umweltbundesamt

AUSTRIA'S ANNUAL NATIONAL GREENHOUSE GAS INVENTORY 1990-2004

Submission under Decision 280/2004/EC

REPORT
REP-0007

Vienna, 2006

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VORWORT

Dieser Bericht

Der vorliegende Bericht präsentiert die neueste Entwicklung an Treibhausgasen (THG) in Österreich. Er folgt in Format und Inhalt den verbindlichen Anforderungen des THG-Überwachungssystems 280/2004/EG[1] der EU zur Umsetzung des Kyoto-Protokolls. Dieses System umfasst die jährliche Übermittlung von aktualisierten THG-Emissionsdaten mit 15. Jänner an die Europäische Kommission. Mit diesem Bericht wird der dafür notwendige Emissionsbericht in englischer Sprache im dafür geforderten CRF[2]-Berichtsformat zusammenfassend wiedergegeben. Eine detaillierte Darstellung der Daten wird der Europäischen Kommission außerdem in digitaler Form übermittelt[3].

Der THG-Trend

Die Gesamtmenge an Treibhausgasemissionen liegt im Jahr 2004 bei 91,3 Millionen Tonnen CO_2 Äquivalente. Dies entspricht einer Verminderung um 1,2 Millionen oder 1,3 % gegenüber dem Vorjahr und einem Anstieg von 15,7 % gegenüber dem Kyoto-Basisjahr 1990.

Treibende Kräfte gegenüber dem Vorjahr sind der Rückgang der Kohlendioxid (CO_2) Emissionen in den Sektoren Kleinverbraucher (CRF Sektor 1 A 4) um 1,1 Mio. Tonnen und Energieversorgung (CRF-Sektor 1 A 1) um 0,6 Mio. Tonnen. Verantwortlich für diesen Rückgang ist das im Durchschnitt relativ warme Jahr – im Vergleich zum Vorjahr gehen die Heizgradtage um 3,1 % zurück – und die Zunahme der Stromerzeugung aus der Wasserkraft von 33,5 TWh 2003 auf 37,3 TWh im Jahr 2004. Auch der Rückgang der Lachgas (N_2O) Emissionen in der chemischen Industrie (CRF-Sektor 2 B, durch den Einsatz von Lachgaszersetzungsanlagen) um 0,6 Mio. Tonnen und in der Landwirtschaft um 0,1 Mio. Tonnen CO_2 Äquivalente trägt zu der generellen Abnahme der Treibhaugasemissionen bei. Steigende CO_2 Emissionen verzeichnen der Verkehr (CRF-Sektor 1 A 3 + 1 A 5) und die Industrie (CRF Sektor 1 A 2 + 2), die gegenüber dem Vorjahr um jeweils 0,6 Mio. Tonnen gestiegen sind. Eine detaillierte Analyse der treibenden Kräfte dieser Inventur wird im „Kyoto-Fortschrittsbericht“ unter **http://www.umweltbundesamt.at/umweltschutz/luft/emiberichte/** zu finden sein.

Rechtlicher Hintergrund

Diese Daten wurden entsprechend den Beschlüssen der Vertragstaatenkonferenzen des *Rahmenübereinkommens der Vereinten Nationen über Klimaänderungen* (BGBl.

[1] Entscheidung Nr. 280/2004/EG des Europäischen Parlaments und des Rates vom 11. Februar 2004 über ein System zur Überwachung der Treibhausgasemissionen in der Gemeinschaft und zur Umsetzung des Kyoto-Protokolls.

[2] Common Reporting Format der UNFCCC.

[3] Der vorliegende Bericht beinhaltet ausserdem die folgenden Elemente des THG-Überwachungssystems 280/2004/EG: Zusammenfassung des Nationalen Inventur-Berichtes im Sinne des Artikels 3 (1) f, Artikel 3 (1) i: methodische Verbesserungen („Recalculations“), Artikel 3 (1) j: Indikatoren und Artikel 3 (1) k: Informationen zu Änderungen des Nationalen Inventursystems.

Nr. 414/1994, UN Framework Convention on Climate Change – UNFCCC) erhoben. Sie umfassen Emissionen und Senken bezüglich der direkten Treibhausgase CO_2, CH_4, N_2O, HFC, PFC und SF_6, sowie der indirekten Treibhausgase NO_x, NMVOC, CO und SO_2.

Die Erhebung der Daten berücksichtigt außerdem die Ergebnisse der jährlichen Überprüfung durch die UNFCCC im Rahmen der so genannten UNFCCC-Tiefenprüfung. Im Oktober 2005 fand die letzte dieser UNFCCC-Tiefenprüfungen der Österreichischen Treibhausgas-Inventur durch internationale Fachexperten statt. Die Ergebnisse dieser Prüfung liegen noch nicht vollständig vor, werden aber soweit noch nicht berücksichtigt in das Inventurverbesserungsprogramm 2006 einfließen.

Das UMWELTBUNDESAMT bereitet sich auf zukünftige Anforderungen vor, die sich aus der Klimarahmenkonvention und vor allem aus dem Inkrafttreten des Kyoto-Protokolls am 16. Februar 2005 ergeben. Entsprechend Artikel 5.1 des Kyoto-Protokolls wird ein Nationales System eingerichtet, dessen Ziel es u. a. ist, die Qualität der Inventur sicherzustellen und kontinuierlich zu verbessern. Dazu wurde ein Gesamtkonzept für das Nationale Inventur System Austria (NISA) entwickelt, das auf der *Österreichischen Luftschadstoff-Inventur* (OLI) als zentralem Kern aufbaut. Ein umfassendes Inventurverbesserungsprogramm und ein Qualitätsmanagementsystem entsprechend ISO 17020 sind integrierter Teil des NISA.

Der vorliegende Bericht wurde vom UMWELTBUNDESAMT auf Grundlage des Umweltkontrollgesetzes BGBl. Nr. 152/1998 erstellt. Dem UMWELTBUNDESAMT wird in diesem Bundesgesetz in § 6 (2) Z.15 unter anderem die Aufgabe übertragen, fachliche Grundlagen zur Erfüllung des Rahmenübereinkommens der Vereinten Nationen über Klimaänderungen zu erstellen. In § 6 (2) Z.20 werden die Entwicklung und Führung von Inventuren und Bilanzen zur Dokumentation des Zustandes und der Entwicklung der Umwelt sowie der Umweltbelastungen und ihrer Ursachen ausdrücklich als besondere Aufgaben des UMWELTBUNDESAMTES genannt.

Diese Aufgabe wird mit der Erstellung sowie der jährlichen Aktualisierung der *Österreichischen Luftschadstoff-Inventur* (OLI) gemäß den in den relevanten internationalen Übereinkommen vereinbarten Richtlinien vom UMWELTBUNDESAMT nachgekommen. Die OLI deckt sowohl Treibhausgasemissionen, als auch Emissionen sonstiger Luftschadstoffe ab und ist damit u. a. die Datenbasis für die Erstellung des vorliegenden Berichts.

Datengrundlage

Das UMWELTBUNDESAMT führt jährlich eine Inventur des Ausstoßes von Luftschadstoffen durch, die als Grundlage für die Erfüllung der nationalen und internationalen Berichtspflichten herangezogen wird. Diese *Österreichische Luftschadstoff-Inventur* (OLI) wird erforderlichen-falls auch für zurückliegende Jahre aktualisiert, um eine vergleichbare Zeitreihe zur Verfügung zu haben. Die in diesem Bericht dargestellten Emissionsdaten ersetzen somit die publizierten Daten vorhergehender Berichte.

Tabelle 1 fasst den Stand der Daten und das Berichtsformat des vorliegenden Berichtes zusammen.

Tabelle 1: Datengrundlage des vorliegenden Berichts

Inventur	Datenstand	Berichtsformat
OLI 2005	Dezember 2005	IPCC Common Reporting Format (CRF)

1 INTRODUCTION

This report updates the Austrian greenhouse gas inventory data for the years up to 2004.

The greenhouse gas inventory is submitted to the European Commission by the Austrian Federal Government in fulfilment of Austria's obligations under article 3 of Decision 280/2004/EC ("Monitoring Decision"; replacing Decision 389/1992/EEC amended by Decision 296/1999/EEC) concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol. The purpose of this decision is to monitor all anthropogenic greenhouse gas emissions not controlled by the Montreal Protocol and to evaluate the progress towards meeting the greenhouse gas reduction commitments under the UNFCCC and the Kyoto Protocol.

According to the above mentioned decision and guidelines the reporting requirements are the same as under the United Nations Framework Convention on Climate Change (UNFCCC), Member States are obliged to determine their anthropogenic emissions by sources and removals by sinks in accordance with the methodologies accepted by the IPCC and agreed upon by the Conference of the Parties to the UNFCCC.

The greenhouse gas inventory has to be submitted to the Commission every year no later than 15 January. Furthermore, Member States have to submit by 15 January elements of their National Inventory Reports (NIRs) relevant for preparation of the community inventory report (Article 3 (1) f). The elements of the so called „Short-NIR" are further specified in Article 4 of the Implementing Provisions to 280/2004/EC (Commission Decision 2005/166/EC).

This report was prepared to fulfil the reporting obligations of Article 3 (1) f („Short-NIR") and of Article 3 (1) i-k (Information on recalculations, reporting on indicators and information on changes of the national systems) of the Monitoring Decision.

2 EMISSION TRENDS

Under the burden sharing agreement of the European Union, Austria is committed to a reduction of its greenhouse gases by 13 % below 1990 levels by 2008-2012. Table 1 shows the summary of Austria's anthropogenic greenhouse gas emissions 1990-2004. Other than in previous reports, 1990 has been chosen as the base year for all greenhouse gases.

Table 1: Austria's anthropogenic greenhouse gas emissions by gas

Greenhouse gas emissions	1990 (Base year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	CO_2 equivalent (Gg)										
CO_2	61,925	63,655	67,321	67,146	66,828	65,435	66,178	70,171	71,935	77,553	77,077
CH_4	9,171	8,513	8,326	8,050	7,929	7,752	7,592	7,470	7,329	7,357	7,407
N_2O	6,242	6,575	6,273	6,289	6,384	6,306	6,192	6,075	6,069	6,039	5,283
HFCs	23	267	347	427	495	542	596	695	782	865	904
PFCs	1,079	69	66	97	45	65	72	82	87	103	115
SF_6	503	1,139	1,218	1,120	908	684	633	637	641	594	513
Total (without ULUCF)	**78,944**	**80,218**	**83,550**	**83,130**	**82,589**	**80,784**	**81,263**	**85,130**	**86,843**	**92,511**	**91,299**

Austria's total greenhouse gases show an increase of 15.7 % from the base year to 2004 (CO_2: +24.5 %). In the period from 2003 to 2004 Austria's total greenhouse gases decreased by 1.3 %, CO_2 emissions decreased by 0.6 %. Figure 1 presents the trend in total GHG emissions 1990-2004 in comparison to Austria's Kyoto reduction target of 13 % from the base year 1990 (BY). Emissions and removals from land use, land-use change and forestry (LULUCF) are excluded.

