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SYNTHESIS AND ASSESSMENT REPORT ON THE GREENHOUSE GAS INVENTORIES SUBMITTED IN 2001[1]

Note by the secretariat

CONTENTS

[1] In the symbol of this document, 2001 refers to the year the inventories were submitted and not to the year of publication.

I. INTRODUCTION

A. Mandate

1. The Conference of the Parties (COP), by its decision 6/CP.5, adopted the guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention,[2] (referred to below as "the review guidelines"), for a trial period covering inventory submissions due in 2000 and 2001 (FCCC/CP/1999/6/Add.1).

2. By its decision 3/CP.5, the COP also adopted guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories,[2] (referred to below as "the reporting guidelines"). These guidelines should be used by Parties included in Annex I to the Convention (Annex I Parties) for reporting inventories due by 15 April each year, beginning in the year 2000.[3]

3. By its decision 6/CP.5, the COP requested the secretariat to conduct an annual synthesis and assessment of greenhouse gas (GHG) inventories for all Annex I Parties, in accordance with the provisions of the review guidelines. The purposes of the synthesis and assessment are to facilitate the consideration of inventory data and other information across Parties, and to identify issues for further consideration during the review of individual inventories, namely desk reviews, centralized reviews and in-country reviews.

4. In accordance with the review guidelines the synthesis and assessment should be conducted by the secretariat in two phases, with the assistance of experts selected for the second phase. The results of this stage of the review will be published on the UNFCCC web site as a synthesis and assessment report, divided into two sections and an addendum. The review guidelines state that the first section should provide information allowing comparisons across Annex I Parties and describe common methodological issues. The second section should contain a preliminary analysis of individual Annex I Party inventories, in particular, to identify outstanding issues requiring clarification during the individual review stage of the process. In addition, an addendum should be prepared containing tables and graphs based on Annex I Party inventory data.

B. Scope of the note

5. This synthesis and assessment report responds to the mandate described in paragraphs 3 and 4 above. It contains the first and second sections of the synthesis and assessment report, covering the national GHG inventories submitted in 2001 by those Annex I Parties that used the common reporting format (CRF) in accordance with the reporting guidelines. An addendum to this report was not prepared, as a document with similar inventory data, in tabular and graphical format, was prepared by the secretariat on the basis of the submissions of Parties for the year 2001(FCCC/SBI/2001/13).[4] This document can be regarded as a substitute for the addendum to this report.[5]

6. This synthesis and assessment report focuses on the inventory information submitted in the CRF and does not provide a comprehensive assessment of the national inventory reports, which have been provided by some Annex I Parties as part of their annual inventory submission.

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[2] The full text of the guidelines is contained in document FCCC/CP/1999/7.

[3] The Subsidiary Body for Implementation (SBI), at its tenth session, set up a two-year trial period beginning in early 2000 to assess those guidelines, particularly the common reporting format, with a view to revising them at COP 7, taking into consideration, inter alia, experience gained by Parties and the secretariat, and the input of the Intergovernmental Panel on Climate Change (FCCC/SBI/1999/8).

[4] See also FCCC/SBI/2001/13/Corr.1.

[5] These documents contain information from all Annex I Parties that submitted inventories in the year 2001 irrespective of whether they reported the inventory data using the CRF or not.

7. The preliminary findings included in the second section are the result of the analysis of the CRF data, taking into account additional information in the national inventory report (NIR) where applicable, performed by the secretariat and the experts who participated in the second phase of the synthesis and assessment. The comments and questions are not intended as a judgement of whether inventory problems exist, but are provided as an indication of potential issues that need to be considered further during the third stage of the review process (individual review of inventories) by the expert review teams.

8. The synthesis and assessment of GHG inventories should also assist in assessing the usefulness of the reporting guidelines, in particular the CRF for supporting the technical review of GHG inventories and will provide useful input to the possible revision of these reporting guidelines by the COP.

C. Possible action by Parties

9. Parties may wish to communicate to the secretariat their views on the content, extent and layout of the synthesis and assessment report on GHG inventories and consider possible changes.

D. Approach

10. The analysis of the inventory data was done according to the sectors, subsectors and source categories which are specified in the CRF and which correspond to those of the Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, (the IPCC Guidelines). The synthesis and assessment report for 2000 did not include tables for comparing inventory data from the land-use change and forestry sector due to the limited disaggregated data provided by Parties. However, following input from experts during the review process of 2000 submissions on the presentation of data for this sector, the 2001 synthesis and assessment report incorporates tables comparing data from Annex I Parties which provided data in CRF tables 5 A-D.

11. To facilitate the analysis of the inventory data, the secretariat considers, for each individual Party, those source categories that are *key sources* in terms of their absolute level of emissions and impact on the trend, applying the tier 1 level and trend assessment as described in the IPCC good practice guidance.[6] With regard to categories, this identification has been performed at the level of detail recommended in that guidance.[7] The land-use change and forestry sector has not been included in the calculation of the key source calculations.[8]

E. Limitations of the synthesis and assessment report

12. The completeness and the scope of this report are affected by the fact that only 30 out of 40 Annex I Parties submitted their inventory using the CRF and by the limited information provided by some of these Parties using the CRF for the first time (see page 9 of this report).

13. Generally, in section II of the report, more issues were identified for those Parties that provided a more complete inventory submission than for those Parties that provided fewer data. The number of issues requiring clarification that are raised for any particular Party in this report does not indicate a lower level of quality of the Party's submission. On the contrary, in the instances where Parties provided more complete submissions and subsequently more issues may have been identified, the synthesis and assessment report will be more useful to the expert review teams in performing their tasks.

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6 Chapter 7, "Methodological choice and recalculations" of the IPCC Good Practice Guidance and Uncertainty Management, referred to in this report as the IPCC good practice guidance.

7 For some Parties, identification of key sources at that level of detail was not possible due to insufficient reporting of disaggregated data. For these Parties, key sources have been identified at the level of category disaggregation provided in Summary table 1.A of the CRF (corresponding to summary Table 7A of the IPCC Guidelines).

8 Emissions and removals associated with carbon stocks in land-use, land-use change and forestry are not covered in the current edition of the IPCC good practice guidance. A separate IPCC report on good practice for this sector is in preparation.

<u>Phase I of the synthesis and assessment</u>

14. To facilitate the review of the GHG inventory data reported by Annex I Parties, the secretariat developed a database for processing and storing data submitted electronically in the CRF tables. Other software tools and specific queries for retrieving and viewing the data stored in the database were also developed in order to facilitate the process of analysing the inventory data during the various stages of the review process. The secretariat continues to improve its data management and processing tools, and has benefited from the suggestions of experts in the course of the review process.

15. During the first phase of the synthesis and assessment, the secretariat compiled the information provided by Parties using the CRF and prepared the preliminary synthesis and assessment report. This included a draft of section I of the report, that consisted of a set of data tables to allow comparison of inventory information across Parties, and a draft country-by-country analysis for section II of the report.

16. *Key sources*, implied emission factors and other methodological information were compared across Parties and, where possible, against default emission factors from the IPCC. For the detection of potential issues in the inventory data comparisons, a preliminary statistical analysis of the data has been performed. For some source categories for which international data sources are available, activity data reported by Parties were compared with data from international data sources, such as United Nations, International Energy Agency (IEA), and Food and Agriculture Organization (FAO) statistics. An assessment of emission trends and implied emission factors from 1990 to 1999 was performed where possible. Furthermore, the inventory data submitted in 2001 were compared with data in previous inventory submissions. Where possible, the national inventory report, or any other accompanying textual information, was used to assess the consistency of the information provided. Specific data checks were also carried out to verify the consistency of the reported data, and to detect omissions and other problems related to inappropriate use of the CRF.

<u>Phase II of the synthesis and assessment</u>

17. The second phase of the synthesis and assessment exercise was conducted with the participation of seven national inventory experts from the roster of experts and one expert from an international organization. The experts invited were Mario Contaldi (Italy), László Gáspár (Hungary), Gabriel Hernández (Latin American Energy Organization (OLADE)), Thelma Krug (Brazil), Carlos Lopez (Cuba), Joe Mangino (United States of America), Martiros Tsarukyan (Armenia), and Risto Sievänen (Finland). These experts were selected according to their expertise in inventory preparation, taking into account geographical balance.

18. The main task of the experts was to assist the secretariat in facilitating the consideration of inventory data and other information across Parties, and in identifying potential issues for further consideration during the review of individual inventories. Mainly, they were asked to provide advice on:

(a) The content of the preliminary draft of section I of the synthesis and assessment report;

(b) The potential problems identified in the preliminary country-by-country analysis of section II of the report.

19. Experts were allocated to work according to inventory sectors in accordance with their expertise. In reviewing all 30 inventory submissions for their specific sector in order to perform the above-mentioned task, they assessed the results of the data comparisons of section I of the report to determine potential inventory issues and developed additional specialized data comparison queries by sector where needed. The potential issues included in the preliminary country-by-country analysis of section II were considered, assessed and completed based on any new findings identified during this second phase.

20. Section I of the draft synthesis and assessment report was sent to Parties for comment, together with the corresponding preliminary findings on the individual Party's GHG inventory (section II). Twenty-one Parties (Australia, Austria, Belgium, Czech Republic, Estonia, Finland, France, Hungary, Ireland, Japan, Latvia, Netherlands, New Zealand, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland, United Kingdom and United States of America) responded to the draft synthesis and assessment report. Any additional information and clarifications contained in the Party's comment in response to the findings have been added below the original finding using ***bold italic*** font, quoting as closely as possible the text provided by the Party. However, retroactive corrections by the Parties to the data have not been taken into account in the respective tables of section I, but have been reflected accordingly in section II of this report.

21. For those Parties whose GHG inventory was subject to an individual review,[9] the answers to the preliminary findings were provided to the expert review teams for their consideration.

[9] The following Parties' GHG inventories submitted in 2001were subjected to an individual review using one or more of the various approaches: Austria (centralized and in-country reviews), Belgium (centralized review), Bulgaria (desk review), Czech Republic (desk review), Denmark (desk review), Estonia (centralized review), European Community (centralized review), Finland (desk and in-country reviews), France (desk and in-country reviews), Germany (centralized review), Greece (centralized review), Iceland (desk review), Ireland (desk review), Italy (desk review), Latvia (desk review), Luxembourg (desk review), Norway (desk review), Portugal (desk review), Slovakia (desk review), Spain (centralized review), Sweden (desk and in-country reviews), Switzerland (desk review).

II. SECTION I

COMPARISON OF GREENHOUSE GAS INVENTORY INFORMATION ACROSS PARTIES

A. Overview

1. Introductory notes

General notes

This section of the synthesis and assessment report contains greenhouse gas inventory information, compiled in tabular format, from the 30 Annex I Parties, referred to below simply as Parties, that provided information in the common reporting format as part of their annual inventory submission in 2001. The tables provide comparisons of implied emission factors and activity data as reported in the CRF, data from international sources, emissions, information on methods used and emission factors as reported by Parties in Summary table 3 of the CRF and other information related to GHG inventory estimates. Where possible, this information is provided for all 30 Parties and for all years from 1990 to 1999. For some sectors and categories, however, trend comparisons across all Parties were not possible due to the lack of data for some or all of these years (see subsection 2 below).

Some of the tables indicate whether a source category is a key source, in terms of its absolute level of emissions or trend assessment, as calculated by the secretariat in accordance with the definitions given in chapter 7 of the IPCC good practice guidance[10] for the tier 1 level assessment[11]. This is indicated by an "L" for level and "T" for trend assessments in the 'key source' columns. The column "Per cent of national total" indicates the contribution of that key source category to the Party's national total of GHG emissions in terms of CO_2 equivalent, excluding emissions and removals from land-use change and forestry.

Default emission factors and other parameters from the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, have been included in the tables, as appropriate, to facilitate comparison with implied emission factors reported by Parties. In addition, where updated default emission factors were available from the IPCC good practice guidance, these have been provided in the relevant footnotes.

Explanatory notes

Blank cells in the tables indicate that a Party did not report information for a given source and gas in the appropriate table of the CRF.

The differences in activity data between the CRF and international data sources were calculated as percentage deviations from the activity data in the CRF. A positive number indicates that the data from the international data source are higher than the data reported in the CRF. Similarly, a negative number indicates that data from the international data source are lower than the data reported in the CRF.

References to the base year refer to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average 1985-1987).

[10] Good practice guidance refers to the IPCC report "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories".
[11] Emissions and removals from land-use change and forestry have not been included in the calculations for the identification of key sources.

