-emissions}_{(housing,\ storage)} * (14/17)$$

*$N_2O$-N losses are calculated as follows:*

$$N_2O\text{-N} = N_2O\text{-emissions}_{(manure\ management)} * (28/44)$$

$NH_3$

For *cattle and swine* the detailed CORINAIR Methodology (Tier 2) was applied.

This method distinguishes between the kind of waste produced by each animal sub-category: solid manure and liquid slurry. This is relevant, because TAN contents and therefore $NH_3$ emissions are highly dependent on the quality of waste and organic matter content in slurry. Furthermore, the detailed methodology suggests different $NH_3$-emission-factors depending on the target of land spreading: emissions are thought to be higher on grassland soils than on cropland soils, due to infiltration of applied animal waste being slower there.

$$NH_3\text{-N}_{spread} = N_{exLFS} * (Frac_{SS} * F_{TAN\ SS} * EF\text{-}NH_{3\ spread\ SS} + Frac_{LS} * F_{TAN\ LS} * EF\text{-}NH_{3\ spread\ LS})$$

$NH_3$-$N_{spread}$ = $NH_3$-N emissions driven by intentional spreading of animal waste from Manure Management systems on agricultural soils (droppings of grazing animals are not included!)

| | | |
|---|---|---|
| $N_{exLFS}$ | = | Annual amount of nitrogen in animal excreta left for spreading on agricultural soils, corrected for losses during manure management; it does not include nitrogen from grazing animals (see above) |
| $Frac_{SS}$ | = | Fraction of nitrogen left for spreading produced as farmyard manure in a solid waste management system (see Table 123) |
| $Frac_{LS}$ | = | Fraction of nitrogen left for spreading produced as liquid slurry in a liquid waste management system (see Table 123) |
| $F_{TAN\ SS}$ | = | Fraction of total ammoniacal nitrogen (TAN) in animal waste produced in a solid waste management system (see Table 128) |
| $F_{TAN\ LS}$ | = | Fraction of total ammoniacal nitrogen (TAN) in animal waste produced as slurry in a liquid waste management system (see Table 128) |
| $EF\text{-}NH_{3\ spread\ SS}$ | | Emission factor for $NH_3$ from animal waste from solid manure system (farmyard manure) spread on agricultural soils (see below) |
| $EF\text{-}NH_{3\ spread\ LS}$ | | Emission factor for $NH_3$ from animal waste from liquid slurry waste management system spread on agricultural soils (see below) |

No appropriate Austrian specific data were available to use different emission factors depending on the target of spreading, i.e. whether animal waste is spread on grassland or cropland soils. Thus, following assumptions were made:

- To avoid underestimation of emissions, emission factors for spreading without incorporation were used.
- Animal waste from solid systems (farmyard manure) is spread on cropland soils only. This is in compliance with CORINAIR detailed method, which does not provide an emission factor for spreading of solid waste on grassland soils.
- For liquid slurry it was assumed, that cattle slurry is applied to grassland soils, while pig slurry is applied to arable soils. This assumption is driven by the idea, that feed for pig husbandry is produced on cropland soils, while fertilized grassland soils serve as feed producing area for cattle husbandry. CORINAIR default values were used:

  Cattle: spreading of liquid slurry on grassland: 0,6

  Pigs: spreading of liquid slurry on arable land: 0,25

#### 7.2.2.2 Sheep (4 B 3), Goats (4 B 4), Horses (4 B 6), Poultry (4 B 9) and Other Animals (4 B 13)

The simple methodology uses an average emission factor per animal for each livestock category and multiplies this factor by the number of animals counted in the annual agricultural census. Table 129 presents the recommended ammonia emission factors for the different livestock categories given in the CORINAIR guidelines.

Emission factors presented in Table 129 include emissions from housing and storage. Emissions from surface spreading of manures are calculated under "land spreading of animal excreta" (see below)

*Table 129: Default CORINAIR ammonia emission factors for the simpler methodology to calculate $NH_3$ emissions from manure management.*[1]

| NFR Category | Livestock category | $NH_3$ loss housing [kg $NH_3$ $head^{-1}$ $yr^{-1}$] | $NH_3$ loss storage [kg $NH_3$ $head^{-1}$ $yr^{-1}$] |
|---|---|---|---|
| 4 B 3 | Sheep [2] | 0.24 | |
| 4 B 4 | Goats [2] | 0.24 | |
| 4 B 6 | Horses (mules and asses included) | 2.9 | |
| 4 B 9 | Laying hens | 0.19 | 0.03 |
| 4 B 9 | Other Poultry (ducks, geese, turkeys) | 0.48 | 0.06 |
| 4 B 13 | Other animals | 0.24 | |

[1] Emissions are expressed as kg $NH_3$ per animal, as counted in the annual agricultural census
[2] The emission factors are calculated for female adult animals; the emissions of the young animals are included in the given values.

The CORINAIR guidelines do not give default values for $NH_3$ emissions from the livestock category *Other Animals*. In Austria deer dominates this livestock category. $NH_3$ emissions from *Other Animals* are assumed to be similar to $NH_3$ emissions from grazing sheep (0.88 kg $NH_3$ $head^{-1}$ $yr^{-1}$). This is the most similar livestock category to deer as deer are kept on pasture.

CORINAIR distinguishes the livestock category "chicken" into "laying hens" and "broilers". In Austria chicken numbers are not distinguished. Thus, $NH_3$ emissions from both laying hens and broilers are estimated with the laying hen emission factor (and therefore slightly overestimated).

**Land spreading of animal excreta**

For *Sheep, Horses, Poultry* the simple CORINAIR methodology is applied:

The share of mineral N (total ammoniacal nitrogen, TAN) is estimated by application of a default factor for each animal waste category. $NH_3$ losses are derived in a second step based on TAN values by application of an CORINAIR default emission factor ($EF\text{-}NH_{3\ spread}$), which is also dependent on the quality of animal waste.

$$NH_3\text{-}N_{spread} = N_{exLFS} * Frac_{TAN} * EF\text{-}NH_{3\ spread}$$

$NH_3\text{-}N_{spread}$ = Emissions of $NH_3$-N driven by intentional spreading of animal waste from manure management systems on agricultural soils (droppings of grazing animals are not included) [t N]
$N_{exLFS}$ = Annual amount of nitrogen in animal excreta left for spreading on agricultural soils, corrected for losses during manure management; it does not include nitrogen from grazing animals (see above).
$Frac_{TAN}$ = Fraction of total ammoniacal nitrogen (= mineral nitrogen) in animal manure [CORINAIR, 1996]
$EF\text{-}NH_{3\ spread}$ = Emission factor for $NH_3$ volatised from spreading of mineral nitrogen [CORINAIR, 1996]

### 7.2.3 Uncertainties

Uncertainties are presented in Table 118

### 7.2.4 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*

There was an inconsistency in the time series of swine in the statistical data set resulting from a changing methodology of the statistical survey in 1992/1993. For consistency reasons for the years 1990, 1991, 1992 the age class split from 1993 was used. The shift from young swine <50 kg to Fattening Pigs >50 kg led to significant higher emissions of those years.

*Table 130: Recalculation difference with respect to last year's submission of $NH_3$ emissions by sub-categories of Category 4 B*

| NFR Categories | [Gg $NH_3$ ] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| **4 B MANURE MANAGEMENT** | 4.74 | 4.70 | 4.71 | 0.08 | 0.53 | 0.70 | 0.61 | 0.55 | 0.47 | 0.36 | 0.25 | 0.45 |
| 4B1a Dairy | 0.05 | 0.05 | 0.05 | 0.04 | 0.49 | 0.66 | 0.57 | 0.50 | 0.42 | 0.32 | 0.21 | 0.34 |
| 4B3 Sheep | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 |
| 4B8 Swine | 4.67 | 4.64 | 4.65 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4B13 Other | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.03 | 0.03 | 0.04 | 0.03 | 0.03 | 0.02 | 0.10 |

### 7.2.5 Planned Improvements

In the next submission land spreading of animal excreta ($NH_3$ Emissions of organic fertilisers) will be reported under category 4 D 1.

A survey on Austria's distribution of manure management systems is planned to be started this year.

## 7.3 Agricultural Soils (4 D)

This chapter describes the estimation of ammonia ($NH_3$), nitrogen oxide ($NO_x$) and non-methane volatile organic compounds (NMVOC) emissions from source category *Agricultural Soils*. In 2002 15.1% of the agricultural $NH_3$ emissions, 99.9% of the agricultural $NO_x$ emissions and 88.9% of the agricultural NMVOC emissions arose from this source category.

### 7.3.1 Source Category Description

In 2002, $NH_3$ emissions from this source category contributed 14.5% to Austria's total. The emission trend shows a decrease by 7.9% since 1990. In the same period $NO_X$ emissions of Agricultural Soils decreased by 12.2%. In 2002 they contributed 2.4% to Austrian's total emissions. This source category's NMVOC emissions contribute only a negligible part (0.9% in 2002). The emissions are quite stable (0.8% over 1990 levels).

*Table 131: Emissions from Agricultural Soils by gas*

| | Sector 4 D by gas [Gg] | | |
|---|---|---|---|
| Year | $NH_3$ | $NO_x$ | NMVOC |
| 1990 | 8.35 | 5.52 | 1.72 |
| 1991 | 9.34 | 5.91 | 1.71 |
| 1992 | 7.22 | 4.94 | 1.65 |
| 1993 | 7.95 | 5.36 | 1.62 |
| 1994 | 9.48 | 5.91 | 1.68 |
| 1995 | 8.29 | 5.42 | 1.69 |
| 1996 | 7.83 | 5.21 | 1.67 |
| 1997 | 8.89 | 5.57 | 1.75 |
| 1998 | 8.17 | 5.26 | 1.71 |
| 1999 | 8.12 | 5.15 | 1.75 |
| 2000 | 7.81 | 5.09 | 1.66 |
| 2001 | 7.93 | 5.16 | 1.73 |
| 2002 | 7.69 | 4.84 | 1.73 |
| *Trend 1990-2002* | *-7.9%* | *-12.2%* | *0.8%* |
| *Share in Austrian Total 2002* | *14.5%* | *2.4%* | *0.9%* |

### 7.3.2 Methodological Issues

Emissions of $NH_3$, $NO_x$ and NMVOC were calculated following the CORINAIR methodology. Wherever feasible, the "detailed methodology" as recommended by CORINAIR has been applied. Detailed description of the methodologies applied are given in the following sub-chapters.

#### Activity Data

Data for necessary input parameters (activity data) were taken from the following sources:

*Table 132: Data sources for nitrogen input to Agricultural Soils*

| NFR Category | Activity | Data Sources |
|---|---|---|
| 4 D 1 | Synthetic Fertilizers | Mineral fertilizer consumption: [ELECTRONIC DATA HANDBOOK, 2001]<br>Urea fertilizer application in Austria: Sales data RWA, 2002(2) |
| 4 D 1 | Organic Fertilizers | Calculations following [GRUBER & STEINWIDDER, 1996] |
| 4 D 1 | Legume Cropland (N-fixing Crops) | Cropped area legume production: [GRÜNER BERICHT, 1999](1),<br>Land use [ha]: Ministerial Reports, [ELECTRONIC DATA HANDBOOK, 2001]<br>Harvest amount: [ELECTRONIC DATA HANDBOOK, 2001] |
| 4 D 1 | Grazing Animals | |

[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 (Raiffeisen Ware Austria, 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 133. From the different synthetic nitrogen or combined fertilizers applied in Austria, only between 2 and 6% are urea fertilizers.

*Table 133: Mineral fertiliser N consumption in Austria 1990-2002*

| 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]. Data of agricultural land use were taken from the [FEDERAL INSTITUTE OF AGRICULTURAL ECONOMICS 2003]

*Table 134: Legume cropping areas and agricultural land use, 1990-2002*

| Year | Legume Areas [ha] | | | | Land use Areas [1000 ha] | | |
|---|---|---|---|---|---|---|---|
| | peas | soja beans | horse/field beans | clover hey, lucerne,.. | Cropland (total) | Grassland (total) | Grassland (extensive) |
| 1990 | 40 619 | 9 271 | 13 131 | 57 875 | 1 408 | 1 993 | 846 |
| 1991 | 37 880 | 14 733 | 14 377 | 65 467 | 1 427 | 1 993 | 846 |
| 1992 | 43 706 | 52 795 | 14 014 | 64 379 | 1 418 | 1 993 | 846 |
| 1993 | 44 028 | 54 064 | 1 064 | 68 124 | 1 402 | 1 982 | 848 |
| 1994 | 38 839 | 46 632 | 10 081 | 72 388 | 1 403 | 1 982 | 848 |
| 1995 | 19 133 | 13 669 | 6 886 | 71 024 | 1 403 | 1 977 | 857 |
| 1996 | 30 782 | 13 315 | 4 574 | 72 052 | 1 403 | 1 977 | 857 |
| 1997 | 50 913 | 15 217 | 2 783 | 75 976 | 1 386 | 1 980 | 851 |
| 1998 | 58 637 | 20 031 | 2 043 | 76 245 | 1 386 | 1 980 | 851 |
| 1999 | 46 007 | 18 541 | 2 333 | 75 028 | 1 386 | 1 957 | 833 |
| 2000 | 41 114 | 15 537 | 2 952 | 74 266 | 1 382 | 1 957 | 833 |
| 2001 | 38 567 | 16 336 | 2 789 | 72 196 | 1 380 | 1 957 | 833 |
| 2002 | 41 605 | 13 995 | 3 415 | 75 429 | 1 379 | 1 957 | 833 |

Harvest data were taken from [BMLFUW, 2003], partly adopted from [JONAS & NIELSEN, 2002] and are presented in Table 135.

*Table 135: Harvest Data, 1990-2002*

| Year | Harvest [1000 t] | | | |
|---|---|---|---|---|
| | clover-hey | soja bean | horse-/fodderbean | peas |
| 1990 | 717 | 18 | 41 | 145 |
| 1991 | 797 | 37 | 37 | 133 |
| 1992 | 587 | 81 | 31 | 137 |
| 1993 | 628 | 103 | 29 | 107 |
| 1994 | 743 | 105 | 27 | 134 |
| 1995 | 823 | 31 | 17 | 60 |
| 1996 | 858 | 27 | 10 | 93 |
| 1997 | 962 | 34 | 6 | 162 |
| 1998 | 1 014 | 51 | 5 | 178 |
| 1999 | 1 025 | 50 | 6 | 140 |
| 2000 | 1440 | 33 | 7 | 97 |
| 2001 | 1349 | 34 | 7 | 112 |

| | | | | |
|---|---|---|---|---|
| 2002 | 1395 | 35 | 9 | 96 |

### 7.3.2.1 Application of fertilizers

*Synthetic fertilizers*

$NH_3$

For the calculation of $NH_3$ emissions from synthetic fertilizers CORINAIR detailed methodology was applied. This method uses specific $NH_3$ emission factors for different types of synthetic fertilizers and for different climatic conditions (see CORINAIR Emission Inventory Guidebook, Tab 5.1, p. B1010-15; Group III countries"). According to CORINAIR, Austria belongs to Group III "*temperate and cool temperate countries*" with largely acidic soils.

In Austria, full time-series data only for urea and non-urea synthetic fertilizers (see Table 133), but with no further specifications, are available. For urea the CORINAIR default value of 0.15 t $NH_3$-N per t of fertilizer-N was applied. As calcium-ammonium-nitrate and ammonium-nitrate fertilizers represent the dominant form of non-urea synthetic fertilizers being used in Europe [FREIBAUER AND KALTSCHMITT, 2001], an average emission factor of 0.02 t $NH_3$-N per t of fertilizer-N was applied (expert judgement ARC Seibersdorf GmbH) for fertilizers other than urea.

