ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

# Austria's Annual Greenhouse Gas Inventory 1990–2010

Submission under Decision 280/2004/EC

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

# AUSTRIA'S ANNUAL GREENHOUSE GAS INVENTORY 1990–2010

## Submission under Decision 280/2004/EC

REPORT
REP-0361

Vienna 2012

**Project manager**

Katja Pazdernik

**Authors**

Michael Anderl, Alexandra Freudenschuß, Simone Haider, Traute Köther, Christoph Lampert, Katja Pazdernik, Stephan Poupa, Maria Purzner Barbara Schodl, Elisabeth Schwaiger, Melanie Sporer, Gudrun Stranner, Peter Weiss, Manuela Wieser, Andreas Zechmeister Gerhard Zethner

**Reviewed and approved by**

Klaus Radunsky

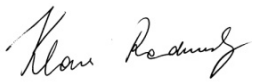
**Layout and typesetting**

Elisabeth Riss

**Title photograph**



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

| Reporting entity | Contracting entitiy |
|---|---|
| **Überwachungsstelle Emissionsbilanzen**<br>*(Inspection Body for Emission Inventories)*<br>at the<br>Umweltbundesamt GmbH<br>Spittelauer Lände 5, 1090 Vienna/Austria | **BMLFUW**<br>(*Federal Ministry of Agriculture, Forestry, Environment and Water Management*)<br><br>Stubenring 1, 1012 Vienna/Austria |
| Date<br>15.01.2012 | Responsible for the content of this report<br>  <br>Dr. Klaus Radunsky<br>(Head of the inspection body) |
| Total Number of Pages<br>49 (including Annex) | |

The source of all tables and figures in this report is the Austrian GHG Inventory compiled by the Inspection Body for Emission Inventories.



For further information about the publications of the Umweltbundesamt please go to:
**http://www.umweltbundesamt.at/**

**Imprint**

Owner and Editor: Umweltbundesamt GmbH
Spittelauer Lände 5, 1090 Vienna/Austria

Printing by: Umweltbundesamt GmbH

*Printed on $CO_2$-neutral 100% recycled paper*.


ISBN 978-3-99004-164-2

# TABLE OF CONTENTS

# VORWORT

## Dieser Bericht

Der vorliegende Bericht präsentiert die neuesten Daten der Treibhausgas- (THG-) Emissionen Österreichs. Diese Daten betreffen die Emissionen des Jahres 2010 sowie die aktualisierte Zeitreihe der Jahre 1990 bis 2009.

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 und einem dazugehörigen Kurzbericht („Short-NIR“) mit 15. Jänner an die Europäische Kommission[2]. Eine detaillierte Darstellung der Daten wird der Europäischen Kommission in digitaler Form übermittelt.

## Rechtlicher Hintergrund

Als Vertragsstaat der Klimarahmenkonvention (*Rahmenübereinkommens der Vereinten Nationen über Klimaänderungen* (UN Framework Convention on Climate Change – UNFCCC, BGBl. Nr. 414/1994)) ist Österreich verpflichtet, jährlich seine 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 $SO_2$ zu erheben und zu berichten. Die dafür anzuwendende Methodik ist in einem umfassenden Regelwerk entsprechend den Beschlüssen der Vertragsstaatenkonferenz der UNFCCC festgelegt.

Auch die Europäische Union (EU) ist Vertragsstaat der Klimarahmenkonvention. Die EU Inventur wird aus der Summe der Mitgliedsstaaten-Inventuren errechnet. Deshalb hat die EU mit dem o. g. THG Überwachungssystem die Anforderungen, die an die EU gestellt werden an die Mitgliedsstaaten weitergegeben und diese dazu verpflichtet, Daten und Informationen, die für die Erstellung der EU Inventur benötigt werden, rechtzeitig zur Verfügung zu stellen. Mit dem vorliegenden Bericht kommt Österreich dieser Berichtspflicht nach.

Die Erhebung der Daten berücksichtigt außerdem die Ergebnisse der jährlichen Überprüfung durch die UNFCCC im Rahmen der so genannten UNFCCC-Tiefenprüfung. Ende August/Anfang September 2011 fand die letzte dieser Tiefenprüfungen der Österreichischen Treibhausgas-Inventur durch internationale Fachexperten statt. Die Ergebnisse dieser Prüfung werden im Frühjahr 2012 veröffentlicht werden. Die im Rahmen der Inventurprüfung eingebrachten Verbesserungsvorschläge wurden teilweise bereits in der diesjährigen Inventur berücksichtigt, teilweise fließen sie in das Inventurverbesserungsprogramm 2012 ein (siehe Tabelle A).

---

[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] Der vorliegende Bericht beinhaltet 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; Artikel 3 (1) k: Informationen zu Änderungen des Nationalen Inventursystems; Artikel 3 (1) g: Informationen des Registers; und Artikel 3 (1) h: Informationen über juristische Personen, die befugt sind, sich an den Mechanismen nach den Artikeln 6, 12 und 17 des Kyoto-Protokolls unter Beachtung der einschlägigen nationalen oder gemeinschaftlichen Bestimmungen zu beteiligen.

*Tabelle A: Jährlicher Prozess zur Erstellung und Überarbeitung der THG Inventur.*

| | |
|---|---|
| 15. Jänner *(Jahr n)* | Übermittlung der THG Inventur an EK (für die Jahre 1990 bis zum Jahr n-2) |
| 15. Jänner bis 28. Februar *(Jahr n)* | Überprüfung der Daten durch die EK |
| 15. April *(Jahr n)* | Übermittlung der THG Inventur an die UNFCCC |
| Juni *(Jahr n)* bis März *(Jahr n+1)* | Überprüfung der Daten durch die UNFCCC:<br>– Stufe 1: Initial Check<br>– Stufe 2: Synthesis and Assessment<br>– Stufe 3: Individual Review |
| bis 15. Januar *(Jahr n + 1)* | Berücksichtigung der Kommentare der EK und der UNFCCC bei der Erstellung und Überarbeitung der THG Inventur |

Zur Erfüllung der Anforderungen, die sich aus der Klimarahmenkonvention und vor allem aus dem Inkrafttreten des Kyoto-Protokolls am 16. Februar 2005 ergeben haben, wurde entsprechend Artikel 5.1 des Kyoto-Protokolls ein Nationales System eingerichtet. Ziel ist es, 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/IEC 17020 sind ein wesentlicher Teil des NISA[3].

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.

Dieser 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 erforderlichenfalls 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 B: Datengrundlage des vorliegenden Berichts.*

| Inventur | Datenstand | Berichtsformat |
|---|---|---|
| OLI 2011 | 11. Jänner 2012 | Common Reporting Format (CRF) |

[3] UMWELTBUNDESAMT (2005): NISA National Inventory System Austria, Implementation Report, REP-0004; Umweltbundesamt, Vienna.

# ZUSAMMENFASSUNG

*Die hier dargestellte Entwicklung der Treibhausgase in Österreich folgt in der Einteilung den Sektoren der Klimastrategie 2007.*[4]

**Treibhausgasbilanz 2010 – Wirtschaftswachstum sorgt für Anstieg der Treibhausgasemissionen**

Die Ergebnisse der aktuellen Treibhausgas-Inventur des Umweltbundesamt zeigen im Jahr 2010 erstmals seit 2005 wieder einen Anstieg: Im Jahr 2010 wurden insgesamt 84,6 Mio. Tonnen Kohlendioxid-Äquivalent emittiert. Gegenüber 2009 ist das ein Anstieg um 4,9 Mio. Tonnen. Unter Berücksichtigung der flexiblen Mechanismen sowie der Bilanz aus Neubewaldung und Entwaldung ergibt sich damit für das dritte Jahr der ersten Verpflichtungsperiode eine Abweichung von 6,2 Mio. Tonnen zum Kyoto-Ziel.

Die Bilanz im Detail:

**Industrie und Energieaufbringung**

Die steigende Produktion im Jahr 2010 spiegelt sich in der Treibhausgasbilanz des Sektors Industrie mit einem deutlichen Zuwachs (+ 1,8 Mio. Tonnen) von 2009 auf 2010 wider. Der Sektor Industrie ist im Jahr 2010 mit ca. 24,7 Mio. Tonnen Kohlendioxid-Äquivalent der größte Emittent an Treibhausgasen in Österreich.

Im Sektor Energieaufbringung wurde 2010 im Vergleich zu 2009 ca. 1,4 Mio. Tonnen Treibhausgase mehr emittiert; in Summe ca. 14,3 Mio. Tonnen. Die Inlandsstromnachfrage ist 2010 wieder deutlich gestiegen, der Energieverbrauch ist 2010 auf Höchstniveau, allerdings kann durch den forcierten Einsatz erneuerbarer Energieträger der Anstieg der Treibhausgasemissionen gedämpft werden.

Seit 2005 unterliegt ein Großteil der Anlagen dieser beiden Sektoren dem EU-Emissionshandel; der Beitrag der Emissionshandelsbetriebe zur Kyoto-Zielerreichung wird nicht mehr durch die aktuelle Emissionsentwicklung bestimmt, sondern ist durch den für 2008 bis 2012 relevanten Nationalen Zuteilungsplan festgelegt.

**Verkehr**

Der Sektor Verkehr ist mit ca. 22,5 Mio. Tonnen im Jahr 2010 der zweitgrößte Emittent von Treibhausgasen in Österreich. Mit einem Plus von 60 % wird in diesem Sektor die mit Abstand höchste Zuwachsrate seit 1990 verzeichnet. Im Vergleich zu 2009 sind die Emissionen im Verkehrssektor 2010 um 0,6 Mio. Tonnen höher. In diesem Sektor sorgt die steigende Produktion für eine verstärkte Nachfrage nach Gütertransportleistung auf der Straße. Aber auch hier sind die THG-Emissionen in den letzten Jahren weniger stark gestiegen als die Verkehrsleistung. So konnten etwa durch den Einsatz von Biokraftstoffen im Jahr 2010 1,7 Mio. Tonnen Kohlendioxid-Äquivalent eingespart werden.

[4] Die Entsprechung der Klimastrategie-Sektoren mit den Sektoren des CRF-Formats wie sie für den englischsprachlichen Teil dieses Berichts verwendet wird, ist wie folgt – CRF Bezeichnung in Klammern: Raumwärme (1.A.4), Verkehr (1.A.3+1.A.5), Energieaufbringung (1.A.1), Industrie (1.A.2+2 ohne F-Gase), Landwirtschaft (4), Abfallwirtschaft (6), F-Gase (F-Gase aus 2), Sonstige (1.B+3);

### Raumwärme

Auf den Sektor Raumwärme entfallen 2010 ca. 11,4 Mio. Tonnen Treibhausgasemissionen. Der verstärkte Einsatz von Fernwärme und Erneuerbaren Energieträgern sowie die bessere thermische Qualität der Gebäude führten in den letzten Jahren zu Emissionsminderungen in diesem Sektor. Die kalte Witterung 2010 sorgt allerdings in diesem Sektor für einen deutlichen Anstieg der Emissionen im Vergleich zu 2009.

### Abfallwirtschaft, Landwirtschaft, F-Gase

Die THG-Emissionen aus den Sektoren Abfallwirtschaft (ca. 1,8 Mio. Tonnen) und Landwirtschaft (ca. 7,4 Mio. Tonnen) sind im Vergleich zu 2009 gesunken. Produktionsbedingt werden 2010 wieder mehr F-Gase (ca. 1,6 Mio. Tonnen) emittiert. Insgesamt verursachen diese drei Sektoren 2010 weniger als 11 Mio. Tonnen der österreichischen Treibhausgasemissionen.

# 1 INTRODUCTION

This report covers the Austrian greenhouse gas inventory data for the years 1990 to 2010; it presents the greenhouse gas emission data for the first, second and third year of the first commitment period under the Kyoto-Protocol.

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 and the reporting requirements, which 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 *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the *Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, and the *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry* as well as the Reporting Guidelines established by the Conference of the Parties to the UNFCCC and under the Kyoto Protocol.

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 (NIR) relevant for the 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. Since 2008 the reporting under Article 3 (1) g (information from the national registry) and 3 (1) h (information on legal entities authorised to participate in mechanisms of the Kyoto Protocol) is obligatory and is therefore also included in this report.

# 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.

The following figure depicts the trend of Austria's GHG emissions and also shows Austria's Kyoto Target for 2008–2012. The figure excludes emission sources and sinks from the sector Land Use, Land Use Change and Forestry (LULUCF) as reported under the UNFCCC.

It has to be noted that for judging the compliance under the Kyoto Protocol sources and sinks related to Article 3.3 of the Kyoto Protocol have to be considered, and also the use of flexible mechanisms under the Kyoto Protocol has to be accounted for.

In 2010 Austria's total greenhouse gas emissions (without LULUCF) amounted to 84.6 million tonnes $CO_2$ equivalents. Compared to the base year 1990 emissions increased by 8.2% and compared to 2009, emissions increased by 6.1%. The trend is dominated by the trend of the most important sector – the energy sector.