Where Parties used indicators (NO, NE, NA, IE, C, 0) these have been reproduced verbatim from the CRF tables provided by Parties. The standard indicators, as described in the UNFCCC reporting guidelines (FCCC/CP/1999/7), are as follows:

NO	Not occurring
NE	Not estimated
NA	Not applicable
IE	Included elsewhere
C	Confidential
"0"	Estimates that are less than one half the unit being used to record the inventory table

To indicate the methods and emission factors used by Parties the following abbreviations have been used (see also footnotes to Summary table 3 of the CRF):

Methods:

D	IPCC default
RA	Reference approach
T1	IPCC tier 1
T1a, T1b, T1c	IPCC tier 1a, tier 1b, and tier 1c, respectively
T2	IPCC tier 2
T3	IPCC tier 3
C	CORINAIR
CS	Country specific
M	Model

Emission factors:

D	IPCC default
C	CORINAIR
CS	Country specific
PS	Plant specific
M	Model

Tables on energy indicate whether implied emission factors given in the CRF are based on gross calorific value (GCV) or net calorific value (NCV). The difference between the NCV and the GCV for each fuel is the latent heat of vaporization of the water produced during combustion of the fuel. For coal and oil, NCV is 5 per cent less than GCV, and for most forms of natural and manufactured gas the difference is 9 to 10 per cent.

For greenhouse gases the following chemical symbols and abbreviations have been used:

CF_4	perfluoromethane
C_2F_6	perfluoroethane
C_3F_8	perfluoropropane
C_4F_{10}	perfluorobutane
$c\text{-}C_4F_8$	perfluorocyclobutane
C_5F_{12}	perfluoropentane
C_6F_{14}	perfluorohexane
CH_4	methane
CO_2	carbon dioxide
HFCs	hydrofluorocarbons
N_2O	nitrous oxide
PFCs	perfluorocarbons
SF_6	sulphur hexafluoride

The following units have been used:

kg	kilogram (10^3 grams)
t	tonne (10^6 grams)
kt	kilotonne (10^9 grams)
Gg	gigagram (10^9 grams)

Mt	megatonne (10^{12} grams)
TJ	terajoule (10^{12} joules)
PJ	petajoule (10^{15} joules)
Gg CO_2 equ	Gg of CO_2 equivalent
Mha	million hectares
NGL	natural gas liquids
FAO	Food and Agriculture Organization of the United Nations

The following other abbreviations have been used:

CRF	common reporting format
NIR	national inventory report
A	actual emissions
P	potential emissions
AD	activity data
EF	emission factor
IEF	implied emission factor
GHG	greenhouse gas
GWP	global warming potential
N	nitrogen
NCV	net calorific value
GCV	gross calorific value
yr	year
L	level (key source applying the IPCC good practice tier 1 level assessment)
T	trend (key source applying the IPCC good practice tier 1 trend assessment)

2. Status of reporting of GHG inventories in the year 2001

Inventories from Annex I Parties submitted in 2001 in accordance with decision 3/CP.5

Parties that submitted their inventories using the CRF were:

Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Denmark, Estonia, European Community,[12] Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland, the United Kingdom and the United States.

[12] The European Community reported Summary table 1.A only but in addition it included in its submission inventory data, in the common reporting format or other formats, for 14 member States individually.

Table 1. Status of reporting inventories in the CRF:[13]

Reporting	Parties
Parties that have submitted inventory data for all years (1990-1999) using the CRF	Austria, Canada, Denmark, European Community (Summary 1.A only), Finland, France, Germany (table 1A(b) & trend, summary tables), Greece, Japan, Netherlands, Portugal, Spain (no sectoral background tables provided except 1A(b) & 1A(c)), Sweden, United Kingdom, United States.
Parties that have submitted inventories using the CRF for one or more years	Australia (1990, 1999 & recalculation tables 1990-1998, trend tables), Belgium (1998, 1999), Bulgaria (1999 & trend tables), Czech Republic (1999), Estonia (1999), Hungary (1999 & trend tables), Iceland (1999 & trend tables), Ireland (1999 & trend tables), Italy (1998, 1999 & trend tables), Latvia (1999 & trend tables), Luxembourg (1999), New Zealand (1999 & recalculation tables 1990-1998, trend tables), Norway (1990, 1999 & recalculation tables 1990,1998, trend tables), Slovakia (1999 & trend tables), Switzerland (1999 & recalculation tables 1990-1998, trend tables)
Parties that have submitted inventories in a format other than the CRF	Monaco (1990-1999, summary tables), Poland (1999, IPCC summary tables)
Parties that did not submit an inventory in 2001	Belarus, Croatia, Liechtenstein, Lithuania, Romania, Russian Federation, Slovenia, Ukraine

Table 2. Provision of national inventory report (NIR) or any other additional information together with the CRF

Reporting	Parties	Description
Parties that provided an NIR[14]	Australia	Information on activity data, emission factors and uncertainty Estimates for all sectors. In addition, methodology supplements, including modifications and additions to previously submitted methodologies for the compilation of the inventory and description of quality control checks performed, have been provided for each sector. The 1999 inventory report includes a more rigorous treatment of uncertainties of emission estimates for key sources than has previously been included. An indication of the quantified level of uncertainty for several sectors is also provided in the national inventory report.
	Austria	Indicates methods and activity data used (mentioned that an extended version of this report is in preparation).
	Bulgaria	Information on methodologies, activity data and emission factors used, and information on application of the IPCC good practice guidance.
	Canada	Information on methodologies, activity data sources and emission factors for all source categories; also describes QA/QC procedures employed.

[13] Information regarding the degree of completeness and timeliness in reporting of inventories by each Party can be found in the status reports on the UNFCCC secretariat web site: http://www.unfccc.int/resource/ghg/statrep2001.html

[14] National inventory reports differ in content, scope and level of detail. The secretariat did not assess to what extent the information provided in the reports follows the reporting guidelines on this matter (see FCCC/CP/1999/7).

Table 2. Provision of national inventory report (NIR) or any other additional information together with the CRF *(continued)*

Reporting	Parties	Description
Parties that provided an NIR	Denmark	Information on the methodologies used, recalculations, uncertainties and QA/QC. In appendices to the report, emission factors for fuel combustion and a brief description of the methodology regarding removals by sinks were also provided. An appendix included emission trends for the years 1990-1999 adjusted for electricity exchange and inter-annual temperature variations. Information on Greenland and the Faroe Islands was also provided.
	Finland	Information about the organization of the national inventory, methods used for the 1999 inventory and summary tables. Further includes a report that describes methodologies, emission factors and activity data in detail, as well as uncertainty estimates, changes compared to previous submission and information on key sources.
	France	Information on the methodologies used for calculation of emissions from all sectors.
	Latvia	Information on methodologies used, sources of information related to methodologies, recalculations, assumptions made and conventions used; also outlines the problems with the compilation of the GHG inventory, determination of uncertainties and QA/QC procedures.
	Netherlands	Information on methods and data used, changes in methods and data, uncertainty and key source assessments, quality assurance/quality control, trends in emissions, and country-specific circumstances and definitions.
	New Zealand	Information on methodologies, activity data, emission factors, Differences compared to previous submissions and uncertainty estimates in the calculations for all source categories.
	Norway	Information on methods used and explanations of major changes in the inventory compared to previous submissions. References to methodologies, emission factors, activity data and measurements were also included.
	Spain	Summary of emission estimates, a brief description of the methodologies used and an explanation of recalculated emission estimates.
	Sweden	Information on methodologies, activity data and emission factors for each sector. Further provides information on uncertainties, quality assurance/quality control, recalculations and upcoming improvements as well as an identification of key sources in the energy sector.
	United Kingdom	Explanations for the changes in the current emission estimates compared to previous submissions as well as a description of the methodologies and emission factors used for each IPCC sector. A description of the QA/QC procedures and uncertainty estimates were also provided.
	United States	Information on methodologies, activity data, emission factors, differences to previous submissions and uncertainty estimates for all categories.

Table 2. Provision of national inventory report (NIR) or any other additional information together with the CRF *(concluded)*

Reporting	Parties	Description
Parties that did not provide any information additional to that in the CRF	Belgium Czech Republic Estonia Germany Greece Hungary Iceland Ireland Italy Japan Luxembourg Portugal Slovakia Switzerland	

3. Summary of key sources

Table 3. Summary of key sources (1999) – tier 1 level assessment (disaggregation level of sources as recommended in IPCC good practice guidance)

Note that Germany, Luxembourg, Poland and Spain are not included in this table because data from these Parties were not reported at the level of detail necessary to identify key sources according to the level of disaggregation recommended by the IPCC good practice guidance.

Source	GHG	Parties	Total Parties
CH_4 from solid waste disposal sites	CH_4	Australia, Austria, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Netherlands, New Zealand, Norway, Portugal, Slovakia, Sweden, Switzerland, United Kingdom, United States	25
CO_2 stationary combustion - oil	CO_2	Australia, Austria, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Netherlands, New Zealand, Norway, Portugal, Slovakia, Sweden, Switzerland, United Kingdom, United States	25
Mobile combustion - road vehicles	CO_2	Australia, Austria, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Netherlands, New Zealand, Norway, Portugal, Slovakia, Sweden, Switzerland, United Kingdom, United States	25
CH_4 from enteric fermentation in domestic livestock	CH_4	Australia, Austria, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Netherlands, New Zealand, Norway, Portugal, Slovakia, Sweden, Switzerland, United Kingdom, United States	24 (all except Japan)
CO_2 stationary combustion - coal	CO_2	Australia, Austria, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Japan, Latvia, Netherlands, New Zealand, Norway, Portugal, Slovakia, Sweden, Switzerland, United Kingdom, United States	24 (all except Iceland)
CO_2 stationary combustion - gas	CO_2	Australia, Austria, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Japan, Latvia, Netherlands, New Zealand, Norway, Portugal, Slovakia, Sweden, Switzerland, United Kingdom, United States	24 (all except Iceland)

Table 3. Summary of key sources – tier 1 level assessment (disaggregation level of sources as recommended in IPCC good practice guidance) *(continued)*

Source	GHG	Parties	Total Parties
Direct N_2O emissions from agricultural soils	N_2O	Australia, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Netherlands, New Zealand, Norway, Portugal, Slovakia, Sweden, United Kingdom, United States	22 (all except Austria, Japan and Switzerland)
CO_2 from cement production	CO_2	Austria, Bulgaria, Canada, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Norway, Portugal, Slovakia, Sweden, Switzerland, United Kingdom	19
Indirect N_2O from nitrogen used in agriculture	N_2O	Bulgaria, Canada, Czech Republic, Denmark, Finland, France, Hungary, Ireland, Italy, Latvia, New Zealand, Norway, Portugal, United Kingdom, United States	15
Fugitive emissions: oil and gas operations	CH_4	Australia, Bulgaria, Canada, Estonia, Hungary, Italy, Latvia, Netherlands, Norway, Slovakia, Switzerland, United Kingdom, United States	13
Mobile combustion - road vehicles	N_2O	Austria, Canada, Finland, France, Italy, Netherlands, Norway, Sweden, Switzerland, United Kingdom, United States	11
N_2O from nitric acid production	N_2O	Bulgaria, Czech Republic, Finland, France, Ireland, Netherlands, Norway, Portugal, Sweden, Switzerland, United Kingdom	11
CH_4 from manure management	CH_4	Austria, Canada, Denmark, France, Hungary, Ireland, Italy, Netherlands, Portugal, Switzerland	10
Mobile combustion-aircraft	CO_2	Canada, France, Greece, Japan, New Zealand, Norway, Portugal, Sweden, Switzerland, United States	10
Animal production	N_2O	Australia, Bulgaria, France, Greece, Ireland, New Zealand, Portugal, Sweden, United Kingdom	9
Mobile combustion - waterborne navigation	CO_2	Canada, Finland, Greece, Italy, Japan, Norway, Portugal, Sweden, United States	9
Ozone-depleting substance substitutes	HFCs +PFCs	Austria, Denmark, France, Italy, Japan, Sweden, Switzerland, United Kingdom, United States	9
Fugitive emissions: oil and gas operations	CO_2	Australia, Austria, Canada, Denmark, France, New Zealand, Norway, United Kingdom	8
CO_2 from iron and steel industry	CO_2	Austria, Bulgaria, Canada, France, New Zealand, Sweden, United States	7
CO_2 stationary combustion - other fuels	CO_2	Finland, France, Italy, Netherlands, Slovakia, Sweden, Switzerland	7
Fugitive emissions: coal mining and handling	CH_4	Australia, Bulgaria, Czech Republic, Hungary, Slovakia, United Kingdom, United States	7