$NO_X$

CORINAIR simple methodology was applied. Emissions of $NO_x$ are calculated as a fixed percentage of total fertilizer nitrogen applied to soil. For all mineral fertilizer types the CORINAIR recommended emission factor, which is based on measured fertilizer losses, of 0,3 % (i.e. 0,003 t $NO_x$-N per t applied fertilizer-N) was applied.

*Organic Fertilizers*

Only $NO_X$-emissions are considered. $NH_3$ emissions are reported under source category *4 B* (see chapter 7.2.2 - land spreading of animal excreta).

$NO_x$ losses from animal manure spreading are not addressed explicitly in the CORINAIR Guidebook. [FREIBAUER AND KALTSCHMITT, 2001] suggest in their calculation of an European greenhouse gas inventory a conservative estimate of 1% of manure nitrogen being emitted in the form of $NO_x$-N. Following these recommendations, an emission factor of 0,01 t $NO_x$-N per t of organic fertilizer-N spread on agricultural soils was used.

#### 7.3.2.2 Unfertilised cultures

***Legume cropland***

$NH_3$

CORINAIR detailed methodology was applied using the CORINAIR default emission factor of 0.01 t of $NH_3$-N per t of N. 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 data (LCA) for the years 1990-2002 can be found in Table 134. Values for biological nitrogen fixation (120 kg N/ ha for peas, soy beans and horse/field beans and 160 kg N/ ha for clover- hey, respectively) were taken from a study by the Federal Environmental Agency [GÖTZ, 1998]; activity data remained constant over the time series.

$NO_X$

According to the CORINAIR guidebook definition, unfertilized cropland includes legume production on agricultural areas. For the calculation of $NO_X$ emissions from unfertilized cropland the CORINAIR simple methodology was applied.

Nitrogen input through legume crop residues is calculated according to the CORINAIR recommended procedure. Nitrogen fixed in biomass, given in annual harvest data (see Table 135) is multiplied with the expansion factor for crop residues [GÖTZ, 1998]. The same $NO_x$ emission factor as for emissions from synthetic fertilizers was applied (0.003 t $NO_x$-N per t applied fertilizer-N).

***Grassland and Pastures***

CORINAIR simple methodology was applied. According to the CORINAIR Guidebook, unfertilized pasture grassland represents areas that receive nitrogen through manure from grazing animals but no fertilizer inputs. For these areas the CORINAIR default value of 4 kg $NH_3$-N per ha was applied.

***NMVOC emissions from vegetation***

CORINAIR simple methodology was applied. Biogenic emissions from vegetation canopies of natural grasslands are derived as described in the following equation [CORINAIR, 1999, p. B 1104-7, Table 4.1]:

$$E\text{-}NMVOC = CA * \varepsilon\text{-}NMVOC * D * \Gamma$$

E-NMVOC = Annual NMVOC emissions from vegetation [t]
CA = Cropping area of vegetation [ha]
$\varepsilon$–NMVOC = NMVOC potential emission rate per unit of dry matter and time unit [mg / dry matter.hours]
D = Foliar biomass density [t dry matter / ha]
$\Gamma$ = Time integral (over 6 or 12 months) of emission hours. This value includes a correction variable that represents the effect of short-term temperature and solar radiation changes [hours]

This method is also suggested to be applied for fertilized cultures. The recommended parameter values for Austria are outlined in Table 134.

Aboveground biomass of agricultural crops was calculated using official cropping area (see Table 134) and expansion factors for leaves. For simplification, wheat was considered to be representative for the vegetation cover of agricultural crop land (see Table 136).

*Table 136: Cereal production in Austria*

| cereal production | |
|---|---|
| | harvest per area |
| Year | dt/ha |
| 1990 | 55.8 |
| 1991 | 54.6 |
| 1992 | 51.6 |
| 1993 | 51.0 |
| 1994 | 54.0 |
| 1995 | 55.1 |
| 1996 | 54.0 |
| 1997 | 59.2 |
| 1998 | 57.0 |
| 1999 | 59.5 |
| 2000 | 54.2 |
| 2001 | 58.7 |
| 2002 | 58.5 |

*Table 137: Parameters for calculation of NMVOC emissions from vegetation canopies of agriculturally used land (iso = isopren; mts = terpene; ovoc = other VOC's)*

| | Effective emission hours [a] (12 mon) | | | Biomass Density [b] D [t / ha] | Emission Potential [c] | | |
|---|---|---|---|---|---|---|---|
| | Γ-mts | Γ-ovoc [hours] | Γ–iso | | ε–iso | ε-mts | ε-ovoc [µg / g dry matter . hour] |
| Grassland | 734 | 734 | 540 | 0,4 | 0 | 0,1 | 1,5 |
| Alpine grassland | 734 | 734 | 540 | 0,2 | 0 | 0,1 | 1,5 |
| Agricultural crops | 734 | 734 | 540 | 0,585 [d] | 0,09 | 0,13 | 1,5 |

a) Γ = integrated effective emission hours, corrected to represent the effects of short term temperature and solar radiation changes on emissions

b) D = foliar biomass density (in t dry matter per ha)

c) ε = average emission potential

d) 2002-value (see Table 136)

The results are highly dependent on the assumptions about biomass density.

### 7.3.3 Uncertainties

The uncertainties presented in Table 138 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 138: Uncertainties of $NH_3$ and $NO_X$ emissions from acricultural soils*

| Direct soil emissions | Uncertainty (standard deviation) | |
|---|---|---|
| | $NH_3$ | $NO_X$ |
| Mineral fertilizer application | 51% | 18% |
| Animal waste application | 20% | |
| Unfertilized cultures | 27% | |
| **Total** | **25%** | **18%** |

For $NH_3$ uncertainty values between 25–51% were estimated, ammonia emissions from synthetic (mineral) fertilizer application showed the maximum of 51% uncertainty.

The overall uncertainty for this inventory (in terms of one standard deviation) was calculated to be around 25% for $NH_3$ and 18% for $NO_x$. The uncertainties are relatively constant over all years of the calculation period; the difference of uncertainties between years was found to be less than 3%.

### 7.3.4 Recalculations

*$NH_3$:*

Data for synthetic fertilizer use has been updated for the years 2000 to 2002. A lower application of urea (see Table 133) led to lower emissions in 2000 and 2001.

*$NO_x$:*

The adjustment of age class split for swine categories for the years 1990–1992 resulted in higher emissions for the years 1990-1992.

A higher mineral fertiliser use (see Table 133) in 2001 led to higher emissions of $NO_x$ in 2001

*NMVOC:*

Revised cereal harvest data per ha led to a slightly higher value in 2001.

*Table 139: Difference to submission 2003 of $NH_3$, $NO_X$, NMVOC emissions from Category 4 D Agricultural Soils*

| Gas | 4 D AGRICULTURAL SOILS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
| $NH_3$ [Gg] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.48 | -0.36 |
| $NO_X$ [Gg] | 0.32 | 0.32 | 0.32 | 0.00 | 0.05 | 0.07 | 0.06 | 0.05 | 0.05 | 0.03 | 0.02 | 0.15 |
| NMVOC [Gg] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |

### 7.3.5 Planned Improvements

In this submission $NH_3$ Emissions of organic fertilisers are reported under category 4 B, in the next submission these emissions will be reported under 4 D 1.

## 7.4 Field Burning of Agricultural Waste (4 F)

This category comprises $SO_2$, NMVOC, $NO_x$ and $NH_3$ emissions from burning straw and residual wood of vinicultures on open fields in Austria.

Burning agricultural residues on open fields in Austria is legally restricted by provincial law and since 1993 additionally by federal law and is only occasionally permitted on a very small scale. Therefore the contribution of emissions from this category to the total emissions is very low.

### 7.4.1 Source Category Description

In 2002, NMVOC emissions from this source category contributed 0.11% to Austria's total. The emission trend shows a decrease by 3.4% since 1990. In the same period $NH_3$ emissions of *Agricultural Soils* decreased by 3.9%. 2002 they contributed 0.05% to Austrian's total emissions. This source category's $SO_2$ and $NO_X$ emissions contribute only a negligible part to Austria's total, their trends are slightly decreasing.

*Table 140: Emissions from Field Burning of Agricultural Waste by gas*

| Year | Sector 4 F by gas [Gg] | | | |
|---|---|---|---|---|
| | $SO_2$ | $NH_3$ | $NO_x$ | NMVOC |
| 1990 | 0.003 | 0.03 | 0.01 | 0.22 |
| 1991 | 0.003 | 0.03 | 0.01 | 0.22 |
| 1992 | 0.003 | 0.03 | 0.01 | 0.22 |
| 1993 | 0.003 | 0.03 | 0.01 | 0.22 |
| 1994 | 0.003 | 0.03 | 0.01 | 0.22 |
| 1995 | 0.003 | 0.03 | 0.01 | 0.22 |
| 1996 | 0.003 | 0.03 | 0.01 | 0.22 |
| 1997 | 0.003 | 0.03 | 0.01 | 0.22 |
| 1998 | 0.003 | 0.03 | 0.01 | 0.22 |
| 1999 | 0.003 | 0.03 | 0.01 | 0.22 |
| 2000 | 0.003 | 0.03 | 0.01 | 0.22 |
| 2001 | 0.003 | 0.03 | 0.01 | 0.22 |
| 2002 | 0.003 | 0.03 | 0.01 | 0.22 |
| *Share in Austrian Total 2002* | *0.01%* | *0.05%* | *0.00%* | *0.11%* |
| *Trend 1990-2002* | *-1.6%* | *-3.9%* | *-2.3%* | *-3.4%* |

### 7.4.2 Methodological Issues

A simple method (Emission = Activity x Emission Factor) using country specific and CORINAIR default emission factors was used.

### Emission factors

*Viniculture*

National emission factors for $SO_2$, $NO_x$ and NMVOC are taken from [JOANNEUM RESEARCH, 1995]. $NH_3$ emission factors are taken from [CORINAIR, 1996].

*Cereals (straw burning)*

National emission factors for $SO_2$ are taken from [JOANNEUM RESEARCH, 1995]. $NO_x$ emission factors are taken from [ENERGIEBERICHT, 1990]. $NH_3$ and NMVOC emission factors were taken from [CORINAIR, 1994].

A calorific value of 7.1 MJ/kg burnt wood which corresponds to burning wood logs in poor operation furnace systems was used to convert the emission factors from [kg/TJ] to [kg/Mg]. Table 141 presents the resulting emission factors.

*Table 141: Emission factors for burning straw and residual wood of vinicultures*

| | $SO_2$ [g/ Mg Waste] | NOx [g/ Mg Waste] | NMVOC [g/ Mg Waste] | NH3 [g/ Mg Waste] |
|---|---|---|---|---|
| Straw | 78 | 177,5 | 5350 | 600 |
| Residual wood of vinicultures | 78 | 284 | 14 200 | 1 900 |

### Activity Data

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 used for all years. Following the [CORINAIR Guidebook, 1994], the average amount of straw burnt is about 5 tons per hectare.

Activity data of viniculture area are taken from the Statistical Yearbooks 1991-2002 [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 hectar viniculture area.

*Table 142: Activity data for burning residual wood of vinicultures 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 |

# 8 WASTE (NFR SECTOR 6)

## 8.1 Sector Overview

This chapter includes information on and descriptions of methodologies applied for estimating $NO_X$, $SO_2$, $NH_3$ and NMVOC emissions as well as references for activity data and emission factors concerning waste management and treatment activities reported under NFR Category *6 Waste* for the period from 1990 to 2002.

Emissions addressed in this chapter include emissions from the subcategories *Solid Waste Disposal on Land* and *Waste Incineration.* There are no $NO_X$, $SO_2$, $NH_3$ and NMVOC emissions reported in the subcategories *Wastewater Handling* and *Other*.

### 8.1.1 Emission Trends

Table 143 and Figure 10 present $SO_2$, $NO_X$, NMVOC and $NH_3$ emissions from NFR Category 6 *Waste* for the period from 1990 to 2002.

As can be seen in the table, the share of this category in Austria's National Totals of $NO_X$ and NMVOC is below 0.1%. $SO_2$ emissions decreased by 16%, however, the trend in total $SO_2$ emissions is –55%, this is the reason for the higher share in national total emissions of $SO_2$ emissions originating from NFR Category 6 *Waste* of 0.15% in 2002 compared to 1990 in 0.08%. $NH_3$ emissions from this category contribute around 1% to national total emissions.

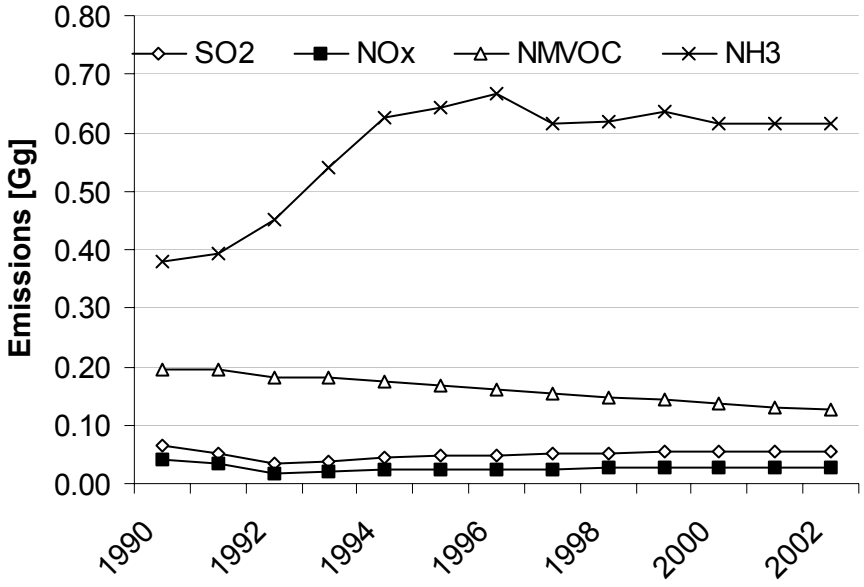



*Figure 10: Emissions from NFR Category 6 Waste and trends 1990-2002*

*Table 143: Emissions of $NO_X$, $SO_2$, $NH_3$ and NMVOCs and their trend from 1990-2002 from NFR Category 6 Waste*

| Year | Emissions [Gg] | | | |
|---|---|---|---|---|
| | $SO_2$ | $NO_X$ | NMVOC | $NH_3$ |
| 1990 | 0.06 | 0.04 | 0.19 | 0.38 |
| 1991 | 0.05 | 0.03 | 0.19 | 0.39 |
| 1992 | 0.03 | 0.02 | 0.18 | 0.45 |
| 1993 | 0.04 | 0.02 | 0.18 | 0.54 |
| 1994 | 0.05 | 0.02 | 0.17 | 0.62 |
| 1995 | 0.05 | 0.02 | 0.17 | 0.64 |
| 1996 | 0.05 | 0.02 | 0.16 | 0.67 |
| 1997 | 0.05 | 0.03 | 0.15 | 0.61 |
| 1998 | 0.05 | 0.03 | 0.15 | 0.62 |
| 1999 | 0.05 | 0.03 | 0.14 | 0.64 |
| 2000 | 0.05 | 0.03 | 0.14 | 0.62 |
| 2001 | 0.05 | 0.03 | 0.13 | 0.61 |
| | 0.05 | 0.03 | 0.13 | 0.61 |
| *Trend 1990-2002* | *-16%* | *-33%* | *-35%* | *62%* |
| *Share in National Total 1990* | *0.08%* | *0.02%* | *0.07%* | *0.66%* |
| *Share in National Total 2002* | *0.15%* | *0.01%* | *0.07%* | *1.16%* |

### $SO_2$ , $NO_x$ Emissions

$SO_2$ and $NO_x$ emissions originate from the subcategory *Waste Incineration*, emissions are decreasing constantly due to decreasing waste incineration activities: $NO_X$ emissions decreased by 33% from 1990 to 2001, $SO_2$ emissions 16% in the same period.