Figure 1: Trend in total GHG emissions 1990-2004

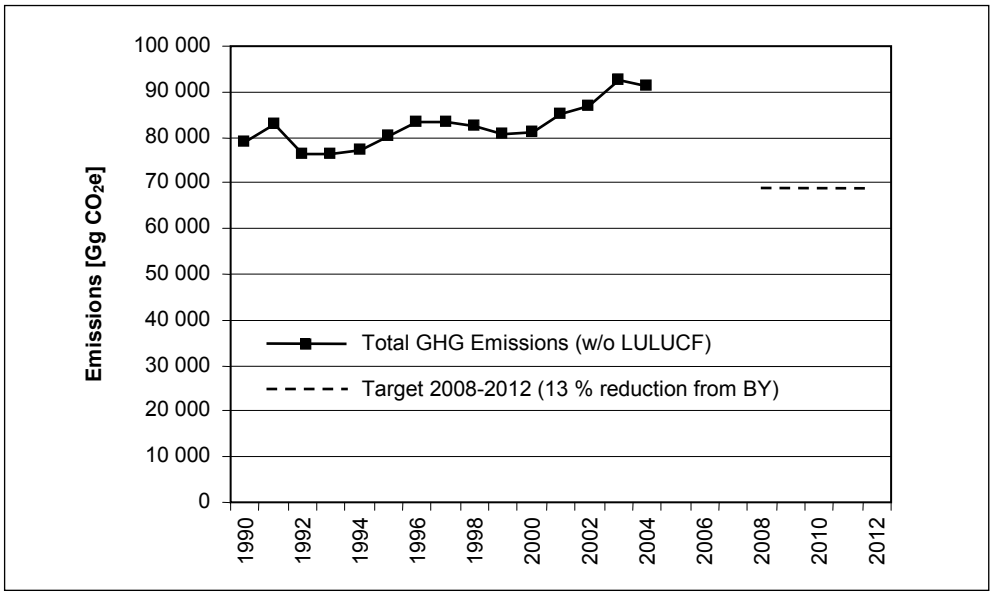


Table 2 (CRF Table 10, sheet 5 of 5) presents a summary of Austria's anthropogenic greenhouse gas emissions by sector for the period from 1990 to 2004:

Table 2: Summary of Austria's anthropogenic greenhouse gas emissions by sector

Greenhouse gas source and sink categories	1990 (Base year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	CO_2 equivalent (Gg)										
1. Energy	55,655	57,828	61,861	60,989	61,054	59,821	59,890	63,999	65,188	70,908	70,582
2. Industrial Processes	10,096	9,713	9,585	10,177	9,659	9,376	10,019	9,893	10,578	10,647	9,880
3. Solvent and Other Product Use	515	422	405	423	405	391	414	426	425	424	422
4. Agriculture	9,122	9,134	8,718	8,687	8,691	8,505	8,334	8,270	8,157	8,007	7,863
5. Land-Use Change and Forestry [(7)]	-9,690	-7,477	-5,598	-12,084	-13,069	-12,981	-13,980	-13,651	-11,659	-13,085	-13,081
6. Waste	3,556	3,119	2,981	2,854	2,780	2,691	2,606	2,541	2,496	2,526	2,552
7. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

[(7)] *Net emissions*

Austria's greenhouse gas emissions by sector in the base year and in 2004 as well as their share and trend are presented in the following table.

GHG	Base year*	2004	Trend BY*-2004	Base year*	2004
	Emissions [Gg CO_2e]			Share [%]	
Total	**78 944**	**91 299**	**15.7 %**	**100 %**	**100 %**
1 Energy	55 655	70 582	26.8 %	70 %	77 %
2 Industry	10 096	9 880	-2.1 %	13 %	11 %
3 Solvent	515	422	-18.0 %	1 %	0 %
4 Agriculture	9 122	7 863	-13.8 %	12 %	9 %
5 LULUCF	-9 690	-13 081	35.0 %	-12.3 %	-14.3 %
6 Waste	3 556	2 552	-28.2 %	5 %	3 %

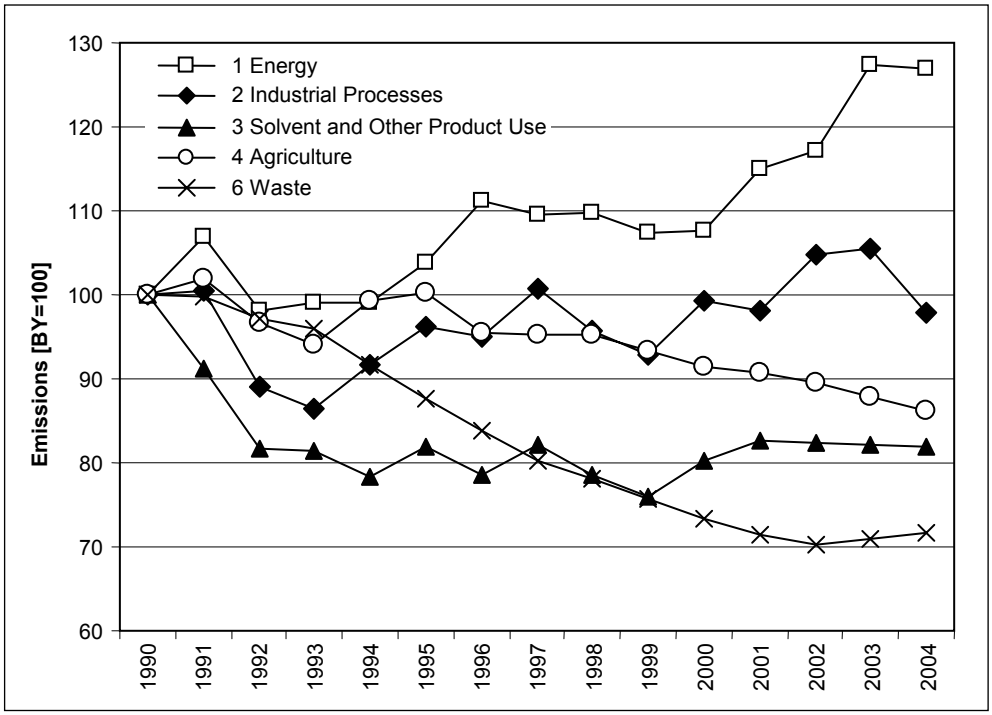
Table 3: Austria's greenhouse gas emissions by sector in the base year and in 2004 as well as their share and trend.

Total emissions without emissions from LULUCF

The dominant sectors are the energy sector, which caused 77 % of total greenhouse gas emissions in Austria in 2004 (70 % in 1990), followed by the Sector Industrial Processes, which caused 11 % of greenhouse gas emissions in 2004 (13 % in 1990).

The trend of Austria's greenhouse gas emissions by sector is presented in Figure 2 in relation to emissions in the base year 1990.

Figure 2: Trend in emissions 1990-2004 by sector in index form (base year = 100)



2.1 Energy (IPCC Category 1)

The trend for greenhouse gas emissions from IPCC category 1 (Energy) shows that emissions increased between 1990 and 1995 and then stabilized between 1996 and 2000. The strong increase between 2000 and 2003 is followed by a slight decrease of emissions in 2004 compared to 2003 (-0.5 %). In 2004 greenhouse gas emissions from Category *1 Energy* amounted to 70 582 Gg CO_2 equivalent which corresponds to 77.3 % of total national emissions.

In 2004, 98.8 % of the emissions from this sector originate from fossil fuel combustion (Sector *1 A*), fugitive emissions from fuels (Sector *1 B*) are of minor importance.

CO_2 contributes 97.5 % to total GHG emissions from *Energy*, CH_4 1.3 % and N_2O 1.2 %.

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

The increasing trend in IPCC Category 1 (Energy) is mainly due to a strong increase of emissions from sub-sector *1 A 3 Transport*, which almost doubled from 1990 to 2004 with 87 %. Apart from an increase of road performance (kilometres driven) in Austria, another main reason for this strong increase is the so-called 'tank tourism'. In the early 1990s fuel prices in Austria were higher compared to neighbouring countries, whereas since the mid-1990s it has been the other way round.

Emissions from sub-sector *1 A 1 Energy Industries* show an increase of 14 % from the base year to 2004. The main drivers for emissions from this sector are total

electricity production (which increased about 30 % from 1990 to 2004; final electricity consumption increased by 34 % over this period) and an increase in heat production, which doubled over this period due to an increase in the demand for district heating in the residential and commercial sector. Furthermore, the share of biomass used as a fuel in this sector and the contribution of hydro plants to total electricity production, which is generally about 73 % and varied from 65 % to 78 % in the period under observation (depending on the annual water situation), are important drivers. Also the climatic circumstances influence emissions from this sector: a cold winter leads to an increase of heat production.

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

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

2.2 Industrial Processes (IPCC Category 2)

Greenhouse gas emissions from the industrial processes sector fluctuated during the period 1990-2004 and show a minimum in 1993. In 2004 they were 2.1 % below the level of the base year. In 2004 greenhouse gas emissions from Category *2 Industrial Processes* amounted to 9 880 Gg CO_2 equivalents, which corresponds to 10.8 % of total national emissions.

The main sources of greenhouse gas emissions in the industrial processes sector are *Metal Production* and *Mineral Products*, which caused 45 % and 31 % of the emissions from this sector in 2004. The emission trend in this sector follows more or less production figures.

The most important GHG of the industry sector was carbon dioxide with 81.6 % of emissions from this category, followed by HFCs with 8.8 %, SF6 with 6 %, N_2O with 2.8 %, PFCs with 1 % and finally CH_4 with 0.1 %.

2.3 Solvent and Other Product Use (IPCC Category 3)

In 2004, 0.5 % of total GHG emissions in Austria (426 Gg CO_2 equivalents) originated from *Solvent and Other Product Use*.

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

55 % of these emissions were N_2O emissions, 45 % were accounted for by CO_2 emissions.

2.4 Agriculture (IPCC Category 4)

Greenhouse gas emissions from the agricultural sector fluctuate in the early 1990s, since 1995 they show a steady downward trend. In 2004 emissions from this category are 13.8 % below the base year level. The decrease is mainly due to decreasing livestock numbers. The fluctuations result from changes in mineral fertilizer sales data which were used as activity data for calculating N_2O emissions from agricultural soils, an important sub-source.

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

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

2.5 LULUCF (IPCC Category 5)

This report presents updated CO_2 emissions and removals and includes N_2O emissions, previously not reported, from cropland and grassland management (5 B and 5 C) that are based on the results of new studies[4,5]. For the forest-related categories, 5 A, 5 B 2, 5 C 2, 5 D 2, 5 E 2 and 5 F 2, the values from 2003 were used for 2004 in this report. Updates for CO_2 emissions and removals of the forest-related categories for the complete time series 1990 to 2004 are planned to be submitted before 15 March 2006. The trend description will be provided with the updated emissions.

[4] Gerzabek, M. H., F. Strebl, M. Tulipan and S. Schwarz (2003). Quantification of carbon pools in agriculturally used soils of Austria by use of a soil information system as basis for the Austrian carbon balance model. OECD Expert Meeting: Soil Organic Carbon and Agriculture: Developing Indicators for Policy Analyses., C. A. S. Smith (ed., 14-18 October 2002, Ottawa, Canada, Agriculture and Agri-Food Canada, Ottawa, CA & Organisation of Economic Co-operation and Development, Paris, FR.

[5] Strebl, F., Gebetsroither, E. und Orthofer R. (2003): Greenhouse Gas Emissions from Cropland & Grassland Management in Austria. Report ARC-S-0221.

2.6 Waste (IPCC Category 6)

Greenhouse gas emissions from Category *6 Waste* decreased steadily during the period 1990-2002, mainly as a result of waste management policies: the amount of landfilled waste has decreased as well as methane recovery. From 2002 to 2004 emissions increased slightly mainly due to increasing amounts of landfilled waste. In 2004 emissions from this category were 28.2 % below the base year level.

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

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

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

3 INDICATORS

Indicators pursuant to article 3 (1) j of the Monitoring Decision are reported in Annex IV. Emission data are consistent with the CRF, denominators are taken from official Austrian statistics.

4 METHOD OF REPORTING AND DATA BASIS

The Austrian greenhouse gas inventory for the period 1990 to 2004 was compiled according to the recommendations for inventories set out in the UNFCCC reporting guidelines according to Decision 18/CP.8, the Common Reporting Format (CRF), Decision 13/CP.9, the new CRF for the Land Use Change and Forestry Sector, the IPCC 1996 Guidelines for National Greenhouse Gas Inventories, which specify the reporting obligations according to Articles 4 and 12 of the UNFCCC as well as the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

Regulations under the UNFCCC and the Kyoto Protocol define the new standards for national emission inventories. These standards include more stringent requirements related to transparency, consistency, comparability, completeness and accuracy of inventories. Each Party shall have in place a national system, no later than one year prior to the start of the first commitment period (2008-2012). This national system shall include all institutional, legal and procedural arrangements made within a Party for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and for reporting and archiving inventory information.

In Austria, emissions of greenhouse gases are estimated together with emissions of air pollutants in a database based on the CORINAIR (CORe INventory AIR)/SNAP (Selected Nomenclature for sources of Air Pollution) systematics. This nomenclature is designed to estimate not only emissions of greenhouse gases but all kinds of air pollutants. To comply with the reporting obligations under the UNFCCC, emissions are transformed according to the IPCC Guidelines into the UNFCCC Common Reporting Format.

The Austrian greenhouse gas inventory is subject to continuous improvement, resulting in recalculations as outlined in Chapters 4.1 and 4.5. Issues identified in the inventory reviews by the UNFCCC are considered in the inventory improvement programme. The last in-depth review took place in October 2005.

Annex 1 to this report presents Austria's greenhouse gas inventory data (CO_2 emissions, CO_2 removals, CH_4, N_2O, HFC, PFC and SF_6) in the format of the CRF Summary Table 10 (Emission Trends).