Table 3. Summary of key sources – tier 1 level assessment (disaggregation level of sources as recommended in IPCC good practice guidance) *(continued)*

Source	GHG	Parties	Total Parties
Other transportation	CO_2	Canada, Finland, Greece, Hungary, Netherlands, Norway, United States	7
Wastewater handling	CH_4	Bulgaria, Estonia, Hungary, Italy, Latvia, Slovakia, Portugal	6
Ammonia production	CO_2	Austria, Estonia, France, Hungary, Ireland, Norway	6
N_2O from manure management	N_2O	France, Italy, Latvia, Portugal, Sweden, Switzerland	6
PFCs from aluminium production	CF4+ C2F6	Canada, Hungary, Iceland, Netherlands, Norway	5
Non-CO_2 stationary combustion - coal	N_2O	Bulgaria, Czech Republic, Greece, Sweden	4
Ferroalloy production	CO_2	Iceland, Norway, Sweden	3
Waste incineration	CO_2	Hungary, Japan, Switzerland	3
Agricultural soils	CH_4	Austria, Greece	2
Aluminium production	CO_2	Iceland, Norway	2
HFC-23 from HCFC production	HFC23	Greece, Netherlands	2
Limestone and dolomite use	CO_2	Japan, Slovakia	2
N_2O from adipic acid production	N_2O	France, Italy	2
Non-CO_2 stationary combustion - biomass	CH_4	France, Latvia	2
Other (chemical industry)	N_2O	France, Iceland	2
Railways	CO_2	Canada, Latvia	2
Wastewater handling	N_2O	Portugal	1
Agricultural soils	CO_2	Finland	1
CH_4 from savanna burning	CH_4	Australia	1
CO_2 from lime production	CO_2	Finland	1
N_2O from savanna burning	N_2O	Australia	1
Non-CO_2 stationary combustion - biomass	N_2O	Finland	1

Table 3. Summary of key sources – tier 1 level assessment (disaggregation level of sources as recommended in IPCC good practice guidance) *(concluded)*

Source	GHG	Parties	Total Parties
Non-CO_2 stationary combustion - oil	N_2O	Sweden	1
Other	CO_2	Finland	1
Other (agricultural soils)	N_2O	Sweden	1
Other (fugitive from solid fuels)	CO_2	Finland	1
Other (industrial processes)	CO_2	Canada	1
Other (mineral products)	CO_2	Austria	1
Other (waste)	CH_4	Austria	1
SF_6 from magnesium production	SF_6	Norway	1
Solid waste disposal	CO_2	Switzerland	1
Solvent and other product use	N_2O	Switzerland	1
Waste incineration	N_2O	Switzerland	1

B. SECTORAL TABLES

1. Energy

Energy - Total CO_2 emissions from the reference approach and the sectoral approach (1999)

CO_2 emissions from total fuel combustion

	Reference approach	Sectoral approach	Difference	Explanation for difference as reported in table 1.A(c) of the CRF
	Gg CO_2		(%)	
Australia	324,722	326,378	-0.51	Four main reasons for the difference between the reference approach and the national approach: 1) It is partly an artefact caused by deficiencies in the design of tables 1.A(b) and 1.A(d). The CRF does not allow for the subtraction of the energy content of the fuels whose carbon is sequestered. It only allows for the subtraction of the sequestered carbon and carbon emitted elsewhere, i.e. in other sectors. Therefore, the energy consumption reported using this method for the reference approach includes energy whi netted out of the national approach. The energy consumption for the reference approach and the national approach will, therefore, never balance using the CRF tables in their current format. 2) The CRF tables assume that all ethane is sourced from oil refineries, derived from crude oil. This is false. In Australia, all ethane supplied to the chemical industry is sourced from gas wells, separated from methane at gas processing plants. It is therefore classed as a gaseous fuel, not a liquid fuel. 3) The difference is partly a consequence of the fact that coal consumption (activity) data used in the reference approach are one-year projections, whereas most coal consumption data used in the national approach are "actuals", collected from power station operators. For petroleum and natural gas, however, both approaches use actual national consumption. 4) It is also partly a consequence of the treatment of emission factors for natural gas in the national approach which has resulted in a slight over estimate of emissions from this fuel.
Austria	51,065	50,658	0.80	The reference approach CO_2 emissions are more than those for the sectoral approach by 0.8 per cent. The following is the Party's explanation: CORINAIR is used as the national method, considering the following items of the official Austrian energy balance (in German): "Energetischer Endverbrauch", "Umwandlungseinsatz", "Verbrauch des Sectors Energie". Differences between national estimates and the reference approach include: **Solid fuels**: Energy consumption: The national approach does not include transformation losses of coking coal to coke oven gas and coke. CO_2 emissions: The national approach does not distinguish between the fuel related and non-fuel related CO_2 emissions for metal production. All CO_2 emissions are included in sector 2.C: Metal production. **Gaseous fuels**: Energy consumption: The national approach does not include energy losses and non-energy use. CO_2 emissions: The national approach uses sector-specific carbon contents (different from IPCC reference factor). **Liquid fuels**: Energy consumption: The national approach does not include energy losses and non-energy use. CO_2 emissions: Heat values and carbon contents are sector and fuel specific. The energy statistic is mass balanced only. **Other fuels**: The national approach considers waste as an additional fuel type (municipal and industrial waste, sludge). Ninety per cent of CO_2 emissions from waste-burning are considered as biogenic.
Belgium				CO_2-emissions from the reference approach have not been reported.
Bulgaria	44,573	44,513	0.14	
Canada	536,175	491,410	9.11	This comparison as programmed in the CRF is not suitable for the Canadian inventory since our national approach does not include fossil fuel based CO_2 from various industrial processes such as ammonia production and aluminium production. When these sources are included in the national approach totals for energy, the two match quite closely.
Czech Republic	115,136	117,501	-2.01	
Denmark		54,561		CO_2 emissions from the reference approach were not reported.
Estonia	16,425	16,425	0.00	
Finland	56,845	56,781	0.11	The relatively high differences in liquid fuels CO_2 emissions is due to statistical difference in national balance. In the national approach, statistical differences arising from CO_2 calculations have not been included in total consumption.
France	N/A	379,591		Detailed data for the reference approach are not available at this time. The same method as that of previous years has been used for the sectoral approach.
Germany		832,036		CO_2 emissions from the reference approach were not reported for the year 1999.
Greece	90,235	90,471	-0.03	
Hungary	56,900	56,490	0.73	
Iceland	1,892	1,930	-1.97	
Ireland	40,856	39,603	3.17	The difference is due largely to the inclusion of 17.166 PJ of natural gas in the reference approach which is used in industry feedstocks and therefore omitted from the national approach.
Italy	416,909	429,759	-2.99	

CO_2 emissions from total fuel combustion

	Reference approach	Sectoral approach	Difference	Explanation for difference as reported in table 1.A(c) of the CRF
	Gg CO_2		(%)	
Japan	1,150,549	1,147,945	0.23	Difference of "CO_2 emissions" was caused by using different "emission factors" and "Fraction of carbon stored" between the reference approach and the national approach. "Emission factors" and "Fraction of carbon stored" used in the national approach were indicated in Environmental Agency The Estimation of CO_2 Emissions in Japan (1992)
Latvia	7,379	7,385	-0.06	The Party explained that this was owing to statistical differences.
Luxembourg		4,740		Emissions according to the reference approach were not reported.
Netherlands	167,331	170,619	-1.93	The Party gives the following explanation for the differences: The energy consumption in the national approach is based on the data from the national inventory. These fuel data are not complete because: 1) Not all CO_2 emissions (from combustion) submitted by industry are accompanied by fuel data in the inventory. 2) In industry reports some of the CO_2 emissions from combustion are allocated as process emissions and thus the corresponding fuel data are not incorporated in the totals for the fuel data. 3) Industries may calculate and report actual CO_2 emissions from energy used as chemical feedstock using different overall CO_2 emission factors for the amount of energy carriers converted into products than used in the reference approach for estimating non-reported feedstock emissions. 4) Industry firms report more heavy fuels used as chemical feedstock than the energy statistics used in the reference approach. The extent of these causes may differ from year to year, which then also causes the fluctuations in the difference between the reference approach and the national approach. In addition, the reference approach figures are calculated using preliminary values for the carbon content of crude oil and NGL. For more information see the national inventory report.
New Zealand	28,076	26,984	4.05	The Party attributes the difference to insufficient data breakdown being available, where the data for manufacture of solid fuels and other energy industries has been manually included in the appropriate final totals.
Norway	34,013	31,728	7.20	The Party explains the differences as follows: 1) The sum of statistical differences in 1999: 700 ktonnes CO_2. 2) Combustion of waste is not included in the reference approach: about 100 ktonnes CO_2 3) Furthermore, combustion of hazardous waste apart from waste oil and landfill gas are also not included in the reference approach. 'Other': Cell formula E12 has been altered in order to sum emission figures up to the Norwegian national total (includes emissions from combustion of methane).
Portugal		52,449		CO_2 emissions from the reference approach were not reported.
Slovakia	41,326	40,783	1.33	The Party explains this anomaly by highlighting the fact that two independent data sets of fuels are used in determining emissions for the two approaches.
Spain	259,637	256,801	1.10	
Sweden	53,520	51,722	5.50	For comparison of emissions from the reference approach and the sectoral approach for 1999, the Party refers to the Appendix II of the Swedish national inventory report for further information.
Switzerland	41,256	41,104	0.37	The difference is mainly due to the differences in energy consumption, i.e. different conversion factors in the reference approach (IPCC factors) and national approach (National factors) as well as fuel allocation problems.
United Kingdom	541,095	509,917	6.11	The following is an explanation from the Party for the discrepancies: A significant proportion of fuel consumption emissions occur in 1.B.1.b Solid fuel transformation, 2.C Metal production, 2.B.1 Ammonia production. Including these sources in 1.A Energy, the comparison reduces the discrepancy to 4.8 per cent. This discrepancy arises from three sources: (I) The statistical difference between 'apparent consumption' used in the reference inventory and 'actual consumption' used in the sectoral inventory. This statistical difference results from losses and errors in the estimates. (2) The sectoral inventory includes emissions from the non-energy use of fuel where they can be specifically identified, e.g. catalytic crackers, iron & steel, lubricants combustion and ammonia production. The reference approach implicitly treats the non-energy use of fuel as if it were combustion. A correction is then applied by deducting an estimate of carbon stored from non-energy fuel use. The carbon stored is estimated from an approximate procedure which does not identify specific processes. The result is that the reference approach is based on a higher estimate of non-energy use emissions than the sectoral inventory. (3) The reference approach uses data on primary fuels such as crude oil and natural gas liquids which are then corrected for imports, exports and stock changes of secondary fuels. Thus the estimates obtained will be highly dependent on the default carbon contents used for the primary fuels. The sectoral approach is based wholly on the consumption of secondary fuels where the carbon contents are known with greater certainty. In particular the carbon contents and calorific values of the primary liquid fuels are likely to vary more than those of secondary fuels.
United States of America	5,485,807	5,453,088		Although theoretically the two methods should arrive at the same estimate for USA energy consumption, the reference approach provides an energy total that is 2.1 per cent lower than the sectoral approach for 1999. The greatest difference lies in the higher estimate of petroleum consumption using the sectoral approach (3.9 %). Table 1.A(b) - The United States reference approach is provided in a separate Excel spreadsheet and is more detailed than this table allows. Specifically, the fuel types provided in the CRF tables differ from the fuel types as defined in the United States, and no "other" options were offered in the CRF table. The United States suggests revising the table to allow for additional fuel types.