### NMVOC Emissions

NMVOC emissions from category Waste mainly originate from *Solid Waste Disposal on Land. Waste Incineration* is minor source and contributes less than 1%.

NMVOC emissions from *Solid Waste Disposal on Land* decreased over the considered period by 33% as a result of the waste management policies and increasing recovery rate of landfill gas.

### $NH_3$ Emissions

$NH_3$ Emissions originate from *Other Waste – Compost Production. Solid Waste Disposal on Land* and *Waste Incineration* are minor sources and account for less than 1% of $NH_3$ emissions. $NH_3$ emissions from this category increased by 62% due to increased compost production.

### 8.1.2 Methodology

In general the CORINAIR methodology, multiplying activity data for each subcategory with an emission factor, is applied. In some cases, however, country-specific methods were used. In those cases detailed information on the applied methods is provided in the corresponding subchapter.

### 8.1.3 Recalculations

Recalculations have been made for subcategory *6 A 1 Managed Waste Disposal on Land* and for subcategory *6 C Waste Incineration*, explanations are provided in the respective subchapters.

### 8.1.4 Completeness

Table 144 gives an overview of the SNAP categories included in this chapter and also provides information on the status of emission estimates of all subcategories. A "✓" indicates that emissions from this subcategory have been estimated.

*Table 144: Overview of subcategories of Category 6 Waste: transformation into SNAP Codes and status of estimation*

| NFR Category | | SNAP | Status | | | |
|---|---|---|---|---|---|---|
| | | | $NO_X$ | $SO_2$ | $NH_3$ | NMVOC |
| 6 A | SOLID WASTE DISPOSAL ON LAND | | | | | |
| 6 A 1 | Managed Waste Disposal | 090401 Solid Waste Disposal on Land | NA | NA | ✓ | ✓ |
| 6 A 2 | Unmanaged Waste Disposal | 090402 Unmanaged Waste Disposal | NA | NA | NA | NA |
| 6 B | WASTEWATER HANDLING | | | | | |
| 6 B 1 | Industrial Wastewater | 091001 Waste water treatment in industry | NA | NA | NA | NA |
| 6 B 2 | Domestic and Commercial Wastewater | 091002 Waste water treatment in residential/commercial sect. | NA | NA | NA | NA |
| 6 C | WASTE INCINERATION | | | | | |
| | | 090901 Incineration of corpses | ✓ | NA | NA | ✓ |
| | | 090201 Incineration of municipal waste | ✓ | ✓ | ✓ | ✓ |
| | | 090208 Incineration of waste oil | ✓ | ✓ | ✓ | ✓ |
| 6 D | OTHER WASTE | | | | | |
| | | 091003 Sludge spreading | NA | NA | NA | NA |
| | | 091005 Compost production | NA | NA | ✓ | NA |

## 8.2 Waste Disposal on Land (CRF Source Category 6 A)

### 8.2.1 Managed Waste Disposal on Land (6 A 1)

#### 8.2.1.1 Source Category Description

In Austria all waste disposal sites are managed sites (landfills).

Managed waste disposal on land accounts for the main contribution to $NH_3$ and NMVOC emissions in the IPCC Category *6 Waste*.

The anaerobic degradation of land filled organic substances results in the formation of landfill gas. About 300 mg per m³ landfill gas are NMVOC and about 10 mg per m³ landfill gas are $NH_3$. 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 period. For example, the amount of the collected landfill gas was about 2% in 1990, and 13% in the year 2002 respectively.

Table 145 presents NMVOC and $NH_3$ emissions from managed waste disposal on land for the period from 1990 to 2002.

As can be seen in the table, the trend of NMVOC and $NH_3$ emissions during the period is decreasing. From 1990 to 2002 emissions decreased by 33% due to increasing amount of collected landfill-gas.

*Table 145: NMVOC and $NH_3$ emissions from Category 6 A 1 1990-2002*

| Year | Emissions [Gg] | |
|---|---|---|
| | NMVOC | $NH_3$ |
| 1990 | 0.19 | 0.006 |
| 1991 | 0.19 | 0.006 |
| 1992 | 0.18 | 0.006 |
| 1993 | 0.18 | 0.006 |
| 1994 | 0.17 | 0.006 |
| 1995 | 0.16 | 0.005 |
| 1996 | 0.16 | 0.005 |
| 1997 | 0.15 | 0.005 |
| 1998 | 0.15 | 0.005 |
| 1999 | 0.14 | 0.005 |
| 2000 | 0.14 | 0.005 |
| 2001 | 0.13 | 0.004 |
| 2002 | 0.13 | 0.004 |
| *Trend 1990-2001* | *-33%* | *-33%* |

#### 8.2.1.2 Methodological Issues

Emissions from solid waste disposal on land was calculated from the amount of directly deposited waste that was split into "residual waste" and "non residual waste".

**Activity data**

Activity data for residual waste and non-residual waste are presented in Table 146. As can be seen from the table, the amount of residual waste decreased substantially from 1990 to 2002, it almost halved, whereas the amount of non-residual waste remained quite constant.

Because of the consideration of emissions from the last 31 years the quantities of "residual waste" since 1960 are needed. Activity data from the year until 1989 was taken from a study [HACKL & MAUSCHITZ, 1999], for the years 1990 to 1997 it was taken from the current BAWP [BMUJF-BWAP, 1998].

The amount of residual waste from 1998 onwards was taken from the UMWELTBUNDESAMT database for solid waste disposals "Deponiedatenbank". 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 UMWELTBUNDESAMT (*Deponiedatenbank* – "Austrian disposal database").

The quantities of "non residual waste" from 1998 to 2002 were also taken from the database for solid waste disposals "Deponiedatenbank", whereas only the amount of waste with bio - degradable lots was considered.

Because no data for "non residual waste" for the years before 1998 is available, the value for 1998 was used for these years.

*Table 146*: Activity data for "*Residual waste" and "Non Residual Waste" 1990–2002*

| | Residual Waste [Mg] | Non Residual Waste [Mg] | Total Waste [Mg] |
|---|---|---|---|
| 1990 | 1 995 747 | 809 752 | 2 805 499 |
| 1991 | 1 799 718 | 809 752 | 2 609 470 |
| 1992 | 1 614 157 | 809 752 | 2 423 909 |
| 1993 | 1 644 718 | 809 752 | 2 454 470 |
| 1994 | 1 142 067 | 809 752 | 1 951 819 |
| 1995 | 1 049 709 | 809 752 | 1 859 461 |
| 1996 | 1 124 169 | 809 752 | 1 933 921 |
| 1997 | 1 082 634 | 809 752 | 1 892 386 |
| 1998 | 1 081 114 | 809 752 | 1 890 866 |
| 1999 | 1 084 625 | 865 523 | 1 950 148 |
| 2000 | 1 052 061 | 869 315 | 1 921 376 |
| 2001 | 1 032 835 | 782 540 | 1 815 375 |
| 2002 | 1 032 835 | 782 540 | 1 815 375 |

The methodology of emission calculation for the two subcategories is presented in the following subchapters.

#### 8.2.1.2.1 Residual waste

"Residual waste" is waste from households and similar establishments, which is directly deposited at landfills without any treatment. It originates in private households, administrative facilities of commerce, industry and public administration, kinder gardens, schools, hospitals, small enterprises, agriculture, market places and other institutions covered by the municipal waste collection 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")***;

The detailed calculation of the $CH_4$ emissions from "residual waste" is shown in Table 147.

First the overall amount of generated landfill gas per ton waste was calculated, taking the DOC-content (see Table 148) of the waste and the average temperature at the landfill (30°C) into account. 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 NMVOC and $NH_3$ content of landfill gas (300mg/m³ and 10mg/m³ respectively) the emitted quantity of these gases from residual waste were obtained.

*Table 147: 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) [K] |
| | | DOC……. | Bio-degradable organic carbon content of directly deposited residual waste (estimated in [ROLLAND&SCHEIBENGRAF, 2003], see Table 148) |
| $G_t$…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 |
| $G_t(a)$...Specific accrued quantity of gas in the $t^{th}$ year [m³/ t waste] | $G_t(a)=G_t-G_{t-1}$ | $G_t$……. | Cumulated specific amount of gas in the year t |
| | | $G_{t-1}$…….. | Cumulated specific amount of gas in the year before t |

| Calculation of | Formula | | Explanation |
|---|---|---|---|
| | | | |
| $G_{geb}$...Quantity of incidental landfill gas in the year t [m³] | $G_{geb}=G_t(a)*waste_{t=0}$ | $G_t(a)$……. | Specific accrued amount of gas in the year t |
| | | $waste_{t=0}$… | 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] | $G=G_T*(1-j)$ | $G_T$……. | Total incidental gas in the year t |
| | | j…… | Collecting factor [ROLLAND&OLIVA, 2004] |
| EM…emissions of NMVOC or $NH_3$, respectively | EM=G*c | c…… | Concentration of NMVOC and $NH_3$ NMVOC = 300 mg/m³ emitted gas $NH_3$ = 10 mg/m³ emitted gas |

*Table 148: 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 and comprises:

- bulk waste
- construction waste
- mixed industrial waste
- road sweepings
- sewage sludge
- rakings
- residual matter from waste treatment

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 with the collecting factor and the share of NMVOC and $NH_3$ in the generated gas. This resulted in the emitted quantity of NMVOC and $NH_3$ of "non residual waste".

The detailed calculation steps are shown in Table 149.

*Table 149: Calculation of NMVOC and $NH_3$ 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, 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 |
| | | $\Sigma_1^3$…….. | Summation of the 3 groups |
| EM… emitted NMVOC or $NH_3$, respectively | EM=G*(j-1)*c | j..... | collecting factor [ROLLAND&OLIVA, 2004] |
| | | c…… | Concentration of NMVOC and $NH_3$ (NMVOC = 300mg/m³ emitted gas; $NH_3$ = 10mg/m³ emitted gas) |

*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 $M_O$.

### 8.2.1.3 Recalculations

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.

The following table presents the recalculation difference with respect to last years resulting from the improvements made as described above.

*Table 150: Recalculation difference with respect to last year's submission from NFR Category 6 A 1 Managed Waste Disposal on Land 1990-2001*

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NMVOC [Mg] | -59.81 | -55.32 | -56.42 | -52.82 | -55.04 | -56.71 | -59.22 | -57.89 | -54.63 | -56.28 | -58.42 | -62.19 |
| $NH_3$ [Mg] | -1.99 | -1.84 | -1.88 | -1.76 | -1.83 | -1.89 | -1.97 | -1.93 | -1.82 | -1.88 | -1.95 | -2.07 |

Negative values indicate that emissions reported in this year's submission are lower.

## 8.3 Waste Incineration (CRF Source Category 6 C)

### 8.3.1 Source Category Description

In this category $SO_2$, $NO_X$, NMVOC and $NH_3$ emissions from *Incineration of Corpses* and *Incineration of Waste Oil* are included as well as emissions from *Incineration of Domestic or Municipal Waste* without energy recovery.

In Austria waste oil is incinerated in especially designed so called "USK-facilities". The emissions of waste oil combustion for energy use (e.g. in cement industry) are reported under *NFR sector 1 A Fuel Combustion*.

In general, municipal, industrial and hazardous waste are combusted in district heating plants or in industrial sites and the energy is used. Therefore their emissions are reported in *NFR sector 1 A Fuel Combustion*. There is only one waste incineration plant which has been operated until 1991 with a capacity of 22 000 tons of waste per year without using the energy. This plant has been rebuilt as a district heating plant starting operation in 1996. Therefore the emissions of this plant are reported under *CRF sector 1 A Fuel Combustion* from 1996 onwards.

Table 151 presents the trend of $SO_2$, $NO_X$, NMVOC and $NH_3$ emissions.

Main source of the considered emissions in the subcategory *Waste Incineration* is *Incineration of Waste Oil*. Only for the years 1990 and 1991 emissions of *Incineration of Domestic or Municipal Waste* is reported (explanation see above). That's why the trend shows a dip in 1992. From 1992 on the trend shows a steady increase due to increasing activity data in the categories *Incineration of Waste Oil* and *Incineration of Corpses* where *Incineration of Corpses* is only a minor source of $NO_X$ and NMVOC emissions.

*Table 151: $SO_2$, $NO_X$, NMVOC and $NH_3$ emissions from Category 6 C.*

| Year | $SO_2$ [Gg] | $NO_X$ [Gg] | NMVOC [Gg] | $NH_3$ [Gg] |
|---|---|---|---|---|
| 1990 | 0.06 | 0.04 | 0.008 | 0.0002 |
| 1991 | 0.05 | 0.03 | 0.008 | 0.0002 |
| 1992 | 0.03 | 0.02 | 0.001 | 0.0002 |
| 1993 | 0.04 | 0.02 | 0.001 | 0.0002 |
| 1994 | 0.05 | 0.02 | 0.001 | 0.0003 |
| 1995 | 0.05 | 0.02 | 0.001 | 0.0003 |
| 1996 | 0.05 | 0.02 | 0.001 | 0.0003 |
| 1997 | 0.05 | 0.03 | 0.001 | 0.0003 |
| 1998 | 0.05 | 0.03 | 0.001 | 0.0003 |
| 1999 | 0.05 | 0.03 | 0.002 | 0.0003 |
| 2000 | 0.05 | 0.03 | 0.002 | 0.0003 |
| 2001 | 0.05 | 0.03 | 0.001 | 0.0003 |
| 2002 | 0.05 | 0.03 | 0.001 | 0.0003 |
| *Trend* | *-16%* | *-33%* | *-82%* | *34%* |

### 8.3.2 Methodological Issues

CORINAIR simple methodology is applied: the quantity of waste is multiplied with an emission factor for $SO_X$, $NO_X$, NMVOC and $NH_3$.

#### 8.3.2.1 Incineration of domestic or municipal waste; Incineration of waste oil

**Emission factors**

National emission factors for $SO_2$, $NO_X$ and NMVOC are taken from [BMWA-EB, 1990], [BMWA-EB, 1996]. $NH_3$ emission factors are taken from [KNOFLACHER, 1993].

A heating value of 8.7 GJ/Mg municipal waste was used to convert emission factors from [kg/TJ] to [kg/Mg].

For waste oil, emission factors for heavy oil were selected and a heating value of 40.3 GJ/Mg Waste Oil was used to convert emission factors from [kg/TJ] to [kg/Mg].

*Table 152: Emission factors of NFR Category 6 C Waste Incineration.*

| | $SO_2$ [g/ Mg Waste] | $NO_X$ [g/ Mg Waste] | NMVOC [g/ Mg Waste] | $NH_3$ [g/ Mg Waste] |
|---|---|---|---|---|
| Municipal Waste | 1 131 | 870 | 330.6 | 0.17 |
| Waste Oil | 18 135 | 8 060 | 403 | 110 |

**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 [BOOS et al., 1995].

*Table 153: Activity data for NFR Category 6 C Waste Incineration.*

| Year | Municipal Waste [Mg] | Waste Oil [Mg] |
|---|---|---|
| 1990 | 22 000 | 2 200 |
| 1991 | 22 000 | 1 500 |
| 1992 | 0 | 1 800 |
| 1993 | 0 | 2 100 |
| 1994 | 0 | 2 500 |
| 1995 | 0 | 2 600 |
| 1996 | 0 | 2 700 |
| 1997 | 0 | 2 800 |
| 1998 | 0 | 2 900 |
| 1999 | 0 | 3 000 |
| 2000 | 0 | 3 000 |
| 2001 | 0 | 3 000 |
| 2002 | 0 | 3 000 |

#### 8.3.2.2 Incineration of corpses

In this category $NO_X$ and NMVOC emission from incineration of corpses is considered, emissions from incineration of carcasses are not estimated.