The complete tables of the Common Reporting Format, including in particular Sectoral Reports, Sectoral Background Tables and a Reference Approach for CO_2 are submitted separately in digital form only (excel files).

The following table summarises the status of the present report:

Reporting Obligation	Format	Inventory	Version
Mechanism for monitoring Community greenhouse gas emissions	Common Reporting Format (CRF)	OLI 2005	December 2005

Table 4: Status of the present report

4.1 Relation with data reported earlier

As a result of the continuous improvement of Austria's GHG inventory, emissions of some sources have been recalculated on the basis of updated data or revised methodologies, thus emission data for 1990 to 2003 which are submitted this year differ from data reported previously.

The following table presents the recalculation difference with respect to last year's submission for each gas (positive values indicate that this year's estimate is higher).

Table 5: Recalculation difference of Austria's greenhouse gas emissions compared to the previous submission

	1990 (Base year)	2003
	Recalculation Difference [%]	
TOTAL	**+0.5 %**	**+1.0 %**
CO_2	+1.1 %	+1.8 %
CH_4	-6.4 %	-5.8 %
N_2O	+9.3 %	+9.0 %
HFC, PFC, SF6	-10.9 %	-22.1 %

Emissions without LULUCF

The main reasons for the increase of reported CO_2 emissions are

- revised coke oven coke net calorific values (cross-sectoral),
- a revised natural gas CO_2 emission factor (cross-sectoral),
- a revised industrial waste CO_2 emission factor (cross-sectoral)
- and higher emissions from Industrial Processes mainly due to the improved methodology for 2 B 1 Ammonia Production.

The main reasons for the decrease of reported methane emissions are methodological changes in the sectors *6 A 1 Managed Waste Disposal on Land* and 6 B Waste Water Handling.

The main reason for the increase of reported N_2O emissions is the revision of the N excretion rates in the Agriculture sector that lead to higher emissions in 4 B Manure Management and 4 D Agricultural soils.

The main reason for the decrease of reported emissions of fluorinated compounds is the incorporation of a new study on HFC use and emissions in the sub-category 2 F 2 Foam Blowing.

A description of these recalculations by sector is given in Chapter 4.5.

Improvements made in response to the issues raised in the UNFCCC review process are summarized in the following table.

Table 6: Improvements made in response to the UNFCCC review process

Energy
1 A 2 a Iron and Steel: Coke oven gas consumption (included in solid fuels) of integrated steel plants has been recalculated.
Cross-sectoral: Natural gas CO_2 emission factors have been changed from 55 t/TJ to 55.4 t/TJ for the whole period by means of calculations based on the chemical specification.
Cross-sectoral: Industrial waste CO_2 emission factors are now based on IPCC default values (104.17 kg/TJ) whereas in the previous submission the values where based on country-specific expert guesses (10 to 50 kg/TJ).
1 B 1 a Coal Mining: Activity data for 2002 and 2003 have been updated
Industrial Processes
2 B 1 Ammonia: During QC checks it was found that CO_2 emissions as reported by the plant operator had not been determined in accordance with the IPCC guidelines. Consequently, CO_2 emissions have been recalculated from the natural gas input (from the national energy balance) with a standard emission factor, accounting additionally for carbon bound in the melamine production.
Agriculture
4 A, 4 B, 4 D Enteric Fermentation, Manure Management, Agricultural Soils: As recommended in the Centralized Review 2004 Austrian N excretion values have been revised. Especially N excretion rates of dairy and mother cows are higher now, which has led to higher emissions of N_2O from source category 4 B and 4 D. With the revision of N excretion rates, the GE intake and VS excretion data were also recalculated. This has led to higher CH_4 emissions from source categories 4 A and 4 B.
Waste
6 A 1 Managed waste disposal on land: For those years where no data were available for non-residual wastes (before 1998) extrapolation according to the GDP was used as recommended by ERT, instead of assuming the amount of non-residual wastes to be constant.

The figures presented in this report replace data reported earlier by Austria under the reporting framework of the UNFCCC, in particular data which had been included in the inventory chapter of the 2001 Third National Climate Report of the UMWELTBUNDESAMT (Austria's Third National Communication, Chapter 4) and in Austria's 2004 and 2005 submissions to the UNFCCC (Austrian Greenhouse Gas Emissions 1990-2002 and 1990-2003).

4.2 Information on Completeness

Geographical coverage is complete. There is no part of the Austrian territory that has not been covered by the inventory.

Emissions from most sources specified in the CRF have been estimated. For information on sources not estimated („NE") and emissions included with sources other than those stipulated in the CRF („IE") please refer to Table 9 Completeness of the CRF.

Compared to last year's submission, some additional sources have been included in the inventory; please refer to Chapter 4.5 Methodological Changes for details.

4.3 National Inventory System Austria (NISA)

The National Inventory System Austria (NISA) is currently evaluated for its compliance with the guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol as specified under the Marrakesh Accord (see decision 20/CP.7). A detailed description of the NISA can be found in Austria's NIR 2005[6]. Here only a short summary is given:

The *Umweltbundesamt* is the Austrian national entity with the legal responsibility for compiling the annual greenhouse gas inventory: the Environmental Control Act („Umweltkontrollgesetz"; Federal Law Gazette 152/1998) regulates the responsibilities of environmental control in Austria and lists the tasks of the *Umweltbundesamt*. One task is the preparation of technical expertise and the data basis in fulfilment of the obligations under the UNFCCC and the UNECE LRTAP Convention. Thus the *Umweltbundesamt* prepares, and updates annually, the Austrian air emissions inventory which covers greenhouse gases and emissions of other air pollutants as stipulated in the above mentioned conventions and their protocols.

The responsibilities for inventory planning, preparation and management are specified and are all allocated within the *Umweltbundesamt*. The department of air emissions is responsible for the preparation of the Austrian air emission inventory and all work related to inventory preparation. Responsibilities are shared by *Umweltbundesamt* experts in the relevant sectors. The preparation of the national greenhouse gas inventory is the responsibility of the inspection body for GHG inventories, and the *Umweltbundesamt* will soon be accredited as inspection body according to the International Standard ISO 17020 (a successful accreditation audit took place in September 2005; the official conclusion of the accreditation is planned for early 2006).

Parts of the legal and institutional arrangements in place are relevant for data availability for the annual compilation of the GHG inventory. The main data sources used, as well as information on who did the actual calculations, are presented in the following chapter.

[6] UMWELTBUNDESAMT (2005) Austria's National Inventory Report, Submission under the United Nations Framework Convention on Climate Change, BE-268; Umweltbundesamt, Vienna.

4.4 Sources of data

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

Table 7: Main data sources for activity data and emission values

Sector	Data Sources for Activity Data	Emission Calculation
Energy	Energy Balance from STATISTIK AUSTRIA, Steam boiler database;	UMWELTBUNDESAMT, plant operators
Industry	National production statistics, import/export statistics, direct information from industry or associations of industry;	UMWELTBUNDESAMT, plant operators Study on emissions of FCs contracted out in 2001 (Contractor: EcoEfficient Technologies, Vienna);
Waste	Database on landfills	UMWELTBUNDESAMT
LULUCF	National forest inventory obtained from the Austrian Federal Office and Research Centre for Forest	UMWELTBUNDESAMT
Solvent	Import/export statistics, production statistics, consumption statistics;	UMWELTBUNDESAMT based on a study by: Forschungsinstitut für Energie und Umweltplanung, Wirtschaft und Marktanalysen GmbH and Institut für industrielle Ökologie[7]
Agriculture	National Studies, national agricultural statistics obtained from STATISTIK AUSTRIA;	UMWELTBUNDESAMT based on a study by: University of Natural Resources and Applied Life Sciences, Research Center Seibersdorf

The main sources for emission factors are:

- national studies for country specific emission factors
- plant-specific data reported by plant operators
- IPCC GPG
- Revised IPCC 1996 Guidelines
- EMEP/CORINAIR Guidebook.

A complete list of data sources for activity and emission data or emission factors used by sector can be found in the National Inventory Report 2006 to be published in spring 2006.

Table *Summary 3* of the CRF (Summary Report for Methods and Emission Factors Used) presents the methods applied and the origin of emission factors used in the present Austrian GHG inventory. Additionally, Annex III presents methodologies for sources that contribute to EC key sources.

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

4.5 Methodological changes with respect to the previous submission

This chapter describes the methodological changes made to the inventory since the previous submission to the UNFCCC (April 2005). Further background information and a complete description of the 2005 inventory are given in Austria's National Inventory Report 2006, which will be published in spring 2006.

4.5.1 Energy (IPCC Category 1)

Combustion Activities (1 A)

Update of activity data:

Cross-sectoral:

Coke oven coke net calorific values have been revised from 1990 to 2003. Consumption of gasworks gas 1990 to 1995 is additionally considered in sub-categories *1 A 2 f* and *1 A 4*.

1 A 1 a Public Electricity and Heat Production:

Natural gas consumption 1997 and biomass consumption 2003 increased due to changes of the national energy balance. Consumption of biomass and industrial waste decreased from 1992 to 2003 due to elimination of double counting.

1 A 1 b Petroleum Refining:

Liquid fuels consumption 1990 to 1992 increased due to changes of the national energy balance. Liquid fuel consumption from 1999 to 2001 has been adapted to plant-specific data.

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

Transformation losses from gasworks are now considered in this category for 1990 to 1995. Natural gas consumption of *Other Energy Industries* 1991 to 1995 changed due to changes of the national energy balance.

1 A 2 a Iron and Steel:

Coke oven gas consumption (included in solid fuels) of integrated steel plants has been recalculated.

Coke oven coke consumption for blast furnaces has been updated for 2003.

1 A 2 b,c,d,e:

The minor changes of each sub-category are due to changes of the energy balance, mainly due to shifts between categories. Final consumption of gasworks gas 1990 to 1995 which is not considered in the energy balance reported to EUROSTAT/IEA is additionally considered in the specific subcategories as specified in the „Austrian energy balance".

1 A 2 f Manufacturing Industries and Construction-Other:

Consumption of hard coal 1990 to 1993 has been moved from *1 A 4 Other Sectors* to „Non metallic Mineral Products Industry" according to cement industry emissions declarations.

1 A 3 b Transport – Road:

Update of the statistical data for light and heavy duty vehicles (new splitting up by Statistik Austria) from 1990-2003.

1 A 3 e Pipeline compressors:

Update of 2003 natural gas consumption according to the updated national energy balance.

1 A 4 Stationary:

Natural gas consumption has been moved from or to other sub-categories of *1 A Fuel Consumption* according to the updated energy balance. Consumption of gas works gas has been additionally considered. Solid biomass consumption from 2000 to 2003 has been revised according to changes of the national energy balance.

Improvements of methodologies and emission factors:

Cross-sectoral:

The natural gas CO_2 emission factor has been changed from 55 t/TJ to 55.4 t/TJ for the whole period by means of calculations based on the chemical specification. Industrial waste CO_2 emission factors are now based on IPCC default values (104.17 kg/TJ) whereas in the previous submission the values where based on country-specific expert guesses (10 to 50 kg/TJ).

1 A 2 f Manufacturing Industries and Construction-Other/Cement industries:

CO_2 emissions from industrial waste have been recalculated for the whole time series. In the previous submission non-fossil CO_2 (1996 to 2003) and a share of emissions from coal (1990 to 1993) were reported as emissions from industrial waste.

1 A 3 a Civil Aviation:

The splitting up of the energy data into national and international aviation of 2003 and 2004 has been updated according to the energy balance. (Statistik Austria)

1 A 4 Other Sectors:

Consideration of „new“ pellets, wood chips, fuelwood heating technologies from 2001 onwards. This results in lower CH_4 emissions from the combustion of biomass.

Fugitive Emissions (1 B)

Update of activity data:

1 B 1 a Coal Mining:

Activity data for 2002 and 2003 have been updated (following recommendations from the ERT).

1 B 2 a Refining/Storage:

Activity data have been updated for 2002 and 2003 according to data from the national energy balance.

1 B 2 b Natural gas transmission and storage:

Activity data for Natural gas storage have been updated

Improvements of methodologies and emission factors:

1 B 2 b *Gas Distribution:*

The method to calculate CH_4 emissions has been changed to the IPCC Tier 1 methodology. The relevant activity data are now the km of distribution mains. The EF is the mean IPCC default EF (0.615 Mg CH_4/km).

4.5.2 Industrial Processes (IPCC Category 2)

Addition of source categories:

2 A 3 Limestone and Dolomite Use:

Limestone used for desulphurization has been added to the inventory.