Energy - Stationary combustion: liquid fuels (1999)

	Key source	Percentage of national total	IEF in CRF based on	Stationary combustion - liquid fuels (CO_2): 1.A.1 Energy industries: Methods and EF used[c]: Methods	EF	CO2 IEF: Total	Public electricity and heat production	Petroleum refining	Manufacture of solid fuels and other energy industries	1.A.2 Manufacturing industries and construction: Methods and EF used[d]: Methods	EF	CO_2 IEF: Total	1.A.4 Other sectors: Methods and EF used[e]: Methods	EF	CO_2 IEF: Total	Commercial/ institutional	Residential	Agricultural/ forestry/ fisheries
		(%)				(t/TJ)						(t/TJ)			(t/TJ)			
Australia	L	7.0	GCV	T2	CS	68.37	69.46	67.91	69.09	T2	CS	67.46	T1, T2	CS	66.51	61.63	62.66	68.84
Austria	L	15.4	NCV	C	CS	40.09	79.23			C	CS	63.53	CS	CS	74.68	75.52	74.74	73.67
Belgium[a]																		
Bulgaria	L	7.3	NCV	T3	CS, D	5.49	73.07	2.08	69.25	T2	CS, D	75.75	T2	CS, D	73.29	74.05	65.24	74.48
Canada	L	9.4	GCV	T1	CS	66.47	71.98	64.38		T1	CS	48.89	T1	CS	85.42	99.80	77.19	92.73
Czech Republic	L	8.2	NCV	T1	D	74.65	75.88	73.48	71.40	T1	D	64.01	T1	D	69.73	72.05	62.44	73.33
Denmark	L	18.0	NCV			56.58	56.18	58.27				78.21			73.03	64.06	73.91	74.37
Estonia	L	11.2	NCV			75.27	75.27					72.61			69.84	72.31	69.72	71.66
Finland	L	18.7	NCV	CS (T2)	CS/PS/D	73.16	76.41	71.66		CS (T2)	CS/PS/D	73.30	CS (T2, T1)	CS/D	73.67	74.33	73.41	73.60
France	L	18.4	NCV	C	CS	69.72	77.46	66.30	77.97	C	CS	74.55	C	CS	73.39	74.27	72.95	73.25
Germany[a]																		
Greece	L	18.0	NCV	C	C and CS	75.03	75.96	73.16		C	C	61.90	C	C	72.89	72.14	72.93	74.90
Hungary	L	9.0	NCV	D	D	76.58	76.58			D	D	41.77	D	D	64.70	67.90	62.65	72.07
Iceland	L	33.1	NCV	T1	D	74.00	74.00	NO	NO	T1	D	81.21	T1	D	73.48	NO	73.40	73.48
Ireland	L	19.9	NCV	T1	PS, CS	78.51	78.58	73.96		T1	PS, CS	73.91	T1	CS	72.53	73.74	71.29	73.30
Italy	L	23.9	NCV			75.49	76.69	71.84	78.33			79.75			74.19	74.43	74.25	74.02
Japan	L	30.8	NCV	T1, RA, CS	D, CS	69.49	NE	NE	NE	T1, RA, CS	D, CS	72.38	T1, RA, CS	D, CS	70.08	70.71	68.32	72.39
Latvia	L	22.0	NCV			76.50	76.50					75.30			71.02	73.31	62.09	73.98
Luxembourg	L	16.7	NCV			73.02	73.02					67.96			70.32	70.00	70.00	73.82
Netherlands	L	5.4	NCV			65.17	76.94	65.02	74.36			52.85			73.56	74.20	73.00	74.82
New Zealand	L	3.2	GCV	T1	CS/D	73.64	68.06	73.65		T1	CS/D	68.42	T1	CS/D	68.14	68.58	60.82	68.90
Norway	L	17.4	NCV	T2	CS	59.59	73.62	56.28	73.55	T2	CS	68.36	T2	CS	73.45	73.57	73.20	73.52
Portugal	L	26.5	NCV	C+T2	C	71.71	72.57	69.79		C+T2	C	69.77	C+T2	C	68.91	71.19	65.06	73.29
Slovakia	L	5.9	NCV	T1	D	50.00	50.00	IE					T1	D	32.37	32.37	NE	IE
Spain[b]																		
Sweden	L	31.5	NCV	CS	CS	75.86	75.26	76.20	75.30	CS	CS	73.60	CS	CS	74.71	74.64	75.32	72.74
Switzerland	L	31.9	NCV	RA, C	RA, CS	76.45	75.58	77.00		C	CS	73.99	C	CS	73.70	73.70	73.70	73.70
United Kingdom	L	9.8	NCV	T2	CS	71.51	75.54	71.59	61.91	T2	CS	72.53	T2	CS	72.13	73.62	71.07	72.88
United States	L	9.7	GCV	T1	CS	73.80	73.80	IE	IE	T1	CS	34.28	T1	CS	66.09	68.06	65.10	IE

[a] The Party provided insufficient data.

[b] The Party did not report liquid fuels from stationary combustion.

[c] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 1.A.1 Energy industries.

[d] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 1.A.2 Manufacturing industries and construction.

[e] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 1.A.4 Other sectors.

Energy - Stationary combustion: solid fuels (1999)

	Stationary combustion - Solid fuels (CO_2)																
	Key source	Percentage of national total	IEF in CRF based on	1.A.1 Energy industries					1.A.2 Manufacturing industries and construction			1.A.4 Other sectors					
				Methods and EF used[c]		CO_2 IEF			Methods and EF used[d]		CO_2 IEF	Methods and EF used[e]		CO_2 IEF			
				Methods	EF	Total	Public electricity and heat production	Manufacture of solid fuels and other energy industries	Methods	EF	Total	Methods	EF	Total	Commercial/ institutional	Residential	Agricultural/ forestry/ fisheries
		(%)				(t/TJ)					(t/TJ)			(t/TJ)			
Australia	L	38.1	GCV	T2	CS	90.45	90.94	55.09	T2	CS	97.39	T1, T2	CS	95.95	95.83	97.65	NA
Austria	L	7.0	NCV	C	CS	91.31	91.31		C	CS	7.35	CS	CS	93.37	95.63	93.16	
Belgium[a]																	
Bulgaria	L	35.2	NCV	T3	CS, D	78.37	108.59	4.90	T2	CS, D	89.16	T2	CS, D	99.58	97.58	99.69	100.38
Canada	L	14.7	GCV	T1	CS	88.12	88.16	79.47	T1	CS	31.12	T1	CS	90.21		90.21	
Czech Republic	L	54.1	NCV	T1	D	99.04	98.86	103.97	T1	D	106.38	T1	D	98.33	99.32	97.96	99.38
Denmark	L	25.8	NCV			95.00	95.00				95.00			95.00		95.00	95.00
Estonia	L	58.5	NCV			101.02	101.02				104.28			98.55	96.30	98.58	96.30
Finland	L	18.5	NCV	CS (T2)	CS/PS/D	91.34	92.71	39.69	CS (T2)	CS/PS/D	97.69	CS (T2, T1)	CS/D	92.75	100.00	93.00	92.55
France	L	8.1	NCV	C	CS	105.90	104.97	106.20	C	CS	114.85	C	CS	95.00	95.00	95.00	95.00
Germany[a]																	
Greece	L	34.7	NCV	C	C and CS	122.11	122.11		C	C	93.26	C	C	96.62		95.27	99.17
Hungary	L	17.7	NCV	D	D	96.19	96.19		D	D	102.11	D	D	94.14	94.84	93.99	94.47
Iceland			NCV				NO		T1	D	92.71				NO	NO	NO
Ireland	L	16.6	NCV	T1	PS, CS	97.67	97.67		T1	PS, CS	98.55	T1	CS	98.83	98.88	98.83	NO
Italy	L	8.5	NCV			117.12	106.72	235.63			67.31			102.24	102.24	102.24	
Japan	L	26.6	NCV	T1, RA, CS	D, CS	97.85	NE	NE	T1, RA, CS	D, CS	101.33	T1, RA, CS	D, CS	105.80	106.15	102.60	
Latvia	L	4.7	NCV			100.56	100.56				100.96			93.41	93.01	94.39	93.78
Luxembourg	L	1.2	NCV								97.12			100.67	100.67	100.67	
Netherlands	L	13.2	NCV			108.17	108.28				2,020.51			98.36	94.00	103.00	94.00
New Zealand	L	4.0	GCV	T1	CS/D	92.99	92.99		T1	CS/D	76.42	T1	CS/D	91.20	91.20	91.20	91.20
Norway	L	1.0	NCV	T2	CS	86.12	86.12		T2	CS	92.91	T2	CS	94.08		94.37	86.12
Portugal	L	14.7	NCV	C+T2	C	92.05	92.02	96.30	C+T2	C	106.42						
Slovakia	L	33.4	NCV	T1	D	97.13	97.13					T1	D	93.88	95.33	93.10	
Spain[b]																	
Sweden	L	9.7	NCV	CS	CS	96.22	100.54	79.00	CS	CS	87.00						
Switzerland	L	0.2	NCV						C	CS	94.00	C	CS	94.00	94.00	94.00	
United Kingdom	L	19.4	NCV	T2	CS	88.07	88.00	91.32	T2	CS	127.05	T2	CS	89.76	87.49	89.95	88.09
United States	L	29.8	GCV	T1	CS	88.62	88.62	IE	T1	CS	87.75	T1	CS	89.47	89.47	89.47	IE

[a] The Party provided insufficient data.

[b] The Party did not report solid fuels from stationary combustion.

[c] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 1.A.1 Energy industries.

[d] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 1.A.2 Manufacturing industries and construction.

[e] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 1.A.4 Other sectors.

Energy - Stationary combustion: gaseous fuels (1999)

	Stationary combustion - gaseous fuels (CO_2)																	
	Key source	Percentage of national total	IEF in CRF based on	1.A.1 Energy industries						1.A.2 Manufacturing industries and construction			1.A.4 Other sectors					
				Methods and EF used[c]		CO_2 IEF				Methods and EF used[d]		CO_2 IEF	Methods and EF used[e]		CO_2 IEF			
				Methods	EF	Total	Public electricity and heat production	Petroleum refining	Manufacture of solid fuels and other energy industries	Methods	EF	Total	Methods	EF	Total	Commercial/ institutional	Residential	Agricultural/ forestry/ fisheries
		(%)				(t/TJ)						(t/TJ)			(t/TJ)			
Australia	L	8.9	GCV	T2	CS	51.29	51.40	51.15	51.15	T2	CS	50.84	T1, T2	CS	51.19	51.18	51.20	51.15
Austria	L	19.2	NCV	C	CS	55.00	55.00		55.00	C	CS	54.15	CS	CS	55.00	55.00	55.00	
Belgium[a]																		
Bulgaria	L	6.9	NCV	T3	CS, D	55.82	55.82	55.82	55.82	T2	CS, D	55.82	T2	CS, D	55.82	55.82	55.82	55.82
Canada	L	20.7	GCV	T1	CS	51.41	49.59	49.59	52.18	T1	CS	33.91	T1	CS	49.59	49.59	49.59	49.59
Czech Republic	L	12.8	NCV	T1	D	55.82	55.82	55.82		T1	D	55.82	T1	D	55.82	55.82	55.82	55.82
Denmark	L	14.3	NCV			56.90	56.89		56.90			56.90			51.65	49.56	56.90	30.42
Estonia	L	6.8	NCV			55.82	55.82					55.82			55.82	55.82	55.82	55.82
Finland	L	10.4	NCV	CS (T2)	CS/PS/D	55.82	55.82	55.82	NO	CS (T2)	CS/PS/D	56.23	CS (T2, T1)	CS/D	55.81	55.78	55.82	55.88
France	L	13.0	NCV	C	CS	57.00	57.00	57.03		C	CS	56.96	C	CS	57.00	57.00	57.00	57.00
Germany[a]																		
Greece	L	2.1	NCV	C	C and CS	55.82	55.82		55.85	C	C	41.52	C	C	55.82	55.82	55.83	
Hungary	L	26.9	NCV	D	D	57.53	57.53			D	D	55.02	D	D	55.82	55.82	55.82	55.82
Iceland						NO	NO	NO	NO			NO			NO	NO	NO	NO
Ireland	L	9.2	NCV	T1	PS, CS	54.99	54.56	65.00	NO	T1	PS, CS	54.94	T1	CS	54.94	54.94	54.94	NO
Italy	L	23.3	NCV			56.03	56.14	55.44	55.44			55.44			55.46	55.46	55.46	55.46
Japan	L	11.0	NCV	T1, RA, CS	D, CS	54.84	NE	NE	NE	T1, RA, CS	D, CS	51.68	T1, RA, CS	D, CS	51.55	51.55	51.55	
Latvia	L	20.9	NCV			55.83	55.83					55.80			55.84	55.70	55.99	55.52
Luxembourg			NCV			56.00	56.00					55.00			55.00	55.00	55.00	
Netherlands	L	34.3	NCV			54.90	54.84	54.31	56.00			57.77			56.00	56.01	55.95	56.10
New Zealand	L	12.2	GCV	T1	CS/D	53.19	52.20	60.86	NE	T1	CS/D	31.98	T1	CS/D	52.08	52.08	52.08	NE
Norway	L	13.0	NCV	T2	CS	57.35	58.00		57.35	T2	CS	58.35	T2	CS	58.00	58.00		
Portugal	L	1.3	NCV	C+T2	C	56.05	56.05			C+T2	C	56.04	C+T2	C	56.05	56.07	56.04	56.07
Slovakia	L	25.8	NCV	T1	D	57.48	57.48	IE	IE			IE	T1	D	57.48	57.48	57.48	IE
Spain[b]																		
Sweden	L	2.4	NCV	CS	CS	56.50	56.50			CS	CS	56.50	CS	CS	56.86	57.48	56.50	56.50
Switzerland	L	11.2	NCV	RA, C	RA, CS	57.48	55.00	59.30	NO	C	CS	55.00	C	CS	55.00	55.00	55.00	55.00
United Kingdom	L	31.5	NCV	T2	CS	61.04	58.64	57.96	70.50	T2	CS	57.96	T2	CS	57.96	57.96	57.96	57.96
United States	L	16.5	GCV	T1	CS	50.04	50.04	IE	IE	T1	CS	48.38	T1	CS	50.04	50.04	50.04	IE

[a] The Party provided insufficient data.