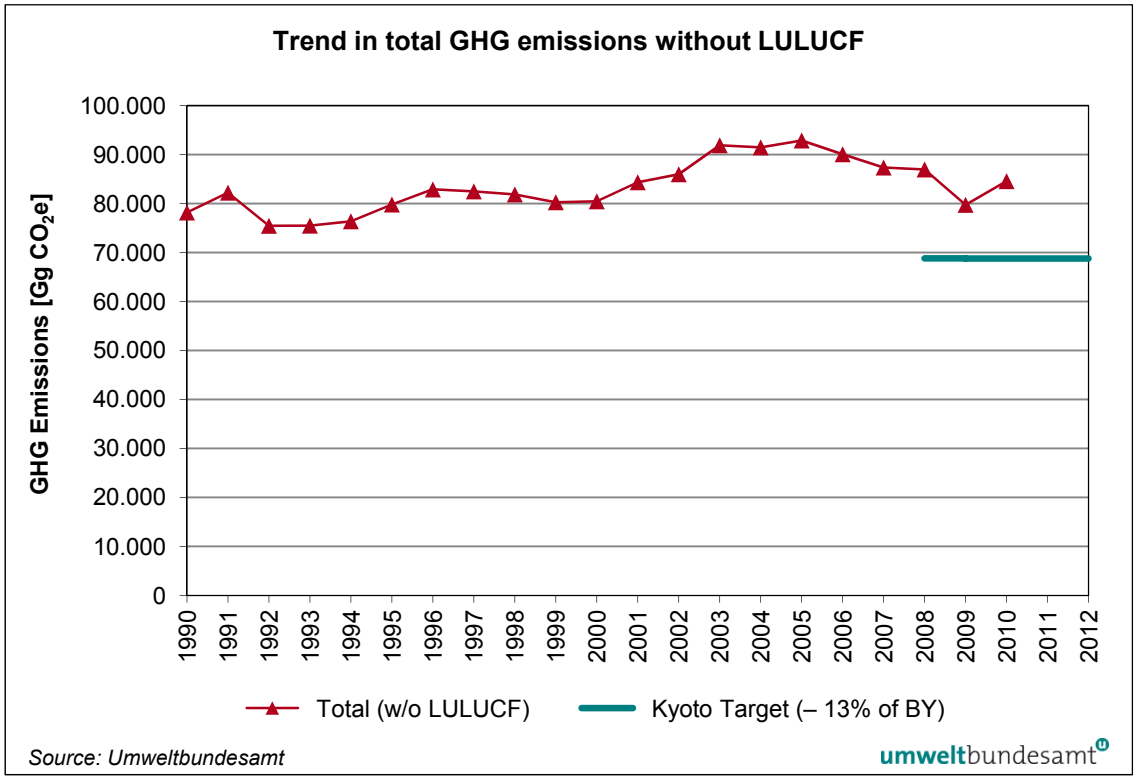



*Figure 1: Trend in total GHG emissions 1990–2010 without LULUCF.*

### Development 2009–2010

The **key driver** for the emissions increase between 2009 and 2010 was the recovery after the weak economic situation in 2009 expressed by:

- the again increased amount of fuel consumed in the transport sector (mainly freight transport on road),
- the increased demand for electricity, as well as
- the rise in industrial production of energy-intensive products (steel).

In addition, weather circumstances contributed to the emissions increase, affecting emissions for heating demand as well as hydro power generation.

GHG emissions from **road transport** increased by 3.6% compared to 2009, mainly due to the increased road freight activity (domestically as well as caused by fuel export). Transport volume (kilometres driven) increased by 2%.

GHG emissions from sector **energy industries** increased by 11% between 2009 and 2010 as a result of the increased power generation on solid fuel basis and the decreased use of renewable sources, especially hydro power.

The rising emissions in the **other sectors** (+ 11%) from 2009 to 2010) are attributable to the increased fuel consumption (gas, heating oil) due to the cold weather 2010. The number of heating degree days increased by 13% from 2009 to 2010.

GHG emissions from **industrial processes** increased by 10% from 2009 to 2010, mainly due to rising emissions in the iron and steel industry.

The sectors solvents showed increasing emissions by about 9.3% from 2009 to 2010, the sectors agriculture (– 2.4%) and waste (– 5.9%) showed decreasing emissions.

*Table 1: Summary of Austria's anthropogenic greenhouse gas emissions by sector.*

| GHG source and sink categories | 1. Energy | 2. Industry | 3. Solvent | 4. Agriculture | 5. LULUCF* | 6. Waste | 7. Other |
|---|---|---|---|---|---|---|---|
| | $CO_2$ equivalents (Gg) | | | | | | |
| 1990 | 55 397 | 10 108 | 512 | 8 558 | – 10 023 | 3 587 | NA |
| 1995 | 57 670 | 9 897 | 422 | 8 719 | – 11 597 | 3 096 | NA |
| 2000 | 59 251 | 10 325 | 425 | 7 904 | – 15 036 | 2 558 | NA |
| 2001 | 63 374 | 10 177 | 425 | 7 856 | – 16 923 | 2 504 | NA |
| 2002 | 64 487 | 10 794 | 427 | 7 752 | – 10 978 | 2 522 | NA |
| 2003 | 70 596 | 10 747 | 418 | 7 544 | – 931 | 2 566 | NA |
| 2004 | 71 071 | 10 116 | 374 | 7 439 | – 5 989 | 2 447 | NA |
| 2005 | 72 113 | 10 623 | 387 | 7 400 | – 7 395 | 2 345 | NA |
| 2006 | 68 944 | 10 984 | 415 | 7 434 | – 1 583 | 2 269 | NA |
| 2007 | 65 845 | 11 460 | 388 | 7 498 | – 519 | 2 159 | NA |
| 2008 | 65 000 | 11 911 | 367 | 7 632 | 385 | 2 030 | NA |
| 2009 | 60 220 | 9 675 | 299 | 7 620 | – 3 644 | 1 912 | NA |
| 2010 | 64 328 | 10 680 | 327 | 7 440 | – 3 611 | 1 799 | NA |

** Net emissions*

The most important GHG in Austria is carbon dioxide ($CO_2$) with a share of 85.5% in 2010. The $CO_2$ emissions primarily result from combustion activities. Methane ($CH_4$), which mainly arises from stock farming and waste disposal, contributes 6.6% to national total GHG emissions, and nitrous oxide with agricultural soils as the main source adds another 6.1%. The remaining 1.9% is due to emissions of fluorinated compounds, which are mostly emitted from the use of these gases as substitutes for ozone depleting substances (ODS) in refrigeration equipment.

*Table 2: Austria's anthropogenic greenhouse gas emissions by gas 1990–2010 without LULUCF.*

| Greenhouse gas emissions | $CO_2$ | $CH_4$ | $N_2O$ | HFCs | PFCs | $SF_6$ | Total (without LULUCF) |
|---|---|---|---|---|---|---|---|
| | $CO_2$ equivalents (Gg) | | | | | | |
| 1990 | 62 060 | 8 304 | 6 198 | 26 | 1 079 | 494 | 78 162 |
| 1995 | 63 944 | 7 616 | 6 606 | 412 | 71 | 1 154 | 79 804 |
| 2000 | 65 972 | 6 620 | 6 288 | 902 | 85 | 596 | 80 463 |
| 2001 | 70 005 | 6 484 | 6 174 | 925 | 96 | 652 | 84 336 |
| 2002 | 71 720 | 6 386 | 6 175 | 969 | 98 | 635 | 85 983 |
| 2003 | 77 758 | 6 383 | 6 098 | 950 | 116 | 567 | 91 872 |
| 2004 | 78 216 | 6 243 | 5 399 | 955 | 137 | 497 | 91 447 |
| 2005 | 79 724 | 6 085 | 5 431 | 986 | 134 | 507 | 92 867 |
| 2006 | 77 033 | 5 968 | 5 472 | 963 | 146 | 465 | 90 046 |
| 2007 | 74 363 | 5 862 | 5 500 | 1 062 | 190 | 375 | 87 351 |
| 2008 | 73 922 | 5 720 | 5 684 | 1 058 | 174 | 383 | 86 940 |
| 2009 | 67 226 | 5 654 | 5 405 | 1 057 | 35 | 349 | 79 726 |
| 2010 | 72 290 | 5 565 | 5 144 | 1 161 | 70 | 345 | 84 575 |

The dominant sector regarding GHG emissions in Austria is Energy, which caused 76% of total greenhouse gas emissions in Austria in 2010 (71% in 1990), followed by the Sectors Industrial Processes (13% in 2010) and Agriculture (8.8% in 2010).

*Table 3: Austria's greenhouse gas emissions by sector in the base year (1990) and in 2010 as well as their share and trend.*

| GHG | 1990 | 2010 | Trend 1990–2010 | 1990 | 2010 |
|---|---|---|---|---|---|
| | Emissions [Gg $CO_2$e] | | | Share [%] | |
| **Total** | **78 162** | **84 575** | **8.2%** | **100.0%** | **100.0%** |
| 1 Energy | 55 397 | 64 328 | 16.1% | 70.9% | 76.1% |
| 2 Industry | 10 108 | 10 680 | 5.7% | 12.9% | 12.6% |
| 3 Solvent | 512 | 327 | – 36.1% | 0.7% | 0.4% |
| 4 Agriculture | 8 558 | 7 440 | – 13.1% | 10.9% | 8.8% |
| 5 LULUCF | – 10 023 | – 3 611 | – 64.0% | – | – |
| 6 Waste | 3 587 | 1 799 | – 49.8% | 4.6% | 2.1% |

*Total emissions without emissions from LULUCF*

In 2010 emissions from *Energy* are 16.1% higher than in the base year, emissions from *Industrial Processes* rose by 5.7%. All the other sectors show decreasing GHG emissions. The most significant decreases in absolute terms occurred in the sectors *Waste* and *Agriculture*.

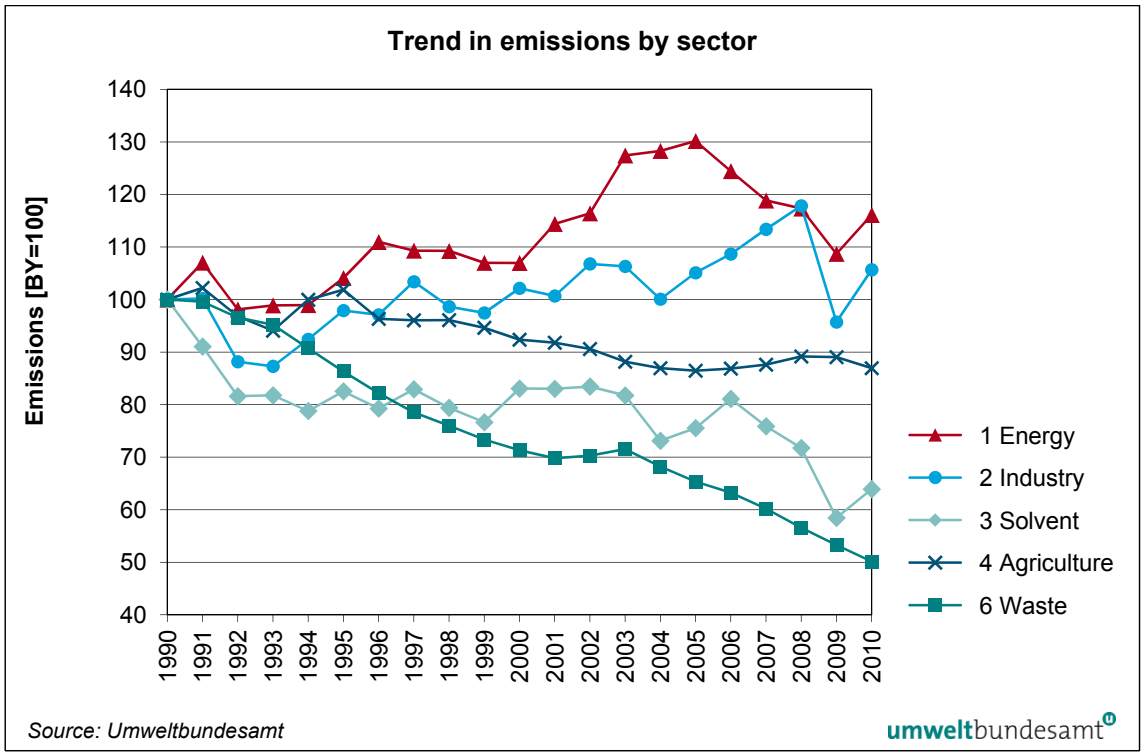



*Figure 2: Trend in emissions 1990–2010 by sector in index form (base year 1990 = 100).*

A description and interpretation of emissions trends per sector is given in the following sub-chapters.

## 2.1 Energy

**In 2010**, greenhouse gas emissions from the energy sector amounted to 64 328 Gg $CO_2$ equivalents which correspond to 76% of the total national emissions. 99% of the emissions from this sector originate from fossil fuel combustion; fugitive emissions from fuels are of minor importance.

The **most important sub-sector** of energy in 2010 was transport with a share of 35%, followed by manufacturing industries and construction (24%), energy industries (22%), and other sectors (18%).

The **overall trend** in greenhouse gas emissions from the sector *Energy* shows increasing emissions with a plus of 16% from 1990 to 2010. The **main driver** for this trend is the strong increase of emissions from road transport. The significant dips and jumps from year to year are mainly due to the weather circumstances in the corresponding years (in particular cold or mild winters, and/or dry or wet summers) which affect the heating demand, and the availability of climate change-friendly electricity from hydro power plants as well as the economic situation (2009).

$CO_2$ contributed 98% to the total **greenhouse gas** emissions from the energy sector, $CH_4$ 0.8% and $N_2O$ 1.1%.

**From 2009 to 2010**, emissions from the energy sector increased by 6.8% mainly due to the recovery from the economic crisis (increased production output, demand for electricity, freight volumes) and unfavourable (hydro power) and cold climatic circumstances.

**Trend 1990-2010 – by subsector**

The strong rise in emissions since 1990 from sub-sector **transport** (+60%) is due to an increase of road performance (kilometres driven). In addition to the increase of road performance within Austria, the amount of fuel bought in Austria but driven elsewhere – an effect mainly caused by different fuel prices of neighbouring countries – increased considerably.

The gradually replacement of vehicles by newer, less consuming cars with less specific fuel consumption as well as the increased use of biofuels have contributed to the decreasing trend of the last few years. However, from 2009 to 2010, total GHG emissions from transport increased by 3.0%, mainly due to higher emissions from freight transport.

Energy related emissions from **manufacturing industries and construction** increased by 22% from 1990 to 2010. Fuel consumption increased by 45% in that period, mainly due to increased use of gas and especially biomass. As gas has a lower carbon content, and $CO_2$ emissions from biomass combustion are not accounted for under the UNFCCC reporting framework, the increase in GHG emissions is significantly smaller compared to the increase in fuel combustion.

In 2010 emissions from sub-sector **energy industries** were 3.3% above the level of the base year. Except for 2010, emissions are continuously decreasing since 2005, basically because of the growing importance of renewable energy sources, the substitution of solid and liquid fuels by natural gas and biomass as well as improvements in efficiency. Since 1990 the share of biomass used as a fuel in this sector increased from 0.9% to 20% (2010), the contribution of hydro and wind power plants to total electricity production decreased from 72% to 67% (2010).

The variation in demand for heating and hot water generation due to climatic circumstances and the shift in the fuel mix are the most important drivers for emissions from **other sectors**. Emissions in 2010 were 21% lower than in the base year. This reduction is mainly attributable to the declining consumption of heating oil and solid fuels. Total fuel consumption of this sub sector increased by 0.3% since 1990.