$NO_X$ and NMVOC emissions from this category are generally low and amount to 0.003 Gg and 0.0003 Gg, respectively for all years from 1990 to 2002. The number of corpses decreased over the period from 1990 to 2002; due to rounding the emissions appear to remain steady.

**Methodology**

The applied emission factors of 300g $NO_X$/Corpse and of 31g NMVOC/Corpse were taken from a Swiss study [BUWAL, 1995].

The number of deaths per year were obtained from STATISTIK AUSTRIA. It is assumed that about 12% of the total number of corpses are incinerated per year (see Table 154).

*Table 154: Number of incinerated corpses and NOx and NMVOC emissions from cremation 1990–2002*

| Year | Total number of corpses | Number of incinerated corpses | NOx emissions [Gg] | NMVOC emissions [Gg] |
|---|---|---|---|---|
| 1990 | 82 952 | 9 954 | 0.003 | 0.0003 |
| 1991 | 83 428 | 10 011 | 0.003 | 0.0003 |
| 1992 | 83 162 | 9 979 | 0.003 | 0.0003 |
| 1993 | 82 517 | 9 902 | 0.003 | 0.0003 |
| 1994 | 80 684 | 9 682 | 0.003 | 0.0003 |
| 1995 | 81 171 | 9 741 | 0.003 | 0.0003 |
| 1996 | 80 790 | 9 695 | 0.003 | 0.0003 |
| 1997 | 79 432 | 9 532 | 0.003 | 0.0003 |
| 1998 | 78 339 | 9 401 | 0.003 | 0.0003 |
| 1999 | 78 200 | 9 384 | 0.003 | 0.0003 |
| 2000 | 76 780 | 9 214 | 0.003 | 0.0003 |
| 2001 | 74 767 | 8 972 | 0.003 | 0.0003 |
| 2002 | 74 767 | 8 972 | 0.003 | 0.0003 |

### 8.3.3 Recalculations

The activity data for incineration of corpses were updated according to the actual death statistics published by STATISTIK AUSTRIA.

## 8.4 Other Waste (CRF Source Category 6 D)

### 8.4.1 Source Category Description

In this category compost production is addressed.

### 8.4.2 Compost Production

This category includes $NH_3$ emissions from compost production, which are presented in Table 155 for the period from 1990 to 2002.

$NH_3$ emissions arising from the subcategory compost production increased over the time period as a result of the increasing amount of composted waste.

*Table 155: Emissions from Category 6 D - Compost Production 1990-2002*

| | $NH_3$ emissions [Gg] |
|---|---|
| 1990 | 0.37 |
| 1991 | 0.39 |
| 1992 | 0.44 |
| 1993 | 0.53 |
| 1994 | 0.62 |
| 1995 | 0.64 |
| 1996 | 0.66 |
| 1997 | 0.61 |
| 1998 | 0.61 |
| 1999 | 0.63 |
| 2000 | 0.61 |
| 2001 | 0.61 |
| 2002 | 0.61 |
| *Trend 1990-2002* | *64%* |

#### 8.4.2.1 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

$NH_3$ emissions were calculated by multiplying an emission factor with the quantity of waste.

### Activity data

Activity data were taken from several national studies. For years where no data were available they were either interpolated or extrapolated or the value of the year before was used.

*Table 156: Activity data for NFR Category 6 D Other Waste (Compost Production)*

| | **Total** | Bio-waste, loppings, home composting(1) | mechanical biological treated residual waste | | Sewage Sludge | |
|---|---|---|---|---|---|---|
| | **[Gg]** | **[Gg]** | **[Gg]** | references | **[Gg]** | 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 157: Emission factors for IPCC Category 6 D Other Waste (Compost Production)*

| | $NH_3$ [kg/t FS] | References |
|---|---|---|
| mechanical biological treated residual waste | 0.6 | [UBA Berlin, 1999]<br>[AMLINGER et al., 2003]<br>[ANGERER, FRÖHLICH, 2002] |
| Bio-waste, lopping, home composting | 0.4 | [AMLINGER et al., 2003] |
| Sewage Sludge | 0.02 | [AMLINGER et al., 2003] |

#### 8.4.2.2 Recalculations

$NH_3$ emissions from compost production have been estimated for this submission, previously these emissions were not estimated.

# ABBREVIATIONS

## General

| | |
|---|---|
| AMA | Agrarmarkt Austria |
| BAWP | Bundes-AbfallwirtschaftsplanFederal Waste Management Plan |
| BMLFUW | Bundesministerium für Land- und Forstwirtschaft, Umwelt und WasserwirtschaftFederal Ministry for Agriculture, Forestry, Environment and Water Management |
| BMUJF | Bundesministerium für Umwelt, Jugend und FamilieFederal Ministry for Environment, Youth and Family(before 2000, now domain of Environment: BMLFUW) |
| BUWAL | Bundesamt für Umwelt, Wald und Landschaft, BernThe Swiss Agency for the Environment, Forests and Landscape (SAEFL), Bern |
| CORINAIR | Core Inventory Air |
| CORINE | Coordination d´information Environmentale |
| CRF | Common Reporting Format |
| DKDB | DampfkesseldatenbankAustrian annual steam boiler inventory |
| EC | European Community |
| EEA | European Environment Agency |
| EIONET | European Environment Information and Observation NETwork |
| EMEP | Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe |
| EPER | European Pollutant Emission Register |
| 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 (of the IPCC) |
| IEA | International Energy Agency |
| IEF | Implied emission factor |
| IFR | Instrument Flight Rules |
| IIR | Informative Inventory Report |
| IPCC | Intergovernmental Panel on Climate Change |
| LTO | Landing/Take-Off cycle |
| MEET | MEET (1999): MEET – Methodology for calculating transport emissions and energy consumption. European Commission, DG VII, Belgium. |
| NACE | Nomenclature des activites economiques de la Communaute Europeenne |
| NAPFUE | Nomenclature for Air Pollution Fuels |
| NEC | National Emissions Ceiling (Directive 2001/81/EC of The European Parliament And Of The Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants - NEC Directive) |
| NFR | Nomenclature for Reporting (Format of Reporting under the UNECE/CLRTAP Convention) |

| | |
|---|---|
| NIR | National Inventory Report (Submission under the United Nations Framework Convention on Climate Change) |
| NISA | National Inventory System Austria |
| OECD | Organisation for Economic Co-operation and Development |
| OLI | Österreichische Luftschadstoff InventurAustrian Air Emission Inventory |
| PHARE | Phare is the acronym of the Programme's original name:'Poland and Hungary: Action for the Restructuring of the Economy'.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.) |
| PRTR | Pollution Release and Transfer Register |
| QA/QC | Quality Assurance/Quality Control |
| QMS | Quality Management System |
| RWA | Raiffeisen Ware Austria (see www.rwa.at) |
| SNAP | Selected Nomenclature on Air Pollutants |
| TAN | Total ammoniacal nitrogen |
| UMWELTBUNDESAMT | UMWELTBUNDESAMT (*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 |
| VFR | Visual Flight Rules |
| WIFO | Wirtschaftsforschungsinstitut (Austrian Institute for Economic Research) |

**Notation Keys**

according to the UN ECE Emission Reporting Guidelines [ECE/EB.AIR/80]

| | |
|---|---|
| "NO"<br>(not occurring) | for emissions by sources of compounds that do not occur for a particular compound or source category within a country. |
| "NE"<br>(not estimated) | for existing emissions by sources of compounds that have not been estimated. Where "NE" is used in an inventory the Party should indicate why emissions could not be estimated. |
| "NA"<br>(not applicable) | is used for activities in a given source category which are believed not to result in significant emissions of a specific compound.. |
| "IE"<br>(included elsewhere) | for emissions by sources of compounds that are estimated but included elsewhere in the inventory instead of in the expected source category. Where "IE" is used in an inventory, the Party should indicate where in the inventory the emissions from the displaced source category have been included and the Party should give the reasons for this inclusion deviation from the expected category. |
| "C"<br>(confidential) | for emissions by sources of compounds which could lead to the disclosure of confidential information. Where "C" is used in an inventory, reference should be made to the Protocol provision that authorizes such practice. |

## 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: 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. Information on the categories of the energy balance and on fuel categories can be found in Chapter 4.7 of the IIR 2004.

## 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 |

| 101A, Coking Coal | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 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 |

| 102A; Bituminous Coal & Anthracite | 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) | 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 |
| 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 |

| 104A; Patent Fuel | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 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 |

| 105A; Lignite and brown coal | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 |

| 106A; BKB-PB | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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** | 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 |

| 107A; Coke Oven Coke | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 |

| 113A; Peat | 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 |
| 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** | 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 |

| 304A; Coke Oven Gas | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |
| 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 |

| 305A; Blast Furnace Gas | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **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 |
| 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 |

| 203X; Residual Fuel Oil | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 |

| 204A; Heating and Other Gas Oil | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 |

| 2050; Diesel | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 |

| 206A Other Kerosene | 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 | 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 |
| 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 |

| 206B; Kerosene Type Jet Fuel | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 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 |

| 207A Gasoline Type Jet Fuel | 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** | 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 |
| 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 |

| 2080 Motor Gasoline | 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** | 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** | 2 553 | 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 |

| 219A; Lubricants | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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** | 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 |

| 220A; White Spirit | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 |
| **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 |

| 222A; Bitumen | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

| 224A; Other Oil Products | 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 | 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** | 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 |

| 303A; LPG | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 |

| 308A; Refinery Gas | 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** | 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 |
| 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 2: NFR FOR 2002, TREND TABLES

The following annex presents emission data for the year 2002 in the "New Format for Reporting - NFR" as submitted under the UNECE/CLRTAP Convention in 2004.

Furthermore, trend tables for $NO_X$, $SO_2$, NMVOC and $NH_3$ as well as for heavy metals, POPs and particulate matter, as included in "Austria's Annual National Air Emissions Inventory 1980-2002. Submission under the Convention on Long-range Transboundary Air Pollution (LRTAP)", are presented.

**TABLE IV 1A: National sector emissions: Main pollutants, particulate matter and heavy metals**
Version 2002-1

COUNTRY: AT (as ISO2 code)
DATE: 09.06.2004 (as DD.MM.YYYY)
YEAR: 2002 (as YYYY, year of Emmissions)

| NFR sectors to be reported to CLRTAP | | | A = Allowable Aggregation | Yearly minimum reporting | | | | | | | | | | | Additional reporting | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Main Pollutants | | | | | Particulate matter | | | Priority metals | | | Other metals | | | | | |
| | | | | NOx | CO | NMVOC | SOx | NH3 | TSP | PM10 | PM2.5 | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn |
| | | | | Gg $NO_2$ | Gg | Gg | Gg $SO_2$ | Gg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg |
| 1 A 1 a | (a) | 1 A 1 a Public Electricity and Heat Production | | 9.95 | 3.32 | 0.57 | 4.54 | 0.18 | 1 387.84 | 1 148.32 | 892.27 | 1.27 | 0.07 | 0.24 | NE | NE | NE | NE | NE | NE |
| 1 A 1 b | (a) | 1 A 1 b Petroleum refining | | 3.44 | 0.72 | IE | 3.69 | 0.09 | 119.21 | 113.25 | 95.37 | 0.29 | 0.15 | 0.01 | NE | NE | NE | NE | NE | NE |
| 1 A 1 c | (a) | 1 A 1 c Manufacture of Solid Fuels and Other Energy Industries | | 1.56 | 0.05 | 0.01 | 0.00 | 0.01 | 5.19 | 4.67 | 3.89 | 0.00 | 0.00 | 0.00 | NE | NE | NE | NE | NE | NE |
| **1 A 2** | (a) | **1 A 2 Manufacturing Industries and Construction** | **A** | 34.08 | 157.11 | 4.01 | 11.04 | 0.19 | 4 855.27 | 4 443.58 | 3 866.04 | 2.60 | 0.16 | 0.19 | NE | NE | NE | NE | NE | NE |
| 1 A 2 a | (a) | 1 A 2 a Iron and Steel | | 5.63 | 135.02 | 0.13 | 6.06 | 0.05 | 449.52 | 358.76 | 272.67 | 0.17 | 0.01 | 0.00 | NE | NE | NE | NE | NE | NE |
| 1 A 2 b | (a) | 1 A 2 b Non-ferrous Metals | | 0.17 | 0.04 | 0.00 | 0.17 | 0.00 | 21.51 | 19.12 | 15.79 | 1.04 | 0.02 | 0.01 | NE | NE | NE | NE | NE | NE |
| 1 A 2 c | (a) | 1 A 2 c Chemicals | | 1.45 | 1.38 | 0.23 | 1.19 | 0.02 | 457.91 | 410.33 | 340.92 | 0.24 | 0.02 | 0.01 | NE | NE | NE | NE | NE | NE |
| 1 A 2 d | (a) | 1 A 2 d Pulp, Paper and Print | | 3.55 | 4.20 | 0.74 | 0.85 | 0.03 | 1 358.19 | 1 217.09 | 1 011.22 | 0.45 | 0.05 | 0.04 | NE | NE | NE | NE | NE | NE |
| 1 A 2 e | (a) | 1 A 2 e Food Processing, Beverages and Tobacco | | 0.59 | 0.09 | 0.01 | 0.37 | 0.01 | 56.17 | 50.32 | 41.80 | 0.00 | 0.00 | 0.00 | NE | NE | NE | NE | NE | NE |
| 1 A 2 f | (a) | 1 A 2 f Other (Please specify in a covering note) | | 22.69 | 16.39 | 2.89 | 2.39 | 0.08 | 2 511.98 | 2 387.96 | 2 183.63 | 0.69 | 0.07 | 0.13 | NE | NE | NE | NE | NE | NE |
| 1 A 3 a ii (i) | | 1 A 3 a ii Civil Aviation (Domestic, LTO) | | 0.06 | 1.74 | 0.05 | 0.01 | 0.00 | 7.02 | 7.02 | 7.02 | 0.00 | 0.00 | 0.00 | NE | NE | NE | NE | NE | NE |
| 1 A 3 a ii (ii) | | 1 A 3 a ii Civil Aviation (Domestic, Cruise) | | 0.18 | 0.05 | 0.02 | 0.02 | 0.00 | 16.77 | 16.77 | 16.77 | 0.00 | 0.00 | 0.00 | NE | NE | NE | NE | NE | NE |
| **1 A 3 b** | (a) | **1 A 3 b Road Transportation** | **A** | 105.91 | 193.71 | 28.64 | 2.11 | 0.32 | 16 598.34 | 8 848.22 | 6 187.75 | 0.01 | 0.10 | 0.00 | NE | NE | NE | NE | NE | NE |

Note 1: Main Pollutants should cover the timespan from 1980 to latest year.
HM should cover the timespan from 1990 to latest year.
PM should cover the timespan from 2000 to latest year.
Note 2: The A=Allowable Aggregation illustrates the level of aggregation that can be used if more detailed information is not available. Gray cells show which sectors can be aggregated into the sector marked A. Black cells occur when two possible levels of aggregation are possible.