2 F Consumption of Halocarbons and SF_6:

HFC emissions from the sub-categories 4 Aerosols/Metered dose inhalers and 5 Solvents have been added to the inventory.

Update of activity data:

2 A 1 Cement Production:

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

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

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

2 A 7b Magnesia Sinter:

Activity data for the whole time series have been changed to Magnesia used for Magnesia sinter production using information from industry. CO_2 emissions have been updated for 2003.

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

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

Improvements of methodologies and emission factors:

2 A 3 Dolomite Use:

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

2 B 1 Ammonia:

During QC checks it was found that CO_2 emissions as reported by the plant operator were not determined in accordance with the IPCC guidelines. Consequently, CO_2 emissions have been recalculated from the natural gas input (from the national energy balance) with a standard emission factor. According to the IPCC guidelines, no account should be taken for intermediate binding of CO_2 in downstream manufacturing processing and products. Nevertheless in the Austrian plant melamine is produced, a product in which carbon can be assumed to be stored for a long time. Thus, account was taken of the carbon bound in the melamine production, and it was subtracted from the total CO_2 emissions.

2 C 1 Iron and Steel:

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

2 F Consumption of Halocarbons and SF_6:

HFC emissions from the sub-category 2 Foam Blowing have been recalculated incorporating the results from a new study on HFC used in foam blowing. The following study was used: Obernosterer R., Smutny R., Jäger

E., Merl A. (2004): HFKW Gase in Dämmschäumen des Bauwesens. Umweltbundesamt, Internal Report

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

4.5.3 Solvent and other Product Use (IPCC Category 3)

Improvements of methodologies and emission factors:

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

4.5.4 Agriculture (IPCC Category 4)

Update of activity data:

4 D 1, 4 D 2, 4 D 3 Agricultural Soils: Revised N excretion data of Austrian livestock has led to higher amounts of animal waste spread on agricultural soils.

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

Improvements of methodologies and emission factors:

4 A, 4 B, 4 D Enteric Fermentation, Manure Management, Agricultural Soils:
As recommended in the Centralized Review 2004, Austrian N excretion values have been revised. Especially N excretion rates of dairy and mother cows are higher now, which has resulted in higher emissions of N_2O from source category 4 B and 4 D.

With the revision of N excretion rates, the GE intake and VS excretion data were also recalculated. This has resulted in higher CH_4 emissions from source categories 4 A and 4 B.

The improved methodology is based on the following literature:

GRUBER, L. & POETSCH, E.M. (2005): Calculation of nitrogen excretion of dairy cows in Austria. Die Bodenkultur, in print.

PÖTSCH, E.M., GRUBER, L. & STEINWIDDER, A. (2005): Answers and comments on the additional questions, following the meeting in Brussels. Internal statement, HBLFA Raumberg-Gumpenstein.

STEINWIDDER, A. & GUGGENBERGER, T. (2003): Erhebungen zur Futteraufnahme und Nährstoffversorgung von Milchkühen sowie Nährstoffbilanzierung auf Grünlandbetrieben in Österreich. Die Bodenkultur 54 (1), 49-66.

UNTERARBEITSGRUPPE N-ADHOC (2004): Überprüfung und Überarbeitung der N-Anfallswerte für einzelne Tierkategorien. Unterlagen ausgearbeitet vom Fachbeirat für Bodenfruchtbarkeit und Bodenschutz des BMLFUW.

ZENTRALE ARBEITSGEMEINSCHAFT ÖSTERREICHISCHER RINDERZÜCHTER (2004): Cattle Breeding in Austria, 148pp.

4.5.5 LULUCF (IPCC Category 5)

Addition of source or sink categories:

5 B 1, 5 C 1, 5 B 2 2, 5 C 2 2:

CO_2 and emissions and removals from cropland and grassland management (categories *5 B 1* and *5 C 1*) including liming have been recalculated and estimations have been made for each year from 1990 onwards. Emissions from land use changes from cropland to grassland (5 B 2 2) and from grassland to cropland (5 C 2 2) have been added.

Update of activity data:

For 2004 the same values were reported for forest areas as for 2003, according to the methodology described.

Activity data for cropland and grassland areas have been taken from the Statistical Yearbooks (1990-2004).

Improvements of methodologies and emission factors:

The following forest-related categories will be delivered before 15 March 2006:
5 A, 5.B.2, 5.C.2, 5.D.2, 5.E.2, 5.F.2.

These will include a recalculation of the forest biomass for the complete time series 1990 to 2004 based on the use of biomass functions as well as additional data for dead wood and forest soils.

Land use changes from and to cropland and grassland have been added to the inventory. The data are based on results of the IACS System (Integrated Administration and Controlling System). Emission factors have been calculated according to the Tier 1 Method (IPCC 2003) except for carbon stocks in soils of cropland and grassland. The estimation of carbon stocks in soils has been taken from national calculations carried out in the following literature:

Gerzabek, M. H., F. Strebl, M. Tulipan and S. Schwarz (2003). Quantification of carbon pools in agriculturally used soils of Austria by use of a soil information system as basis for the Austrian carbon balance model. OECD Expert Meeting: Soil Organic Carbon and Agriculture: Developing Indicators for Policy Analyses, C. A. S. Smith (ed., 14-18 October 2002, Ottawa, Canada), Agriculture and Agri-Food Canada, Ottawa, CA & Organisation of Economic Co-operation and Development, Paris, FR.

Strebl, F., Gebetsroither, E. und Orthofer R. (2003): Greenhouse Gas Emissions from Cropland & Grassland Management in Austria. Report ARC-S-0221.

4.5.6 Waste (IPCC Category 6)

Update of activity data

6 A 1 Managed waste disposal on land:

The activity data (1998 to 2004) have been updated. According to the Austrian Landfill Ordinance, the operators of landfill sites have to report their activity data annually. Based on reports received after the due date, there are minor changes of the activity data in this submission compared to the previous submission.

For those years where no data were available on non-residual wastes (before 1998) extrapolation according to the GDP was used as recommended by ERT, instead of assuming the amount of non-residual wastes to be constant.

Double Counting of the amount of construction waste has been corrected.

Improvements of methodology:

6 A 1 Managed Waste Disposal on Land:

The IPCC Tier 2 Methodology is now used instead of a country-specific one.

6 B Waste Water Handling

For calculating CH_4 emissions, the IPCC Methodology is now used instead of a country-specific one.

6 C Waste Incineration:

For incineration of municipal solid waste without energy recovery, the IPCC default CO_2 emission factor is now used because the emission factor used in the previous submission was based on a non-verified expert guess. CO_2, CH_4 and N_2O emissions from the incineration of clinical waste without energy recovery are additionally estimated by means of activity data based on expert guesses and IPCC default emission factors.

CO_2 emissions from cremation are now reported as „NA“ due to elimination of double counting with category *1 A 4 a Commercial/Institutional-Gaseous fuels.*

4.6 Quality Assurance and Quality Control (QA/QC)

A quality management system (QMS) has been designed to achieve to the objectives of *good practice guidance*, namely to improve transparency, consistency, comparability, completeness and confidence in national inventories of emissions estimates. The QMS is based on the International Standard ISO 17020 *General Criteria for the operation of various types of bodies performing inspections*. The QMS ensures that all requirements of a type A inspection body as stipulated in ISO 17020 are met, which include strict independence, impartiality and integrity.

The Quality Assurance and Quality Control (QA/QC) procedures within the QMS correspond to the QA/QC system outlined in IPCC-GPG Chapter 8 „Quality Assurance and Quality Control”. The implementation of QA/QC procedures as required by IPCC-GPG support the development of national greenhouse gas inventories that can be readily assessed in terms of quality and completeness. A QMS goes beyond QA/QC

activities and comprises supporting and management processes in addition to the QA/QC procedures in inventory compilation. A system of standard operating procedures (SOPs) ensures agreed standards as well as transparency within (i) the inventory compilation process (ii) supporting processes (e.g. archiving) and (iii) management processes (e.g. annual management reviews, internal audits, regular training of personnel, error prevention).

The Austrian Quality Management System is described in detail in Austria's NIR 2005[6]. Since the last submission, a successful accreditation audit of the *Umweltbundesamt* as inspection body has taken place. Formal accreditation is planned for early 2006.

4.7 Uncertainty Assessment

A first comprehensive uncertainty analysis was performed in the form of a pilot study by WINIWARTER & RYPDAL[8], 2001 on greenhouse gases CO_2, CH_4, and N_2O for 1990 and 1997. Information on this uncertainty estimate using the Monte Carlo Analysis can be found in Austria's NIR 2005.

Last year updated uncertainty estimates for all key sources of the inventory were provided. They are based on estimates made in the first uncertainty analysis as described in the NIR 2005 and on the judgement of experts preparing their relevant part of the inventory (references and detailed explanations are provided in the NIR 2005[6]). This year uncertainty estimates have been updated for sources calculated with improved methods and for the additional key sources. The uncertainty estimates are presented in Annex II.

4.8 Comparison of the Sectoral Approach with the Reference Approach

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

Table 8 shows a comparison of CO_2 emissions calculated from the two approaches.

[8] WINIWARTER, W.; RYPDAL, K. (2001): Assessing the Uncertainty Associated with National Greenhouse Gas Emission[Inventories]: A Case Study for Austria, Atmospheric Environment 35 (2001) 5425-5440.

Table 8: Comparison of CO_2 emissions of the two approaches

Year	Reference Approach				Sectoral Approach *1 A Fuel Combustion*				
	Liquid [Gg CO_2]	Solid [Gg CO_2]	Gaseous [Gg CO_2]	Total [Gg CO_2]	Liquid [Gg CO_2]	Solid [Gg CO_2]	Gaseous [Gg CO_2]	Other [Gg CO_2]	Total [Gg CO_2]
1990	28 569	15 914	12 238	**56 722**	28 119	13 922	11 169	732	**53 942**
1991	30 989	16 771	12 939	**60 699**	30 596	14 517	11 771	805	**57 690**
1992	30 068	12 953	12 705	**55 725**	29 331	10 666	11 834	956	**52 787**
1993	31 105	11 649	13 399	**56 154**	30 744	9 493	12 340	675	**53 251**
1994	30 350	11 808	13 782	**55 941**	30 113	9 377	12 962	820	**53 272**
1995	30 915	13 496	15 048	**59 459**	30 315	10 740	14 059	839	**55 953**
1996	33 385	13 665	16 017	**63 067**	32 941	10 759	15 219	1 073	**59 993**
1997	32 862	14 446	15 437	**62 745**	32 147	11 319	14 679	1 017	**59 161**
1998	35 117	12 634	15 848	**63 599**	34 269	9 113	14 995	818	**59 196**
1999	33 160	12 678	16 125	**61 963**	32 521	9 166	15 147	1 105	**57 940**
2000	32 295	14 240	15 388	**61 924**	31 829	10 724	14 566	942	**58 061**
2001	34 927	14 763	16 309	**65 999**	34 424	11 272	15 483	917	**62 096**
2002	35 837	15 048	16 494	**67 379**	35 319	11 400	15 451	917	**63 310**
2003	38 770	16 277	17 833	**72 881**	38 315	12 680	16 689	917	**68 922**
2004	38 436	15 408	17 988	**71 832**	37 908	12 289	16 962	917	**68 605**

Table 9 shows the difference (in per cent) between the two approaches, the yearly average of which is 5.9 % for total CO_2.

Year	Liquid	Solid	Gaseous	Total
1990	1.60 %	14.31 %	9.57 %	**5.15 %**
1991	1.28 %	15.52 %	9.92 %	**5.22 %**
1992	2.51 %	21.44 %	7.36 %	**5.57 %**
1993	1.18 %	22.71 %	8.59 %	**5.45 %**
1994	0.79 %	25.93 %	6.33 %	**5.01 %**
1995	1.98 %	25.67 %	7.03 %	**6.27 %**
1996	1.35 %	27.00 %	5.24 %	**5.12 %**
1997	2.22 %	27.63 %	5.16 %	**6.06 %**
1998	2.47 %	38.63 %	5.69 %	**7.44 %**
1999	1.96 %	38.32 %	6.46 %	**6.94 %**
2000	1.46 %	32.79 %	5.65 %	**6.65 %**
2001	1.46 %	30.97 %	5.33 %	**6.29 %**
2002	1.47 %	32.00 %	6.75 %	**6.43 %**
2003	1.19 %	28.37 %	6.85 %	**5.74 %**
2004	1.39 %	25.38 %	6.05 %	**4.70 %**

Table 9: Deviation between CO_2 emissions from the two approaches

Positive numbers indicate that CO_2 emissions from the reference approach are higher than emissions from the sectoral approach.