## 2.2 Industrial Processes

**In 2010,** greenhouse gas emissions from industrial processes amounted to 10 680 Gg $CO_2$ equivalents, which corresponds to 13% of the total national emissions.

The **overall trend** in greenhouse gas emissions from industrial processes shows increasing emissions with an increase of 5.7% from 1990 to 2010. Within this period emissions fluctuated showing a minimum in 1993. **Main drivers** for the trend in emissions from this sector were (i) the termination of primary aluminium production in 1993, (ii) the introduction of $N_2O$ abatement techniques in the chemical industry in 2004 and again in 2009 (which became fully operational) in 2010) (iii) increasing metal production resulting in 9.0% higher GHG emissions in 2010 compared to 1990 and (iv) a strong increase of HFC emissions in the period 1992 to 2010 from 32 to 1 161 Gg $CO_2$ equivalents.

**From 2009 to 2010**, emissions from this sector increased by 10.4%, mainly due to the recovery of industry (especially metal industry) from the effects of the economic downturn in 2009.

The most important **greenhouse gas** of this sector was carbon dioxide with 84% of emissions from this category, followed by HFCs with 11%, $SF_6$ with 3.2%, PFCs with 0.7%, $N_2O$ with 0.6%, and finally $CH_4$ with 0.2%.

The **most important sub-sectors** of the industrial processes sector are metal production and mineral products, which caused 51% and 27% of the emissions from this sector in 2010.

## 2.3 Solvent and Other Product Use

**In 2010**, greenhouse gas emissions from solvent and other product use amounted to 327 Gg $CO_2$ equivalents, which corresponds to 0.4% of the total national emissions.

The **overall trend** in greenhouse gas emissions from solvent and other product use shows decreasing emissions, with a decrease of 36% from 1990 to 2010. The **main driver** is a decreasing use of solvents as a result of legal measures and decreasing $N_2O$ use.

**From 2009 to 2010** emissions increased by 9.3% mainly due to the rebound in the economy.

54% of these **greenhouse gas** emissions were indirect $CO_2$ emissions, 46% were contributed by $N_2O$ emissions.

## 2.4 Agriculture

**In 2010,** emissions from agriculture amounted to 7 440 Gg $CO_2$ equivalent, which corresponds to 8.8% of the total national emissions.

The **overall trend** in greenhouse gas emissions from agriculture shows decreasing emissions, with a decrease of 13.1% from 1990 to 2010. The **main drivers** for this trend are decreasing livestock numbers and lower amounts of N-fertilizers applied on agricultural soils. Fluctuations which can be seen in particular in the first half of the 1990s result from the variability of mineral fertilizer sales data related to volatility in prices.

**From 2009 to 2010** emissions decreased by 2.4% mainly due to decreased mineral fertilizer application.

In the Austrian **greenhouse gas** inventory the sector agriculture is the largest source for both $N_2O$ and $CH_4$ emissions: In 2010 75% (12 Gg) of total $N_2O$ emissions and 64% (171 Gg) of total $CH_4$ emissions in Austria originated from this sector. For $N_2O$ this corresponds to 52% of the GHG emissions from agriculture and for methane to 48%.

The **most important sub-sectors** of agriculture are enteric fermentation, which contributed 44% of total greenhouse gas emissions from the agricultural sector, followed by agricultural soils with a contribution of 39%.

## 2.5 LULUCF

The submission 2012 contains for the first time estimates based on the results of the new NFI 2007/09. The previously reported biomass increment and drain rates, dead wood stock changes and land-use-change areas to and from forests for the years after 2002 were based on the means of the NFI 2000/02 results. These were updated now by the values of the new NFI results. The NFI 2007/09 showed a significant increase in the harvest rates after 2002. As a consequence, the net sink of forest biomass decreased significantly in the years after 2002. Furthermore, the results of the whole time series were impacted by the revision of single biomass functions, by a slight change in the interpolation procedure, by estimating/reporting the soil C stock changes for subsector 5.A.1 for the first time and by a more stratified estimate of the soil C stocks and related changes for land-use-change lands to and from forests (see chapter 3.5.6).

As a consequence of all these improvements and updating steps, the net sink of Land use, land-use change and forestry is for the years before 2002 on average about 23 % lower as in previous submissions. But still, each of these years had a significant LULUCF net sink. For the years after 2002 the new NFI results with a significant increase in biomass drain show a clear decrease in the net sink of the biomass of the subsector "forest land remaining forest land"(5.A.1). This leads, together with the new estimates of the soil C changes, even to net emissions of sector 5.A.1 in the years 2003, 2007 and 2008. In 2008 the LULUCF sector as a whole represents a net emission source.

**In 2010,** net removals from this category amounted to 3 611 Gg $CO_2$ equivalents, which corresponds to 4% of national total GHG emissions (without LULUCF) compared to 13% in the base year.[5]

The **overall trend** in net removals from LULUCF is minus 64% over the observed period. The **main driver** for this trend is the change of the biomass carbon stock in forest land. Fluctuations are due to weather conditions which affect the growth rates on the one hand (e.g. very low increment in 2003) and wind throws on the other, as well as timber demand and prices (e.g. very high harvest rates in 2007 and 2008).

The **most important sub-sector is** forest land (5.A) with net removals of 5 411 Gg $CO_2$ in 2010. Small $CO_2$, $CH_4$ and $N_2O$ emissions arise from the other sub-sectors, where total net emissions amounted to 1 800 Gg $CO_2$ equivalents in 2010.

The last available NFI for the estimates in the forest sector is the NFI 2007/09. For the years after 2008 the mean results for the NFI period 2007/09 are reported.

## 2.6 Waste

The **overall trend** in greenhouse gas emissions from waste shows decreasing emissions, with a decrease of 50% from 1990 to 2010. The **main driver** for this trend is the implementation of waste management policies: Waste separation, reuse and recycling activities have increased from 1990 on and the amount of deposited waste has decreased especially since 2004 when pre-treatment of waste became obligatory (although some exceptions were granted to some Austrian provinces). Furthermore, methane recovery has improved. The legal basis for the reduced deposition as well as the landfill gas recovery is the Landfill Ordinance. Since 2009 all of the waste generated has to be pre-treated before deposition (without exception).

**From 2009 to 2010** GHG emissions decreased by 5.9% as a result of the implementation of the Landfill Ordinance described above as well as due to the declining emissions from waste being deposited in the past.

**In 2010**, greenhouse gas emissions from the waste sector amounted to 1 799 Gg $CO_2$ equivalents, which corresponds to 2.1% of the total national emissions.

The most important **greenhouse gas** of the waste sector is $CH_4$ with a share of 79.5% of the total GHG emissions from this sector in 2010, followed by $N_2O$ with 20.4%, and $CO_2$ with 0.1%.

The **most important sub-sector** of the waste sector is solid waste disposal on land, which caused 75% of the emissions from this sector in 2010; the second largest source is waste water handling with 16%.

[5] However, the LULUCF sector as described here is not included under the Kyoto Protocol, instead of that Article 3.3 KP activities are included: afforestation, reforestation and deforestation (Austria decided not to include activities under Article 3.4 of the KP).

# 3 METHOD OF REPORTING AND DATA BASIS

The Austrian greenhouse gas inventory for the period 1990 to 2010 was compiled according to the recommendations for inventories as 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, 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.

These regulations under the UNFCCC and the Kyoto Protocol define the standard for national emission inventories related to transparency, consistency, comparability, completeness and accuracy of inventories. Above this, each Party shall have in place a national system including 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.

To meet these requirements Austria has set up a national system – the National Inventory System Austria (NISA) – covering all aspects from establishing a legal basis for inventory preparation along with defining responsibilities, over availability of data, quality control and quality assurance to continuous improvement of the inventory (see Chapter 3.3).

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) system. 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 (CRF).

The Austrian greenhouse gas inventory is subject to continuous improvement, resulting in recalculations as outlined in Chapters 3.1 and 3.5. Issues identified in the inventory reviews by the UNFCCC are considered in the inventory improvement programme. The last in-depth review took place in September 2008.

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 the Reference Approach for $CO_2$ are submitted separately in digital form only.

*Table 4: Status of the present report.*

| Reporting Obligation | Format | Inventory | Version |
|---|---|---|---|
| Mechanism for monitoring Community greenhouse gas emissions | Common Reporting Format (CRF) | OLI 2011 | January 11th 2012 |

## 3.1 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 2009 which are submitted this year differ slightly from data reported previously.

The following table presents the recalculation difference with respect to last years' 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) | 2009 |
|---|---|---|
| | Recalculation Difference [%] | |
| **Total** | **– 0.01%** | **– 0.42%** |
| $CO_2$ | – 0.01% | – 0.46% |
| $CH_4$ | 0.00% | – 0.21% |
| $N_2O$ | – 0.01% | – 0.23% |
| HFC, PFC, $SF_6$ | 0.00% | 0.07% |

*Emissions without LULUCF*

National total emissions (excluding LULUCF) for the **base year** have slightly been revised since last years' submission (– 0.01%). The value for **2009** estimated this year is 0.42% lower than those submitted last year. These recalculations have lead to a revised trend 1990–2009 from + 2.4% to + 8.2%.

The lower emissions of the year 2009 are mainly attributable to recalculated $CO_2$ emissions occurring in the sector energy, due to revisions of the energy balance. In addition a shift of natural gas consumption (12 PJ) from 1.A.4 Other sectors to 1.A.1.b Petroleum refining, 1.A.1.c Other energy industries and 1.A.2.f Other manufacturing industries has lead to revised data on subsector level for 2009.

Revisions of $CH_4$ and $N_2O$ are of minor importance, and mainly arise in the sector 1A4. A description of the recalculations is given by sector in Chapter 3.5.

Improvements made in response to the issues raised in the UNFCCC review process are summarized in Table 6, as far as methodological issues are concerned and improvements have led to adjusted emission data. All other improvements (e.g. those made with regard to transparency or explanatory issues) will be included in the NIR 2012.

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

| Finding | Reference | Improvement made |
|---|---|---|
| **General** | | |
| Recalculations: The ERT reiterates the recommendation that Austria includes explanations for recalculations in CRF table 8(b) | ARR 2010 § 23 | AUT has filled out CRF table 8(b) for 2008 in NIR 2011. |
| **Energy – stationary** | | |
| The ERT recommends that Austria use country-specific NCVs also in the reference approach. | ARR 2009 § 42 | All values used are now CS. |

| Finding | Reference | Improvement made |
|---|---|---|
| **Energy – mobile** | | |
| Aviation: For the 2009 annual inventory submission the estimates of emissions from aviation for 2000 onwards were updated using detailed information from Statistik Austria (change to CORINAIR Tier 3a bottom up methodology).<br>The ERT recommends that Austria explains in more detail how it has ensured consistency across the time series from 1990 to provides explanations on how it has ensured consistency across the time-series when performing the recalculations. | ARR 2009 § 43<br>ARR 2010 § 48 | Austria has already given explanations on this issue in its NIR 2010, but has further elaborated on this in NIR 2011. |
| Waterborne navigation/international bunker fuels: The ERT recommends that Austria improve the transparency with regard to the sources of data used to differentiate between domestic and international marine fuel use.<br>The ERT recommends to improve the transparency used to define the split between domestic navigation and marine international bunker. | ARR 2010 § 49<br>Centralised Review 2011 (Saturday paper) | The time-series of fuel consumption of domestic navigation has been reassessed and domestic navigation recalculated with a new bottom-up approach (now domestic navigation includes all navigation between harbours located in Austria expressed in x-ton kilometers) |
| **Industrial Processes and Solvents and Other Product Use** | | |
| No improvements (resulting in changed emissions) were made in response to the UNFCCC Review process | | |
| **Agriculture** | | |
| The ERT asks whether it is possible to use the relative areas of individual crops within the total cereals area to provide a breakdown of the area burnt on a crop by crop basis. | ARR 2010 § 78 | Austria considered the recommendation in NIR 2011 |
| An error in the calculation of $N_2O$ emissions from certain crop residues has resulted in increasing the estimated emissions from crop residues for 1990 and 2007. | ARR 2010 § 74 | Austria has already corrected this error in submission 2010 |
| During the Centralised Review 2011 Austria were asked whether there are any specific studies conducted that support the hypothesis that there are no methane emissions during or after the fermentation process particularly from leakage. | Centralised Review 2011 | Estimations now consider methane losses from anaerobic digesters |
| **LULUCF** | | |
| CSC in Litter pool and mineral soil pool due to LUC is calculated following the equation with 20 year transition period for both LUC “to forest” and “from forest”. According to the GPG-LULUCF Chapter 3 (ex.3.3.2.2.1. p3.89), the method of litter loss estimation due to LUC to non-forest land use is stated as “Any litter and dead wood pools should be assumed oxidized following land conversion”. Thus, the applied method for “from forest” seems to be not in line with the default methodology of litter calculation. | Centralised Review 2011 | The method was changed for submission 2012 to be in line with the IPCC GPG. The litter pool at LUC areas from forests is estimated to be oxidized in the year of LUC. |
| **Waste** | | |
| No improvements (resulting in changed emissions) were made in response to the UNFCCC Review process | | |

## 3.2 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.

## 3.3 National Inventory System Austria (NISA)

This section provides a short description of the most important aspects of NISA; a detailed description including all required information as set down in Decision 15/CMP.1, part II ("Reporting of supplementary information under Article 7, paragraph 2", D. National systems in accordance with Article 5, paragraph 1) can be found in the Austrian Initial Report[6], in Austria's NIR 2011[7] and in the NISA Implementation Report[8].

### Legal Arrangements

Austria has a centralized inventory system, with all the work related to inventory preparation being carried out at a single national entity. The most important legal arrangement is the Austrian Environmental Control Act (Umweltkontrollgesetz[9]), which defines the main responsibility for inventory preparation and identifies the Umweltbundesamt as the single national entity with the overall responsibility for inventory preparation. Within the Umweltbundesamt the "Inspection Body for Emission Inventories" is responsible for the compilation of the greenhouse gas inventory.

To ensure the availability of data necessary for the annual compilation of the GHG inventory further legal and institutional arrangements have been made, which are described in more detail in Austria's NIR and in full detail in the NISA Implementation Report.

### QMS

A Quality Management System (QMS) has been designed and implemented to fulfil all requirements of *good practice*. Since 2005, the unit in the Umweltbundesamt responsible for inventory preparation is accredited according to the Standard ISO/ICE 17020 *General Criteria for the operation of various types of bodies performing inspections* as "Inspection Body for Emission Inventories". This standard takes into account standards regarding a QMS as set out in the EN/ISO 9000 series and goes beyond: it also provides a clear statement of requirements regarding competence and independence; impartiality, integrity and confidentiality.