[b] The Party did not report gaseous fuels from stationary combustion.

[c] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 1.A.1 Energy industries.

[d] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 1.A.2 Manufacturing industries and construction.

[e] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 1.A.4 Other sectors.

Energy - Stationary combustion: other fuels (1999)

	Stationary Combustion - Other fuels (CO_2)															
	Key source	Percentage of national total	IEF in CRF based on	1.A.1 Energy industries				1.A.2 Manufacturing industries and construction			1.A.4 Other sectors					
				Methods and EF used		CO_2 IEF		Methods and EF used		CO_2 IEF	Methods and EF used		CO_2 IEF			
				Methods	EF	Total	Public electricity and heat production	Methods	EF	Total	Methods	EF	Total	Commercial/ institutional	Residential	Agricultural/ forestry/ fisheries
		(%)				(t/TJ)				(t/TJ)				(t/TJ)		
Australia						NA	NA							NA	NA	NA
Austria			NCV					C	CS	7.5	CS	CS	10.0	10.0		
Belgium																
Bulgaria						NO	NO									
Canada																
Czech Republic																
Denmark																
Estonia			NCV										64.9	86.6	62.4	98.3
Finland	L	10.2	NCV	CS (T2)	CS/PS/D	102.9	102.9	CS (T2)	CS/PS/D	99.9	CS (T2, T1)	CS/D	104.9	105.2	104.9	104.9
France	L	4.8	NCV	C	CS	103.9	56.9	C	CS	49.4	C	CS	57.0	57.0	57.0	
Germany																
Greece						NO	NO									
Hungary			NCV	D	D	79.9	79.9	D	D	30.6						
Iceland			NCV					T1	D	99.7				NO	NO	NO
Ireland			NCV	T1	PS, CS	54.9	54.9							NO	NO	NO
Italy	L	1.3	NCV			94.2	93.9			93.9			56.7	38.5	65.1	
Japan						NO	NO			NO			NO	NO	NO	NO
Latvia																
Luxembourg																
Netherlands	L	6.1	NCV			1239.2	1239.2			20717.7						
New Zealand						NO	NO			NO				NO	NO	NO
Norway			NCV	T2	CS	25.2	25.2				T2	CS	4.8	4.8		
Portugal			NCV					C+T2	C	76.0						
Slovakia	L	4.3	NCV	T1	D	50.0	50.0				T1	D	57.0	57.0		IE
Spain																
Sweden	L	1.5	NCV	CS	CS	35.4	35.4	CS	CS	59.5						
Switzerland	L	5.0	NCV			NO	NO	C	CS	75.9	C	CS	73.7	NO	NO	73.7
United Kingdom			NCV	T2	CS	34.5	34.5	T2	CS	94.3						
United States			GCV	T1	CS	7.1	7.1							NE	NE	IE

Note

This table is provided for the purpose of completeness. Parties reported emissions and activity data from different fuels under Other fuels in the CRF and, consequently, the CO_2 IEFs may not be comparable.

Energy - Energy industries: all fuel types

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	141,807									188,071
Austria	12,377	13,400	9,808	9,133	9,395	10,922	11,406	11,870	10,848	11,373
Belgium									30,015	26,444
Bulgaria										26,322
Canada	144,277	143,735	152,371	143,826	146,647	152,961	152,221	159,790	177,041	180,047
Czech Republic										53,848
Denmark	26,216	35,142	29,778	31,268	35,624	32,153	44,379	35,275	31,506	28,237
Estonia										13,478
Finland	18,517	19,107	17,510	19,945	24,645	22,456	27,509	24,673	21,395	21,029
France	65,495	77,232	69,530	56,161	52,439	55,169	59,468	55,984	68,432	61,389
Germany	412,896	398,899	376,304	366,002	362,678	356,954	358,448	341,967	344,232	329,754
Greece	43,302	42,149	44,091	44,366	46,317	45,056	44,205	47,668	50,254	50,220
Hungary										23,614
Iceland										3
Ireland										15,728
Italy									151,975	146,563
Japan	338,908	341,967	349,458	331,667	369,322	359,370	360,447	356,859	349,661	371,437
Latvia									3,543	3,116
Luxembourg										103
Netherlands	52,117	52,190	54,130	53,800	55,980	57,314	58,900	57,902	59,957	57,041
New Zealand										6,629
Norway	7,395									9,661
Portugal	15,910	16,586	19,534	17,780	17,121	19,752	16,342	16,877	18,740	18,160
Slovakia										29,215
Spain	74,783	75,028	83,033	77,114	78,029	83,568	71,307	81,832	81,378	88,576
Sweden	10,170	11,280	11,319	10,829	13,119	11,576	16,669	11,491	12,671	11,129
Switzerland	891	1,201	1,280	962	1,039	1,094	1,267	1,176	1,423	1,126
United Kingdom	228,089	226,050	215,977	199,254	196,560	197,766	197,683	183,604	188,985	179,116
United States	1,757,344	1,736,959	1,735,396	1,793,606	1,813,883	1,810,565	1,880,288	1,953,514	2,010,670	1,953,353

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										32.6
Austria	8.3	-26.8	-6.9	2.9	16.3	4.4	4.1	-8.6	4.8	-8.1
Belgium										
Bulgaria										
Canada	-0.4	6.0	-5.6	2.0	4.3	-0.5	5.0	10.8	1.7	24.8
Czech Republic										
Denmark	34.1	-15.3	5.0	13.9	-9.7	38.0	-20.5	-10.7	-10.4	7.7
Estonia										
Finland	3.2	-8.4	13.9	23.6	-8.9	22.5	-10.3	-13.3	-1.7	13.6
France	17.9	-10.0	-19.2	-6.6	5.2	7.8	-5.9	22.2	-10.3	-6.3
Germany										
Greece	-2.7	4.6	0.6	4.4	-2.7	-1.9	7.8	5.4	-0.1	16.0
Hungary										
Iceland										
Ireland										
Italy									-3.6	
Japan	0.9	2.2	-5.1	11.4	-2.7	0.3	-1.0	-2.0	6.2	9.6
Latvia										
Luxembourg										
Netherlands									-4.9	9.4
New Zealand										
Norway										30.6
Portugal	4.2	17.8	-9.0	-3.7	15.4	-17.3	3.3	11.0	-3.1	14.1
Slovakia										
Spain	2.5	80.0	-59.2	9.2	55.4	-122.6	105.3	-4.5	72.0	18.4
Sweden	10.9	0.3	-4.3	21.1	-11.8	44.0	-31.1	10.3	-12.2	9.4
Switzerland	3.1	0.8	-3.2	0.8	0.6	1.7	-0.9	2.5	-3.0	26.4
United Kingdom	-20.4	-100.7	-167.2	-26.9	12.1	-0.8	-140.8	53.8	-98.7	-21.5
United States	-1.2	-0.1	3.4	1.1	-0.2	3.9	3.9	2.9	-2.9	11.2

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	8,780.09									8,920.45
Austria	1,849.78	2,320.08	1,866.24	2,055.28	1,883.79	1,648.46	1,511.38	2,047.69	2,201.51	2,257.61
Belgium										
Bulgaria										1,389.23
Canada	35,450.85	33,458.64	35,705.44	33,891.25	31,815.50	33,868.93	32,272.92	33,766.27	37,679.50	35,821.29
Czech Republic										1,711.80
Denmark	2,267.59	2,500.57	2,412.98	2,461.94	3,818.75	4,449.47	6,240.88	5,675.31	5,224.66	5,039.24
Estonia										1,320.78
Finland	2,606.90	2,638.30	2,486.40	2,481.50	3,009.30	2,972.40	3,145.10	2,608.10	2,843.60	2,871.40
France	20,926.34	25,556.56	22,435.66	19,658.38	19,988.93	21,239.90	21,144.49	21,921.93	24,124.77	22,648.50
Germany										
Greece	7,947.64	8,462.08	8,330.02	8,483.29	8,505.50	9,008.93	9,164.95	8,978.75	8,863.11	8,427.98
Hungary										4,199.46
Iceland										3.31
Ireland										4,601.72
Italy									90,311.00	79,231.50
Japan	161,303.41	154,718.75	159,106.38	133,523.79	157,787.38	136,610.21	128,391.17	112,703.18	104,344.15	104,763.35
Latvia									1,662.40	1,404.00
Luxembourg										3.24
Netherlands	7,865.30								8,936.01	9,072.37
New Zealand										218.57
Norway	1,942.12									2,694.34
Portugal	8,006.57	8,227.58	10,921.04	8,325.50	7,243.28	8,422.98	5,917.64	5,917.64	8,518.61	8,318.10
Slovakia										2,998.16
Spain										
Sweden	4,269.46	5,093.38	4,871.39	4,749.22	7,027.01	5,903.40	8,881.32	5,830.84	6,360.97	5,777.78
Switzerland										212.75
United Kingdom	38,940.13	37,801.46	35,433.73	33,958.96	30,845.72	30,875.84	30,070.15	24,514.14	22,939.70	21,553.12
United States	96,804.12	91,150.13	73,887.91	81,805.36	74,986.19	50,953.25	56,029.47	64,098.22	90,760.75	73,400.41

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										1.6
Austria	25.4	-19.6	10.1	-8.3	-12.5	-8.3	35.5	7.5	2.5	22.0
Belgium										
Bulgaria										
Canada	-5.6	6.7	-5.1	-6.1	6.5	-4.7	4.6	11.6	-4.9	1.0
Czech Republic										
Denmark	10.3	-3.5	2.0	55.1	16.5	40.3	-9.1	-7.9	-3.5	122.2
Estonia										
Finland	1.2	-5.8	-0.2	21.3	-1.2	5.8	-17.1	9.0	1.0	10.1
France	22.1	-12.2	-12.4	1.7	6.3	-0.4	3.7	10.0	-6.1	8.2
Germany										
Greece	6.5	-1.6	1.8	0.3	5.9	1.7	-2.0	-1.3	-4.9	6.0
Hungary										
Iceland										
Ireland										
Italy									-12.3	
Japan	-4.1	2.8	-16.1	18.2	-13.4	-6.0	-12.2	-7.4	0.4	-35.1
Latvia										
Luxembourg										
Netherlands									1.5	15.3
New Zealand										
Norway										38.7
Portugal	2.8	32.7	-23.8	-13.0	16.3	-29.7	0.0	44.0	-2.4	3.9
Slovakia										
Spain										
Sweden	19.3	-4.4	-2.5	48.0	-16.0	50.4	-34.3	9.1	-9.2	35.3
Switzerland										
United Kingdom	-11.4	-23.7	-14.7	-31.1	0.3	-8.1	-55.6	-15.7	-13.9	-44.7
United States	-5.8	-18.9	10.7	-8.3	-32.0	10.0	14.4	41.6	-19.1	-24.2