Reasons for deviations between CO_2 emissions:

- In the reference approach the IPCC default net calorific values are used. In the sectoral approach country-specific net calorific values are taken to calculate the energy consumption.
- The selected emission factors (carbon content) of the two approaches are different.
- *Liquid Fuels:* Energy balance is mass-balanced but not carbon balanced. Fuel category *Other Oil* is an aggregation of several fuel types and therefore it is difficult to quantify a reliable carbon emission factor for the reference approach. The reference approach takes a share of feedstocks used for plastics and solvent production as non-carbon stored. In the sectoral approach a share of emissions from the waste incineration of plastics is included in category *1 A 1 a Public Electricity and Heat Production*. Emissions from solvent use are included in category *3 Solvent and Other Products Use*. In the sectoral approach a share of municipal solid waste without energy recovery is considered in category 6C for 1990 and 1991.
- *Solid fuels:* The reference Approach includes process emissions from blast furnaces and steel production which are included in category *2 C Metal Production* as well as process emissions from carbide production which are included in category *2 B 4 Carbide Production*.
- *Gaseous fuels:* The national approach uses sector-specific carbon contents and heating values different to IPCC default factors. Process emissions from ammonia-production are included in category *2 B 1 Ammonia Production*.
- *Other fuels:* The sectoral approach considers waste an additional fuel type (e.g. municipal solid waste, hazardous waste and industrial fuel waste)

Simple approach to quantifying the deviation:

- By quantifying the deviation between the two approaches with a simple approach it can be seen that the remaining difference is lower than -1.7 % for all years. Note that this may be interpreted as emissions according to the sectoral approach (plus process emissions) being even higher than emissions according to the reference approach.
- Currently it is not possible to quantify the amount of solvents and plastic products which are imported or exported by products, bulk or waste. Furthermore it is known that petrol coke is imported and used for carbide production but not considered in the energy balance.

Table 10: Quantification of deviation between the two approaches

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

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

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

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

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

ANNEX I: EMISSION TRENDS

This Annex presents emission trends for CO_2, CH_4, N_2O and FCs.

This report uses the following UNFCCC notation keys for all tables:

NE (not estimated):.....for existing emissions by sources and removals by sinks of greenhouse gases which have not been estimated.

IE (included elsewhere): .....for emissions by sources and removals by sinks of greenhouse gases estimated but included elsewhere in the inventory instead of the expected source/sink category.

NO (not occurring): .....for emissions by sources and removals by sinks of greenhouse gases that do not occur for a particular gas or source/sink category.

NA (not applicable): .....for activities in a given source/sink category that do not result in emissions or removals of a specific gas.

C (confidential): .....for emissions which could lead to the disclosure of confidential information if reported at the most disaggregated level. In this case a minimum of aggregation is required to protect business information.

Table A.I-1: Emission Trends CO_2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	Gg										
1. Energy	**54,043.98**	**56,080.09**	**60,064.39**	**59,281.94**	**59,337.49**	**58,110.22**	**58,225.76**	**62,278.63**	**63,477.08**	**69,154.62**	**68,815.53**
A. Fuel Combustion (Sectoral Approach)	53,941.96	55,953.06	59,993.36	59,161.43	59,195.66	57,939.69	58,061.23	62,095.90	63,310.05	68,921.58	68,605.49
1. Energy Industries	13,662.77	12,640.16	13,739.10	13,836.36	12,855.01	12,479.51	12,401.82	13,660.15	13,440.89	16,165.18	15,535.20
2. Manufacturing Industries and Construction	13,452.56	14,145.86	14,207.64	16,003.89	14,948.22	13,973.17	14,525.89	14,089.85	14,750.13	14,558.85	15,327.95
3. Transport	12,400.34	14,462.60	16,038.79	14,975.68	17,170.95	16,596.83	17,734.54	19,037.45	20,986.18	22,849.66	23,454.78
4. Other Sectors	14,391.26	14,671.84	15,968.89	14,308.37	14,179.03	14,848.56	13,354.02	15,185.57	14,091.83	15,258.58	14,180.97
5. Other	35.02	32.60	38.94	37.13	42.45	41.62	44.95	122.88	41.02	89.31	106.59
B. Fugitive Emissions from Fuels	102.03	127.03	71.03	120.51	141.83	170.53	164.53	182.73	167.03	233.04	210.04
1. Solid Fuels	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
2. Oil and Natural Gas	102.03	127.03	71.03	120.51	141.83	170.53	164.53	182.73	167.03	233.04	210.04
2. Industrial Processes	**7,571.56**	**7,373.85**	**7,072.50**	**7,662.55**	**7,306.58**	**7,154.21**	**7,758.52**	**7,686.09**	**8,253.05**	**8,195.17**	**8,059.64**
A. Mineral Products	3,264.86	2,851.58	2,764.01	2,963.72	2,810.50	2,796.31	2,953.94	2,972.30	3,081.08	3,066.60	3,103.39
B. Chemical Industry	581.75	580.43	586.85	579.59	576.46	579.68	583.87	536.31	548.04	588.74	524.74
C. Metal Production	3,724.95	3,941.84	3,721.65	4,119.24	3,919.62	3,778.22	4,220.70	4,177.48	4,623.93	4,539.83	4,431.51
D. Other Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E. Production of Halocarbons and SF_6											
F. Consumption of Halocarbons and SF_6											
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	**282.67**	**189.88**	**172.81**	**190.09**	**172.24**	**158.37**	**181.02**	**193.60**	**192.35**	**191.10**	**189.84**
4. Agriculture											
A. Enteric Fermentation											
B. Manure Management											
C. Rice Cultivation											
D. Agricultural Soils [(2)]											
E. Prescribed Burning of Savannas											

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	Gg										
F. Field Burning of Agricultural Residues											
G. Other											
5. Land Use, Land-Use Change and Forestry	**-9,701.38**	**-7,488.58**	**-5,609.30**	**-12,095.09**	**-13,080.08**	**-12,992.38**	**-13,991.05**	**-13,664.54**	**-11,669.69**	**-13,094.21**	**-13,092.55**
A. Forest Land	-9,271.23	-7,357.97	-5,503.20	-11,977.78	-12,994.43	-12,924.78	-13,933.24	-13,632.10	-11,598.29	-13,059.89	-13,059.89
B. Cropland	-660.00	-409.94	-385.30	-373.02	-340.66	-322.59	-313.10	-328.79	-296.00	-279.18	-238.30
C. Grassland	202.36	229.35	229.22	215.90	215.20	215.18	215.48	256.54	184.80	205.05	165.83
D. Wetlands	1.96	3.57	3.57	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86
E. Settlements	9.82	17.85	17.85	14.28	14.28	14.28	14.28	14.28	14.28	14.28	14.28
F. Other Land	15.71	28.56	28.56	22.67	22.67	22.67	22.67	22.67	22.67	22.67	22.67
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**26.89**	**10.97**	**11.30**	**11.62**	**11.94**	**12.26**	**12.26**	**12.26**	**12.26**	**12.26**	**12.26**
A. Solid Waste Disposal on Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
B. Waste-water Handling											
C. Waste Incineration	26.89	10.97	11.30	11.62	11.94	12.26	12.26	12.26	12.26	12.26	12.26
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other *(please specify)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total Emissions/Removals with LULUCF	**52,223.72**	**56,166.22**	**61,711.70**	**55,051.10**	**53,748.18**	**52,442.69**	**52,186.52**	**56,506.04**	**60,265.05**	**64,458.93**	**63,984.73**
Total Emissions without LULUCF	**61,925.10**	**63,654.80**	**67,321.00**	**67,146.19**	**66,828.26**	**65,435.06**	**66,177.56**	**70,170.58**	**71,934.74**	**77,553.14**	**77,077.28**
Memo Items:											
International Bunkers	**885.97**	**1,327.42**	**1,466.42**	**1,525.57**	**1,578.21**	**1,541.67**	**1,674.93**	**1,409.06**	**1,526.13**	**1,305.01**	**1,531.80**
Aviation	885.97	1,327.42	1,.466.42	1,525.57	1,578.21	1,541.67	1,674.93	1,409.06	1,526.13	1,305.01	1,531.80
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Multilateral Operations	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass	**9,750.24**	**11,192.76**	**11,915.67**	**11,996.42**	**11,409.13**	**12,727.22**	**11,911.28**	**13,199.37**	**12,758.54**	**14,360.55**	**14,456.04**

Table A.I-2: Emission Trends CH_4

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
						Gg					
Total Emissions	**436.74**	**405.37**	**396.46**	**383.33**	**377.58**	**369.16**	**361.50**	**355.73**	**348.99**	**350.34**	**352.70**
1. Energy	**40.28**	**41.94**	**44.07**	**40.49**	**40.44**	**41.36**	**41.07**	**42.28**	**41.96**	**43.17**	**45.23**
A. Fuel Combustion (Sectoral Approach)	21.96	19.45	20.33	15.87	15.29	15.19	14.14	14.95	13.54	14.18	14.13
1. Energy Industries	0.16	0.15	0.18	0.19	0.18	0.16	0.16	0.18	0.20	0.25	0.28
2. Manufacturing Industries and Construction	0.41	0.45	0.46	0.49	0.47	0.46	0.47	0.47	0.48	0.49	0.49
3. Transport	2.91	1.99	1.81	1.62	1.56	1.39	1.28	1.20	1.14	1.08	1.00
4. Other Sectors	18.48	16.86	17.88	13.57	13.08	13.16	12.23	13.11	11.72	12.35	12.37
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. Fugitive Emissions from Fuels	18.32	22.48	23.74	24.62	25.15	26.17	26.93	27.32	28.42	28.98	31.10
1. Solid Fuels	0.52	0.28	0.24	0.24	0.24	0.24	0.27	0.26	0.30	0.25	0.05
2. Oil and Natural Gas	17.80	22.21	23.50	24.38	24.91	25.93	26.66	27.07	28.11	28.74	31.05
2. Industrial Processes	**0.36**	**0.34**	**0.35**	**0.36**	**0.39**	**0.35**	**0.35**	**0.32**	**0.36**	**0.35**	**0.35**
A. Mineral Products	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
B. Chemical Industry	0.35	0.33	0.34	0.35	0.38	0.34	0.35	0.32	0.35	0.34	0.35
C. Metal Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D. Other Production											
E. Production of Halocarbons and SF_6											
F. Consumption of Halocarbons and SF_6											
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use											
4. Agriculture	**230.02**	**220.14**	**216.81**	**213.78**	**212.92**	**208.82**	**206.62**	**204.44**	**200.09**	**199.20**	**198.34**
A. Enteric Fermentation	179.13	171.16	168.75	165.79	164.47	162.84	161.87	159.48	156.59	155.55	155.94
B. Manure Management	50.49	48.48	47.55	47.48	47.94	45.47	44.23	44.46	43.05	43.18	41.89
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	Gg										
D. Agricultural Soils [(2)]	0.33	0.44	0.45	0.45	0.45	0.45	0.45	0.43	0.38	0.41	0.42
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	0.07	0.07	0.06	0.07	0.07	0.07	0.06	0.07	0.07	0.06	0.09
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Cropland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**166.08**	**142.95**	**135.23**	**128.69**	**123.83**	**118.63**	**113.47**	**108.68**	**106.59**	**107.62**	**108.78**
A. Solid Waste Disposal on Land	160.71	137.71	130.27	124.08	119.52	114.52	109.63	105.09	103.23	104.50	105.66
B. Waste-water Handling	4.85	4.21	3.87	3.53	3.19	2.93	2.68	2.42	2.18	1.93	1.93
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
D. Other	0.52	1.04	1.09	1.08	1.12	1.18	1.16	1.17	1.17	1.19	1.19
7. Other *(please specify)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo Items:											
International Bunkers	**0.01**	**0.02**	**0.02**	**0.03**	**0.03**	**0.03**	**0.03**	**0.02**	**0.03**	**0.02**	**0.03**
Aviation	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.02	0.03	0.02	0.03
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Multilateral Operations	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass											