| *NFR sectors to be reported to CLRTAP* | | | A = Allowable Aggregation | *Yearly minimum reporting* | | | | | | | | | | | | *Additional reporting* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Main Pollutants | | | | | Particulate matter | | | Priority metals | | | | Other metals | | | | | |
| | | | | NOx | CO | NMVOC | SOx | NH3 | TSP | PM10 | PM2.5 | Pb | Cd | Hg | | As | Cr | Cu | Ni | Se | Zn |
| | | | | Gg $NO_2$ | Gg | Gg | Gg $SO_2$ | Gg | Mg | Mg | Mg | Mg | Mg | Mg | | Mg | Mg | Mg | Mg | Mg | Mg |
| 1 A 3 b i | | 1 A 3 b i R.T., Passenger cars | | 41.96 | 151.65 | 13.73 | 1.20 | 0.27 | 2 542.00 | 2 542.00 | 2 542.00 | 0.01 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| 1 A 3 b ii | | 1 A 3 b ii R.T., Light duty vehicles | | 6.39 | 6.08 | 0.91 | 0.27 | 0.01 | 978.00 | 978.00 | 978.00 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| 1 A 3 b iii | | 1 A 3 b iii R.T., Heavy duty vehicles | | 57.02 | 10.30 | 3.18 | 0.64 | 0.02 | 1 511.00 | 1 511.00 | 1 511.00 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| 1 A 3 b iv | | 1 A 3 b iv R.T., Mopeds & Motorcycles | | 0.55 | 25.68 | 5.14 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| 1 A 3 b v | | 1 A 3 b v R.T., Gasoline evaporation | | NA | NA | 5.69 | NA | NA | NA | NA | NA | NA | NA | NA | | NE | NE | NE | NE | NE | NE |
| 1 A 3 b vi | | 1 A 3 b vi R.T., Automobile tyre and brake wear | | NA | NA | NA | NA | NA | 11 567.34 | 3 817.22 | 1 156.73 | NA | 0.10 | NA | | NE | NE | NE | NE | NE | NE |
| 1 A 3 b vii | | 1 A 3 b vii R.T., Automobile road abrasion | | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | | NE | NE | NE | NE | NE | NE |
| 1 A 3 c | (a) | 1 A 3 c Railways | | 1.66 | 0.48 | 0.23 | 0.09 | 0.00 | 1 605.49 | 568.49 | 205.54 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| 1 A 3 d ii | | 1 A 3 d ii National Navigation | | 0.57 | 2.78 | 0.67 | 0.02 | 0.00 | 40.07 | 40.07 | 40.07 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| **1 A 3 e** | **(a)** | **1 A 3 e Other (Please specify in a covering note)** | **A** | 0.98 | 0.03 | 0.00 | 0.00 | 0.01 | 3.28 | 2.95 | 2.46 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| 1 A 3 e i | | 1 A 3 e i Pipeline compressors | | 0.98 | 0.03 | 0.00 | 0.00 | 0.01 | 3.28 | 2.95 | 2.46 | NA | NA | NA | | NE | NE | NE | NE | NE | NE |
| 1 A 3 e ii | | 1 A 3 e ii Other mobile sources and machinery | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| 1 A 4 a | (a) | 1 A 4 a Commercial / Institutional | | 1.10 | 6.00 | 0.67 | 0.57 | 0.03 | 159.70 | 143.24 | 127.02 | 0.10 | 0.01 | 0.01 | | NE | NE | NE | NE | NE | NE |
| **1 A 4 b** | **(a)** | **1 A 4 b Residential** | **A** | 15.14 | 335.14 | 38.41 | 8.93 | 0.60 | 8 162.22 | 7 352.27 | 6 548.41 | 2.44 | 0.27 | 0.22 | | NE | NE | NE | NE | NE | NE |
| 1 A 4 b i | | 1 A 4 b i Residential plants | | 14.19 | 315.50 | 33.89 | 8.91 | 0.60 | 7 971.78 | 7 161.83 | 6 357.97 | 2.44 | 0.27 | 0.22 | | NE | NE | NE | NE | NE | NE |
| 1 A 4 b ii | | 1 A 4 b ii Household and gardening (mobile) | | 0.95 | 19.64 | 4.52 | 0.02 | 0.00 | 190.44 | 190.44 | 190.44 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |

Note 1: Main Pollutants should cover the timespan from 1980 to latest year.

HM should cover the timespan from 1990 to latest year.

PM should cover the timespan from 2000 to latest year.

Note 2: The A=Allowable Aggregation illustrates the level of aggregation that can be used if more detailed information is not available. Grey cells show which sectors can be aggregated into the sector marked A. Black cells occur when two possible levels of aggregation are possible.

| NFR sectors to be reported to CLRTAP | | | A = Allowable Aggregation | Yearly minimum reporting | | | | | | | | | | | | Additional reporting | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Main Pollutants | | | | | Particulate matter | | | Priority metals | | | | Other metals | | | | | |
| | | | | NOx | CO | NMVOC | SOx | NH3 | TSP | PM10 | PM2.5 | Pb | Cd | Hg | | As | Cr | Cu | Ni | Se | Zn |
| | | | | Gg $NO_2$ | Gg | Gg | Gg $SO_2$ | Gg | Mg | Mg | Mg | Mg | Mg | Mg | | Mg | Mg | Mg | Mg | Mg | Mg |
| **1 A 4 c** | (a) | **1 A 4 c Agriculture / Forestry / Fishing** | **A** | 23.15 | 46.90 | 10.26 | 0.80 | 0.05 | 3 341.52 | 3 287.45 | 3 233.48 | 0.14 | 0.04 | 0.01 | | NE | NE | NE | NE | NE | NE |
| 1 A 4 c i | | 1 A 4 c i Stationary | | 1.00 | 21.80 | 2.51 | 0.43 | 0.04 | 538.68 | 484.61 | 430.64 | 0.14 | 0.04 | 0.01 | | NE | NE | NE | NE | NE | NE |
| 1 A 4 c ii | | 1 A 4 c ii Off-road Vehicles and Other Machinery | | 22.15 | 25.10 | 7.74 | 0.37 | 0.01 | 2 802.84 | 2 802.84 | 2 802.84 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| 1A 4 c iii | | 1A 4 c iii National Fishing | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | | NE | NE | NE | NE | NE | NE |
| 1 A 5 a | (a) | 1 A 5 a Other, Stationary (including Military) | | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | | NE | NE | NE | NE | NE | NE |
| 1 A 5 b | (a) | 1 A 5 b Other, Mobile (Including military) | | 0.09 | 0.24 | 0.02 | 0.01 | 0.00 | 15.54 | 15.54 | 15.54 | 0.00 | 0.00 | 0.00 | | NE | NE | NE | NE | NE | NE |
| **1 B 1** | (a) | **1 B 1 Fugitive Emissions from Solid Fuels** | **A** | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | | NE | NE | NE | NE | NE | NE |
| 1 B 1 a | (a) | 1 B 1 a Coal Mining and Handling | | NA | NA | NA | NA | NA | NE | NE | NE | NA | NA | NA | | NE | NE | NE | NE | NE | NE |
| 1 B 1 b | (a) | 1 B 1 b Solidfuel transformation | | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | | NE | NE | NE | NE | NE | NE |
| 1 B 1 c | (a) | 1 B 1 c Other (Please specify in a covering note) | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | | NE | NE | NE | NE | NE | NE |
| **1 B 2** | (a) | **1 B 2 Oil and natural gas** | **A** | IE | IE | 3.39 | 0.14 | IE | IE | IE | IE | IE | IE | IE | | NE | NE | NE | NE | NE | NE |
| **1 B 2 a** | (a) | **1 B 2 a Oil** | **A** | NA | NA | 3.24 | NA | NA | NA | NA | NA | NA | NA | NA | | NE | NE | NE | NE | NE | NE |
| 1 B 2 a i | (a) | 1 B 2 a i Exploration Production, Transport | | NA | NA | 0.94 | NA | NA | NA | NA | NA | NA | NA | NA | | NE | NE | NE | NE | NE | NE |
| 1 B 2 a iv | (a) | 1 B 2 a iv Refining / Storage | | NA | NA | 1.16 | NA | NA | NA | NA | NA | NA | NA | NA | | NE | NE | NE | NE | NE | NE |
| 1 B 2 a v | (a) | 1 B 2 a v Distribution of oil products | | NA | NA | 1.14 | NA | NA | NA | NA | NA | NA | NA | NA | | NE | NE | NE | NE | NE | NE |
| 1 B 2 a vi | (a) | 1 B 2 a vi Other | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | | NE | NE | NE | NE | NE | NE |
| 1 B 2 b | (a) | 1 B 2 b Natural gas | | NA | NA | 0.15 | 0.14 | NA | NA | NA | NA | NA | NA | NA | | NE | NE | NE | NE | NE | NE |
| 1 B 2 c | (a) | 1 B 2 c Venting and flaring | | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | | NE | NE | NE | NE | NE | NE |

Note 1: Main Pollutants should cover the time span from 1990 to latest year

PM10 should cover the time span from 1990 to latest year

PM2.5 should cover the time span from 2000 to latest year

Note 2: The A= Allowable Aggregation illustrates the level of aggregation that can be used if more detailed information is not available. Grey cells show which sectors can be aggregated into the sectors marked A. Black cells do not exist where two possible levels of aggregation are possible

| *NFR sectors to be reported to CLRTAP* | | | A = Allowable Aggregation | *Yearly minimum reporting* | | | | | | | | | | | | *Additional reporting* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Main Pollutants | | | | | Particulate matter | | | Priority metals | | | Other metals | | | | | | |
| | | | | NOx | CO | NMVOC | SOx | NH3 | TSP | PM10 | PM2.5 | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn |
| | | | | Gg $NO_2$ | Gg | Gg | Gg $SO_2$ | Gg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg |
| **2 A** | (a) | **2 A MINERAL PRODUCTS (b)** | **A** | NA | 10.03 | 5.41 | NA | NA | 23 858.33 | 11 494.15 | 3 574.76 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 2 A 1 | (a) | 2 A 1 Cement Production | | NA | NA | NA | NA | NA | 288.91 | 136.65 | 43.00 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 2 A 2 | (a) | 2 A 2 Lime Production | | NA | NA | NA | NA | NA | 20.12 | 9.52 | 3.00 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 2 A 3 | (a) | 2 A 3 Limestone and Dolomite Use | | NA | NA | NA | NA | NA | 615.77 | 291.24 | 91.85 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 2 A 4 | (a) | 2 A 4 Soda Ash Production and use | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 2 A 5 | (a) | 2 A 5 Asphalt Roofing | | NE | 10.03 | 5.16 | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| 2 A 6 | (a) | 2 A 6 Road Paving with Asphalt | | NE | NE | 0.25 | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| 2 A 7 | (a) | 2 A 7 Other including Non Fuel Mining & Construction (Please specify in a covering note) | | NE | NE | NE | NE | NE | 22 933.53 | 11 056.74 | 3 436.91 | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| **2 B** | (a) | **2 B CHEMICAL INDUSTRY** | **A** | 0.66 | 11.10 | 12.34 | 3.19 | 0.06 | 442.66 | 259.42 | 136.68 | 0.00 | 0.00 | 0.00 | NE | NE | NE | NE | NE | NE |
| 2 B 1 | (a) | 2 B 1 Ammonia Production | | 0.22 | 0.03 | IE | IE | 0.01 | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 2 B 2 | (a) | 2 B 2 Nitric Acid Production | | 0.37 | NA | NA | NA | 0.00 | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 2 B 3 | (a) | 2 B 3 Adipic Acid Production | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NE | NE | NE | NE | NE | NE |
| 2 B 4 | (a) | 2 B 4 Carbide Production | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 2 B 5 | (a) | 2 B 5 Other (Please specify in a covering note) | | 0.07 | 11.07 | 12.34 | 3.19 | 0.05 | 442.66 | 259.42 | 136.68 | 0.00 | 0.00 | 0.00 | NE | NE | NE | NE | NE | NE |
| 2 C | (a) | 2 C METAL PRODUCTION | | 0.23 | 30.64 | 0.41 | 0.75 | 0.00 | 3 176.35 | 2 335.75 | 1 138.02 | 5.93 | 0.20 | 0.26 | NE | NE | NE | NE | NE | NE |
| 2 D | (a) | 2 D OTHER PRODUCTION (b) | **A** | 0.82 | 0.60 | 2.85 | IE | IE | 1.90 | 0.90 | 0.30 | IE | IE | IE | NE | NE | NE | NE | NE | NE |
| 2 D 1 | (a) | 2 D 1 Pulp and Paper | | 0.82 | 0.60 | 0.60 | IE | IE | IE | IE | IE | IE | IE | IE | NE | NE | NE | NE | NE | NE |
| 2 D 2 | (a) | 2 D 2 Food and Drink | | NA | NA | 2.24 | NA | NA | 1.90 | 0.90 | 0.30 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 2 G | (a) | 2 G OTHER (Please specify in a covering note) | | NA | NA | NA | NA | 0.00 | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |

Note 1: Main Pollutants should cover the timespan from 1980 to latest year.

HM should cover the timespan from 1990 to latest year.

PM should cover the timespan from 2000 to latest year.

Note 2: The A=Allowable Aggregation illustrates the level of aggregation that can be used if more detailed information is not available. Grey cells show which sectors can be aggregated into the sector marked A. Black cells occur when two possible levels of aggregation are possible.

| NFR sectors to be reported to CLRTAP | | | A = Allowable Aggregation | Yearly minimum reporting | | | | | | | | | | | | Additional reporting | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Main Pollutants | | | | | Particulate matter | | | Priority metals | | | Other metals | | | | | | |
| | | | | NOx | CO | NMVOC | SOx | NH3 | TSP | PM10 | PM2.5 | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn |
| | | | | Gg $NO_2$ | Gg | Gg | Gg $SO_2$ | Gg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg |
| 3 A | (a) | 3 A PAINT APPLICATION | | NA | NA | 23.48 | NA | NA | NA | NA | NE | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 3 B | (a) | 3 B DEGREASING AND DRY CLEANING | | NA | NA | 9.58 | NA | NA | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 3 C | (a) | 3 C CHEMICAL PRODUCTS, MANUFACTURE AND PROCESSING | | NA | NA | 11.77 | NA | NA | NA | NA | NA | 0.04 | 0.00 | NA | NE | NE | NE | NE | NE | NE |
| 3 D | (a) | 3 D OTHER including products containing HMs and POPs (Please specify in a covering note) | | NA | NA | 37.80 | NA | NA | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| **4 B** | (a) | **4 B MANURE MANAGEMENT (c)** | **A** | NA | NA | NA | NA | 43.13 | 946.00 | 436.07 | 164.50 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 B 1 | (a) | 4 B 1 Cattle | | NA | NA | NA | NA | 25.76 | 485.73 | 194.29 | 57.87 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 B 1 a | (a) | 4 B 1 a Dairy | | NA | NA | NA | NA | 9.57 | 138.41 | 55.36 | 16.49 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 B 1 b | (a) | 4 B 1 b Non-Dairy | | NA | NA | NA | NA | 16.19 | 347.32 | 138.93 | 41.38 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 B 2 | (a) | 4 B 2 Buffalo | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NE | NE | NE | NE | NE | NE |
| 4 B 3 | (a) | 4 B 3 Sheep | | NA | NA | NA | NA | 0.80 | 71.53 | 28.61 | 8.52 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 B 4 | (a) | 4 B 4 Goats | | NA | NA | NA | NA | 0.15 | 8.85 | 3.53 | 1.04 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 B 5 | (a) | 4 B 5 Camels and Llamas | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NE | NE | NE | NE | NE | NE |
| 4 B 6 | (a) | 4 B 6 Horses | | NA | NA | NA | NA | 0.74 | 13.01 | 5.19 | 1.53 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 B 7 | (a) | 4 B 7 Mules and Asses | | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | IE | NE | NE | NE | NE | NE | NE |
| 4 B 8 | (a) | 4 B 8 Swine | | NA | NA | NA | NA | 10.57 | 165.13 | 65.74 | 19.88 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 B 9 | (a) | 4 B 9 Poultry | | NA | NA | NA | NA | 5.01 | 201.14 | 138.29 | 75.43 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 B 13 | (a) | 4 B 13 Other | | NA | NA | NA | NA | 0.10 | 0.62 | 0.42 | 0.23 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 C | (a) | 4 C RICE CULTIVATION | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NE | NE | NE | NE | NE | NE |

Note 1: Main Pollutants should cover the timespan from 1980 to latest year.