---

[6] BMLFUW (2006): Austria's Initial Report under Article 7, paragraph 4, of the Kyoto Protocol, Federal Ministry of Agriculture and Forestry, Environment and Water Management, Vienna.

[7] UMWELTBUNDESAMT (2011): Austria's National Inventory Report 2011, Submission under the United Nations Framework Convention on Climate Change and under the Kyoto Protocol, REP-0308; Umweltbundesamt, Vienna.

[8] UMWELTBUNDESAMT (2005): NISA National Inventory System Austria, Implementation Report, REP-0004; Umweltbundesamt, Vienna. http://www.umweltbundesamt.at/umweltkontrolle/

[9] „Umweltkontrollgesetz"- Bundesgesetz über die Umweltkontrolle und die Einrichtung einer Umweltbundesamt Gesellschaft mit beschränkter Haftung; Federal Law Gazette 152/1998

#### Sector Experts

Within the inventory system specific responsibilities for the different emission source/sink categories (“sector experts”) are defined. Sector experts collect activity data, emission factors and all relevant information needed for finally estimating emissions. The sector experts are also responsible for the choice of methods, data processing and archiving and for contracting studies, if needed. As part of the quality management system, the head of the “Inspection body for GHG inventory“ approves the methodological choices. Finally, sector experts perform Quality Assurance and Quality Control (QA/QC) activities.

The main data sources used, as well as information on who did the actual calculations, are presented in the Chapter 3.4.

#### Data Management

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

As part of the QMS’s documentation and archiving procedures a reliable data management system has been established to fulfil the data collecting and reporting requirements. This ensures the necessary documentation and archiving for future reconstruction of the inventory and consequently enables easy access to up-to-date and previously submitted data for the quantitative evaluation of recalculations.

#### Corrective and Preventive Actions

As part of the QMS an efficient process is established to grant transparency when collecting and analyzing findings by UNFCCC review experts or any other issues concerning the quality of activity data, emission factors, methods and other relevant technical elements of inventories. Any findings and discrepancies are documented; responsibilities, resources and a time schedule are attributed to each of these in the improvement plan. Measures, which include possible recalculations, are taken by the sector experts.

#### Changes since the last submission

There were no changes in the NISA since the last submission.

## 3.4 Sources of data

The national energy balance is the most important data basis for the Austrian Air Emissions Inventory. The Austrian statistical office (Statistik Austria) is required by contract with the Federal Ministry of Agriculture, Forestry, Environment and Water Management and with the Federal Ministry of Economics and Labour to annually prepare the national energy balance. The compilation of several other relevant statistics is regulated by law; other data sources include reporting obligations under national and European regulations and reports of companies and associations.

The following table presents the main data sources used for activity data as well as information on who did the actual calculations (for unpublished studies a detailed description of the methodologies is given in the NIR):

*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; EU-ETS; Steam boiler database; | Umweltbundesamt, plant operators |
| Transport | Energy Balance from Statistik Austria | Umweltbundesamt (Aviation), Technical University Graz (Road and Off-road transport) |
| Industry | National production statistics, import/export statistics; EU-ETS; direct information from industry or associations of industry | Umweltbundesamt, plant operators F-gases based on a study by: Öko-Recherche GmbH, Frankfurt (2010) |
| Solvent | Short term statistics for trade and services Austrian foreign trade statistics Structural business statistics Surveys at companies and associations | Umweltbundesamt, based on studies by: Institut für industrielle Ökologie and Forschungsinstitut für Energie und Umweltplanung, Wirtschaft und Marktanalysen GmbH[10] |
| Agriculture | National Studies, national agricultural statistics obtained from Statistik Austria | Umweltbundesamt, based on studies by: University of Natural Resources and Applied Life Sciences, Research Center Seibersdorf |
| LULUCF | National forest inventory obtained from the Austrian Federal Office and Research Centre for Forests<br>National agricultural statistics and land use statistics obtained from Statistik Austria | Umweltbundesamt |
| Waste | Database on landfills (1998–2007), Electronic Data Management (from 2008-2010) | Umweltbundesamt |

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,
- 2006 IPCC Guidelines,
- EMEP/CORINAIR Guidebook,
- EMEP/EEA air pollutant emission inventory guidebook (formerly referred to as the EMEP CORINAIR emission inventory Guidebook).

A complete list of data sources for activity and emission data or emission factors used by sector for the submission 2012 can be found in the National Inventory Report 2012 to be published in spring 2012.

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

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.

## 3.5 Recalculations

This chapter describes the changes made to the inventory since the last submission to the UNFCCC (April 2011). Further background information and a complete description of the recalculation of the inventory for the period 1990–2009 will be given in Austria's National Inventory Report 2012, which will be published in spring 2012.

### 3.5.1 Energy (Sector 1)

#### Combustion Activities (1 A)

**Stationary sources**

***Update of activity data***

Updates of activity data and NCVs follow the updates of the IEA-compliant energy balance compiled by the federal statistics authority Statistik Austria.

*Energy balance update and corrections*

Revisions affect the years from 1999 onwards with the following significant changes:

**Hard coal**

Revision of final consumption 2009 (– 0.5 PJ) which affects category *1.A.4 Other Sectors.*

**Coking coke**

Revision of final consumption 2009 (– 0.6 PJ) which affects category *1.A.4 Other Sectors.* Revision of non energy use 2009 (– 2.6 PJ) which affects category *1.A.2.a Iron and Steel.*

**Residual fuel oil**

Revision of final consumption 2009 (– 2.7 PJ) which affects categories 1.*A.2 Manufacturing industries and construction* and *1.A.4 Other Sectors.*

**Kerosene**

Harmonization of international bunkers fuel consumption with the output of the inventory bottom up model for air transport.

**Motor Gasoline**

Revision of final consumption 2009 (– 3.0 PJ) which affects category *1.A.3.b Road Transportation*.

**Natural Gas**

Revision of gross inland consumption 2002–2005 (between – 3.8 PJ to + 10 PJ) and 2009 (+ 1.5 PJ). For the year 2009 final energy consumption (1.A.4 and 1.A.2) has been revised by – 12.3 PJ, the transformation sector (1.A.1.a) has been revised by + 0.9 PJ, energy industries (1.A.1.b and 1.A.1.c) has been revised by + 9.0 PJ and non energy use has been revised by + 4.0 PJ.

For 2005 to 2009 the non energy use of natural gas which could not be allocated to process emissions under *2.B.1 Ammonia Production* is now considered under *1.A.2.f Other Manufacturing Industries*.

**Biomass**

Revision of log wood final consumption 2001 – 2009 (-3.3 PJ) which affects category *1.A.4 Other Sectors.* Revision of other solid biomass gross consumption 2005 (-4.0 PJ) and 2009 (+3.7 PJ). This affects the transformation sector (1.A.1.a) as well as final consumption allocated to *1.A.2 Manufacturing Industries and Construction* and *1.A.4 Other Sectors*.

**Mobile sources**

**Update/Improvement of activity data**

In 2010, the following updates have been implemented in the transport emission calculation models GLOBEMI and GEORG which result in revised emission data for the whole time series:

*1.A.3.b Road Transport*

- An update of the quantity structure of road transport (result of new traffic census) resulted in an increase of the transport volume (+ 2%) and consequently of fuel consumption (+ 0.9%) in 2009 compared to previous submission. These data has been generated from automatic vehicle counting checkpoints on highways.
- An adaption of out-dated age pattern and failure rates of the Austrian vehicle fleet to actual fleet structure data from national statistics has lead to an adjustment of the Austrian inland fleet towards newer vehicles.
- Update of statistical energy data, particularly the biodiesel/alternative fuel consumption.

*1.A.2.f Manufacturing Industries and Construction – Other – mobile sources*

Activity data of mobile machinery (especially in industry) has been updated for the whole time series and adjusted downwards according to the revised national energy balance.

***Update of methodology and emission factor***

*1.A.3.b Road Transport*

Adaptation of the specific $CO_2$ emission factors of passenger cars according to the national $CO_2$ monitoring data for the Austrian fleet.

*1.A.3.d Navigation*

An improved method was introduced for separate reporting of emissions/activity data from national and international navigation. The calculation method is based on statistical data expressed in national tkm and leads to less emissions from national navigation.

### 3.5.2 Fugitive Emissions (1 B)

No recalculations have occurred in this sector.

### 3.5.3 Industrial Processes (Sector 2)

*2.A.4 Soda Ash Production and Use*

The data on total marketed soda ash use is provided by Solvay Austria GmbH by personal communication. Data for 2009 had to be revised as in hindsight a strong decrease in soda ash production due to the economic crises had become apparent. This leads to a downward change in emissions.

*2.B.1 Ammonia Production*

Plant specific data on natural gas use for the production of Ammonia for the years 1990-2010 became available in 2011. This leads to a minor change in emissions for the whole time series (upwards and downwards).

*2.C.1 Pig Iron and Electric Furnace Activity*

Activity data for 2008 and 2009 was updated as revised data of the energy balance became available in 2011. This leads to a minor change in emissions. Activity data on electric furnace activity from 2005-2010 also became available. This leads to minor changes in IEFs.

*2.F.1/2/3/4/5 ODS Substitutes (HFCs)*

Updated activity data for 2009 as well as new information on lifetime on some refrigeration equipment became available. This leads to minor changes in emissions.

### 3.5.4 Solvent and other Product Use (Sector 3)

**Update of activity data**

3.A, 3.B, 3.C and 3.D.5.

The short-term statistics for trade and services and the Austrian foreign trade statistics were updated for 2009.

Activity data concerning non-solvent use and the solvent content of products has been updated by surveys conducted at companies and associations.

### 3.5.5 Agriculture (Sector 4)

**Improvements of methodologies and emission factors**

*4.B Manure management – $CH_4$*

In response to a question raised by the ERT during the Centralized Review 2011, the estimations now consider methane losses from anaerobic digesters. In the calculations, the methane conversion factor (MCF) of anaerobic digesters was increased from 0% to 2%, resulting in higher $CH_4$ emissions.

Additionally, only the number of biogas plants under contract for electricity supply has been taken as activity data to ensure a conservative estimate (Ökostrombericht 2011).

### 3.5.6 LULUCF (Sector 5)

*Revision of the data series for LULUCF are due to the following changes:*

*5.A Forestland*

The intermediate interpolation steps for increment and drain between the NFI observation periods were deleted. There is no logic for the validity of such interpolation steps since increment and drain do not change linearly across time. So, the NFI increment and drain results are taken as a basis for the full NFI observation period and the single year values are estimated then from these average annual NFI results for the single NFI observation periods with the help of related annual indices.

The whole time series was recalculated on basis of partly new biomass functions. We used slightly improved functions for the branch biomass and a modified function for the root biomass. It was realized that the previously used function for the root biomass from Wirth et al. (2004) leads to unrealistic high root biomasses for dimensions with higher DBH due to an extreme rise of the shape of the curve at larger DBHs. This had a significant impact on the results for increment biomass, but also on the results for drain biomass. So, a different root function from Wirth et al. (2004) was selected which includes besides DBH also the tree age as explaining parameter and leads to more realistic estimates for the root biomass. The use of the new functions leads to approximately 12 % lower net biomass removals of sector 5.A.1 for the whole time series compared to the estimates of previous submissions.

For submission 2012 litter and soil C stock changes of sector 5.A.1 were estimated and reported for the first time. This was done with the Yasso model and with data for litter input as estimated on basis of the results of the Austrian NFIs 1986/90, 1992/96, 2000/02 and 2007/09 and on basis of the results of the Austrian forest soil surveys. According to the model results the litter plus soil of sector 5.A.1 was an emission source in the whole time series since 1990 with an annual average C stock loss of 0.2 t C per ha and year and with total annual emissions of approximately 0.7 Mt C per year.

More stratified estimates of the soil C stock changes were estimated for all land-use-change subcategories to and from forests for submission 2012. The soil C stock changes were stratified according to the specific soil C pools of different land use forms (as in previous submissions), and an additional stratification of the soil and litter C pools according to Austrian growth regions on basis of the results of the Austrian soil surveys was carried out. For these estimates, the LUC areas to and from forests according to the NFIs were also further stratified according to growth regions on basis of the NFI results (in addition to the stratification according to different previous or post land-use forms). These further stratified estimates have also a significant impact on the soil C stock changes of the LUC-subcategories to and from forest lands compared to previous estimates. The sink of the mineral soil C pool of subsector 5.A.2 is 40% lower, those of the litter pool 60% higher compared to previous submissions. On the other hand, the total emissions from mineral soil from all subcategories with LUC from forest to other land uses are in submission 2012 25% lower, those of the litter pool 5% higher than in previous submissions (also due to the changed estimate assuming an oxidation of the whole litter layer in the year of LUC instead of 20-years decay time as in previous submissions – see chapter 3.1).

For the submission 2012, the results of NFI 2007/09 were for the first time available. On basis of these results, biomass increment and drain, changes in dead wood stocks and all LUC areas to and from forests for the years from 2002 on were revised. The NFI 2007/09 showed a significant increase in harvest in these years. In previous submissions the average results of the NFI 2000/02 were reported for these years. So, the use of the new NFI results causes significant lower biomass net sinks for sector 5.A.1 in the years since 2002 than in previous submissions.

In accordance with the conclusions and recommendations of the "Report of the technical assessment of the forest management reference level submission of Austria submitted in 2011", these improvements and updating steps will have also an impact on the Austrian forest management reference level and trigger related adjustments of this reference level. The estimates for the 5.A.1 litter and soil C pool changes need to be considered in the reference level revision. Furthermore, adjustments of the reference levels due to the improved expansion ratios from stemwood to total tree biomass are needed. Then, it was also realised that the projected harvest rates do not account for the full biomass drain, but only for the harvest of "useable" trees. In addition, there exists also a biomass drain due to mortality. This drain will be added to the projected harvest rates to account for the full biomass drain in the reference level estimates and in order to achieve consistency between the reference level and the historic values.

*5.B Cropland*

The cropland sector was also affected by the new NFI results because the LUC areas from forest land to cropland since 2002 and the related emissions/removals were revised on basis of the new NFI results. In addition, the more stratified estimates of the soil C stock changes of such LUC lands for the whole time series lead to a revision of the related emissions/removals (see chapter Forestland). The whole time series of such LUC was revised due to the changed estimate assuming an oxidation of the whole litter layer in the year of LUC instead of 20-years decay time as in previous submissions (see chapter 3.1).