Table A.I-3: Emission Trends N_2O

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
						Gg					
Total Emissions/ Removals with LULUCF	**20.17**	**21.25**	**20.27**	**20.32**	**20.63**	**20.38**	**20.01**	**19.64**	**19.61**	**19.51**	**17.08**
Total Emissions without LULUCF	**20.14**	**21.21**	**20.23**	**20.29**	**20.59**	**20.34**	**19.97**	**19.60**	**19.58**	**19.48**	**17.04**
1. Energy	2.47	2.80	2.81	2.76	2.80	2.72	2.59	2.69	2.68	2.73	2.63
A. Fuel Combustion (Sectoral Approach)	2.47	2.80	2.81	2.76	2.80	2.72	2.59	2.69	2.68	2.73	2.63
1. Energy Industries	0.15	0.16	0.15	0.15	0.16	0.17	0.17	0.20	0.19	0.23	0.24
2. Manufacturing Industries and Construction	0.52	0.55	0.54	0.59	0.57	0.58	0.56	0.55	0.55	0.54	0.49
3. Transport	0.85	1.14	1.09	1.00	1.06	0.96	0.93	0.94	0.98	0.99	0.94
4. Other Sectors	0.94	0.94	1.03	1.02	1.00	1.01	0.92	0.99	0.95	0.97	0.96
5. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01
B. Fugitive Emissions from Fuels	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
1. Solid Fuels	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
2. Oil and Natural Gas	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA	IE,NA
2. Industrial Processes	**2.94**	**2.77**	**2.82**	**2.78**	**2.89**	**2.98**	**3.07**	**2.54**	**2.60**	**2.85**	**0.91**
A. Mineral Products	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
B. Chemical Industry	2.94	2.77	2.82	2.78	2.89	2.98	3.07	2.54	2.60	2.85	0.91
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other Production											
E. Production of Halocarbons and SF_6											
F. Consumption of Halocarbons and SF_6											
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**
4. Agriculture	**13.85**	**14.55**	**13.44**	**13.54**	**13.61**	**13.29**	**12.89**	**12.83**	**12.76**	**12.33**	**11.93**
A. Enteric Fermentation											
B. Manure Management	3,24	3,16	3,10	3,07	3,06	3,02	2,98	2,95	2,89	2,87	2,86

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	Gg										
C. Rice Cultivation											
D. Agricultural Soils [(2)]	10.60	11.39	10.33	10.47	10.55	10.27	9.91	9.87	9.87	9.46	9.07
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
F. Field Burning of Agricultural Residues	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.03**	**0.03**	**0.04**
A. Forest Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Cropland	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04
C. Grassland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**0.13**	**0.34**	**0.42**	**0.45**	**0.54**	**0.61**	**0.68**	**0.79**	**0.79**	**0.82**	**0.82**
A. Solid Waste Disposal on Land											
B. Waste-water Handling	0.05	0.19	0.26	0.30	0.38	0.44	0.51	0.62	0.62	0.64	0.65
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
D. Other	0.08	0.15	0.16	0.15	0.16	0.17	0.17	0.17	0.17	0.18	0.18
7. Other *(please specify)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo Items:											
International Bunkers	**0.03**	**0.05**	**0.05**	**0.05**	**0.06**	**0.05**	**0.06**	**0.05**	**0.05**	**0.05**	**0.05**
Aviation	0.03	0.05	0.05	0.05	0.06	0.05	0.06	0.05	0.05	0.05	0.05
Marine	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Multilateral Operations	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**	**IE**
CO_2 Emissions from Biomass											

Table A.I-4: Emission Trends HFCs, PFCs and SF_6

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990 (Base year)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Emissions of HFCs - CO_2 equivalent (Gg)	**23.03**	**267.34**	**346.84**	**427.42**	**494.89**	**542.20**	**596.26**	**695.10**	**782.44**	**864.92**	**904.39**
HFC-23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-32	IE,NA,NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-41	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-43-10mee	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-125	NA,NO	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05
HFC-134	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-134a	0.00	0.15	0.19	0.23	0.27	0.30	0.31	0.33	0.35	0.37	0.35
HFC-152a	NA,NO	0.06	0.07	0.08	0.09	0.10	0.11	0.24	0.35	0.43	0.53
HFC-143	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-143a	NA,NO	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04
HFC-227ea	NA,NO	NA,NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HFC-236fa	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
HFC-245ca	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Unspecified mix of listed HFCs[5] - (Gg CO_2 equivalent)	18.88	41.64	42.58	43.53	44.71	46.25	47.79	49.91	51.53	52.57	54.80
Emissions of PFCs - CO_2 equivalent (Gg)	**1,079.24**	**68.74**	**66.27**	**96.83**	**44.75**	**64.54**	**72.33**	**82.15**	**86.87**	**102.54**	**114.72**
CF_4	0.14	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
C_2F_6	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
C_3F_8	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0,00	0,00	0,00
C_4F_{10}	NA,NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c-C_4F_8	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_5F_{12}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
C_6F_{14}	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
Emissions of SF_6 - CO_2 equivalent (Gg)	**502.58**	**1,139.16**	**1,218.05**	**1,120.15**	**907.99**	**683.96**	**633.31**	**636.62**	**640.83**	**593.52**	**512.51**
SF_6	0.02	0.05	0.05	0.05	0.04	0.03	0.03	0.03	0.03	0.02	0.02

ANNEX II: UNCERTAINTY ASSESSMENT FOR KEY SOURCES

This Annex presents activity data and emission factor uncertainty and/or uncertainty of the emission estimate („combined uncertainty") for key sources of the Austrian GHG inventory, based on the key source assessment of the 2005 submission. The key source analysis of the 2006 submission will be presented in the NIR 2006[9].

Sources of uncertainties will be explained in the NIR 2006.

Table A.II: Uncertainties for Key Sources of the Austrian GHG Inventory (KS Assessment 2005)

IPCC Category	Description	Gas	AD	EF	Combined
			Uncertainty* [%]		
1 A gaseous	Stationary Combustion	CO_2	2.0	0.5	2.1
1 A 1 a liquid	Public Electricity and Heat Production	CO_2	0.5	0.5	0.7
1 A 1 a other	Public Electricity and Heat Production	CO_2	10.0	20.0	22.4
1 A 1 a solid	Public Electricity and Heat Production	CO_2	0.5	0.5	0.7
1 A 1 b liquid	Petroleum refining	CO_2	0.5	0.5	0.7
1 A 1 c liquid	Manuf. of Solid fuels and Other Energy Ind.	CO_2	0.5	0.5	0.7
1 A 2 mob-liquid	Manufacturing Industries and Construction	CO_2	1.0	0.5	1.1
1 A 2 solid	Manufacturing Industries and Construction	CO_2	1.0	0.5	1.1
1 A 2 stat-liquid	Manufacturing Industries and Construction	CO_2	1.0	0.5	1.1
1 A 2 other	Manufacturing Industries and Construction	CO_2	10.0	20	22.4
1 A 3 b diesel oil	Road Transportation	CO_2	0.5	0.5	0.7
1 A 3 b gasoline	Road Transportation	CO_2	0.5	0.5	0.7
1 A 3 b gasoline	Road Transportation	N_2O	10.0	40	41.2
1 A 4 mob-diesel	Other Sectors	CO_2	1.0	0.5	1.1
1 A 4 biomass	Other Sectors	CH_4	10.0	50.0	51.0
1 A 4 gaseous	Other Sectors	CO_2	2.0	0.5	2.1
1 A 4 stat-liquid	Other Sectors	CO_2	1.0	0.5	1.1
1 A 4 solid	Other Sectors	CO_2	1.0	0.5	1.1
2 A 1	Cement Production	CO_2	5.0	2.0	5.4
2 A 2	Lime Production	CO_2	50.0	5.0	50.2
2 A 3	Limestone and Dolomite Use	CO_2	15.0	2.0	15.1
2 A 7 b	Magnesite Sinter Plants	CO_2	2.0	5.0	5.4
2 B 1	Ammonia Production	CO_2			5.0
2 B 2	Nitric Acid Production	N_2O			3.0
2 C 1	Iron and Steel Production	CO_2	2.0	5.0	5.4
2 C 4	SF6 used in Al and Mg Foundries	SF_6	5.0		5.0
2 C 3	Aluminium production	PFCs	2.0	50.0	50.0
2 F 6	Semiconductor Manufacture	FCs	5.0	10.0	11.2
2 F 1/2/3	ODS Substitutes	HFCs	20.0	50.0	53.9

[9] Austria's National Inventory Report 2006, submission under the United Nations Framework Convention on Climate Change (the NIR is due for reporting under the Monitoring Mechanism (280/2004/EC) by March 15 and will be reported under the UNFCCC by April 15 – it will be published in April).

IPCC Category	Description	Gas	AD	EF	Combined
			Uncertainty* [%]		
2 F 8	Other Sources of SF6	SF_6	25.0	50.0	55.9
3	Solvent and Other Product Use	CO_2	15.0	10.0	18.0
3	Solvent and Other Product Use	N_2O	50.0		50.0
4 A 1	Cattle	CH_4		8.0	8.0
4 B 1	Cattle	N_2O	10.0	75.0	75.7
4 B 1	Cattle	CH_4	10.0	69.0	69.7
4 B 8	Swine	CH_4	10.0	70.0	70.7
4 D 1	Direct Soil Emissions	N_2O		48.0	48.0
4 D 3	Indirect Emissions	N_2O		48.0	48.0
6 A	Solid Waste disposal on land	CH_4	15.0	30.0	33.5
6 B	Wastewater Handling	N_2O	20.0	50.0	53.9

** referring to 2 standard deviations (95 % confidence interval)*

Note: *Uncertainties for activity data for stationary combustion of IPCC Category 1 A Fuel Combustion were estimated for gross inland consumption.*

ANNEX III: INFORMATION ON METHODOLOGIES FOR EC KEY SOURCES

This Annex presents methodologies, data sources and emission factors used in the Austrian GHG Inventory for EC key sources for the purpose of Article 4(1)(b) of the Monitoring Decision.

Abbreviations used are explained at the end of the table.

Table A.III-1: Summary report for methods, activity data and emission factors used (Energy)

GREENHOUSE GAS SOURCE AND SINK	**CO_2**				**CH_4**				**N_2O**			
CATEGORIES	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**
1. Energy												
A. Fuel Combustion												
1. Energy Industries												
a. Public Electricity and Heat Production	Yes	T2	NS (< 50 MWth), PS (>= 50 MWth)	CS	No				Yes	T2	NS, PS	CS
Liquid fuels	Yes	T2	NS, PS	CS	No				No			
Solid fuels	Yes	T2	NS, PS	CS	No				Yes	T2	NS,PS	CS
Gaseous fuels	Yes	T2	NS, PS	CS	No				No			
Other fuels	Yes	T2	NS, PS	CS(MSW) D(Ind. Waste)	No				No			
b. Petroleum Refining	Yes	T2	NS	CS	No				No			
Liquid fuels	Yes	T2	NS	CS	No				No			
c. Manufacture of Solid Fuels and Other Energy Industries	Yes	T2	NS	CS	No				No			
Solid fuels	Yes	-	-	-	No				No			
Gaseous fuels	Yes	T2	NS	CS	No				No			
2. Manufacturing Industries and Construction	Yes	T2	NS, PS (95 % of Iron and steel, cement Ind.)	CS, D	No				No			
Liquid fuels	Yes	T2	NS, PS	CS	No				No			

GREENHOUSE GAS SOURCE AND SINK	CO_2				CH_4				N_2O			
CATEGORIES	**Key source(1)**	**Method applied(2)**	**Activity data(3)**	**Emission factor(4)**	**Key source(1)**	**Method applied(2)**	**Activity data(3)**	**Emission factor(4)**	**Key source(1)**	**Method applied(2)**	**Activity data(3)**	**Emission factor(4)**
Solid fuels	Yes	T2	NS, PS	CS	No				No			
Gaseous fuels	Yes	T2	NS, PS	CS	No				No			
Other fuels	Yes	T2	NS, PS	D	No				No			
a. Iron and Steel	No				No				No			
b. Non-Ferrous Metals	No				No				No			
c. Chemicals	No				No				No			
d. Pulp, Paper and Print	No				No				No			
e. Food Processing, Beverages and Tobacco	No				No				No			
f. Other *(as specified in table 1.A(a)s2)*	No				No				No			
3. Transport	Yes				No				Yes			
a. Civil Aviation	Yes	CS	NS	CS	No				No			
Jet kerosene	Yes	CS	NS	CS	No				No			
b. Road Transportation	Yes	CS	NS	CS	No				Yes	CS	NS	CS
Gasoline	Yes	CS	NS	CS	No				Yes	CS	NS	CS
Diesel	Yes	CS	NS	CS	No				Yes	CS	NS	CS
Other fuels	Yes				No				No			
c. Railways	Yes	CS	NS	CS	No				No			
Liquid fuels	Yes	CS	NS	CS	No				No			
d. Navigation	Yes	CS	NS	CS	No				No			
Gas/Diesel oil	Yes	CS	NS	CS	No				No			
e. Other Transportation *(as specified in table 1.A(a)s3)*	No				No				No			
4. Other Sectors	Yes				No				No			
a. Commercial/Institutional	Yes	T2	NS	CS	No				No			
Liquid fuels	Yes	T2	NS	CS	No				No			
Solid fuels	Yes	T2	NS	CS	No				No			