Energy - Energy industries by fuel type: solid

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	119,873									161,067
Austria	6,379	6,932	4,088	3,129	3,233	4,517	4,664	5,007	3,510	3,813
Belgium										
Bulgaria										22,020
Canada	78,674	82,365	85,180	77,859	81,052	83,079	84,800	91,329	97,337	95,639
Czech Republic										49,539
Denmark	22,457	30,903	25,682	26,935	29,151	24,251	34,011	25,005	20,858	17,567
Estonia										10,960
Finland	9,279	9,204	7,536	9,328	12,565	9,724	13,895	12,044	8,171	8,309
France	38,376	45,284	40,588	30,247	26,622	28,203	31,994	27,830	37,851	32,457
Germany										
Greece	35,257	33,594	35,672	35,798	37,714	35,953	34,941	38,466	40,501	39,764
Hungary										11,892
Iceland										
Ireland										7,454
Italy									31,584	30,268
Japan	100,499	105,104	108,854	116,531	124,765	134,545	139,789	148,496	146,838	162,185
Latvia									315	184
Luxembourg										
Netherlands	27,025								27,161	23,491
New Zealand										1,139
Norway	50									60
Portugal	7,903	8,358	8,613	9,455	9,878	11,329	10,424	10,424	9,891	9,673
Slovakia										15,035
Spain										
Sweden	4,873	4,938	5,016	4,583	4,618	4,317	5,388	4,209	4,748	3,905
Switzerland										NO
United Kingdom	180,801	179,415	168,239	140,228	132,575	126,668	117,122	99,703	102,662	86,085
United States	1,509,262	1,494,955	1,511,979	1,566,740	1,577,337	1,587,739	1,677,667	1,729,688	1,743,996	1,711,931

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										34.4
Austria	8.7	-41.0	-23.5	3.3	39.7	3.2	7.4	-29.9	8.6	-40.2
Belgium										
Bulgaria										
Canada	4.7	3.4	-8.6	4.1	2.5	2.1	7.7	6.6	-1.7	21.6
Czech Republic										
Denmark	37.6	-16.9	4.9	8.2	-16.8	40.2	-26.5	-16.6	-15.8	-21.8
Estonia										
Finland	-0.8	-18.1	23.8	34.7	-22.6	42.9	-13.3	-32.2	1.7	-10.5
France	18.0	-10.4	-25.5	-12.0	5.9	13.4	-13.0	36.0	-14.3	-15.4
Germany										
Greece	-4.7	6.2	0.4	5.4	-4.7	-2.8	10.1	5.3	-1.8	12.8
Hungary										
Iceland										
Ireland										
Italy									-4.2	
Japan	4.6	3.6	7.1	7.1	7.8	3.9	6.2	-1.1	10.5	61.4
Latvia										
Luxembourg										
Netherlands									-13.5	-13.1
New Zealand										
Norway										20.7
Portugal	5.8	3.1	9.8	4.5	14.7	-8.0	0.0	-5.1	-2.2	22.4
Slovakia										
Spain										
Sweden	1.3	1.6	-8.6	0.8	-6.5	24.8	-21.9	12.8	-17.8	-19.9
Switzerland										
United Kingdom	-0.8	-6.2	-16.6	-5.5	-4.5	-7.5	-14.9	3.0	-16.1	-52.4
United States	-0.9	1.1	3.6	0.7	0.7	5.7	3.1	0.8	-1.8	13.4

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	13,154									18,084
Austria	4,147	4,146	3,854	3,949	4,279	4,756	5,231	4,815	5,136	5,302
Belgium										
Bulgaria										2,913
Canada	30,152	27,911	31,486	32,076	33,780	36,013	35,148	34,695	42,025	48,587
Czech Republic										2,597
Denmark	1,491	1,739	1,683	1,871	2,654	3,453	4,127	4,595	5,423	5,630
Estonia										1,197
Finland	2,659	2,775	2,998	3,117	3,495	3,552	3,920	4,000	4,738	4,756
France	1,583	1,891	2,060	2,176	2,092	1,966	2,700	2,697	2,670	2,244
Germany										
Greece	97	92	89	85	98	94	99	224	890	2,028
Hungary										7,456
Iceland										
Ireland										3,598
Italy									29,888	36,795
Japan	77,105	82,144	81,498	81,613	86,770	88,215	92,267	95,660	98,478	104,489
Latvia									1,566	1,528
Luxembourg										100
Netherlands	15,520								21,958	22,557
New Zealand										4,911
Norway	5,306									6,778
Portugal								56	331	169
Slovakia										8,942
Spain										
Sweden	435	527	668	725	631	692	685	690	663	670
Switzerland										913
United Kingdom	8,215	8,698	12,139	24,837	32,621	39,690	49,863	58,635	62,534	70,675
United States	151,058	150,646	149,321	144,867	161,381	171,751	146,457	159,587	175,781	167,978

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										37.5
Austria	0.0	-7.1	2.5	8.4	11.2	10.0	-8.0	6.7	3.2	27.9
Belgium										
Bulgaria										
Canada	-7.4	12.8	1.9	5.3	6.6	-2.4	-1.3	21.1	15.6	61.1
Czech Republic										
Denmark	16.7	-3.3	11.2	41.9	30.1	19.5	11.3	18.0	3.8	277.7
Estonia										
Finland	4.3	8.0	4.0	12.1	1.6	10.4	2.0	18.5	0.4	78.8
France	19.4	9.0	5.6	-3.9	-6.0	37.3	-0.1	-1.0	-16.0	41.7
Germany										
Greece	-4.7	-3.2	-5.0	15.3	-4.4	5.4	126.4	298.3	127.8	1991.7
Hungary										
Iceland										
Ireland										
Italy									23.1	
Japan	6.5	-0.8	0.1	6.3	1.7	4.6	3.7	2.9	6.1	35.5
Latvia										
Luxembourg										
Netherlands									2.7	45.3
New Zealand										
Norway										27.7
Portugal									-48.8	
Slovakia										
Spain										
Sweden	21.2	26.7	8.6	-13.0	9.7	-1.1	0.8	-4.0	1.2	54.1
Switzerland										
United Kingdom	5.9	39.6	104.6	31.3	21.7	25.6	17.6	6.6	13.0	760.4
United States	-0.3	-0.9	-3.0	11.4	6.4	-14.7	9.0	10.1	-4.4	11.2

Energy - Energy Industries

Contribution (%) of each fuel type to total CO_2 emissions 1990 and 1999

	Liquid fuels		Solid fuels		Gaseous fuels	
	1990	1999	1990	1999	1990	1999
Australia	6.2	4.7	84.5	85.6	9.3	9.6
Austria	14.9	19.9	51.5	33.5	33.5	46.6
Belgium						
Bulgaria		5.3		83.7		11.1
Canada	24.6	19.9	54.5	53.1	20.9	27.0
Czech Republic		3.2		92.0		4.8
Denmark	8.6	17.8	85.7	62.2	5.7	19.9
Estonia		9.8		81.3		8.9
Finland	14.1	13.7	50.1	39.5	14.4	22.6
France	32.0	36.9	58.6	52.9	2.4	3.7
Germany						
Greece	18.4	16.8	81.4	79.2	0.2	4.0
Hungary		17.8		50.4		31.6
Iceland		100.0		0.0		0.0
Ireland		29.3		47.4		22.9
Italy		54.1		20.7		25.1
Japan	47.6	28.2	29.7	43.7	22.8	28.1
Latvia		45.1		5.9		49.0
Luxembourg		3.1		0.0		96.9
Netherlands	15.1	15.9	51.9	41.2	29.8	39.5
New Zealand		3.3		17.2		74.1
Norway	26.3	27.9	0.7	0.6	71.8	70.2
Portugal	50.3	45.8	49.7	53.3	0.0	0.9
Slovakia		10.3		51.5		30.6
Spain					0.0	
Sweden	42.0	51.9	47.9	35.1	4.3	6.0
Switzerland		18.9				81.1
United Kingdom	17.1	12.0	79.3	48.1	3.6	39.5
United States	5.5	3.8	85.9	87.6	8.6	8.6

Energy - Manufacturing industries and construction, all fuel types

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	50,029	49,405	47,228	47,423	48,180	51,144	52,159	51,387	51,174	51,661
Austria	7,434	6,815	6,949	6,849	6,661	7,510	8,780	9,028	9,655	8,630
Belgium									31,878	30,478
Bulgaria										9,488
Canada	62,090	58,301	57,585	57,401	60,670	61,490	64,199	64,334	61,109	60,137
Czech Republic										34,156
Denmark	6,040	6,369	6,467	6,416	6,513	6,070	6,332	6,305	6,079	6,121
Estonia										660
Finland	14,358	13,840	13,505	13,205	13,987	13,866	13,534	15,194	15,282	15,844
France	76,919	77,956	75,552	70,782	74,188	73,393	74,173	75,208	77,045	77,213
Germany	196,457	173,008	159,701	147,771	149,378	149,050	145,486	147,034	142,729	139,028
Greece	9,792	9,640	9,285	9,028	8,870	9,603	10,341	10,531	10,696	9,406
Hungary										9,924
Iceland										305
Ireland										4,238
Italy									77,811	80,484
Japan	339,227	337,590	327,780	332,138	340,622	345,719	352,685	353,503	343,015	357,939
Latvia									1,275	1,146
Luxembourg										1,785
Netherlands	41,881	42,660	42,510	39,920	40,950	43,430	42,100	44,535	43,982	43,549
New Zealand										5,826
Norway	3,098									3,839
Portugal	8,797	9,062	8,938	8,809	9,325	9,045	9,500	9,500	9,537	10,354
Slovakia										
Spain	48,817	50,038	49,176	47,361	51,310	55,333	49,440	54,698	56,481	54,798
Sweden	11,615	11,539	10,261	11,418	12,861	13,370	12,784	12,997	12,660	11,991
Switzerland	5,237	5,410	4,994	4,862	4,861	5,098	4,853	4,736	4,893	5,499
United Kingdom	94,578	95,291	93,761	92,363	93,863	91,653	92,532	92,667	89,806	88,668
United States	1,023,471	1,007,631	1,064,906	1,062,396	1,090,872	1,101,048	1,140,592	1,141,146	1,113,319	1,155,610

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										3.3
Austria	-8.3	2.0	-1.4	-2.7	12.7	16.9	2.8	6.9	-10.6	16.1
Belgium										
Bulgaria										
Canada	-6.1	-1.2	-0.3	5.7	1.4	4.4	0.2	-5.0	-1.6	-3.1
Czech Republic										
Denmark	5.4	1.5	-0.8	1.5	-6.8	4.3	-0.4	-3.6	0.7	1.3
Estonia										
Finland	-3.6	-2.4	-2.2	5.9	-0.9	-2.4	12.3	0.6	3.7	10.4
France	1.3	-3.1	-6.3	4.8	-1.1	1.1	1.4	2.4	0.2	0.4
Germany	-11.9	-7.7	-7.5	1.1	-0.2	-2.4	1.1	-2.9	-2.6	-29.2
Greece	-1.6	-3.7	-2.8	-1.7	8.3	7.7	1.8	1.6	-12.1	-3.9
Hungary										
Iceland										
Ireland										
Italy									3.4	
Japan	-0.5	-2.9	1.3	2.6	1.5	2.0	0.2	-3.0	4.4	5.5
Latvia										
Luxembourg										
Netherlands									-1.0	4.0
New Zealand										
Norway										23.9
Portugal	3.0	-1.4	-1.4	5.9	-3.0	5.0	0.0	0.4	8.6	17.7
Slovakia										
Spain	2.5	-1.7	-3.7	8.3	7.8	-10.7	10.6	3.3	-3.0	12.3
Sweden	-0.7	-11.1	11.3	12.6	4.0	-4.4	1.7	-2.6	-5.3	3.2
Switzerland	3.3	-7.7	-2.6	0.0	4.9	-4.8	-2.4	3.3	12.4	5.0
United Kingdom	0.8	-1.6	-1.5	1.6	-2.4	1.0	0.1	-3.1	-1.3	-6.2
United States	-1.5	5.7	-0.2	2.7	0.9	3.6	0.0	-2.4	3.8	12.9

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	10,908									11,929
Austria	2,621	1,797	2,029	1,715	1,476	2,036	2,319	2,235	2,640	1,903
Belgium										
Bulgaria										3,688
Canada	15,451	13,177	12,511	12,824	13,559	12,395	12,735	12,367	11,793	11,238
Czech Republic										7,533
Denmark	3,363	3,569	3,411	3,136	2,714	2,981	3,107	2,642	2,525	2,495
Estonia										88
Finland	4,294	3,888	3,888	3,754	3,864	3,611	3,580	4,018	4,101	4,790
France	21,668	22,547	20,701	20,020	19,815	19,925	20,371	19,759	20,033	20,144
Germany										
Greece	5,479	5,217	5,232	4,862	4,900	5,654	6,487	6,820	6,557	6,009
Hungary										2,477
Iceland										268
Ireland										2,540
Italy									24,720	26,109
Japan	153,532	151,150	149,147	152,195	157,882	160,637	161,489	157,185	156,580	161,857
Latvia										625
Luxembourg										370
Netherlands	7,229								2,771	3,087
New Zealand										539
Norway	2,684									2,826
Portugal	6,013	6,270	6,113	6,058	6,566	6,639	7,046	7,046	7,153	7,491
Slovakia										
Spain										
Sweden	7,391	6,602	6,591	7,269	8,036	8,635	8,099	8,771	8,424	8,116
Switzerland										2,512
United Kingdom	27,438	29,119	29,988	30,347	30,208	27,375	27,093	24,594	22,759	20,120
United States	338,299	314,070	349,932	325,752	336,852	318,177	347,248	346,390	334,118	345,626