HM should cover the timespan from 1990 to latest year.

PM should cover the timespan from 2000 to latest year.

Note 2: The A=Allowable Aggregation illustrates the level of aggregation that can be used if more detailed information is not available. Gray cells show which sectors can be aggregated into the sector marked A. Black cells occur when two possible levels of aggregation are possible.

| *NFR sectors to be reported to CLRTAP* | | | A = Allowable Aggregation | *Yearly minimum reporting* | | | | | | | | | | | | *Additional reporting* | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Main Pollutants | | | | | Particulate matter | | | Priority metals | | | Other metals | | | | | | |
| | | | | NOx | CO | NMVOC | SOx | NH3 | TSP | PM10 | PM2.5 | Pb | Cd | Hg | As | Cr | Cu | Ni | Se | Zn |
| | | | | Gg $NO_2$ | Gg | Gg | Gg $SO_2$ | Gg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg | Mg |
| **4 D** | (a) | **4 D AGRICULTURAL SOILS** | A | 4.84 | NA | 1.73 | NA | 7.69 | 14 906.81 | 6 702.03 | 640.79 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 D 1 | (a) | 4 D 1 Direct Soil Emission | | 4.84 | NA | 1.73 | NA | 7.69 | 14 906.81 | 6 702.03 | 640.79 | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 4 F | (a) | 4 F FIELD BURNING OF AGRICULTURAL WASTES | | 0.01 | 1.72 | 0.22 | 0.00 | 0.03 | NE | NE | NE | 0.06 | 0.01 | 0.00 | NE | NE | NE | NE | NE | NE |
| 4 G | (a) | 4 G OTHER (d) | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NE | NE | NE | NE | NE | NE |
| 5 B | (a) | 5 B FOREST AND GRASSLAND CONVERSION | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 6 A | (a) | 6 A SOLID WASTE DISPOSAL ON LAND | | NA | 9.48 | 0.13 | NA | 0.00 | 64.78 | 30.65 | 9.65 | 0.00 | 0.00 | 0.00 | NE | NE | NE | NE | NE | NE |
| 6 B | (a) | 6 B WASTE-WATER HANDLING | | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 6 C | (a) | 6 C WASTE INCINERATION (e) | | 0.03 | 0.01 | 0.00 | 0.05 | 0.00 | NE | NE | NE | 0.01 | 0.00 | 0.01 | NE | NE | NE | NE | NE | NE |
| 6 D | (a) | 6 D OTHER WASTE (f) | | NA | NA | NA | NA | 0.61 | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| 7 | (a) | 7 OTHER | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NE | NE | NE | NE | NE | NE |
| | | **National Total** | | 204.47 | 811.85 | 192.65 | 35.96 | 53.00 | 79 714.28 | 47 250.83 | 26 926.30 | 12.90 | 1.02 | 0.95 | NE | NE | NE | NE | NE | NE |
| *Memo Items* | | | | | | | | | | | | | | | | | | | | | |
| 1 A 3 a i (i) | (a) | International Aviation (LTO) | | 0.74 | 0.69 | 0.24 | 0.06 | 0.00 | 60.25 | 60.25 | 60.25 | 0.00 | 0.00 | 0.00 | NE | NE | NE | NE | NE | NE |
| 1 A 3 a i (ii) | (a) | International Aviation (Cruise) | | 4.10 | 0.80 | 0.36 | 0.42 | 0.00 | 459.47 | 459.47 | 459.47 | 0.00 | 0.00 | 0.00 | NE | NE | NE | NE | NE | NE |
| 1 A 3 d i | (a) | International Navigation | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NE | NE | NE | NE | NE | NE |
| 5 E | (a) | 5 E Other | | 0.90 | NA | 124.62 | NA | NA | NA | NA | NA | NA | NA | NA | NE | NE | NE | NE | NE | NE |
| X | | X(1108 Volcanoes) | | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NE | NE | NE | NE | NE | NE |

(a) Sectors already reported to UNFCCC for NOx, CO, NMVOC, SO.
(b) Including Product handling.
(c) Including NH3 from Enteric Fermentation.
(d) Including PM sources.
(e) Excludes waste incineration for energy (this is included in 1 A 1).
(f) Includes accidental fires.

Trend table 1: $SO_X$ [Gg] 1980-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1980 | 344.49 | 341.93 | 2.56 | 14.88 | NA | 0.05 | NA | 0.41 | NO | 359.82 | 0.12 |
| 1981 | 303.67 | 301.78 | 1.89 | 14.43 | NA | 0.05 | NA | 0.41 | NO | 318.56 | 0.13 |
| 1982 | 288.07 | 286.32 | 1.75 | 13.98 | NA | 0.05 | NA | 0.41 | NO | 302.50 | 0.12 |
| 1983 | 212.79 | 211.20 | 1.59 | 13.53 | NA | 0.05 | NA | 0.41 | NO | 226.78 | 0.15 |
| 1984 | 193.31 | 191.64 | 1.67 | 13.08 | NA | 0.05 | NA | 0.41 | NO | 206.85 | 0.20 |
| 1985 | 174.91 | 173.38 | 1.53 | 12.64 | NA | 0.05 | NA | 0.41 | NO | 187.99 | 0.21 |
| 1986 | 155.55 | 154.09 | 1.46 | 12.09 | NA | 0.05 | NA | 0.41 | NO | 168.09 | 0.19 |
| 1987 | 134.49 | 132.97 | 1.52 | 11.54 | NA | 0.05 | NA | 0.41 | NO | 146.48 | 0.21 |
| 1988 | 102.93 | 101.28 | 1.65 | 5.02 | NA | 0.05 | NA | 0.21 | NO | 108.20 | 0.23 |
| 1989 | 96.70 | 94.98 | 1.73 | 4.49 | NA | 0.05 | NA | 0.13 | NO | 101.37 | 0.28 |
| 1990 | 76.58 | 74.58 | 2.00 | 3.34 | NA | 0.00 | NA | 0.06 | NO | 79.99 | 0.28 |
| 1991 | 73.58 | 72.28 | 1.30 | 3.46 | NA | 0.00 | NA | 0.05 | NO | 77.10 | 0.32 |
| 1992 | 57.68 | 55.68 | 2.00 | 3.67 | NA | 0.00 | NA | 0.03 | NO | 61.38 | 0.34 |
| 1993 | 54.82 | 52.72 | 2.10 | 3.86 | NA | 0.00 | NA | 0.04 | NO | 58.73 | 0.36 |
| 1994 | 49.16 | 47.88 | 1.28 | 3.88 | NA | 0.00 | NA | 0.05 | NO | 53.08 | 0.38 |
| 1995 | 48.03 | 46.50 | 1.53 | 3.88 | NA | 0.00 | NA | 0.05 | NO | 51.96 | 0.42 |
| 1996 | 45.43 | 44.23 | 1.20 | 3.85 | NA | 0.00 | NA | 0.05 | NO | 49.33 | 0.47 |
| 1997 | 41.50 | 41.44 | 0.07 | 3.89 | NA | 0.00 | NA | 0.05 | NO | 45.44 | 0.48 |
| 1998 | 36.58 | 36.54 | 0.04 | 3.91 | NA | 0.00 | NA | 0.05 | NO | 40.55 | 0.50 |
| 1999 | 34.53 | 34.39 | 0.14 | 3.90 | NA | 0.00 | NA | 0.05 | NO | 38.49 | 0.49 |
| 2000 | 31.40 | 31.25 | 0.15 | 3.93 | NA | 0.00 | NA | 0.05 | NO | 35.39 | 0.53 |
| 2001 | 33.61 | 33.45 | 0.16 | 3.94 | NA | 0.00 | NA | 0.05 | NO | 37.60 | 0.51 |
| 2002 | 31.97 | 31.83 | 0.14 | 3.93 | NA | 0.00 | NA | 0.05 | NO | 35.96 | 0.48 |

Trend table 2: $NO_X$ [Gg] 1980-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1980 | 226.85 | 226.85 | IE | 13.98 | NA | 5.08 | NA | 0.19 | NO | 246.11 | 1.15 |
| 1981 | 213.73 | 213.73 | IE | 12.71 | NA | 5.14 | NA | 0.19 | NO | 231.77 | 1.25 |
| 1982 | 210.76 | 210.76 | IE | 11.45 | NA | 5.16 | NA | 0.19 | NO | 227.57 | 1.15 |
| 1983 | 214.32 | 214.32 | IE | 10.27 | NA | 5.25 | NA | 0.19 | NO | 230.03 | 1.44 |
| 1984 | 215.44 | 215.44 | IE | 9.07 | NA | 5.29 | NA | 0.19 | NO | 229.99 | 1.94 |
| 1985 | 220.62 | 220.62 | IE | 7.88 | NA | 5.28 | NA | 0.19 | NO | 233.97 | 2.11 |
| 1986 | 215.33 | 215.33 | IE | 6.68 | NA | 5.27 | NA | 0.19 | NO | 227.47 | 1.87 |
| 1987 | 213.88 | 213.88 | IE | 5.49 | NA | 5.72 | NA | 0.19 | NO | 225.27 | 2.07 |
| 1988 | 208.17 | 208.17 | IE | 5.27 | NA | 4.98 | NA | 0.11 | NO | 218.52 | 2.28 |
| 1989 | 204.14 | 204.14 | IE | 4.99 | NA | 5.27 | NA | 0.07 | NO | 214.47 | 2.79 |
| 1990 | 201.67 | 201.67 | IE | 4.80 | NA | 5.52 | NA | 0.04 | NO | 212.03 | 2.77 |
| 1991 | 206.84 | 206.84 | IE | 4.48 | NA | 5.92 | NA | 0.03 | NO | 217.27 | 3.12 |
| 1992 | 197.88 | 197.88 | IE | 4.55 | NA | 4.95 | NA | 0.02 | NO | 207.41 | 3.40 |
| 1993 | 191.59 | 191.59 | IE | 1.97 | NA | 5.37 | NA | 0.02 | NO | 198.95 | 3.61 |
| 1994 | 185.84 | 185.84 | IE | 1.92 | NA | 5.92 | NA | 0.02 | NO | 193.70 | 3.77 |
| 1995 | 182.48 | 182.48 | IE | 1.47 | NA | 5.43 | NA | 0.02 | NO | 189.40 | 4.23 |
| 1996 | 186.95 | 186.95 | IE | 1.45 | NA | 5.22 | NA | 0.02 | NO | 193.65 | 4.66 |
| 1997 | 182.93 | 182.93 | IE | 1.55 | NA | 5.57 | NA | 0.03 | NO | 190.08 | 4.85 |
| 1998 | 187.22 | 187.22 | IE | 1.53 | NA | 5.27 | NA | 0.03 | NO | 194.04 | 5.01 |
| 1999 | 182.80 | 182.80 | IE | 1.53 | NA | 5.16 | NA | 0.03 | NO | 189.51 | 4.92 |
| 2000 | 183.49 | 183.49 | IE | 1.66 | NA | 5.10 | NA | 0.03 | NO | 190.28 | 5.36 |
| 2001 | 189.54 | 189.54 | IE | 1.71 | NA | 5.17 | NA | 0.03 | NO | 196.44 | 5.16 |
| 2002 | 197.88 | 197.88 | IE | 1.71 | NA | 4.85 | NA | 0.03 | NO | 204.47 | 4.84 |

Trend table 3: NMVOC [Gg] 1980-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1980 | 197.30 | 186.09 | 11.21 | 23.98 | 210.53 | 4.91 | NA | 0.20 | NO | 436.91 | 0.12 |
| 1981 | 197.46 | 186.74 | 10.72 | 22.77 | 187.39 | 4.84 | NA | 0.20 | NO | 412.66 | 0.13 |
| 1982 | 196.45 | 186.42 | 10.03 | 21.84 | 184.22 | 4.96 | NA | 0.20 | NO | 407.67 | 0.12 |
| 1983 | 198.59 | 188.79 | 9.80 | 21.54 | 181.11 | 4.87 | NA | 0.20 | NO | 406.31 | 0.16 |
| 1984 | 202.13 | 192.17 | 9.96 | 21.34 | 178.05 | 4.93 | NA | 0.20 | NO | 406.65 | 0.21 |
| 1985 | 201.63 | 191.61 | 10.02 | 20.36 | 172.82 | 4.96 | NA | 0.20 | NO | 399.97 | 0.23 |
| 1986 | 196.86 | 186.80 | 10.06 | 19.36 | 171.65 | 4.87 | NA | 0.20 | NO | 392.95 | 0.20 |
| 1987 | 195.40 | 185.20 | 10.20 | 19.45 | 170.50 | 4.90 | NA | 0.20 | NO | 390.44 | 0.22 |
| 1988 | 183.53 | 173.46 | 10.07 | 19.91 | 169.36 | 5.02 | NA | 0.19 | NO | 378.01 | 0.25 |
| 1989 | 172.28 | 161.99 | 10.29 | 19.89 | 148.42 | 4.97 | NA | 0.20 | NO | 345.75 | 0.30 |
| 1990 | 162.63 | 152.00 | 10.63 | 16.37 | 116.95 | 1.94 | NA | 0.19 | NO | 298.09 | 0.30 |
| 1991 | 166.14 | 154.75 | 11.39 | 17.88 | 100.08 | 1.93 | NA | 0.19 | NO | 286.22 | 0.33 |
| 1992 | 153.16 | 141.85 | 11.31 | 19.40 | 82.33 | 1.87 | NA | 0.18 | NO | 256.95 | 0.37 |
| 1993 | 145.11 | 134.14 | 10.97 | 20.88 | 82.43 | 1.84 | NA | 0.18 | NO | 250.44 | 0.39 |
| 1994 | 132.34 | 124.12 | 8.22 | 21.28 | 77.06 | 1.90 | NA | 0.17 | NO | 232.76 | 0.42 |
| 1995 | 127.65 | 120.22 | 7.43 | 21.01 | 81.75 | 1.91 | NA | 0.17 | NO | 232.48 | 0.46 |
| 1996 | 124.67 | 118.14 | 6.52 | 20.99 | 78.07 | 1.89 | NA | 0.16 | NO | 225.78 | 0.54 |
| 1997 | 107.19 | 101.20 | 5.99 | 20.89 | 82.93 | 1.97 | NA | 0.15 | NO | 213.13 | 0.60 |
| 1998 | 102.95 | 97.13 | 5.81 | 20.54 | 75.54 | 1.93 | NA | 0.15 | NO | 201.11 | 0.66 |
| 1999 | 96.87 | 91.78 | 5.09 | 20.79 | 69.96 | 1.97 | NA | 0.14 | NO | 189.73 | 0.64 |
| 2000 | 90.07 | 84.97 | 5.10 | 20.48 | 77.74 | 1.87 | NA | 0.14 | NO | 190.30 | 0.67 |
| 2001 | 89.76 | 86.50 | 3.26 | 21.01 | 82.63 | 1.95 | NA | 0.13 | NO | 195.47 | 0.65 |
| 2002 | 86.95 | 83.56 | 3.39 | 21.00 | 82.63 | 1.94 | NA | 0.13 | NO | 192.65 | 0.60 |