GREENHOUSE GAS SOURCE AND SINK	CO_2				CH_4				N_2O			
CATEGORIES	**Key source(1)**	**Method applied(2)**	**Activity data(3)**	**Emission factor(4)**	**Key source(1)**	**Method applied(2)**	**Activity data(3)**	**Emission factor(4)**	**Key source(1)**	**Method applied(2)**	**Activity data(3)**	**Emission factor(4)**
Gaseous fuels	Yes	T2	NS	CS	No				No			
b. Residential	Yes	T2	NS	CS	No				No			
Liquid fuels	Yes	T2	NS	CS	No				No			
Solid fuels	Yes	T2	NS	CS	No				No			
Gaseous fuels	Yes	T2	NS	CS	No				No			
c. Agriculture/Forestry/Fisheries	Yes	T2	NS	CS	No				No			
Liquid fuels	Yes	T2	NS	CS	No				No			
Solid fuels	Yes	T2	NS	CS	No				No			
Gaseous fuels	Yes	T2	NS	CS	No				No			
5. Other	Yes	M	AS	CS	No				No			
Liquid fuels	Yes	M	AS	CS	No				No			
Solid fuels	Yes	NO	NO	NO	No				No			
a. Stationary	No				No				No			
b. Mobile	No				No				No			
B. Fugitive Emissions from Fuels	No				No				No			
1. Solid Fuels	No				Yes				No			
a. Coal Mining	No				Yes	C	NS	C	No			
b. Solid Fuel Transformation	No				No				No			
c. Other *(as specified in table 1.B.1)*	No				No				No			
2. Oil and Natural Gas	Yes				Yes				No			
a. Oil	Yes	CS	AS	CS	No				No			
b. Natural Gas	No				Yes	D	AS	D	No			
c. Venting and Flaring	Yes	IE	IE	IE	No				No			
d. Other *(as specified in table 1.B.2)*	No				No				No			

Table A.III-2: Summary report for methods, activity data and emission factors used (industrial processes)

GREENHOUSE GAS SOURCE AND SINK	CO_2				CH_4				HFCs				PFCs				SF_6				N_2O			
CATEGORIES	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Emission factor[4]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**
2. Industrial Processes																								
A. Mineral Products	Yes				No				No															
1. Cement Production	Yes	CS	PS	CS	No				No															
2. Lime Production	Yes	CS	PS	CS	No				No															
3. Limestone and Dolomite Use	No				No				No															
4. Soda Ash Production and Use	No				No				No															
5. Asphalt Roofing	No				No				No															
6. Road Paving with Asphalt	No				No				No															
7. Other *(as specified in table 2(I)A-G)*	No				No				No															
B. Chemical Industry	Yes				No				Yes				No				No				No			
1. Ammonia Production	Yes	CS	NS,PS	CS	No				No				No				No				No			
2. Nitric Acid Production	No				No	PS			Yes	CS	PS	PS	No				No				No			
3. Adipic Acid Production	No				No	NO			Yes	N	NO	NO	No				No				No			
4. Carbide Production	No				No				No				No				No				No			
5. Other *(as specified in table 2(I)A-G)*	No				No	No			Yes	N	NO	NO	No				No				No			
C. Metal Production	Yes				No				No								Yes				No			
1. Iron and Steel Production	Yes	T2	NS	CS,D	No				No								No				No			
2. Ferroalloys Production	No				No				No								No				No			
3. Aluminium Production	No				No				No								Yes	T3b	NS	PS	No			
4. SF_6 Used in Aluminium and Magnesium Foundries	No				No				No								No				No			

GREENHOUSE GAS SOURCE AND SINK	CO_2				CH_4				HFCs				PFCs				SF_6				N_2O			
CATEGORIES	Key source[1]	Method applied[2]	Activity data[3]	Emission factor[4]	Key source[1]	Emission factor[4]	Method applied[2]	Activity data[3]	Emission factor[4]	Key source[1]	Method applied[2]	Activity data[3]	Key source[1]	Method applied[2]	Activity data[3]	Emission factor[4]	Key source[1]	Method applied[2]	Activity data[3]	Emission factor[4]	Key source[1]	Method applied[2]	Activity data[3]	Emission factor[4]
5. Other *(as specified in table 2(I)A-G)*	No				No				No								No				No			
D. Other Production	No																							
1. Pulp and Paper	No																							
2. Food and Drink	No																							
E. Production of Halocarbons and SF_6													Yes	NO	NO	NO	Yes	NO	NO	NO	No			
1. By-product Emissions													No				No				No			
2. Fugitive Emissions													No				No				No			
3. Other *(as specified in table 2(II)*													No				No				No			
F. Consumption of Halocarbons and SF_6													Yes	CS	Q	CS	No				Yes	CS	Q	CS
1. Refrigeration and Air Conditioning Equipment													No				No				No			
2. Foam Blowing													No				No				No			
3. Fire Extinguishers													No				No				No			
4. Aerosols/Metered Dose Inhalers													No				No				No			
5. Solvents													No				No				No			
6. Other applications using ODS substitutes													No				No				No			
7. Semiconductor Manufacture													No				No				No			
8. Electrical Equipment													No				No				No			
9. Other *(as specified in table 2(II)*													No				No				No			
G. Other	No				No				No				No				No				No			

Table A.III-3: Summary report for methods, activity data and emission factors used (solvent and other product use, agriculture)

GREENHOUSE GAS SOURCE AND SINK	CO_2				CH_4				N_2O			
CATEGORIES	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**
3. Solvent and Other Product Use												
A. Paint Application	No								No			
B. Degreasing and Dry Cleaning	No								No			
C. Chemical Products, Manufacture and Processing	No								No			
D. Other	No								No			
4. Agriculture												
A. Enteric Fermentation					Yes							
1. Cattle					Yes	T2	NS	CS				
2. Buffalo					No							
3. Sheep					Yes	T1	NS	D				
4. Other					No							
B. Manure Management					Yes				Yes			
1. Cattle					Yes	T2	NS	CS	No			
2. Buffalo					No				No			
3. Sheep					No				No			
4. Other					No				No			
8. Swine					Yes	T2	NS	CS	No			
12. Solid Storage and Dry Lot					No				Yes	T1	NS	D, CS
13. Other					No				No			
C. Rice Cultivation					No							

GREENHOUSE GAS SOURCE AND SINK	CO_2				CH_4				N_2O			
CATEGORIES	Key source[1]	Method applied[2]	Activity data[3]	Emission factor[4]	Key source[1]	Method applied[2]	Activity data[3]	Emission factor[4]	Key source[1]	Method applied[2]	Activity data[3]	Emission factor[4]
D. Agricultural Soils	No				No				Yes			
1. Direct Soil Emissions	No				No				Yes	T1a,b	NS	D
2. Pasture, range and paddock manure	No				No				Yes	T1b	NS	D
3. Indirect Emissions	No				No				Yes	T1a,b	NS	D
4. Other *(as specified in table 4.D)*	No				No				No			
E. Prescribed Burning of Savannas					No				No			
F. Field Burning of Agricultural Residues					No				No			
G. Other					No				No			

Table A III-4: Summary report for methods, activity data and emission factors used (land-use change and forestry, waste, other)

GREENHOUSE GAS SOURCE AND SINK	CO_2				CH_4				N_2O			
CATEGORIES	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**
5. Land-Use, Land-Use Change and Forestry												
A. Forest Land	No				No				No			
1. Forest Land remaining Forest Lands	No				No				No			
2. Land converted to Forest Lands	No				No				No			
B. Cropland	No				No				No			
1. Cropland remaining Cropland	No				No				No			
2. Land converted to Cropland	No				No				No			
C. Grassland	No				No				No			
1. Grassland remaining Grassland	No				No				No			
2. Land converted to Grassland	No				No				No			
D. Wetlands	No				No				No			
1. Wetlands remaining Wetlands	No				No				No			
2. Land converted to Wetlands	No				No				No			
E. Settlements	No				No				No			
1. Settlements remaining Settlements	No				No				No			
2. Land converted to Settlements	No				No				No			
F. Other Land	No				No				No			
1. Other Land remaining Other Land					No				No			
2. Land converted to Other Land	No				No				No			
G. Other (please specify)	No				No				No			
Harvested Wood Products	No				No				No			

GREENHOUSE GAS SOURCE AND SINK	CO_2				CH_4				N_2O			
CATEGORIES	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**	**Key source[1]**	**Method applied[2]**	**Activity data[3]**	**Emission factor[4]**
6. Waste												
A. Solid Waste Disposal on Land	No				Yes							
1. Managed Waste Disposal on Land	No				Yes	T2	NS	CS				
2. Unmanaged Waste Disposal Sites	No				Yes	NO	NO	NO				
3. Other *(as specified in table 6.A)*	No				No							
B. Wastewater Handling					Yes				Yes			
1. Industrial Wastewater					No				No			
2. Domestic and Commercial Wastewater					Yes	D	NS	D,CS	Yes	CS,D	NS	CS,D
3. Other *(as specified in table 6.B)*					No				No			
C. Waste Incineration	No				No				No			
D. Other	No				No				No			
7. Other (as specified in Summary 1.A)												
Memo Items:[8]												
International Bunkers	No				No				No			
Aviation	No				No				No			
Marine	No				No				No			
CO_2 Emissions from Biomass	No				No				No			

Legend for tables A.III-1 to A.III-4

(1) *Key sources of the Community. To be completed by Commission/EEA with results from key category analysis from previous inventory submission.*

(2) *Use the following notation keys to specify the method applied:*

D *(IPCC default),*	***T1a, T1b, T1c*** *(IPCC Tier 1a, Tier 1b and Tier 1c, respectively),*	***C*** *(CORINAIR),*	***COPERT X*** *(Copert Model X = Version)*
RA *(Reference Approach),*	***T2*** *(IPCC Tier 2),*	***CS*** *(Country Specific).*	
T1 *(IPCC Tier 1),*	***T3*** *(IPCC Tier 3),*	***M*** *(Model)*	

If using more than one method within one source category, enumerate the relevant methods. Explanations regarding country-specific methods or any modifications to the default IPCC methods, as well as information regarding the use of

Different methods per source category where more than one method is indicated, should be provided in the documentation box.

(3) *Use the following notation keys to specify the sources of activity data used :*

NS *(national statistics),*	***IS*** *(International statistics),*	***AS*** *(associations, business organizations)*
RS *(regional statistics),*	***PS*** *(Plant Specific data)*	***Q*** *(specific questionnaires, surveys)*

If keys above are not appropriate for national circumstances, use additional keys and explain those in the documentation box.

Where a mix of AD sources has been used, use different notations in one and the same cells with further explanations in the documentation box.

(4) *Use the following notation keys to specify the emission factor used:*

D *(IPCC default),*	***CS*** *(Country-Specific),*
C *(CORINAIR),*	***PS*** *(Plant-Specific).*

Where a mix of emission factors has been used, use different notations in one and the same cells with further explanations in the documentation box.

Documentation box:

* *The full information on methodological issues, such as methods, activity data and emission factors used, can be found in the relevant sector sections of chapter 5 of the NIR. If any additional information is needed*

  To understand the content of this table, use this documentation box to provide references to the relevant section of the NIR where further details can be found.
* *Where a mix of methods/emission factors has been used within one source category, use this documentation box to specify those methods/emission factors for the various sub-sources where they have been applied*

(see also footnotes 2 to 4 to this table).

ANNEX IV: INDICATORS

This Annex presents data of indicators pursuant to Article 3 (1) j of the Monitoring Decision (280/2004/EC), a detailed description of the indicators can be found in Annex II of the „Implementing Provisions" (Commission Decision 2005/166/EC).

Information on all Priority Indicators (including Additional Priority Indicators) is provided, however, data for some Supplementary Indicators was not available (indicated by NA in the cells).

Footnotes are used if the indicators presented below are not fully in line with the definitions as laid down in the Implementing Provisions, and for further explanations.