*5.C Grassland*

The grassland sector was also affected by the new NFI results because the LUC areas from forest land to grassland since 2002 and the related emissions/removals were revised on basis of the new NFI results. In addition, the more stratified estimates of the soil C stock changes of such LUC lands for the whole time series lead to a revision of the related emissions/removals (see chapter Forestland). The whole time series of such LUC was revised due to the changed estimate assuming an oxidation of the whole litter layer in the year of LUC instead of 20-years decay time as in previous submissions (see chapter 3.1).

*5.D Wetlands*

The wetlands sector was also affected by the new NFI results because the LUC areas from forest land to wetlands since 2002 and the related emissions/removals were revised on basis of the new NFI results. In addition, the more stratified estimates of the soil C stock changes of such LUC lands for the whole time series lead to a revision of the related emissions/removals (see chapter Forestland). The whole time series of such LUC was revised due to the changed estimate assuming an oxidation of the whole litter layer in the year of LUC instead of 20-years decay time as in previous submissions (see chapter 3.1).

Furthermore, for area consistency reasons also the LUC areas from other categories to wetlands and, as a consequence, the related emissions/removals had to be revised due to the new NFI results.

*5.E Settlements*

The settlements sector was also affected by the new NFI results because the LUC areas from forest land to settlements since 2002 and the related emissions/removals were revised on basis of the new NFI results. In addition, the more stratified estimates of the soil C stock changes of such LUC lands for the whole time series lead to a revision of the related emis-

sions/removals (see chapter Forestland). The whole time series of such LUC was revised due to the changed estimate assuming an oxidation of the whole litter layer in the year of LUC instead of 20-years decay time as in previous submissions (see chapter 3.1).

Furthermore, for area consistency reasons also the LUC areas from other categories to settlements and, as a consequence, the related emissions/removals had to be revised due to the new NFI results.

*5.F Other land*

The other land sector was also affected by the new NFI results because the LUC areas from forest land to other land since 2002 and the related emissions/removals were revised on basis of the new NFI results. In addition, the more stratified estimates of the soil C stock changes of such LUC lands for the whole time series lead to a revision of the related emissions/removals (see chapter Forestland). The whole time series of such LUC was revised due to the changed estimate assuming an oxidation of the whole litter layer in the year of LUC instead of 20-years decay time as in previous submissions (see chapter 3.1).

Furthermore, for area consistency reasons also the LUC areas from grassland to other land and, as a consequence, the related emissions/removals had to be revised due to the new NFI results.

*LULUCF KP estimates*

The ARD areas for the years since 2002 and the related emissions/removals were revised on basis of the new NFI results. In addition, the more stratified estimates of the soil C stock changes of the ARD lands for the whole time series lead to a revision of the related emissions/removals at ARD lands (see chapter Forestland). The whole time series of D was revised due to the changed estimate assuming an oxidation of the whole litter layer in the year of D instead of 20-years decay time as in previous submissions (see chapter 3.1).

### 3.5.7 Waste (Sector 6)

**Update of activity data**

*6.C Waste incineration*

The amount of waste oil and clinical waste incinerated in small facilities has been revised based on updated information and is now lower than in previous estimates.

*6.D Other waste*

Emissions for the years 2008 and 2009 have been recalculated on basis of new/updated activity data, mainly on waste amounts treated in mechanical biological treatment plants.

## 3.6 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/IEC 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/IEC 17020 are met, which include strict independence, impartiality and integrity. Since December 2005 the Umweltbundesamt has been accredited as inspection body (Id.No.241) in accordance with the Austrian Accreditation Law.

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

The Austrian Quality Management System is described in detail in Austria’s NIR 2011[7)].

**Changes to the QMS since the last submission**

On the 13th and 14th January 2011 a comprehensive external audit by the accreditation body took place at the Umweltbundesamt. This ‘Re-Accreditation’ is obligatory every 5 years and aims at examining the “Inspection Body for Emission Inventories” respectively its QM-System in detail. Only minor measures were to be implemented, generally it confirmed the inspection body’s commitment to high quality, and approved conformity with the standard renewing the accreditation of 2005.

Following a recommendation of the accreditation audit to streamline the documentation of the management system, a completely revised quality manual was produced; in the course of this work the revision of ISO/IEC 17020 was taken into account, the new manual being more user-friendly and providing an improved presentation of requirements relating to reporting obligations in the context of emission inventories. The management processes of the QMS and the process of inventory preparation remained mostly unchanged; however the documentation and some blanks and checklists have been improved (e.g. the checklists for QA/QC that have been incorporated into the documentation files, and simplification of the management review process and report, respectively).

## 3.7 Uncertainty Assessment

After a first uncertainty analysis in 2000[11] and sector-specific uncertainty updates by expert judgements in the following years, a second comprehensive uncertainty analysis was performed by WINIWARTER the greenhouse gases $CO_2$, $CH_4$, $N_2O$, HFC, PFC and $SF_6$ for 1990 and 2005. Information on the more general results of this uncertainty analysis can be found in Austria's NIR 2008[12]. Table 8 shows the key results of the latest uncertainty evaluation of the Austrian GHG Inventory implemented at last for the submission of the National Inventory Report 2011[13] using the method developed in WINIWARTER (2008)[14] based on the Tier 2 approach (Monte-Carlo Analysis).

*Table 8: Key results of the Austrian GHG inventory uncertainty analysis 2011.*

| | **Random uncertainty** | **$CO_2$** | **$CH_4$** | **$N_2O$** | **PFC*** | **HFC** | **$SF_6$*** | **Total GHG emissions** |
|---|---|---|---|---|---|---|---|---|
| 1990 | Mean value [Tg] | 62.07 | 8.30 | 6.19 | 1.08 | 0.03 | 0.49 | 78.17 |
| | Standard deviation | 0.42 | 0.62 | 2.68 | 0.26 | 0.01 | 0.04 | 2.80 |
| | **2s** | **1.3%** | **15.0%** | **86.6%** | **48.7%** | **50.7%** | **16.1%** | **7.2%** |
| 2009 | Mean value [Tg] | 67.53 | 5.67 | 5.41 | 0.04 | 1.05 | 0.35 | 80.05 |
| | Standard deviation | 0.58 | 0.41 | 2.43 | 0.00 | 0.28 | 0.08 | 2.54 |
| | **2s** | **1.7%** | **14.5%** | **89.7%** | **13.5%** | **54.1%** | **44.0%** | **6.4%** |

**Due to the definition of key category FC emissions from 2.F.7, PFC emissions are partly considered in $SF_6$ emissions.*

Uncertainty calculation and reporting according to IPCC GPG (2000) Table 6.1 for key categories is presented in Annex II.

## 3.8 Comparison of the Sectoral Approach with the Reference Approach

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

Table 9 shows $CO_2$ emissions calculated from the two approaches.

[11] 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.

[12] UMWELTBUNDESAMT (2008): Anderl, M.; Freudenschuß, A.; Kampel, E.; Köther, T.; Muik, B; Poupa S.; S.; Schodl, B.; Schwaiger, E., Weiss, P.; Wieser, M. & Zethner, G.: Austria's National Inventory Report 2008. Reports, Bd. REP-152. Umweltbundesamt, Wien.

[13] As the uncertainties of the national total emissions estimated by Tier 2 analysis did not vary significantly over the last years, Austria decided to perform the Monte Carlo analysis every two years instead of every year. The next Tier 2 analysis will be provided in National Inventory Report 2011.

[14] WINIWARTER, W. (2008): Quantifying Uncertainties of the Austrian Greenhouse Gas Inventory, ARC-sys-0154.

*Table 9: $CO_2$ emissions by type of fuel.*

| 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 | 28 022 | 17 039 | 12 146 | **57 207** | 28 113 | 13 924 | 11 301 | 732 | **54 070** |
| 1991 | 30 424 | 17 789 | 12 841 | **61 055** | 30 589 | 14 518 | 11 940 | 805 | **57 852** |
| 1992 | 29 519 | 13 908 | 12 610 | **56 037** | 29 322 | 10 666 | 12 000 | 956 | **52 945** |
| 1993 | 30 603 | 12 542 | 13 298 | **56 444** | 30 731 | 9 495 | 12 453 | 675 | **53 354** |
| 1994 | 29 938 | 12 723 | 13 679 | **56 339** | 30 100 | 9 379 | 13 111 | 820 | **53 410** |
| 1995 | 30 454 | 14 414 | 14 935 | **59 804** | 30 309 | 10 741 | 14 339 | 839 | **56 228** |
| 1996 | 32 880 | 14 491 | 15 897 | **63 267** | 32 921 | 10 760 | 15 287 | 1 073 | **60 041** |
| 1997 | 32 396 | 15 304 | 15 321 | **63 021** | 32 123 | 11 318 | 14 720 | 1 017 | **59 179** |
| 1998 | 34 556 | 13 559 | 15 729 | **63 844** | 34 247 | 8 905 | 15 144 | 818 | **59 114** |
| 1999 | 32 539 | 13 513 | 16 004 | **62 056** | 32 399 | 9 192 | 15 412 | 828 | **57 831** |
| 2000 | 31 849 | 15 072 | 15 273 | **62 194** | 31 883 | 10 423 | 14 686 | 834 | **57 827** |
| 2001 | 34 197 | 15 513 | 16 186 | **65 896** | 34 136 | 11 177 | 15 632 | 958 | **61 903** |
| 2002 | 34 755 | 15 829 | 16 160 | **66 743** | 35 226 | 11 081 | 15 582 | 1 163 | **63 052** |
| 2003 | 37 212 | 16 846 | 17 721 | **71 779** | 38 052 | 12 543 | 17 092 | 1 389 | **69 076** |
| 2004 | 37 675 | 16 538 | 18 042 | **72 255** | 38 417 | 12 247 | 17 405 | 1 505 | **69 574** |
| 2005 | 38 728 | 16 657 | 19 116 | **74 502** | 38 864 | 11 890 | 18 460 | 1 374 | **70 588** |
| 2006 | 37 388 | 16 855 | 17 949 | **72 192** | 36 993 | 11 680 | 17 269 | 1 486 | **67 428** |
| 2007 | 36 422 | 15 963 | 16 927 | **69 312** | 35 692 | 10 898 | 16 324 | 1 430 | **64 345** |
| 2008 | 35 175 | 14 750 | 17 887 | **67 812** | 34 639 | 10 187 | 17 219 | 1 495 | **63 541** |
| 2009 | 33 472 | 11 267 | 17 515 | **62 255** | 32 680 | 7 667 | 16 873 | 1 532 | **58 752** |
| 2010 | 35 092 | 13 248 | 19 246 | **67 585** | 33 779 | 9 059 | 18 402 | 1 610 | **62 851** |

Table 10 shows the difference (in percent) between reference and sectoral approach $CO_2$ emissions.

*Table 10: Difference (in %) of $CO_2$ emissions by type of fuel.*

| Year | Liquid | Solid | Gaseous | Total |
|---|---|---|---|---|
| 1990 | – 0.32% | 22.37% | 7.48% | 5.80% |
| 1991 | – 0.54% | 22.53% | 7.55% | 5.54% |
| 1992 | 0.67% | 30.39% | 5.08% | 5.84% |
| 1993 | – 0.42% | 32.10% | 6.79% | 5.79% |
| 1994 | – 0.54% | 35.65% | 4.33% | 5.48% |
| 1995 | 0.48% | 34.20% | 4.15% | 6.36% |
| 1996 | – 0.12% | 34.68% | 3.99% | 5.37% |
| 1997 | 0.85% | 35.22% | 4.08% | 6.49% |
| 1998 | 0.90% | 52.27% | 3.86% | 8.00% |
| 1999 | 0.43% | 47.00% | 3.84% | 7.31% |
| 2000 | – 0.11% | 44.60% | 3.99% | 7.55% |
| 2001 | 0.18% | 38.80% | 3.54% | 6.45% |
| 2002 | – 1.34% | 42.85% | 3.71% | 5.85% |
| 2003 | – 2.21% | 34.31% | 3.68% | 3.91% |
| 2004 | – 1.93% | 35.04% | 3.66% | 3.85% |
| 2005 | – 0.35% | 40.09% | 3.56% | 5.55% |

| Year | Liquid | Solid | Gaseous | Total |
|---|---|---|---|---|
| 2006 | 1.07% | 44.30% | 3.94% | 7.06% |
| 2007 | 2.05% | 46.48% | 3.69% | 7.72% |
| 2008 | 1.55% | 44.79% | 3.88% | 6.72% |
| 2009 | 2.42% | 46.96% | 3.81% | 5.96% |
| 2010 | 3.89% | 46.24% | 4.58% | 7.53% |

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

### 3.8.1 Explanation of differences

*Liquid Fuels:* The energy balance is mass-balanced but not carbon balanced. The 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 feedstock used for plastics and solvent production as non-carbon stored. In the sectoral approach emissions from waste incineration including plastics and waste oil are included in *Other Fuels*. 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 *6.C.* for 1990 and 1991.

*Diesel and Gasoline:* In the Reference Approach $CO_2$ emissions from diesel and gasoline are fully accounted for as fossil emissions while in the sectoral approach the share of mixed biofuel is accounted for as biogenic.

*Solid fuels:* The reference approach includes process emissions from blast furnaces and steel production which are included in category *2.C. Metal Production* as well as process emissions from carbide production which are included in category *2.B.4. Carbide Production*. In the sectoral approach plant-specific $CO_2$ emission factors have been used for large coal boilers since 2005.

*Gaseous fuels:* Process emissions from ammonia production are included in category *2.B.1. Ammonia Production*.

*Other fuels:* The sectoral approach considers waste as an additional fuel type (e.g. municipal solid waste, hazardous waste and industrial fuel waste).

*Carbon Stored:* The reference approach uses IPCC default values for “fractions of carbon stored”.

### 3.8.2 Quantification of differences

By quantifying the difference between the two approaches the remaining difference is between – 0.4 to + 2.8%. Currently it is not possible to quantify all fossil carbon flows such as solvents and plastic products which are imported or exported by products, bulk or waste.