Trend table 4: CO[Gg] 1980-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1980 | 1689.04 | 1689.04 | IE | 52.80 | NA | 30.26 | NA | 13.83 | NO | 1785.93 | 0.35 |
| 1981 | 1648.14 | 1648.14 | IE | 50.65 | NA | 30.26 | NA | 13.82 | NO | 1742.87 | 0.38 |
| 1982 | 1624.39 | 1624.39 | IE | 48.26 | NA | 30.26 | NA | 13.85 | NO | 1716.76 | 0.35 |
| 1983 | 1601.29 | 1601.29 | IE | 47.85 | NA | 30.25 | NA | 13.79 | NO | 1693.19 | 0.44 |
| 1984 | 1647.76 | 1647.76 | IE | 48.06 | NA | 30.25 | NA | 13.77 | NO | 1739.84 | 0.59 |
| 1985 | 1623.02 | 1623.02 | IE | 46.71 | NA | 30.25 | NA | 13.74 | NO | 1713.71 | 0.64 |
| 1986 | 1560.95 | 1560.95 | IE | 44.69 | NA | 30.24 | NA | 13.61 | NO | 1649.49 | 0.57 |
| 1987 | 1489.74 | 1489.74 | IE | 44.95 | NA | 30.24 | NA | 13.63 | NO | 1578.56 | 0.63 |
| 1988 | 1406.02 | 1406.02 | IE | 45.92 | NA | 30.24 | NA | 13.82 | NO | 1496.00 | 0.69 |
| 1989 | 1346.65 | 1346.65 | IE | 46.27 | NA | 30.24 | NA | 14.16 | NO | 1437.32 | 0.85 |
| 1990 | 1186.40 | 1186.40 | IE | 46.37 | NA | 1.75 | NA | 14.12 | NO | 1248.63 | 0.85 |
| 1991 | 1195.56 | 1195.56 | IE | 41.67 | NA | 1.75 | NA | 14.07 | NO | 1253.06 | 0.93 |
| 1992 | 1148.79 | 1148.79 | IE | 44.97 | NA | 1.75 | NA | 13.73 | NO | 1209.24 | 1.01 |
| 1993 | 1108.38 | 1108.38 | IE | 47.15 | NA | 1.75 | NA | 13.56 | NO | 1170.84 | 1.08 |
| 1994 | 1054.93 | 1054.93 | IE | 48.65 | NA | 1.75 | NA | 13.00 | NO | 1118.33 | 1.14 |
| 1995 | 968.76 | 968.76 | IE | 48.44 | NA | 1.74 | NA | 12.45 | NO | 1031.38 | 1.26 |
| 1996 | 979.46 | 979.46 | IE | 45.31 | NA | 1.74 | NA | 11.92 | NO | 1038.44 | 1.41 |
| 1997 | 915.69 | 915.69 | IE | 48.65 | NA | 1.73 | NA | 11.47 | NO | 977.54 | 1.52 |
| 1998 | 875.46 | 875.46 | IE | 49.76 | NA | 1.73 | NA | 11.11 | NO | 938.05 | 1.62 |
| 1999 | 829.50 | 829.50 | IE | 48.58 | NA | 1.72 | NA | 10.74 | NO | 890.53 | 1.59 |
| 2000 | 769.65 | 769.65 | IE | 51.40 | NA | 1.72 | NA | 10.24 | NO | 833.01 | 1.65 |
| 2001 | 772.98 | 772.98 | IE | 52.49 | NA | 1.72 | NA | 9.80 | NO | 836.99 | 1.59 |
| 2002 | 748.27 | 748.27 | IE | 52.36 | NA | 1.72 | NA | 9.49 | NO | 811.85 | 1.49 |

Trend table 5: $NH_3$ [Gg] 1980-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1980 | 1.43 | 1.43 | IE | 0.21 | NA | 49.93 | NA | 0.01 | NO | 51.57 | 0.00 |
| 1981 | 1.34 | 1.34 | IE | 0.20 | NA | 50.79 | NA | 0.01 | NO | 52.34 | 0.00 |
| 1982 | 1.32 | 1.32 | IE | 0.20 | NA | 51.08 | NA | 0.01 | NO | 52.61 | 0.00 |
| 1983 | 1.29 | 1.29 | IE | 0.19 | NA | 52.09 | NA | 0.01 | NO | 53.58 | 0.00 |
| 1984 | 1.32 | 1.32 | IE | 0.20 | NA | 52.49 | NA | 0.01 | NO | 54.01 | 0.00 |
| 1985 | 1.36 | 1.36 | IE | 0.19 | NA | 52.18 | NA | 0.01 | NO | 53.73 | 0.00 |
| 1986 | 1.38 | 1.38 | IE | 0.18 | NA | 51.60 | NA | 0.01 | NO | 53.16 | 0.00 |
| 1987 | 1.38 | 1.38 | IE | 0.18 | NA | 52.54 | NA | 0.01 | NO | 54.11 | 0.00 |
| 1988 | 1.35 | 1.35 | IE | 0.19 | NA | 49.93 | NA | 0.01 | NO | 51.48 | 0.00 |
| 1989 | 1.37 | 1.37 | IE | 0.19 | NA | 51.02 | NA | 0.01 | NO | 52.58 | 0.00 |
| 1990 | 1.35 | 1.35 | IE | 0.19 | NA | 55.54 | NA | 0.38 | NO | 57.45 | 0.00 |
| 1991 | 1.50 | 1.50 | IE | 0.18 | NA | 56.52 | NA | 0.39 | NO | 58.58 | 0.00 |
| 1992 | 1.47 | 1.47 | IE | 0.16 | NA | 53.04 | NA | 0.45 | NO | 55.12 | 0.00 |
| 1993 | 1.56 | 1.56 | IE | 0.18 | NA | 54.83 | NA | 0.54 | NO | 57.10 | 0.00 |
| 1994 | 1.53 | 1.53 | IE | 0.13 | NA | 56.42 | NA | 0.62 | NO | 58.71 | 0.00 |
| 1995 | 1.56 | 1.56 | IE | 0.10 | NA | 55.94 | NA | 0.64 | NO | 58.24 | 0.00 |
| 1996 | 1.64 | 1.64 | IE | 0.10 | NA | 54.42 | NA | 0.67 | NO | 56.83 | 0.00 |
| 1997 | 1.61 | 1.61 | IE | 0.10 | NA | 55.74 | NA | 0.61 | NO | 58.06 | 0.00 |
| 1998 | 1.60 | 1.60 | IE | 0.10 | NA | 54.94 | NA | 0.62 | NO | 57.26 | 0.00 |
| 1999 | 1.54 | 1.54 | IE | 0.12 | NA | 53.66 | NA | 0.64 | NO | 55.96 | 0.00 |
| 2000 | 1.44 | 1.44 | IE | 0.10 | NA | 51.98 | NA | 0.62 | NO | 54.13 | 0.00 |
| 2001 | 1.55 | 1.55 | IE | 0.08 | NA | 52.23 | NA | 0.61 | NO | 54.48 | 0.00 |
| 2002 | 1.48 | 1.48 | IE | 0.06 | NA | 50.84 | NA | 0.61 | NO | 53.00 | 0.00 |

Trend table 6: Cd [Mg] 1985-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1985 | 2.08 | 2.08 | IE | 0.84 | 0.00 | 0.22 | NA | 0.14 | NO | 3.27 | 0.00 |
| 1986 | 1.84 | 1.84 | IE | 0.71 | 0.00 | 0.22 | NA | 0.12 | NO | 2.89 | 0.00 |
| 1987 | 1.44 | 1.44 | IE | 0.65 | 0.00 | 0.22 | NA | 0.10 | NO | 2.42 | 0.00 |
| 1988 | 1.20 | 1.20 | IE | 0.62 | 0.00 | 0.22 | NA | 0.08 | NO | 2.12 | 0.00 |
| 1989 | 1.09 | 1.09 | IE | 0.58 | 0.00 | 0.22 | NA | 0.06 | NO | 1.95 | 0.00 |
| 1990 | 1.01 | 1.01 | IE | 0.46 | 0.00 | 0.01 | NA | 0.06 | NO | 1.54 | 0.00 |
| 1991 | 1.03 | 1.03 | IE | 0.38 | 0.00 | 0.01 | NA | 0.05 | NO | 1.48 | 0.00 |
| 1992 | 0.97 | 0.97 | IE | 0.26 | 0.00 | 0.01 | NA | 0.01 | NO | 1.25 | 0.00 |
| 1993 | 0.92 | 0.92 | IE | 0.22 | 0.00 | 0.01 | NA | 0.00 | NO | 1.15 | 0.00 |
| 1994 | 0.85 | 0.85 | IE | 0.18 | 0.00 | 0.01 | NA | 0.00 | NO | 1.05 | 0.00 |
| 1995 | 0.78 | 0.78 | IE | 0.16 | 0.00 | 0.01 | NA | 0.00 | NO | 0.95 | 0.00 |
| 1996 | 0.82 | 0.82 | IE | 0.15 | 0.00 | 0.01 | NA | 0.00 | NO | 0.98 | 0.00 |
| 1997 | 0.79 | 0.79 | IE | 0.16 | 0.00 | 0.01 | NA | 0.00 | NO | 0.97 | 0.00 |
| 1998 | 0.74 | 0.74 | IE | 0.16 | 0.00 | 0.01 | NA | 0.00 | NO | 0.91 | 0.00 |
| 1999 | 0.73 | 0.73 | IE | 0.17 | 0.00 | 0.01 | NA | 0.00 | NO | 0.91 | 0.00 |
| 2000 | 0.70 | 0.70 | IE | 0.18 | 0.00 | 0.01 | NA | 0.00 | NO | 0.89 | 0.00 |
| 2001 | 0.77 | 0.77 | IE | 0.19 | 0.00 | 0.01 | NA | 0.00 | NO | 0.97 | 0.00 |
| 2002 | 0.81 | 0.81 | IE | 0.20 | 0.00 | 0.01 | NA | 0.00 | NO | 1.02 | 0.00 |

Trend table 7: Hg [Mg] 1985-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1985 | 2.98 | 2.98 | IE | 0.67 | NA | 0.03 | NA | 0.09 | NO | 3.77 | 0.00 |
| 1986 | 2.60 | 2.60 | IE | 0.63 | NA | 0.03 | NA | 0.08 | NO | 3.34 | 0.00 |
| 1987 | 2.15 | 2.15 | IE | 0.61 | NA | 0.03 | NA | 0.07 | NO | 2.86 | 0.00 |
| 1988 | 1.81 | 1.81 | IE | 0.59 | NA | 0.03 | NA | 0.06 | NO | 2.50 | 0.00 |
| 1989 | 1.61 | 1.61 | IE | 0.58 | NA | 0.03 | NA | 0.06 | NO | 2.28 | 0.00 |
| 1990 | 1.58 | 1.58 | IE | 0.53 | NA | 0.00 | NA | 0.05 | NO | 2.16 | 0.00 |
| 1991 | 1.50 | 1.50 | IE | 0.49 | NA | 0.00 | NA | 0.05 | NO | 2.04 | 0.00 |
| 1992 | 1.19 | 1.19 | IE | 0.44 | NA | 0.00 | NA | 0.02 | NO | 1.65 | 0.00 |
| 1993 | 0.97 | 0.97 | IE | 0.41 | NA | 0.00 | NA | 0.02 | NO | 1.40 | 0.00 |
| 1994 | 0.76 | 0.76 | IE | 0.40 | NA | 0.00 | NA | 0.02 | NO | 1.18 | 0.00 |
| 1995 | 0.72 | 0.72 | IE | 0.47 | NA | 0.00 | NA | 0.02 | NO | 1.21 | 0.00 |
| 1996 | 0.72 | 0.72 | IE | 0.43 | NA | 0.00 | NA | 0.02 | NO | 1.17 | 0.00 |
| 1997 | 0.70 | 0.70 | IE | 0.43 | NA | 0.00 | NA | 0.02 | NO | 1.15 | 0.00 |
| 1998 | 0.61 | 0.61 | IE | 0.33 | NA | 0.00 | NA | 0.01 | NO | 0.96 | 0.00 |
| 1999 | 0.63 | 0.63 | IE | 0.28 | NA | 0.00 | NA | 0.01 | NO | 0.92 | 0.00 |
| 2000 | 0.63 | 0.63 | IE | 0.24 | NA | 0.00 | NA | 0.01 | NO | 0.88 | 0.00 |
| 2001 | 0.69 | 0.69 | IE | 0.24 | NA | 0.00 | NA | 0.01 | NO | 0.95 | 0.00 |
| 2002 | 0.68 | 0.68 | IE | 0.26 | NA | 0.00 | NA | 0.01 | NO | 0.95 | 0.00 |

Trend table 8: Pb [Mg] 1985-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1985 | 257.61 | 257.61 | IE | 62.45 | 0.06 | 1.12 | NA | 5.85 | NO | 327.09 | 0.00 |
| 1986 | 254.56 | 254.56 | IE | 52.38 | 0.06 | 1.12 | NA | 5.27 | NO | 313.39 | 0.00 |
| 1987 | 248.78 | 248.78 | IE | 47.85 | 0.06 | 1.12 | NA | 4.69 | NO | 302.52 | 0.00 |
| 1988 | 224.24 | 224.24 | IE | 45.16 | 0.07 | 1.12 | NA | 2.59 | NO | 273.18 | 0.00 |
| 1989 | 195.72 | 195.72 | IE | 41.74 | 0.07 | 1.12 | NA | 1.64 | NO | 240.28 | 0.00 |
| 1990 | 170.58 | 170.58 | IE | 32.09 | 0.07 | 0.06 | NA | 1.02 | NO | 203.81 | 0.00 |
| 1991 | 140.41 | 140.41 | IE | 27.09 | 0.06 | 0.06 | NA | 0.78 | NO | 168.40 | 0.00 |
| 1992 | 97.47 | 97.47 | IE | 18.61 | 0.06 | 0.06 | NA | 0.49 | NO | 116.68 | 0.00 |
| 1993 | 68.13 | 68.13 | IE | 15.15 | 0.05 | 0.06 | NA | 0.38 | NO | 83.77 | 0.00 |
| 1994 | 46.18 | 46.18 | IE | 12.03 | 0.05 | 0.06 | NA | 0.27 | NO | 58.57 | 0.00 |
| 1995 | 11.43 | 11.43 | IE | 4.68 | 0.04 | 0.06 | NA | 0.01 | NO | 16.22 | 0.00 |
| 1996 | 11.30 | 11.30 | IE | 4.25 | 0.04 | 0.06 | NA | 0.01 | NO | 15.66 | 0.00 |
| 1997 | 9.90 | 9.90 | IE | 4.79 | 0.04 | 0.06 | NA | 0.01 | NO | 14.80 | 0.00 |
| 1998 | 8.36 | 8.36 | IE | 4.71 | 0.04 | 0.06 | NA | 0.01 | NO | 13.18 | 0.00 |
| 1999 | 7.51 | 7.51 | IE | 4.91 | 0.04 | 0.06 | NA | 0.01 | NO | 12.53 | 0.00 |
| 2000 | 6.32 | 6.32 | IE | 5.47 | 0.04 | 0.06 | NA | 0.01 | NO | 11.90 | 0.00 |
| 2001 | 6.91 | 6.91 | IE | 5.59 | 0.04 | 0.06 | NA | 0.01 | NO | 12.61 | 0.00 |
| 2002 | 6.86 | 6.86 | IE | 5.93 | 0.04 | 0.06 | NA | 0.00 | NO | 12.89 | 0.00 |