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										9.4
Austria	-31.4	12.9	-15.5	-13.9	37.9	13.9	-3.6	18.1	-27.9	-27.4
Belgium										
Bulgaria										
Canada	-14.7	-5.1	2.5	5.7	-8.6	2.7	-2.9	-4.6	-4.7	-27.3
Czech Republic										
Denmark	6.1	-4.4	-8.1	-13.4	9.8	4.2	-15.0	-4.4	-1.2	-25.8
Estonia										
Finland	-9.4	0.0	-3.5	2.9	-6.5	-0.9	12.2	2.1	16.8	11.6
France	4.1	-8.2	-3.3	-1.0	0.6	2.2	-3.0	1.4	0.6	-7.0
Germany										
Greece	-4.8	0.3	-7.1	0.8	15.4	14.7	5.1	-3.9	-8.4	9.7
Hungary										
Iceland										
Ireland										
Italy									5.6	
Japan	-1.6	-1.3	2.0	3.7	1.7	0.5	-2.7	-0.4	3.4	5.4
Latvia										
Luxembourg										
Netherlands									11.4	-57.3
New Zealand										
Norway										5.3
Portugal	4.3	-2.5	-0.9	8.4	1.1	6.1	0.0	1.5	4.7	24.6
Slovakia										
Spain										
Sweden	-10.7	-0.2	10.3	10.5	7.5	-6.2	8.3	-4.0	-3.7	9.8
Switzerland										
United Kingdom	6.1	3.0	1.2	-0.5	-9.4	-1.0	-9.2	-7.5	-11.6	-26.7
United States	-7.2	11.4	-6.9	3.4	-5.5	9.1	-0.2	-3.5	3.4	2.2

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	24,940.6									23,059.6
Austria	608.7	731.4	636.1	728.7	628.3	628.6	635.2	675.4	704.2	529.0
Belgium										
Bulgaria										3,435.7
Canada	7,174.6	6,456.7	6,128.5	5,767.8	6,716.7	6,514.2	6,772.9	6,940.5	6,663.4	6,752.0
Czech Republic										19,370.1
Denmark	1,489.4	1,615.2	1,383.0	1,473.4	1,961.9	1,385.9	1,376.0	1,386.0	1,207.4	1,156.7
Estonia										518.6
Finland	6,409.6	5,698.7	5,466.9	5,304.6	5,863.7	5,665.4	5,399.2	5,874.7	5,780.0	5,734.1
France	10,391.2	11,184.8	12,673.0	10,016.1	13,061.6	11,194.2	11,166.8	11,179.7	11,527.6	10,388.4
Germany										
Greece	4,144.0	4,254.1	3,901.5	4,062.8	3,947.7	3,927.9	3,826.1	3,557.5	3,585.1	2,851.6
Hungary										2,238.2
Iceland										33.2
Ireland										763.4
Italy									15,412.3	15,297.6
Japan	178,866.3	178,634.7	170,164.6	170,318.5	172,023.8	173,541.7	178,798.8	182,688.3	172,499.2	181,008.0
Latvia										67.2
Luxembourg										549.3
Netherlands	6,699.4								6,403.0	6,927.8
New Zealand										1,418.5
Norway	414.3									510.2
Portugal	2,781.1	2,791.9	2,825.7	2,751.6	2,758.5	2,406.0	2,453.8	2,453.8	1,862.0	2,014.2
Slovakia										
Spain										
Sweden	3,050.4	3,588.4	3,031.2	3,100.7	3,225.4	3,220.6	3,156.5	3,154.8	3,095.5	2,920.9
Switzerland										99.1
United Kingdom	37,983.0	38,281.5	37,937.5	35,456.8	34,106.7	32,639.6	30,587.1	31,116.1	29,250.1	28,003.6
United States	251,389.4	253,007.5	253,276.2	256,028.4	265,971.5	266,639.3	259,345.0	261,300.2	260,229.5	289,449.9

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										-7.5
Austria	20.2	-13.0	14.5	-13.8	0.0	1.1	6.3	4.3	-24.9	-13.1
Belgium										
Bulgaria										
Canada	-10.0	-5.1	-5.9	16.5	-3.0	4.0	2.5	-4.0	1.3	-5.9
Czech Republic										
Denmark	8.4	-14.4	6.5	33.1	-29.4	-0.7	0.7	-12.9	-4.2	-22.3
Estonia										
Finland	-11.1	-4.1	-3.0	10.5	-3.4	-4.7	8.8	-1.6	-0.8	-10.5
France	7.6	13.3	-21.0	30.4	-14.3	-0.2	0.1	3.1	-9.9	0.0
Germany										
Greece	2.7	-8.3	4.1	-2.8	-0.5	-2.6	-7.0	0.8	-20.5	-31.2
Hungary										
Iceland										
Ireland										
Italy									-0.7	
Japan	-0.1	-4.7	0.1	1.0	0.9	3.0	2.2	-5.6	4.9	1.2
Latvia										
Luxembourg										
Netherlands									8.2	3.4
New Zealand										
Norway										23.1
Portugal	0.4	1.2	-2.6	0.3	-12.8	2.0	0.0	-24.1	8.2	-27.6
Slovakia										
Spain										
Sweden	17.6	-15.5	2.3	4.0	-0.1	-2.0	-0.1	-1.9	-5.6	-4.2
Switzerland										
United Kingdom	0.8	-0.9	-6.5	-3.8	-4.3	-6.3	1.7	-6.0	-4.3	-26.3
United States	0.6	0.1	1.1	3.9	0.3	-2.7	0.8	-0.4	11.2	15.1

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	14,181									16,672
Austria	4,005	4,095	4,082	4,205	4,549	4,837	5,777	6,066	6,271	6,174
Belgium										
Bulgaria										2,365
Canada	39,465	38,667	38,946	38,809	40,394	42,582	44,691	45,027	42,652	42,148
Czech Republic										7,252
Denmark	1,188	1,185	1,673	1,806	1,837	1,703	1,849	2,277	2,346	2,470
Estonia										53
Finland	2,094	2,751	2,751	2,620	2,380	2,570	2,419	2,379	2,672	2,724
France	18,623	19,926	19,510	20,102	19,881	21,060	22,277	22,760	23,876	24,832
Germany										
Greece	169	169	151	103	22	21	28	153	553	545
Hungary										4,781
Iceland										
Ireland										934
Italy									37,656	39,046
Japan	6,829	7,805	8,468	9,625	10,716	11,540	12,398	13,631	13,936	15,075
Latvia										454
Luxembourg										866
Netherlands	18,341								21,917	21,456
New Zealand										3,868
Norway										502
Portugal								132	521	848
Slovakia										
Spain										
Sweden	600	560	571	618	712	645	711	686	701	685
Switzerland										1,523
United Kingdom	29,157	27,890	25,836	26,559	29,506	31,553	34,767	36,888	37,746	40,489
United States	433,783	440,554	461,698	480,615	488,049	516,232	533,999	533,456	518,971	520,534

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										17.6
Austria	2.2	-0.3	3.0	8.2	6.3	19.4	5.0	3.4	-1.5	54.2
Belgium										
Bulgaria										
Canada	-2.0	0.7	-0.4	4.1	5.4	5.0	0.8	-5.3	-1.2	6.8
Czech Republic										
Denmark	-0.2	41.1	8.0	1.7	-7.3	8.6	23.2	3.0	5.3	107.9
Estonia										
Finland	31.4	0.0	-4.8	-9.2	8.0	-5.9	-1.6	12.3	1.9	30.1
France	7.0	-2.1	3.0	-1.1	5.9	5.8	2.2	4.9	4.0	33.3
Germany										
Greece	0.1	-10.6	-31.9	-78.2	-8.0	37.7	437.8	261.9	-1.5	222.3
Hungary										
Iceland										
Ireland										
Italy									3.7	
Japan	14.3	8.5	13.7	11.3	7.7	7.4	9.9	2.2	8.2	120.8
Latvia										
Luxembourg										
Netherlands									-2.1	17.0
New Zealand										
Norway										
Portugal									62.8	
Slovakia										
Spain										
Sweden	-6.7	2.0	8.2	15.3	-9.5	10.2	-3.5	2.2	-2.3	14.3
Switzerland										
United Kingdom	-4.3	-7.4	2.8	11.1	6.9	10.2	6.1	2.3	7.3	38.9
United States	1.6	4.8	4.1	1.5	5.8	3.4	-0.1	-2.7	0.3	20.0

Contribution (%) of each fuel type to total CO_2 emissions 1990 and 1999

	Liquid fuels		Solid fuels		Gaseous fuels	
	1990	1999	1990	1999	1990	1999
Australia	21.8	23.1	49.9	44.6	28.3	32.3
Austria	35.3	22.1	8.2	6.1	53.9	71.5
Belgium						
Bulgaria		38.9		36.2		24.9
Canada	24.9	18.7	11.6	11.2	63.6	70.1
Czech Republic		22.1		56.7		21.2
Denmark	55.7	40.8	24.7	18.9	19.7	40.3
Estonia		13.4		78.6		8.0
Finland	29.9	30.2	44.6	36.2	14.6	17.2
France	28.2	26.1	13.5	13.5	24.2	32.2
Germany						
Greece	56.0	63.9	42.3	30.3	1.7	5.8
Hungary		25.0		22.6		48.2
Iceland		87.9		10.9		0.0
Ireland		59.9		18.0		22.0
Italy		32.4		19.0		48.5
Japan	45.3	45.2	52.7	50.6	2.0	4.2
Latvia		54.5		5.9		39.6
Luxembourg		20.7		30.8		48.5
Netherlands	17.3	7.1	16.0	15.9	43.8	49.3
New Zealand		9.3		24.3		66.4
Norway	86.6	73.6	13.4	13.3	0.0	13.1
Portugal	68.4	72.4	31.6	19.5	0.0	8.2
Slovakia						
Spain						
Sweden	63.6	67.7	26.3	24.4	5.2	5.7
Switzerland		45.7		1.8		27.7
United Kingdom	29.0	22.7	40.2	31.6	30.8	45.7
United States	33.1	29.9	24.6	25.0	42.4	45.0

Energy - Other sectors (commercial/institutional, residential, agricultural/forestry/fisheries): all fuel types

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	12,486	12,559	12,895	13,376	13,492	13,961	14,045	14,572	14,769	14,821
Austria	13,305	15,795	14,351	14,741	14,714	14,839	14,462	14,178	12,862	13,011
Belgium									32,115	31,643
Bulgaria										2,491
Canada	69,415	68,821	71,091	73,881	73,489	73,957	79,476	76,576	68,085	71,894
Czech Republic										16,211
Denmark	8,945	9,201	9,004	8,991	7,960	8,684	9,276	8,525	8,024	7,865
Estonia										1,083
Finland	7,571	7,206	7,354	6,608	6,883	6,679	6,483	6,598	6,659	6,369
France	94,375	104,195	103,357	100,784	94,777	97,146	105,557	99,072	103,306	102,167
Germany	203,439	204,882	188,877	197,590	187,470	190,544	215,916	198,396	191,163	174,402
Greece	5,341	5,556	5,428	5,380	5,413	5,685	7,541	7,781	8,136	7,938
Hungary										13,385
Iceland										798
Ireland										9,903
Italy									77,145	81,345
Japan	158,233	164,502	169,778	168,984	167,049	177,029	173,326	171,614	167,056	165,624
Latvia									1,048	978
Luxembourg										1,515
Netherlands	34,320	40,390	37,330	40,060	38,460	38,930	45,200	36,431	35,852	35,301
New Zealand										2,800
Norway	4,339									3,874
Portugal	3,621	3,772	3,881	3,899	4,188	4,003	4,584	5,021	4,722	5,285
Slovakia										6,748
Spain	24,070	27,534	26,881	25,863	26,936	26,605	27,635	27,544	28,102	29,506
Sweden	10,673	10,486	9,739	9,713	9,736	9,359	9,422	8,617	8,470	8,692
Switzerland	18,631	19,810	19,830	19,100	18,023	19,013	19,810	18,785	19,402	18,437
United Kingdom	112,041	123,373	120,077	123,269	118,154	113,815	127,060	117,276	118,627	117,421
United States	549,373	560,840	570,246	588,644	580,617	586,246	623,239	608,569	558,376	577,133