Table 11 shows the differences that can be easily quantified. Positive numbers indicate $CO_2$ emissions not included in the sectoral approach. Negative numbers indicate $CO_2$ emissions which are not considered by the reference approach. The remaining differences are mainly due to the use of country-specific emission factors and NCVs within the sectoral approach and the use of "default fractions of carbon stored" within the reference approach.

*Table 11: Quantification of differences.*

| Year | Natural Gas[1] [Gg $CO_2$] | 2 B 1 Ammonia Production[3] [Gg $CO_2$] | Coke Oven Coke[4] [Gg $CO_2$] | Other Fuels [Gg $CO_2$] | Biofuels[5] [Gg $CO_2$] | Total [Gg $CO_2$] | Remaining difference[2] |
|---|---|---|---|---|---|---|---|
| 1990 | 19 | 826 | 2 704 | -732 | 0 | 2 817 | 0.6% |
| 1991 | 17 | 884 | 2 722 | -805 | 0 | 2 818 | 0.6% |
| 1992 | 15 | 595 | 2 458 | -956 | 0 | 2 111 | 1.8% |
| 1993 | 14 | 831 | 2 526 | -675 | 0 | 2 697 | 0.7% |
| 1994 | 11 | 556 | 2 767 | -820 | 0 | 2 515 | 0.7% |
| 1995 | 13 | 583 | 3 136 | -839 | 0 | 2 893 | 1.2% |
| 1996 | 12 | 597 | 2 918 | – 1 073 | 0 | 2 454 | 1.2% |
| 1997 | 10 | 591 | 3 316 | – 1 017 | 0 | 2 900 | 1.5% |
| 1998 | 0 | 585 | 3 214 | – 818 | 0 | 2 980 | 2.8% |
| 1999 | 2 | 590 | 3 102 | – 828 | 0 | 2 866 | 2.2% |
| 2000 | 5 | 735 | 3 489 | – 834 | 0 | 3 395 | 1.6% |
| 2001 | 3 | 551 | 3 449 | – 958 | 0 | 3 044 | 1.5% |
| 2002 | 5 | 573 | 3 879 | – 1 163 | 0 | 3 293 | 0.6% |
| 2003 | 5 | 643 | 3 721 | – 1 389 | 0 | 2 979 | – 0.4% |
| 2004 | 4 | 694 | 3 650 | – 1 505 | 0 | 2 842 | – 0.2% |
| 2005 | 5 | 739 | 4 128 | – 1 374 | 125 | 3 622 | 0.4% |
| 2006 | 5 | 752 | 4 206 | – 1 486 | 879 | 4 356 | 0.6% |
| 2007 | 5 | 673 | 4 214 | – 1 430 | 1 010 | 4 471 | 0.7% |
| 2008 | 5 | 724 | 4 187 | – 1 495 | 993 | 4 414 | – 0.2% |
| 2009 | 5 | 796 | 3 243 | – 1 532 | 1 254 | 3 767 | – 0.4% |
| 2010 | 5 | 883 | 3 979 | – 1 610 | 1 327 | 4 583 | 0.2% |

[1] *Distribution losses which are not considered in the sectoral approach.*

[2] *Negative numbers indicate that $CO_2$ emissions from the reference approach are lower than emissions from the sectoral approach.*

[3] *Process emissions of natural gas used for ammonia production.*

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

[5] *Share of biofuel in diesel and gasoline.*

# 4 ADDITIONAL REPORTING UNDER ARTICLE 3 OF DECISION 280/2004/EC

## 4.1 Article 3 (1) d

Austria decided not to make use of additional activities under Article 3(4) Kyoto Protocol, but reports the mandatory Article 3(3) activities. This includes emissions/removals from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation (since 1990).

Article 3.3 activities are a net sink in Austria: net $CO_2$ removals amounted to 1 259 Gg $CO_2$ equivalents in 2010 (Afforestation and Reforestation: – 2 621 Gg $CO_2$ equivalents; Deforestation: 1 362 Gg $CO_2$ equivalents).

These figures are still preliminary and have a very high uncertainty, because the assessments of the C stock changes at the ARD areas in the Kyoto-period are running now and have therefore not been available for the estimates.

## 4.2 Article 3 (1) g

AAUs, RMUs, ERUs or CERs issued or transferred to the Austrian registry in the reporting period, the year 2009, can be found in the separate file AT_Report_Art31g_2012.xls which is submitted together with this report.

## 4.3 Article 3 (1) h

Austria has authorised Kommunalkredit Public Consulting GmbH (Türkenstraße 9, 1092 Vienna) to participate in the mechanisms according to Article 6, 12 and 17 of the Kyoto Protocol.

## 4.4 Article 3 (1) j

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

## 4.5 Article 3 (1) k

The national inventory system is unchanged compared to the description given in chapter 3.3 and in the Austrian Initial Report under the Kyoto Protocol[15].

[15] http://unfccc.int/files/national_reports/initial_reports_under_the_kyoto_protocol/application/pdf/at-initial-report-200611-corr.pdf

# 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 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **Total Emissions/Removals with LULUCF** | **51 995.41** | **52 307.32** | **50 899.43** | **53 044.87** | **60 704.83** | **76 790.33** | **72 191.57** | **72 292.40** | **75 410.65** | **73 801.23** | **74 258.78** | **63 532.16** | **68 629.72** |
| **Total Emissions without LULUCF** | **62 059.59** | **63 943.97** | **65 972.21** | **70 004.86** | **71 720.08** | **77 758.24** | **78 215.90** | **79 723.89** | **77 032.53** | **74 362.72** | **73 921.54** | **67 225.70** | **72 290.47** |
| **1. Energy** | **54 171.69** | **56 355.12** | **57 991.22** | **62 085.59** | **63 218.98** | **69 308.67** | **69 783.93** | **70 792.85** | **67 660.35** | **64 582.13** | **63 752.74** | **59 016.72** | **63 088.31** |
| A. Fuel Combustion (Sectoral Approach) | 54 069.60 | 56 227.97 | 57 826.57 | 61 902.73 | 63 051.83 | 69 075.52 | 69 573.77 | 70 587.69 | 67 428.20 | 64 344.97 | 63 540.58 | 58 751.56 | 62 851.15 |
| 1. Energy Industries | 13 792.28 | 12 918.64 | 12 221.05 | 13 825.71 | 13 473.50 | 16 287.24 | 16 324.94 | 16 274.46 | 15 159.58 | 13 842.49 | 13 627.84 | 12 751.75 | 14 173.77 |
| 2. Manufacturing Industries and Construction | 12 685.28 | 13 487.03 | 13 860.68 | 13 715.61 | 14 045.90 | 14 679.06 | 15 098.71 | 16 367.95 | 16 100.60 | 15 931.88 | 15 932.80 | 14 538.21 | 15 455.70 |
| 3. Transport | 13 772.38 | 15 677.97 | 18 625.31 | 20 116.15 | 22 016.41 | 23 861.12 | 24 377.15 | 24 676.51 | 23 401.42 | 23 576.57 | 22 323.08 | 21 544.80 | 22 205.42 |
| 4. Other Sectors | 13 784.66 | 14 111.77 | 13 078.73 | 14 203.90 | 13 474.10 | 14 205.63 | 13 729.96 | 13 225.20 | 12 722.54 | 10 949.42 | 11 611.69 | 9 871.11 | 10 969.98 |
| 5. Other | 35.01 | 32.56 | 40.80 | 41.36 | 41.91 | 42.47 | 43.03 | 43.56 | 44.06 | 44.61 | 45.17 | 45.70 | 46.27 |
| B. Fugitive Emissions from Fuels | 102.09 | 127.15 | 164.65 | 182.85 | 167.15 | 233.15 | 210.15 | 205.15 | 232.16 | 237.16 | 212.16 | 265.16 | 237.17 |
| 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 | IE.NA.NO | IE.NA.NO |
| 2. Oil and Natural Gas | 102.09 | 127.15 | 164.65 | 182.85 | 167.15 | 233.15 | 210.15 | 205.15 | 232.16 | 237.16 | 212.16 | 265.16 | 237.17 |
| **2. Industrial Processes** | **7 581.71** | **7 387.93** | **7 776.11** | **7 702.91** | **8 270.70** | **8 216.04** | **8 230.86** | **8 705.79** | **9 111.29** | **9 544.40** | **9 952.02** | **8 051.45** | **9 023.24** |
| A. Mineral Products | 3 274.18 | 2 862.55 | 2 965.71 | 2 983.49 | 3 093.10 | 3 081.21 | 3 178.18 | 3 132.87 | 3 306.72 | 3 517.56 | 3 530.92 | 2 915.62 | 2 935.52 |
| B. Chemical Industry | 582.56 | 583.54 | 589.70 | 541.95 | 553.66 | 595.00 | 589.62 | 559.25 | 593.00 | 525.08 | 593.32 | 539.08 | 607.80 |
| C. Metal Production | 3 724.96 | 3 941.84 | 4 220.70 | 4 177.48 | 4 623.93 | 4 539.83 | 4 463.06 | 5 013.66 | 5 211.58 | 5 501.76 | 5 827.79 | 4 596.75 | 5 479.91 |
| D. Other Production | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| E. Production of Halocarbons and $SF_6$ | | | | | | | | | | | | | |
| F. Consumption of Halocarbons and $SF_6$ | | | | | | | | | | | | | |
| G. Other | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 (Base year) | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **3. Solvent and Other Product Use** | **279.30** | **189.95** | **192.62** | **204.10** | **218.14** | **221.26** | **188.85** | **212.99** | **250.73** | **228.07** | **210.69** | **153.46** | **176.89** |
| **4. Agriculture** | | | | | | | | | | | | | |
| A. Enteric Fermentation | | | | | | | | | | | | | |
| B. Manure Management | | | | | | | | | | | | | |
| C. Rice Cultivation | | | | | | | | | | | | | |
| D. Agricultural Soils [(2)] | | | | | | | | | | | | | |
| E. Prescribed Burning of Savannas | | | | | | | | | | | | | |
| F. Field Burning of Agricultural Residues | | | | | | | | | | | | | |
| G. Other | | | | | | | | | | | | | |
| **5. Land Use, Land-Use Change and Forestry** | **–10 064.17** | **–11 636.65** | **–15 072.78** | **–16 959.99** | **–11 015.25** | **–967.91** | **–6 024.33** | **–7 431.49** | **–1 621.88** | **–561.49** | **337.25** | **–3 693.53** | **–3 660.75** |
| A. Forest Land | –11 862.92 | –13 143.37 | –16 452.00 | –18 352.99 | –12 651.32 | –2 613.20 | –7 695.76 | –9 148.49 | –3 333.89 | –2 305.75 | –1 410.95 | –5 459.25 | –5 411.09 |
| B. Cropland | 203.64 | 254.63 | 293.91 | 299.79 | 376.04 | 386.18 | 407.95 | 403.69 | 413.66 | 444.96 | 466.52 | 516.90 | 518.20 |
| C. Grassland | 257.02 | 53.33 | 102.74 | 109.59 | 303.18 | 305.83 | 308.13 | 309.94 | 309.12 | 311.88 | 311.87 | 287.69 | 280.75 |
| D. Wetlands | 191.08 | 241.34 | 285.56 | 296.49 | 313.96 | 324.24 | 335.06 | 329.47 | 332.01 | 346.88 | 345.94 | 347.46 | 355.78 |
| E. Settlements | 281.46 | 210.77 | 91.45 | 95.33 | 164.05 | 170.56 | 178.73 | 249.28 | 249.53 | 249.78 | 250.03 | 252.39 | 248.40 |
| F. Other Land | 865.55 | 746.64 | 605.55 | 591.81 | 478.84 | 458.48 | 441.55 | 424.62 | 407.69 | 390.76 | 373.83 | 361.28 | 347.22 |
| G. Other | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| **6. Waste** | **26.89** | **10.97** | **12.26** | **12.26** | **12.26** | **12.26** | **12.26** | **12.26** | **10.15** | **8.12** | **6.09** | **4.06** | **2.03** |
| 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 | NA.NO | NA.NO |
| B. Waste-water Handling | | | | | | | | | | | | | |
| C. Waste Incineration | 26.89 | 10.97 | 12.26 | 12.26 | 12.26 | 12.26 | 12.26 | 12.26 | 10.15 | 8.12 | 6.09 | 4.06 | 2.03 |
| D. Other | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 (Base year) | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **7. Other *(please specify)*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| **Memo Items:** | | | | | | | | | | | | | |
| **International Bunkers** | **924.70** | **1 375.60** | **1 752.24** | **1 711.16** | **1 608.21** | **1 506.68** | **1 789.05** | **2 021.80** | **2 100.87** | **2 231.18** | **2 232.59** | **1 935.68** | **2 100.06** |
| Aviation | 885.97 | 1 327.42 | 1 695.58 | 1 651.28 | 1 540.85 | 1 452.97 | 1 724.93 | 1 959.83 | 2 048.88 | 2 175.79 | 2 181.97 | 1 893.40 | 2 049.55 |
| Marine | 38.72 | 48.17 | 56.66 | 59.88 | 67.36 | 53.71 | 64.12 | 61.97 | 51.99 | 55.38 | 50.62 | 42.28 | 50.51 |
| **Multilateral Operations** | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **$CO_2$ Emissions from Biomass** | 9 903.46 | 11 422.77 | 12 442.81 | 13 514.62 | 12 470.62 | 12 940.28 | 13 104.22 | 16 086.14 | 17 494.89 | 19 316.51 | 20 783.19 | 21 099.92 | 22 600.50 |