Trend table 9: PAH [Mg] 1985-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1985 | 11.95 | 11.95 | IE | 7.88 | 0.15 | 8.47 | NA | 0.00 | NO | 28.45 | NE |
| 1986 | 11.28 | 11.28 | IE | 7.82 | 0.15 | 8.46 | NA | 0.00 | NO | 27.72 | NE |
| 1987 | 11.08 | 11.08 | IE | 7.91 | 0.15 | 8.46 | NA | 0.00 | NO | 27.60 | NE |
| 1988 | 10.26 | 10.26 | IE | 7.46 | 0.15 | 8.46 | NA | 0.00 | NO | 26.34 | NE |
| 1989 | 9.75 | 9.75 | IE | 7.57 | 0.15 | 8.46 | NA | 0.00 | NO | 25.93 | NE |
| 1990 | 9.62 | 9.62 | IE | 7.44 | 0.15 | 0.49 | NA | 0.00 | NO | 17.69 | NE |
| 1991 | 10.43 | 10.43 | IE | 7.18 | 0.15 | 0.49 | NA | 0.00 | NO | 18.25 | NE |
| 1992 | 9.56 | 9.56 | IE | 3.59 | 0.11 | 0.49 | NA | 0.00 | NO | 13.74 | NE |
| 1993 | 9.32 | 9.32 | IE | 0.52 | 0.07 | 0.48 | NA | 0.00 | NO | 10.40 | NE |
| 1994 | 8.38 | 8.38 | IE | 0.59 | 0.06 | 0.48 | NA | 0.00 | NO | 9.51 | NE |
| 1995 | 8.82 | 8.82 | IE | 0.49 | 0.04 | 0.48 | NA | 0.00 | NO | 9.83 | NE |
| 1996 | 9.51 | 9.51 | IE | 0.90 | 0.02 | 0.48 | NA | 0.00 | NO | 10.91 | NE |
| 1997 | 8.57 | 8.57 | IE | 0.47 | 0.01 | 0.48 | NA | 0.00 | NO | 9.52 | NE |
| 1998 | 8.21 | 8.21 | IE | 0.41 | 0.00 | 0.48 | NA | 0.00 | NO | 9.10 | NE |
| 1999 | 8.01 | 8.01 | IE | 0.25 | 0.00 | 0.48 | NA | 0.00 | NO | 8.74 | NE |
| 2000 | 7.49 | 7.49 | IE | 0.19 | 0.00 | 0.48 | NA | 0.00 | NO | 8.16 | NE |
| 2001 | 8.46 | 8.46 | IE | 0.19 | 0.00 | 0.48 | NA | 0.00 | NO | 9.13 | NE |
| 2002 | 8.20 | 8.20 | IE | 0.21 | 0.00 | 0.48 | NA | 0.00 | NO | 8.88 | NE |

Trend table 10: DIOXIN [g] 1985-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1985 | 109.92 | 109.92 | IE | 51.30 | 5.19 | 6.05 | NA | 15.90 | NO | 188.36 | NE |
| 1986 | 108.06 | 108.06 | IE | 51.02 | 6.20 | 6.05 | NA | 15.89 | NO | 187.22 | NE |
| 1987 | 115.76 | 115.76 | IE | 50.81 | 0.24 | 6.05 | NA | 15.89 | NO | 188.75 | NE |
| 1988 | 111.55 | 111.55 | IE | 41.60 | 1.06 | 6.05 | NA | 15.48 | NO | 175.73 | NE |
| 1989 | 103.11 | 103.11 | IE | 41.13 | 1.06 | 6.05 | NA | 15.29 | NO | 166.64 | NE |
| 1990 | 102.16 | 102.16 | IE | 39.00 | 1.06 | 0.35 | NA | 18.19 | NO | 160.77 | NE |
| 1991 | 80.60 | 80.60 | IE | 35.15 | 1.04 | 0.35 | NA | 17.75 | NO | 134.90 | NE |
| 1992 | 53.30 | 53.30 | IE | 21.88 | 0.02 | 0.35 | NA | 0.53 | NO | 76.09 | NE |
| 1993 | 49.43 | 49.43 | IE | 17.01 | 0.02 | 0.35 | NA | 0.22 | NO | 67.03 | NE |
| 1994 | 44.20 | 44.20 | IE | 11.26 | 0.00 | 0.35 | NA | 0.08 | NO | 55.90 | NE |
| 1995 | 45.50 | 45.50 | IE | 12.22 | 0.00 | 0.35 | NA | 0.08 | NO | 58.16 | NE |
| 1996 | 47.57 | 47.57 | IE | 11.17 | 0.00 | 0.35 | NA | 0.08 | NO | 59.17 | NE |
| 1997 | 46.91 | 46.91 | IE | 12.15 | 0.00 | 0.35 | NA | 0.08 | NO | 59.49 | NE |
| 1998 | 43.56 | 43.56 | IE | 11.45 | 0.00 | 0.35 | NA | 0.08 | NO | 55.44 | NE |
| 1999 | 38.46 | 38.46 | IE | 12.60 | 0.00 | 0.35 | NA | 0.08 | NO | 51.48 | NE |
| 2000 | 35.17 | 35.17 | IE | 14.05 | 0.00 | 0.35 | NA | 0.08 | NO | 49.64 | NE |
| 2001 | 39.43 | 39.43 | IE | 14.26 | 0.00 | 0.35 | NA | 0.08 | NO | 54.11 | NE |
| 2002 | 36.78 | 36.78 | IE | 15.25 | 0.00 | 0.35 | NA | 0.08 | NO | 52.45 | NE |

Trend table 11: HCB [kg] 1985-2002

| NFR-Sectors | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 ENERGY | 1 A FUEL COMBUSTION ACTIVITIES | 1 B FUGITIVE EMISSIONS FROM FUELS | 2 INDUSTRIAL PROCESSES | 3 SOLVENT AND OTHER PRODUCT USE | 4 AGRICULTURE | 5 LAND USE CHANGE AND FORESTRY | 6 WASTE | 7 OTHER | **NATIONAL TOTAL** | International Bunkers |
| 1985 | 83.35 | 83.35 | IE | 13.27 | 7.71 | 1.21 | NA | 1.11 | NO | 106.65 | NE |
| 1986 | 80.33 | 80.33 | IE | 13.21 | 8.12 | 1.21 | NA | 1.11 | NO | 103.98 | NE |
| 1987 | 82.79 | 82.79 | IE | 13.18 | 8.11 | 1.21 | NA | 1.11 | NO | 106.40 | NE |
| 1988 | 78.47 | 78.47 | IE | 11.16 | 8.22 | 1.21 | NA | 0.70 | NO | 99.76 | NE |
| 1989 | 74.18 | 74.18 | IE | 11.06 | 9.34 | 1.21 | NA | 0.52 | NO | 96.31 | NE |
| 1990 | 73.47 | 73.47 | IE | 9.71 | 9.05 | 0.07 | NA | 0.39 | NO | 92.70 | NE |
| 1991 | 69.81 | 69.81 | IE | 8.03 | 6.39 | 0.07 | NA | 0.28 | NO | 84.58 | NE |
| 1992 | 56.53 | 56.53 | IE | 4.94 | 7.49 | 0.07 | NA | 0.11 | NO | 69.14 | NE |
| 1993 | 53.86 | 53.86 | IE | 3.70 | 6.47 | 0.07 | NA | 0.04 | NO | 64.15 | NE |
| 1994 | 47.71 | 47.71 | IE | 2.45 | 1.25 | 0.07 | NA | 0.02 | NO | 51.50 | NE |
| 1995 | 50.08 | 50.08 | IE | 2.67 | 0.00 | 0.07 | NA | 0.02 | NO | 52.84 | NE |
| 1996 | 52.93 | 52.93 | IE | 2.44 | 0.00 | 0.07 | NA | 0.02 | NO | 55.46 | NE |
| 1997 | 49.08 | 49.08 | IE | 2.65 | 0.00 | 0.07 | NA | 0.02 | NO | 51.83 | NE |
| 1998 | 46.12 | 46.12 | IE | 2.50 | 0.00 | 0.07 | NA | 0.02 | NO | 48.71 | NE |
| 1999 | 43.01 | 43.01 | IE | 2.76 | 0.00 | 0.07 | NA | 0.02 | NO | 45.86 | NE |
| 2000 | 39.12 | 39.12 | IE | 3.07 | 0.00 | 0.07 | NA | 0.02 | NO | 42.29 | NE |
| 2001 | 44.54 | 44.54 | IE | 3.12 | 0.00 | 0.07 | NA | 0.02 | NO | 47.75 | NE |
| 2002 | 41.49 | 41.49 | IE | 3.34 | 0.00 | 0.07 | NA | 0.02 | NO | 44.91 | NE |

Trend table 12: TSP [Mg] 1990-2002

| | NFR sectors | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| 1 | ENERGY | 30 748 | 31 675 | 32 434 | 32 442 | 34 953 | 36 317 |
| 1 A | FUEL COMBUSTION ACTIVITIES | 30 748 | 31 675 | 32 434 | 32 442 | 34 953 | 36 317 |
| 1 B | FUGITIVE EMISSIONS FROM FUELS | IE | IE | IE | IE | IE | IE |
| 2 | INDUSTRIAL PROCESSES | 23 897 | 25 075 | 28 352 | 27 442 | 27 241 | 27 479 |
| 3 | SOLVENT AND OTHER PRODUCT USE | NA | NA | NA | NA | NA | NA |
| 4 | AGRICULTURE | 17 068 | 16 775 | 16 759 | 15 871 | 15 878 | 15 853 |
| 5 | LAND USE CHANGE AND FORESTRY | NA | NA | NA | NA | NA | NA |
| 6 | WASTE | 166 | 184 | 62 | 84 | 65 | 65 |
| 7 | OTHER | NO | NO | NO | NO | NO | NO |
| | **NATIONAL TOTAL** | **71 879** | **73 710** | **77 607** | **75 839** | **78 137** | **79 714** |
| | International Bunkers | 307 | 456 | 530 | 576 | 555 | 520 |

Trend table 13: PM 10 [Mg] 1990-2002

| | NFR sectors | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| 1 | ENERGY | 23 916 | 24 335 | 24 210 | 23 781 | 25 447 | 25 992 |
| 1 A | FUEL COMBUSTION ACTIVITIES | 23 916 | 24 335 | 24 210 | 23 781 | 25 447 | 25 992 |
| 1 B | FUGITIVE EMISSIONS FROM FUELS | IE | IE | IE | IE | IE | IE |
| 2 | INDUSTRIAL PROCESSES | 13 188 | 12 893 | 14 426 | 14 007 | 13 919 | 14 090 |
| 3 | SOLVENT AND OTHER PRODUCT USE | NA | NA | NA | NA | NA | NA |
| 4 | AGRICULTURE | 7 689 | **7 555** | 7 553 | 7 142 | 7 148 | 7 138 |
| 5 | LAND USE CHANGE AND FORESTRY | NA | NA | NA | NA | NA | NA |
| 6 | WASTE | 79 | 87 | 29 | 40 | 31 | 31 |
| 7 | OTHER | NO | NO | NO | NO | NO | NO |
| | **NATIONAL TOTAL** | **44 871** | **44 871** | **46 218** | **44 970** | **46 544** | **47 251** |
| | International Bunkers | 307 | 456 | 530 | 576 | 555 | 520 |

Trend table 14: PM 2,5 [Mg] 1990-2002

| | NFR sectors | 1990 | 1995 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|
| 1 | ENERGY | 20 263 | 20 623 | 20 238 | 19 725 | 20 986 | 21 242 |
| 1 A | FUEL COMBUSTION ACTIVITIES | 20 263 | 20 623 | 20 238 | 19 725 | 20 986 | 21 242 |
| 1 B | FUGITIVE EMISSIONS FROM FUELS | IE | IE | IE | IE | IE | IE |
| 2 | INDUSTRIAL PROCESSES | 5 067 | 4 463 | 4 935 | 4 808 | 4 786 | 4 870 |
| 3 | SOLVENT AND OTHER PRODUCT USE | NA | NA | NA | NA | NA | NA |
| 4 | AGRICULTURE | 908 | 868 | 870 | 804 | 808 | 805 |
| 5 | LAND USE CHANGE AND FORESTRY | NA | NA | NA | NA | NA | NA |
| 6 | WASTE | 25 | 27 | 9 | 12 | 10 | 10 |
| 7 | OTHER | NO | NO | NO | NO | NO | NO |
| | **NATIONAL TOTAL** | 26 262 | 25 982 | 26 051 | 25 350 | 26 589 | 26 926 |
| | International Bunkers | 307 | 456 | 530 | 576 | 555 | 520 |

# ANNEX 3: EXTRACTS FROM AUSTRIAN LEGISLATION

This annex presents 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 Verord-

nung 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, BGBI 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.

Anlage

(§ 6)

**Emissionsmessungen**

1. Einzelmessungen

a) Einzelmessungen sind für alle im § 3 Abs. 1 und 3 und im § 4 angeführten Stoffe bei jenem Betriebszustand durchzuführen, in dem nachweislich die Anlagen vorwiegend betrieben werden. Die Durchführung der Messungen hat nach den Regeln der Technik zu erfolgen.

2. Kontinuierliche Messungen

a) Die Datenaufzeichnung hat durch ein automatisch registrierendes Messgerät in Form von Halbstundenmittelwerten unter Angabe von Datum, Uhrzeit und Messstelle zu erfolgen. Die Verfügbarkeit der Daten hat mindestens 90% zu betragen. Als Bezugszeitraum gilt ein Monat.

b) Das registrierende Messgerät ist im Abnahmeversuch und alle drei Jahre durch einen Sachverständigen aus dem im § 6 Abs. 5 angeführten Personenkreis zu kalibrieren.

c) Jährlich ist eine Funktionskontrolle des registrierenden Messgerätes durch einen Sachverständigen aus dem im § 6 Abs. 5 angeführten Personenkreis vorzunehmen.

**Sinter plants:**

**BGBl II 1997/ 163 Verordnung für Anlagen zum Sintern von Eisenerzen**

§ 5 (1) Der Betriebanlageninhaber hat Einzelmessungen der Emissionskonzentration der im § 3 Abs. 1 Z 2 lit. a und b und Z 3 angeführten Stoffe entsprechend der Z 1 in der Anlage zu dieser Verordnung in regelmäßigen, drei Jahre nicht übersteigenden Zeitabständen, durchzuführen zu lassen (wiederkehrende Emissionsmessungen).

(2) Der Betriebanlageninhaber hat kontinuierliche Messungen der Emissionskonzentrationen von Staub, Stickstoffoxiden und Schwefeldioxid entsprechend der Z 2 der Anlage dieser Verordnung durchzuführen.

(3) Zur Durchführung der Messungen gemäß Abs. 1 sowie zur Funktionskontrolle und Kalibrierung von Messgeräten für Messungen gemäß Abs. 2 sind akkreditierte Stellen im Rahmen des fachlichen Umfangs ihrer Akkreditierung (§ 11 Abs. 2 des Akkreditierungsgesetzes, BGBl Nr 468/ 1992), Anstalten des Bundes oder eines Bundeslandes, staatlich autorisierte Anstalten, Ziviltechniker oder Gewerbebetreibende, jeweils im Rahmen ihrer Befugnisse, heranzuziehen.

§ 6 Die Ergebnisse der Messungen gemäß § 5 sind in einem Messbericht festzuhalten, der zu enthalten hat:

1. bei Messungen gemäß § 5 Abs. 1 die Messwerte und die Betriebsbedingungen während der Messungen (Betriebszustand, Verbrauch an Brennstoff und Einsatzmaterial),

2. bei Messungen gemäß § 5 Abs. 2 die Messwerte in Form von Aufzeichnungen eines kontinuierlich registrierenden Messgerätes.

Der Messbericht ist mindestens drei Jahre, bei Messungen gemäß § 5 Abs. 1 jedenfalls bis zur jeweils nächsten Messung, in der Betriebsanlage derart aufzubewahren, dass er den behördlichen Organen jederzeit zur Einsicht vorgewiesen werden kann.

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.