Table A.IV: Indicators pursuant to Article 3 (1) j of the Monitoring Decision for the years 1990-2004

No	Indicator	Numerator/ Denominator	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	Priority Indicators																
1	Total CO_2 intensity of GDP, t/Mio Euro	Total CO_2 emissions, kt	61 925	65 477	60 035	60 406	60 757	63 655	67 321	67 146	66 828	65 435	66 178	70 171	71 935	77 553	77 077
		GDP, Bio Euro (EC95)[10]	163.54	169.42	173.42	174.00	178.63	182.04	186.81	190.24	197.02	203.56	210.39	212.14	214.19	217.19	222.49
2	Energy related CO_2 intensity of GDP, t/Mio Euro	CO_2 emissions from energy consumption, kt	53 942	57 690	52 787	53 251	53 272	55 953	59 993	59 161	59 196	57 940	58 061	62 096	63 310	68 922	68 605
		GDP, Bio Euro (EC95)[10]	163.54	169.42	173.42	174.00	178.63	182.04	186.81	190.24	197.02	203.56	210.39	212.14	214.19	217.19	222.49
3	CO_2 emissions from passenger cars, kt		8 748	9 762	9 525	9 360	9 346	9 337	9 051	8 976	9 750	9 492	9 648	10 202	11 511	12 361	12 672
	Number of kilometres by passenger cars[11], Mkm		41 380	46 582	45 585	44 953	45 164	45 260	44 308	44 479	48 972	48 401	50 014	53 845	61 856	67 413	70 049

[10] GDP and Cross Values-Added refer to 2000

[11] Activity data is consistent with emission data

No	Indicator	Numerator/ Denominator	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
4	Energy related CO_2 intensity of industry, t/Mio Euro	CO_2 emissions from industry, kt	13 453	13 722	12 583	12 959	13 963	14 146	14 208	16 004	14 948	13 973	14 526	14 090	14 750	14 559	15 328
		Gross value-added total industry[12], Bio Euro (EC95)[10]	40.85	42.22	42.19	41.72	43.36	44.32	45.47	46.75	48.36	50.38	52.83	53.54	53.83	54.61	56.99
5	Specific CO_2 emissions of households, t/dwelling	CO_2 emissions from fossil fuel consumption households, kt	9 906	11 004	10 104	9 984	9 286	9 858	10 694	10 035	10 055	9 952	9 709	10 267	9 786	10 289	9 784
		Stock of permanently occupied dwellings, 1000	2 947	2 998	3 016	3 028	3 072	3 109	3 142	3 163	3 191	3 230	3 261	3 284	3 296	3 302	3 429
6	CO_2 intensity of the commercial and institutional sector, t/Mio Euro	CO_2 emissions from fossil fuel consumption in commercial and institutional sector, kt	2 442	2 638	2 993	3 131	2 636	3 232	3 539	2 535	2 427	3 158	2 004	3 187	2 556	3 264	2 660
		Gross value-added services, Bio Euro (EC95)[10]	92.03	95.52	99.09	99.97	102.21	104.58	106.76	107.91	111.99	114.69	118.80	120.01	120.77	123.20	125.69
7	Specific CO_2 emissions of public and autoproducer power plants, t/TJ	CO_2 emissions from public and autoproducer thermal power stations[13], kt	11 876	12 233	9 234	9 228	10 185	12 045	12 888	13 144	11 564	11 429	10 563	11 683	11 287	13 411	13 638
		All products –output bypublic and autoproducer thermal power stations, PJ	146.15	138.10	124.50	124.42	125.52	136.50	124.97	129.25	114.62	111.23	111.51	109.35	106.74	108.36	109.77

[12] NACE 11 is also included

[13] SNAP 0101 + 0301 Auto-Producers

No	Indicator	Numerator/ Denominator	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	Additional Priority Indicators																
1	CO_2 emissions from freight transport on road, kt		3 132	3 702	3 883	4 228	4 190	4 572	6 433	5 425	6 717	6 276	7 151	7 828	8 552	9 435	9 630
	Freight transport on road [11], Mtkm		6 146	6 879	7 174	7 612	7 722	8 245	10 609	9 549	11 336	10 965	12 251	13 214	14 177	15 385	15 724
2	Total CO_2 intensity – iron and steel industry, t/Mio Euro	Total CO_2 emissions from iron and steel, kt	8 504	8 139	7 023	7 352	7 870	8 712	8 385	9 410	8 846	8 632	9 534	9 345	10 122	10 052	10 289
		Gross value-added – iron and steel industry[14], Bio Euro (EC95) [10]	1.97	1.99	1.77	1.51	1.52	1.63	1.63	1.91	1.88	2.14	2.11	2.34	2.12	2.12	2.14
3	Energy related CO_2 intensity – chemical industry, t/Mio Euro	Energy related CO_2 emissions chemical industries, kt	955	960	1 076	1 085	1 031	1 066	1 113	1 205	1 130	1 538	1 416	1 381	1 426	1 409	1 595
		Gross value-added chemical industry, Bio Euro (EC95) [10]	1.59	1.63	1.67	1.78	1.70	1.77	1.82	1.83	1.90	2.05	2.34	2.12	2.23	2.26	2.26
4	Energy related CO_2 intensity – glass, pottery and building materials industry, t/Mio Euro	Energy related CO_2 emissions glass, pottery and building materials[15], kt	1 669	1 668	1 673	1 621	1 693	1 520	1 551	1 698	1 600	1 365	1 428	1 376	1 485	1 498	1 528
		Gross value-added – glass, pottery and buildings materials industry, Bio Euro (EC95) [10]	2.29	2.22	2.16	2.10	2.24	2.10	2.18	2.27	2.12	2.17	2.29	2.37	2.28	2.27	2.32
5	Specific CO_2 emissions of iron and steel industry, t/t	Total CO_2 emissions from iron and steel, kt	8 504	8 139	7 023	7 352	7 870	8 712	8 385	9 410	8 846	8 632	9 534	9 345	10 122	10 052	10 289
		Production of oxygen steel, kt	3 921	3 896	3 592	3 738	3 968	4 538	4 032	4 718	4 801	4 722	5 183	5 346	5 647	5 707	5 901

[14] Total NACE 27 (thus also including non-ferrous metal industries)

[15] SNAP 030311, 030317, 030319

No	Indicator	Numerator/ Denominator	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
6	Specific energy related CO_2 emissions of cement industry, t/t	Energy related CO_2 emissions from glass, pottery and building materials[16], kt	1 055	1 038	1 107	1 038	1 089	867	848	932	853	826	866	807	830	821	804
		Cement production, kt	4 679	4 821	4 822	4 858	4 763	3 839	3 779	3 909	3 668	3 658	4 047	4 035	4 061	4 129	4 129
	Supplementar Indicators y																
1	Specific diesel related CO_2 emissions of passenger cars, g/100km	CO_2 emissions of diesel-driven passenger cars, kt	1 448	1 664	1 778	1 920	2 171	2 394	2 638	2 896	3 347	3 550	3 897	4 382	5 196	5 875	6 352
		Number of kilometres of diesel-driven passenger cars[11], Mio km	7 501	8 673	9 314	10 106	11 457	12 632	14 054	15 605	18 208	19 608	21 863	24 968	29 997	34 235	37 343
2	Specific petrol related CO_2 emissions of passenger cars, g/100km	CO_2 emissions of petrol-driven passenger cars, kt	7 300	8 098	7 747	7 440	7 175	6 943	6 413	6 080	6 403	5 942	5 751	5 820	6 315	6 486	6 321
		Number of kilometres of petrol-driven passenger cars[11], Mio km	33 879	37 909	36 271	34 847	33 707	32 628	30 254	28 874	30 763	28 793	28 152	28 877	31 859	33 177	32 706
3	Specific CO_2 emissions of passenger cars, t/pkm	CO_2 emissions from passenger cars, kt	8 748	9 762	9 525	9 360	9 346	9 337	9 051	8 976	9 750	9 492	9 648	10 202	11 511	12 361	12 672
		Passenger transport by cars[11], Mpkm	63 249	71 201	69 631	68 216	68 423	68 569	67 126	67 253	73 898	72 892	75 172	80 767	92 598	100715	104443
4	Specific air-transport emissions, t/passenger	CO_2 emissions from domestic air transport, kt	32	38	43	49	54	58	63	71	77	81	82	220	75	161	191
		Domestic air-passengers[17], Mio	365 425	735 049	674 699	697 589	714 178	697 822	747 313	749 781	857 149	917 267	1007 048	1070 863	1045 706	1082 194	1110 216

[16] SNAP 030311

[17] Number of passengers is not used as activity data for estimating emissions

No	Indicator	Numerator/ Denominator	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
5	Energy related CO_2 intensity – food, drink and tobacco industry, t/Mio Euro	Energy related CO_2 emissions food industries, kt	851	913	835	872	903	940	881	1 060	965	974	1 151	1 069	1 249	1 109	1 179
		Gross value-added – food, drink and tobacco industry, Mio Euro (EC95) [10]	2.75	2.89	3.08	2.99	3.10	3.27	3.14	3.18	3.42	3.71	3.67	3.56	3.75	3.57	3.68
6	Energy related CO_2 intensity – paper and printing industry, t/Mio Euro	Energy related CO_2 emissions paper and printing, kt	2 237	2 588	2 199	2 037	2 559	2 291	2 232	2 858	2 675	2 024	2 182	2 022	1 935	1 800	1 844
		Gross value-added – paper and printing industry, Mio Euro (EC95) [10]	2.65	2.49	2.24	2.43	2.68	2.92	2.83	3.03	3.03	3.52	3.80	4.03	3.85	3.68	3.66
7	Specific CO_2 emissions of households for space heating, t/m²	CO_2 emissions for space heating in households, kt	8 907	9 867	9 035	8 884	8 254	8 754	9 477	8 851	8 831	8 703	8 464	8 956	8 515	8 942	8 489
		Surface area of permanently occupied dwellings, Mio m^2	249	255	258	259	265	272	277	281	284	290	295	298	303	307	331
8	Specific CO_2 emissions of commercial and institutional sector for space heating, kg/m²	CO_2 emissions from space heating in commercial and institutional, kt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Surface area of services buildings, Mio m^2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9	Specific CO_2 emissions of public power plants, t/TJ	CO_2 emissions from public thermal power stations[18], kt	8 878	9 219	6 293	6 015	6 483	7 567	9 271	9 541	8 072	7 960	7 643	8 795	8 610	10 741	9 982
		All products output by public thermal power stations, PJ	61.1	64.0	48.5	50.6	56.3	62.0	75.2	73.2	73.2	73.5	66.2	79.0	79.7	98.8	97.6

[18] SNAP 0101

No	Indicator	Numerator/ Denominator	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
10	Specific CO_2 emissions of autoproducer plants, t/TJ	CO_2 emissions from autoproducers, kt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		All products output by autoproducer thermal power stations, PJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	Carbon intensity of total power generation, t/TJ	CO_2 emissions from classical power production, kt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		All products output by public and autoproducer power stations, PJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
12	Carbon intensity of transport, t/TJ	CO_2 emissions from transport, kt	12 400	13 993	13 937	14 116	14 078	14 463	16 039	14 976	17 171	16 597	17 735	19 037	20 986	22 850	23 455
		Total final energy consumption from transport[19], PJ	198.2	218.3	218.7	222.4	223.1	227.2	246.5	236.4	262.6	253.6	270.1	282.2	304.5	323.3	335.1
13	Specific energy related CO_2 emissions of paper industry, t/t	Energy related CO_2 emissions paper and printing industries, kt	2 237	2 588	2 199	2 037	2 559	2 291	2 232	2 858	2 675	2 024	2 182	2 022	1 935	1 800	1 844
		Physical output of paper, kt	2 932	3 090	3 252	3 301	3 603	3 599	3 653	3 817	4 009	4 142	4 385	4 250	4 419	4 564	4 852
14	CO_2 emissions from the industry sector, kt		13 453	13 722	12 583	12 959	13 963	14 146	14 208	16 004	14 948	13 973	14 526	14 090	14 750	14 559	15 328
	Total final energy consumption from industry[20], PJ		292	295	289	288	287	290	307	337	329	334	347	363	360	378	382
15	CO_2 emissions from households, kt		9 906	11 004	10 104	9 984	9 286	9 858	10 694	10 035	10 055	9 952	9 709	10 267	9 786	10 289	9 784
	Total final energy consumption from households[21], PJ		299.8	333.6	316.3	322.5	303.4	325.3	355.1	337.3	337.0	339.8	330.0	358.3	342.5	360.2	355.6

[19] Including Off-Road Transport, Pipelines and International Aviation

[20] Including Heat

[21] Including District heating and Solar thermal