*Table A.I-2: Emission Trends $CH_4$.*

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 (Base year) | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **Total Emissions/ Removals with LULUCF** | **395.48** | **362.69** | **315.25** | **308.76** | **304.14** | **303.99** | **297.28** | **289.77** | **284.20** | **279.13** | **272.39** | **269.27** | **265.00** |
| **Total Emissions without LULUCF** | **395.45** | **362.69** | **315.25** | **308.76** | **304.11** | **303.97** | **297.28** | **289.77** | **284.19** | **279.12** | **272.38** | **269.26** | **264.99** |
| **1. Energy** | **31.90** | **31.14** | **25.20** | **25.17** | **23.91** | **23.69** | **23.90** | **24.26** | **23.65** | **23.40** | **23.63** | **23.80** | **25.12** |
| A. Fuel Combustion (Sectoral Approach) | 21.97 | 20.39 | 15.05 | 15.12 | 13.91 | 13.60 | 12.93 | 13.05 | 11.95 | 11.31 | 11.40 | 10.77 | 11.84 |
| 1. Energy Industries | 0.16 | 0.16 | 0.16 | 0.19 | 0.20 | 0.24 | 0.27 | 0.25 | 0.29 | 0.30 | 0.31 | 0.34 | 0.37 |
| 2. Manufacturing Industries and Construction | 0.34 | 0.40 | 0.44 | 0.46 | 0.46 | 0.52 | 0.57 | 0.61 | 0.62 | 0.62 | 0.65 | 0.64 | 0.68 |
| 3. Transport | 3.07 | 3.08 | 1.92 | 1.80 | 1.77 | 1.67 | 1.50 | 1.33 | 1.16 | 1.02 | 0.86 | 0.77 | 0.72 |
| 4. Other Sectors | 18.40 | 16.76 | 12.53 | 12.66 | 11.48 | 11.16 | 10.58 | 10.85 | 9.88 | 9.37 | 9.58 | 9.01 | 10.07 |
| 5. Other | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| B. Fugitive Emissions from Fuels | 9.93 | 10.75 | 10.15 | 10.05 | 10.00 | 10.09 | 10.97 | 11.22 | 11.69 | 12.09 | 12.23 | 13.03 | 13.29 |
| 1. Solid Fuels | 0.52 | 0.28 | 0.27 | 0.26 | 0.30 | 0.25 | 0.05 | 0.00 | 0.00 | IE.NA.NO | IE.NA.NO | IE.NA.NO | IE.NA.NO |
| 2. Oil and Natural Gas | 9.41 | 10.47 | 9.88 | 9.79 | 9.69 | 9.85 | 10.92 | 11.22 | 11.69 | 12.09 | 12.23 | 13.03 | 13.29 |
| **2. Industrial Processes** | **0.71** | **0.69** | **0.70** | **0.67** | **0.71** | **0.70** | **0.70** | **0.75** | **0.92** | **0.91** | **0.89** | **0.85** | **0.87** |
| A. Mineral Products | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| B. Chemical Industry | 0.70 | 0.68 | 0.70 | 0.67 | 0.70 | 0.69 | 0.70 | 0.75 | 0.92 | 0.90 | 0.88 | 0.84 | 0.87 |
| C. Metal Production | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 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 | NA | NA |

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 (Base year) | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **3. Solvent and Other Product Use** | | | | | | | | | | | | | |
| **4. Agriculture** | **199.65** | **192.00** | **180.38** | **177.99** | **174.10** | **172.28** | **171.88** | **169.77** | **169.07** | **169.73** | **169.00** | **171.35** | **170.90** |
| A. Enteric Fermentation | 178.73 | 172.08 | 162.71 | 160.48 | 157.20 | 155.71 | 155.69 | 153.74 | 153.23 | 153.84 | 153.52 | 155.49 | 155.07 |
| B. Manure Management | 20.53 | 19.43 | 17.17 | 17.03 | 16.48 | 16.12 | 15.75 | 15.61 | 15.39 | 15.42 | 15.03 | 15.40 | 15.33 |
| C. Rice Cultivation | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D. Agricultural Soils [(2)] | 0.33 | 0.44 | 0.45 | 0.43 | 0.38 | 0.41 | 0.37 | 0.37 | 0.41 | 0.42 | 0.41 | 0.42 | 0.46 |
| E. Prescribed Burning of Savannas | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| F. Field Burning of Agricultural Residues | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.07 | 0.05 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| G. Other | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **5. Land Use, Land-Use Change and Forestry** | **0.03** | **0.00** | **0.01** | **0.00** | **0.03** | **0.03** | **0.00** | **0.00** | **0.01** | **0.01** | **0.01** | **0.01** | **0.01** |
| A. Forest Land | 0.03 | 0.00 | 0.01 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| B. Cropland | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| C. Grassland | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D. Wetlands | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| E. Settlements | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| F. Other Land | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| G. Other | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **6. Waste** | **163.20** | **138.86** | **108.97** | **104.93** | **105.40** | **107.30** | **100.80** | **94.98** | **90.55** | **85.08** | **78.86** | **73.27** | **68.10** |
| A. Solid Waste Disposal on Land | 157.82 | 133.61 | 105.05 | 101.08 | 101.64 | 103.62 | 96.84 | 91.00 | 86.63 | 81.16 | 75.05 | 69.43 | 64.31 |
| B. Waste-water Handling | 4.85 | 4.21 | 2.68 | 2.43 | 2.18 | 1.95 | 1.79 | 1.64 | 1.48 | 1.39 | 1.30 | 1.30 | 1.30 |
| C. Waste Incineration | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| D. Other | 0.52 | 1.04 | 1.24 | 1.41 | 1.58 | 1.74 | 2.16 | 2.33 | 2.44 | 2.52 | 2.51 | 2.53 | 2.48 |

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 (Base year) | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **7. Other *(please specify)*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| **Memo Items:** | | | | | | | | | | | | | |
| **International Bunkers** | **0.02** | **0.02** | **0.03** | **0.03** | **0.04** | **0.04** | **0.05** | **0.04** | **0.04** | **0.05** | **0.05** | **0.04** | **0.04** |
| Aviation | 0.01 | 0.02 | 0.03 | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| Marine | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Multilateral Operations** | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **$CO_2$ Emissions from Biomass** | | | | | | | | | | | | | |

*Table A.I-3: Emission Trends $N_2O$.*

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 (Base year) | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **Total Emissions/ Removals with LULUCF** | **20.13** | **21.44** | **20.40** | **20.03** | **20.04** | **19.79** | **17.53** | **17.63** | **17.78** | **17.88** | **18.49** | **17.59** | **16.75** |
| **Total Emissions without LULUCF** | **19.99** | **21.31** | **20.28** | **19.92** | **19.92** | **19.67** | **17.42** | **17.52** | **17.65** | **17.74** | **18.34** | **17.43** | **16.59** |
| **1. Energy** | **1.79** | **2.13** | **2.36** | **2.45** | **2.47** | **2.55** | **2.53** | **2.61** | **2.54** | **2.49** | **2.42** | **2.27** | **2.30** |
| A. Fuel Combustion (Sectoral Approach) | 1.79 | 2.13 | 2.36 | 2.45 | 2.47 | 2.55 | 2.53 | 2.61 | 2.54 | 2.49 | 2.42 | 2.27 | 2.30 |
| 1. Energy Industries | 0.15 | 0.16 | 0.16 | 0.19 | 0.19 | 0.22 | 0.24 | 0.25 | 0.29 | 0.30 | 0.33 | 0.32 | 0.36 |
| 2. Manufacturing Industries and Construction | 0.26 | 0.32 | 0.43 | 0.43 | 0.40 | 0.41 | 0.41 | 0.47 | 0.49 | 0.51 | 0.51 | 0.48 | 0.48 |
| 3. Transport | 0.62 | 0.87 | 0.98 | 1.01 | 1.09 | 1.13 | 1.10 | 1.08 | 1.00 | 0.95 | 0.85 | 0.79 | 0.75 |
| 4. Other Sectors | 0.75 | 0.78 | 0.78 | 0.82 | 0.79 | 0.79 | 0.78 | 0.81 | 0.76 | 0.72 | 0.74 | 0.67 | 0.71 |
| 5. Other | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 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 | 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 | 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 | IE.NA | IE.NA |
| **2. Industrial Processes** | **2.94** | **2.77** | **3.07** | **2.54** | **2.60** | **2.85** | **0.91** | **0.88** | **0.90** | **0.87** | **1.05** | **0.53** | **0.20** |
| A. Mineral Products | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| B. Chemical Industry | 2.94 | 2.77 | 3.07 | 2.54 | 2.60 | 2.85 | 0.91 | 0.88 | 0.90 | 0.87 | 1.05 | 0.53 | 0.20 |
| C. Metal Production | NA | NA | 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 | NA | NA |

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 (Base year) | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **3. Solvent and Other Product Use** | **0.75** | **0.75** | **0.75** | **0.71** | **0.67** | **0.64** | **0.60** | **0.56** | **0.53** | **0.52** | **0.51** | **0.47** | **0.48** |
| **4. Agriculture** | **14.08** | **15.12** | **13.28** | **13.28** | **13.21** | **12.67** | **12.35** | **12.37** | **12.53** | **12.69** | **13.17** | **12.97** | **12.42** |
| A. Enteric Fermentation | | | | | | | | | | | | | |
| B. Manure Management | 3.02 | 3.08 | 2.98 | 2.97 | 2.93 | 2.93 | 2.94 | 2.91 | 2.92 | 2.94 | 2.94 | 2.98 | 2.97 |
| C. Rice Cultivation | | | | | | | | | | | | | |
| D. Agricultural Soils [(2)] | 11.06 | 12.04 | 10.30 | 10.31 | 10.28 | 9.73 | 9.41 | 9.46 | 9.61 | 9.75 | 10.23 | 9.99 | 9.45 |
| E. Prescribed Burning of Savannas | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| F. Field Burning of Agricultural Residues | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| G. Other | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **5. Land Use, Land-Use Change and Forestry** | **0.13** | **0.13** | **0.12** | **0.12** | **0.12** | **0.12** | **0.11** | **0.12** | **0.12** | **0.14** | **0.15** | **0.16** | **0.16** |
| A. Forest Land | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| B. Cropland | 0.13 | 0.13 | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 | 0.12 | 0.12 | 0.14 | 0.15 | 0.16 | 0.16 |
| C. Grassland | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| D. Wetlands | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| E. Settlements | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| F. Other Land | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| G. Other | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| **6. Waste** | 0.13 | 0.13 | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 | 0.12 | 0.12 | 0.14 | 0.15 | 0.16 | 0.16 |
| A. Solid Waste Disposal on Land | | | | | | | | | | | | | |
| B. Waste-water Handling | 0.35 | 0.40 | 0.66 | 0.74 | 0.74 | 0.73 | 0.73 | 0.77 | 0.81 | 0.83 | 0.84 | 0.84 | 0.84 |
| C. Waste Incineration | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| D. Other | 0.08 | 0.14 | 0.17 | 0.19 | 0.22 | 0.24 | 0.30 | 0.32 | 0.34 | 0.35 | 0.35 | 0.35 | 0.34 |

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 (Base year) | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **7. Other *(please specify)*** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| **Memo Items:** | | | | | | | | | | | | | |
| **International Bunkers** | **0.04** | **0.06** | **0.08** | **0.08** | **0.08** | **0.07** | **0.08** | **0.09** | **0.09** | **0.09** | **0.09** | **0.08** | **0.09** |
| Aviation | 0.03 | 0.05 | 0.06 | 0.06 | 0.05 | 0.05 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.06 | 0.07 |
| Marine | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| **Multilateral Operations** | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO | NO |
| **$CO_2$ Emissions from Biomass** | | | | | | | | | | | | | |

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

| GREENHOUSE GAS SOURCE AND SINK CATEGORIES | 1990 (Base year) | 1995 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gg | | | | | | | | | | | | |
| **Emissions of HFCs – Gg $CO_2$ equivalent** | **26.32** | **411.88** | **901.85** | **924.89** | **969.18** | **949.51** | **955.10** | **986.36** | **962.57** | **1 061.91** | **1 057.99** | **1 056.61** | **1 160.63** |
| HFC-23 (Gg) | NA.NO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| HFC-32 (Gg) | NA.NO | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 |
| HFC-41 (Gg) | NA.NO | NA.NO | 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 (Gg) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| HFC-125 (Gg) | NA.NO | 0.01 | 0.04 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.07 | 0.08 | 0.08 | 0.08 | 0.10 |
| HFC-134 (Gg) | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| HFC-134a (Gg) | 0.02 | 0.28 | 0.40 | 0.40 | 0.40 | 0.42 | 0.42 | 0.40 | 0.36 | 0.37 | 0.38 | 0.37 | 0.36 |
| HFC-152a (Gg) | NA.NO | 0.08 | 0.60 | 0.61 | 0.95 | 0.64 | 0.43 | 0.21 | 0.25 | 0.25 | 0.09 | 0.13 | 0.14 |
| HFC-143 (Gg) | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| HFC-143a (Gg) | NA.NO | 0.00 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.09 |
| HFC-227ea (Gg) | NA.NO | NA.NO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| HFC-236fa (Gg) | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| HFC-245ca (Gg) | NA.NO | NA.NO | 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 (Gg $CO_2$ equivalent) | 1.93 | 8.53 | 3.85 | 4.14 | 4.05 | 3.88 | 4.06 | 3.98 | 5.03 | 7.07 | 7.39 | 1.71 | 1.62 |
| **Emissions of PFCs (Gg $CO_2$ equivalent)** | **1 079.24** | **71.27** | **84.79** | **95.91** | **97.70** | **116.44** | **136.65** | **133.82** | **145.72** | **190.12** | **173.53** | **35.05** | **69.85** |
| $CF_4$ (Gg) | 0.14 | 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 | IE.NA.NO |
| $C_2F_6$ (Gg) | 0.02 | 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 | IE.NA.NO |
| C $_3F_8$ (Gg) | IE.NA.NO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $C_4F_{10}$ (Gg) | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| c-$C_4F_8$ (Gg) | 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 | IE.NA.NO | IE.NA.NO |
| $C_5F_{12}$ (Gg) | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO | NA.NO |
| $C_6F_{14}$ (Gg) | NA.NO | NA.NO | 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 PFCs (Gg $CO_2$ equivalent) | 29.05 | 68.39 | 67.46 | 81.67 | 83.46 | 102.20 | 125.49 | 125.04 | 135.50 | 182.55 | 166.39 | 28.64 | 63.93 |
| **Emissions of $SF_6$ (Gg $CO_2$ equivalent)** | **494.28** | **1 154.06** | **595.54** | **652.28** | **634.81** | **566.62** | **497.35** | **507.33** | **465.15** | **374.54** | **382.84** | **349.14** | **345.01** |
| $SF_6$ (Gg) | 0.02 | 0.05 | 0.02 | 0.03 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 |

# ANNEX II: TIER 1 UNCERTAINTY ASSESSMENT

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 2011 submission. Sources of uncertainties are explained in the NIR 2011. The key source analysis of the 2012 submission will be presented in the NIR 2012[16].

*Table A.II: Uncertainties for Key Sources of the Austrian GHG Inventory (KS Assessment 2011).*

| IPCC Source category | Gas | AD | EF | Combined | Combined as % of total national emissions in 2009 | Introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|
| | | Uncertainty [%] | | | | |
| 1 A 1 a liquid: Public Electricity and Heat Production | $CO_2$ | 0.5 | 0.5 | 0.7 | 0.01 | 0.01 |
| 1.A 1.a other: Public Electricity and Heat Production | $CO_2$ | 10.0 | 20.0 | 22.4 | 0.22 | 0.22 |
| 1.A 1.a solid: Public Electricity and Heat Production | $CO_2$ | 0.5 | 0.5 | 0.7 | 0.03 | 0.04 |
| 1.A 1.b liquid: Petroleum refining | $CO_2$ | 0.5 | 0.5 | 0.7 | 0.02 | 0.03 |
| 1.A.2 mobile-liquid: Manufacturing Industries and Construction | $CO_2$ | 3.0 | 0.5 | 3.0 | 0.04 | 0.06 |
| 1.A.2 other: Manufacturing Industries and Construction | $CO_2$ | 10.0 | 20.0 | 22.4 | 0.21 | 0.18 |
| 1.A.2 solid: Manufacturing Industries and Construction | $CO_2$ | 1.0 | 0.5 | 1.1 | 0.07 | 0.09 |
| 1.A.2 stat-liquid: Manufacturing Industries and Construction | $CO_2$ | 3.0 | 0.5 | 3.0 | 0.06 | 0.08 |
| 1.A.3.a jet kerosene: Civil Aviation | $CO_2$ | 3.0 | 3.0 | 4.2 | 0.00 | 0.00 |
| 1.A.3.b diesel oil: Road Transportation | $CO_2$ | 3.0 | 3.0 | 4.2 | 0.84 | 0.94 |
| 1.A.3.b gasoline: Road Transportation | $CO_2$ | 3.0 | 3.0 | 4.2 | 0.30 | 0.32 |
| 1.A.4 biomass: Other Sectors | $CH_4$ | 10.0 | 50.0 | 51.0 | 0.13 | 0.09 |
| 1.A.4 mobile-diesel: Other Sectors | $CO_2$ | 3.0 | 0.5 | 3.0 | 0.03 | 0.04 |
| 1.A.4 other: Other Sectors | $CO_2$ | 10.0 | 20.0 | 22.4 | 0.01 | 0.08 |
| 1.A.4 solid: Other Sectors | $CO_2$ | 1.0 | 0.5 | 1.1 | 0.00 | 0.02 |
| 1.A.4 stat-liquid: Other Sectors | $CO_2$ | 3.0 | 0.5 | 3.0 | 0.20 | 0.29 |
| 1.A gaseous: Fuel Combustion (stationary) | $CO_2$ | 2.0 | 0.5 | 2.1 | 0.45 | 0.63 |
| 1.B.2.b: Natural gas | $CH_4$ | 3.0 | 5.8 | 6.5 | 0.01 | 0.01 |
| 2.A.1: Cement Production | $CO_2$ | 5.0 | 2.0 | 5.4 | 0.13 | 0.18 |
| 2.A.2: Lime Production | $CO_2$ | 20.0 | 5.0 | 20.6 | 0.14 | 0.19 |

[16] Austria’s National Inventory Report 2012, 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 Source category | Gas | AD | EF | Com-bined | Combined as % of total national emissions in 2009 | Introduced into the trend in total national emissions |
|---|---|---|---|---|---|---|
| | | Uncertainty [%] | | | | |
| 2.A.3: Limestone and Dolomite Use | $CO_2$ | 20.0 | 2.0 | 20.1 | 0.06 | 0.08 |
| 2.A.7.b: Sinter Production | $CO_2$ | 2.0 | 5.0 | 5.4 | 0.02 | 0.02 |
| 2.B.1: Ammonia Production | $CO_2$ | 2.0 | 4.6 | 5.0 | 0.03 | 0.02 |
| 2.B.2: Nitric Acid Production | $N_2O$ | 0.0 | 5.0 | 5.0 | 0.01 | 0.05 |
| 2.C.1: Iron and Steel Production | $CO_2$ | 0.5 | 0.5 | 0.7 | 0.04 | 0.04 |
| 2.C.3: Aluminium production | $CO_2$ | 2.0 | 0.5 | 2.1 | 0.00 | 0.01 |
| 2.C.3: Aluminium production | PFCs | 2.0 | 50.0 | 50.0 | 0.00 | 0.11 |
| 2.C.4: SF6 Used in Al and Mg Foundries | $SF_6$ | 0.0 | 5.0 | 5.0 | 0.00 | 0.02 |
| 2.F.1/2/3/4./5: ODS Substitutes | HFCs | 20.0 | 50.0 | 53.9 | 0.73 | 0.79 |
| 2.F.9: Other Sources of SF6 | $SF_6$ | 25.0 | 50.0 | 55.9 | 0.18 | 0.14 |
| 3: SOLVENT AND OTHER PRODUCT USE | $CO_2$ | 5.0 | 10.0 | 11.2 | 0.02 | 0.02 |
| 4.A.1: Cattle | $CH_4$ | 10.0 | 20.0 | 22.4 | 0.88 | 0.59 |
| 4.B.1: Cattle | $CH_4$ | 10.0 | 50.0 | 51.0 | 0.15 | 0.06 |
| 4.B.1: Cattle | $N_2O$ | 10.0 | 100.0 | 100.5 | 0.97 | 0.15 |
| 4.B.8: Swine | $CH_4$ | 10.0 | 50.0 | 51.0 | 0.05 | 0.04 |
| 4.D.1: Direct Soil Emissions | $N_2O$ | 5.0 | 150.0 | 150.1 | 3.52 | 0.31 |
| 4.D.2: Pasture, Range and Paddock Manure | $N_2O$ | 5.0 | 150.0 | 150.1 | 0.18 | 0.15 |
| 4.D.3: Indirect Emissions | $N_2O$ | 5.0 | 150.0 | 150.1 | 2.28 | 0.42 |
| 6.A: Solid Waste Disposal on Land | $CH_4$ | 12.0 | 25.0 | 27.7 | 0.52 | 0.72 |
| 6.B: Wastewater Handling | $N_2O$ | 20.0 | 50.0 | 53.9 | 0.18 | 0.14 |
| **Total** | | | | | **4.63** | **1.88** |

# ANNEX III: INDICATORS

This Annex presents the 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 one Supplementary Indicator was not available (indicated by NA in the cells).[17]

*Table A.III: Indicators pursuant to Article 3 (1) j of the Monitoring Decision for the years 1990, 1995, 2000–2010.*

| No | Indicator | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Priority** | | | | | | | | | |
| 1 | Total $CO_2$ intensity of GDP [t $CO_2$/Mio Euro] | 351.4 | 330.9 | 292.4 | 325.1 | 303.0 | 282.0 | 276.5 | 261.4 | 274.8 |
| 2 | Energy related $CO_2$ intensity of GDP [t $CO_2$/Mio Euro] | 306.1 | 291.0 | 256.3 | 287.8 | 265.2 | 244.0 | 237.7 | 228.5 | 238.9 |
| 3 | Specific $CO_2$ emissions of passenger cars [g $CO_2$/ km] | 212.3 | 205.8 | 192.5 | 176.9 | 171.2 | 168.1 | 164.5 | 159.6 | 155.9 |
| 4 | Energy related $CO_2$ intensity of industry [t/Mio Euro] | 290.1 | 284.7 | 255.4 | 279.0 | 261.2 | 242.0 | 242.7 | 257.6 | 262.3 |
| 5 | Specific $CO_2$ emissions of households [t $CO_2$/dwelling] | 3.40 | 3.17 | 2.76 | 2.53 | 2.31 | 2.03 | 2.06 | 1.97 | 2.16 |
| 6 | $CO_2$ intensity of the commercial and institutional sector [t $CO_2$/Mio Euro] | 25.12 | 28.53 | 22.62 | 23.52 | 24.11 | 18.07 | 20.68 | 12.28 | 14.17 |
| 7 | Specific $CO_2$ emissions of public and autoproducer power plants [t $CO_2$/TJ] | 166.8 | 150.9 | 128.6 | 123.0 | 121.5 | 117.7 | 106.7 | 97.3 | 101.8 |
| | **Additional Priority** | | | | | | | | | |
| 1 | Freight transport on road [g $CO_2$/ ton-km] | 140.6 | 120.5 | 94.6 | 87.7 | 87.2 | 85.3 | 84.4 | 83.8 | 81.2 |
| 2 | Total $CO_2$ intensity – iron and steel industry [t $CO_2$/Mio Euro] | 2,651 | 3,193 | 2,525 | 3,490 | 3,657 | 3,494 | 3,655 | 3,500 | 3,395 |
| 3 | Energy related $CO_2$ intensity – chemical industry [t $CO_2$/Mio Euro] | 575.2 | 532.8 | 492.4 | 516.4 | 412.2 | 327.1 | 386.6 | 371.5 | 360.4 |
| 4 | Energy related $CO_2$ intensity – glass, pottery and building materials industry [t $CO_2$/Mio Euro] | 672.6 | 651.1 | 609.6 | 641.1 | 656.8 | 693.0 | 749.0 | 740.7 | 711.3 |
| 5 | Specific $CO_2$ emissions of iron and steel industry [t $CO_2$/t production] | 2.17 | 1.92 | 1.82 | 1.79 | 1.78 | 1.72 | 1.75 | 1.91 | 1.72 |

[17] The units of the transport indicators (No. 3 Priority Indicator, No. 1 Additional Priority Indicator, and No.1–3 Supplementary Indicator) were changed to the common unit g $CO_2$/km (the suggested unit was g $CO_2$/100 km). Furthermore, the names of the transport indicators No.3 and 4 Supplementary Indicator have been adapted to be consistent.

| No | Indicator | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Specific energy related $CO_2$ emissions of cement industry [t $CO_2$/t production] | 0.225 | 0.226 | 0.214 | 0.194 | 0.207 | 0.213 | 0.205 | 0.200 | 0.193 |
| | **Supplementary** | | | | | | | | | |
| 1 | Specific diesel related $CO_2$ emissions of passenger cars [g $CO_2$/ km] | 193.7 | 189.1 | 179.1 | 166.7 | 159.8 | 158.4 | 157.6 | 153.5 | 152.2 |
| 2 | Specific petrol related $CO_2$ emissions of passenger cars [g $CO_2$/ km] | 216.2 | 212.1 | 202.6 | 190.6 | 187.3 | 182.5 | 175.1 | 168.7 | 161.2 |
| 3 | Passenger transport on road [g $CO_2$/passenger-km] | 155.7 | 159.1 | 157.1 | 148.7 | 144.3 | 142.2 | 139.7 | 136.0 | 133.3 |
| 4 | Passenger transport by air [kg $CO_2$/passenger] | 234.0 | 226.1 | 125.8 | 110.8 | 110.7 | 106.4 | 96.3 | 99.9 | 81.6 |
| 5 | Energy related $CO_2$ intensity – food, drink and tobacco industry [t $CO_2$/Mio Euro] | 234.2 | 182.3 | 169.6 | 176.2 | 167.3 | 136.3 | 141.7 | 184.6 | 196.1 |
| 6 | Energy related $CO_2$ intensity – paper and printing industry [t $CO_2$/Mio Euro] | 864.7 | 803.4 | 653.9 | 618.6 | 550.4 | 512.9 | 527.0 | 555.8 | 578.4 |
| 7 | Specific $CO_2$ emissions of households for space heating [t $CO_2$/m²] | 33.84 | 30.32 | 25.42 | 22.71 | 20.49 | 17.87 | 18.13 | 17.18 | 18.72 |
| 8 | Specific $CO_2$ emissions of commercial and institutional sector for space heating [kg $CO_2$/m²] | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| 9 | Specific $CO_2$ emissions of public power plants [t $CO_2$/TJ] | 166.4 | 143.5 | 133.3 | 112.2 | 110.2 | 103.1 | 93.9 | 84.2 | 84.7 |
| 10 | Specific $CO_2$ emissions of autoproducer plants [t $CO_2$/TJ] | 168.2 | 168.2 | 117.6 | 161.5 | 157.2 | 158.2 | 145.7 | 138.6 | 156.5 |
| 11 | Carbon intensity of total power generation [t $CO_2$/TJ] | 68.37 | 59.04 | 48.19 | 59.28 | 57.43 | 53.87 | 49.09 | 42.72 | 49.60 |
| 12 | Carbon intensity of transport [t $CO_2$/TJ] | 65.95 | 64.07 | 63.63 | 65.05 | 62.51 | 61.71 | 60.36 | 60.19 | 60.25 |
| 13 | Specific energy related $CO_2$ emissions of paper industry [t $CO_2$/t production] | 0.755 | 0.643 | 0.536 | 0.465 | 0.424 | 0.421 | 0.427 | 0.456 | 0.445 |
| 14 | Carbon intensity in Industry [kt $CO_2$ /PJ] | 58.58 | 61.75 | 54.65 | 54.68 | 52.05 | 50.86 | 49.68 | 45.98 | 48.63 |
| 15 | Carbon intensitiy Households [kt $CO_2$ /PJ] | 40.92 | 37.51 | 34.86 | 31.56 | 30.10 | 28.01 | 27.93 | 26.85 | 27.21 |

ENVIRONMENT AGENCY AUSTRIA **umweltbundesamt**

**Umweltbundesamt GmbH**
Spittelauer Lände 5
1090 Wien/Österreich

Tel.: +43-(0)1-313 04
Fax: +43-(0)1-313 04/5400

office@umweltbundesamt.at
www.umweltbundesamt.at

**In "Austria's Annual Greenhouse Gas Inventory 1990–2010" the Umweltbundesamt presents up-to-date figures of greenhouse gas (GHG) emissions in Austria. In 2010, the third year of the first commitment period under the Kyoto Protocol, GHG emissions amounted to 84.6 million tonnes of CO2 equivalents. This corresponds to an 8.2% increase against base-year levels and a 6.1% increase since 2009. The key drivers for the increase from 2009 to 2010 were the recovery from the economic crisis in 2009 with rising industrial production, an increase in road freight transport and increased demand for electricity, but also cold climate conditions. The content and format of this report are in accordance with obligations under the greenhouse gas monitoring mechanism 280/2004/EC for implementing the Kyoto Protocol. Updated emission data have to be reported to the European Commission by 15 January each year.**

EMAS
Geprüftes Umweltmanagement
REG.NO. AT- 000484

ISN 978-3-99004-164-2