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										18.7
Austria	18.7	-9.1	2.7	-0.2	0.9	-2.5	-2.0	-9.3	1.2	-2.2
Belgium										
Bulgaria										
Canada	-0.9	3.3	3.9	-0.5	0.6	7.5	-3.6	-11.1	5.6	3.6
Czech Republic										
Denmark	2.9	-2.1	-0.1	-11.5	9.1	6.8	-8.1	-5.9	-2.0	-12.1
Estonia										
Finland	-4.8	2.1	-10.1	4.2	-3.0	-2.9	1.8	0.9	-4.4	-15.9
France	10.4	-0.8	-2.5	-6.0	2.5	8.7	-6.1	4.3	-1.1	8.3
Germany	0.7	-7.8	4.6	-5.1	1.6	13.3	-8.1	-3.6	-8.8	-14.3
Greece	4.0	-2.3	-0.9	0.6	5.0	32.7	3.2	4.6	-2.4	48.6
Hungary										
Iceland										
Ireland										
Italy									5.4	
Japan	4.0	3.2	-0.5	-1.1	6.0	-2.1	-1.0	-2.7	-0.9	4.7
Latvia										
Luxembourg										
Netherlands									-1.5	2.9
New Zealand										
Norway										-10.7
Portugal	4.2	2.9	0.5	7.4	-4.4	14.5	9.5	-6.0	11.9	46.0
Slovakia										
Spain	14.4	-2.4	-3.8	4.2	-1.2	3.9	-0.3	2.0	5.0	22.6
Sweden	-1.7	-7.1	-0.3	0.2	-3.9	0.7	-8.5	-1.7	2.6	-18.6
Switzerland	6.3	0.1	-3.7	-5.6	5.5	4.2	-5.2	3.3	-5.0	-1.0
United Kingdom	10.1	-2.7	2.7	-4.1	-3.7	11.6	-7.7	1.2	-1.0	4.8
United States	2.1	1.7	3.2	-1.4	1.0	6.3	-2.4	-8.2	3.4	5.1

Energy - Other sectors (commercial/institutional, residential, agricultural/forestry/fisheries) by fuel type: liquid

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	5,500									6,148
Austria	7,854	9,339	8,295	8,535	8,502	8,558	8,552	8,979	8,031	8,074
Belgium										
Bulgaria										594
Canada	22,239	20,718	21,249	21,095	20,601	20,055	21,012	20,486	17,721	18,258
Czech Republic										960
Denmark	7,068	6,909	6,734	6,441	5,838	5,941	6,285	5,894	5,559	5,424
Estonia										816
Finland	7,274	6,969	7,117	6,437	6,703	6,488	5,989	6,090	6,265	5,972
France	59,845	64,117	64,590	61,938	57,476	59,299	62,489	58,877	59,408	57,377
Germany										
Greece	5,204	5,365	5,232	5,167	5,216	5,484	7,319	7,570	7,938	7,799
Hungary										1,146
Iceland										798
Ireland										5,840
Italy									23,677	23,918
Japan	136,229	142,134	146,723	144,155	141,618	149,455	144,625	142,904	137,619	135,788
Latvia									422	418
Luxembourg										870
Netherlands	1,098								346	322
New Zealand										1,703
Norway	4,301									3,859
Portugal	3,621	3,772	3,881	3,899	4,188	4,003	4,584	4,584	4,686	5,241
Slovakia										36
Spain										
Sweden	10,332	10,160	9,454	9,407	9,457	9,062	9,116	8,321	8,158	8,372
Switzerland										14,310
United Kingdom	20,156	21,157	21,443	21,721	21,228	20,456	21,918	20,035	19,825	17,525
United States	153,824	152,004	149,967	150,747	147,528	145,946	154,258	149,658	137,854	145,288

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										11.8
Austria	18.9	-11.2	2.9	-0.4	0.7	-0.1	5.0	-10.6	0.5	2.8
Belgium										
Bulgaria										
Canada	-6.8	2.6	-0.7	-2.3	-2.6	4.8	-2.5	-13.5	3.0	-17.9
Czech Republic										
Denmark	-2.2	-2.5	-4.4	-9.4	1.8	5.8	-6.2	-5.7	-2.4	-23.3
Estonia										
Finland	-4.2	2.1	-9.5	4.1	-3.2	-7.7	1.7	2.9	-4.7	-17.9
France	7.1	0.7	-4.1	-7.2	3.2	5.4	-5.8	0.9	-3.4	-4.1
Germany										
Greece	3.1	-2.5	-1.2	0.9	5.1	33.4	3.4	4.9	-1.8	49.9
Hungary										
Iceland										
Ireland										
Italy									1.0	
Japan	4.3	3.2	-1.8	-1.8	5.5	-3.2	-1.2	-3.7	-1.3	-0.3
Latvia										
Luxembourg										
Netherlands									-6.9	-70.7
New Zealand										
Norway										-10.3
Portugal	4.2	2.9	0.5	7.4	-4.4	14.5	0.0	2.2	11.8	44.7
Slovakia										
Spain										
Sweden	-1.7	-7.0	-0.5	0.5	-4.2	0.6	-8.7	-2.0	2.6	-19.0
Switzerland										
United Kingdom	5.0	1.4	1.3	-2.3	-3.6	7.1	-8.6	-1.0	-11.6	-13.1
United States	-1.2	-1.3	0.5	-2.1	-1.1	5.7	-3.0	-7.9	5.4	-5.5

Energy - Other sectors (commercial/institutional, residential, agricultural/forestry/fisheries) by fuel type: solid

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	583									193
Austria	2,558	3,033	2,255	1,957	2,040	1,650	1,835	1,560	1,243	1,219
Belgium										
Bulgaria										1,847
Canada	191	190	166	160	142	195	193	179	158	151
Czech Republic										7,060
Denmark	320	403	320	301	76	225	159	138	98	85
Estonia										151
Finland	57	13	13	16	15	19	25	9	26	24
France	4,403	4,414	3,098	2,549	1,472	2,502	2,216	1,484	1,045	1,045
Germany										
Greece	120	172	175	193	180	181	203	191	167	112
Hungary										1,157
Iceland										
Ireland										2,607
Italy									306	297
Japan	5,048	4,260	4,275	4,651	5,171	5,842	6,041	5,624	5,771	5,216
Latvia									325	268
Luxembourg										25
Netherlands	174								41	40
New Zealand										497
Norway	35									11
Portugal										
Slovakia										2,260
Spain										
Sweden	157	104	58	45	25	12	5	16	8	
Switzerland										14
United Kingdom	19,007	20,193	17,443	18,642	15,534	11,190	11,642	10,520	9,301	9,855
United States	14,562	13,288	13,504	13,392	12,981	12,621	12,835	13,653	10,443	10,443

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										-66.9
Austria	18.6	-25.6	-13.2	4.2	-19.1	11.2	-15.0	-20.3	-1.9	-52.3
Belgium										
Bulgaria										
Canada	-0.7	-12.5	-4.1	-11.0	36.9	-0.8	-7.3	-12.0	-4.2	-21.2
Czech Republic										
Denmark	26.1	-20.7	-5.9	-74.8	196.3	-29.6	-13.2	-28.7	-13.8	-73.6
Estonia										
Finland	-77.4	0.0	22.7	-3.8	25.2	32.3	-62.8	175.3	-5.1	-57.1
France	0.3	-29.8	-17.7	-42.2	69.9	-11.4	-33.0	-29.6	0.0	-76.3
Germany										
Greece	43.8	1.4	10.2	-6.7	0.8	12.2	-6.1	-12.5	-32.8	-6.4
Hungary										
Iceland										
Ireland										
Italy									-3.0	
Japan	-15.6	0.4	8.8	11.2	13.0	3.4	-6.9	2.6	-9.6	3.3
Latvia										
Luxembourg										
Netherlands									-1.7	-77.0
New Zealand										
Norway										-67.3
Portugal										
Slovakia										
Spain										
Sweden	-33.3	-44.9	-21.4	-45.5	-50.0	-60.0	217.0	-50.0		-100.0
Switzerland										
United Kingdom	6.2	-13.6	6.9	-16.7	-28.0	4.0	-9.6	-11.6	6.0	-48.2
United States	-8.8	1.6	-0.8	-3.1	-2.8	1.7	6.4	-23.5	0.0	-28.3

Energy - Other sectors (commercial/institutional, residential, agricultural/forestry/fisheries) by fuel type: gaseous

Trends in CO_2 emissions 1990 to 1999

Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	6,402									8,480
Austria	2,889	3,415	3,800	4,249	4,169	4,626	4,069	3,634	3,581	3,712
Belgium										
Bulgaria										51
Canada	46,985	47,912	49,675	52,627	52,746	53,708	58,271	55,911	50,207	53,485
Czech Republic										8,191
Denmark	1,557	1,889	1,951	2,249	2,047	2,518	2,832	2,494	2,366	2,356
Estonia										98
Finland	99	116	116	132	137	142	297	322	241	260
France	30,057	35,594	35,599	36,226	35,758	35,293	40,798	38,639	42,781	43,691
Germany										
Greece	17	19	21	20	18	19	19	20	31	26
Hungary										11,082
Iceland										
Ireland										1,456
Italy									48,112	50,286
Japan	16,957	18,108	18,780	20,179	20,261	21,732	22,660	23,086	23,666	24,620
Latvia									300	291
Luxembourg										620
Netherlands	33,048								35,446	34,938
New Zealand										600
Norway										3
Portugal								6	36	44
Slovakia										4,446
Spain										
Sweden	184	221	227	261	255	285	301	281	304	320
Switzerland										3,537
United Kingdom	72,878	82,024	81,190	82,907	81,393	82,169	93,501	86,721	89,501	90,042
United States	380,987	395,548	406,774	424,505	420,107	427,679	456,146	445,258	410,079	421,403

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										32.5
Austria	18.2	11.3	11.8	-1.9	10.9	-12.0	-10.7	-1.5	3.7	28.5
Belgium										
Bulgaria										
Canada	2.0	3.7	5.9	0.2	1.8	8.5	-4.0	-10.2	6.5	13.8
Czech Republic										
Denmark	21.3	3.3	15.3	-9.0	23.0	12.5	-12.0	-5.1	-0.4	51.4
Estonia										
Finland	17.7	0.0	13.5	4.5	3.6	108.6	8.5	-25.3	7.9	163.7
France	18.4	0.0	1.8	-1.3	-1.3	15.6	-5.3	10.7	2.1	45.4
Germany										
Greece	9.2	14.8	-4.7	-13.0	7.6	0.0	4.4	56.6	-14.8	55.9
Hungary										
Iceland										
Ireland										
Italy									4.5	
Japan	6.8	3.7	7.5	0.4	7.3	4.3	1.9	2.5	4.0	45.2
Latvia										
Luxembourg										
Netherlands									-1.4	5.7
New Zealand										
Norway										
Portugal									24.4	
Slovakia										
Spain										
Sweden	20.4	2.7	14.8	-2.3	11.6	5.6	-6.6	8.3	5.2	73.9
Switzerland										
United Kingdom	12.5	-1.0	2.1	-1.8	1.0	13.8	-7.3	3.2	0.6	23.6
United States	3.8	2.8	4.4	-1.0	1.8	6.7	-2.4	-7.9	2.8	10.6

Energy - Other sectors (commercial/institutional, residential, agricultural/forestry/fisheries)

Contribution (%) of each fuel type to total CO_2 emissions 1990 and 1999

	Liquid fuels		Solid fuels		Gaseous fuels	
	1990	1999	1990	1999	1990	1999
Australia	44.1	41.5	4.7	1.3	51.3	57.2
Austria	59.0	62.1	19.2	9.4	21.7	28.5
Belgium						
Bulgaria		23.8		74.1		2.1
Canada	32.0	25.4	0.3	0.2	67.7	74.4
Czech Republic		5.9		43.6		50.5
Denmark	79.0	69.0	3.6	1.1	17.4	30.0
Estonia		75.3		13.9		9.0
Finland	96.1	93.8	0.7	0.4	1.3	4.1
France	63.4	56.2	4.7	1.0	31.8	42.8
Germany						
Greece	97.4	98.3	2.2	1.4	0.3	0.3
Hungary		8.6		8.6		82.8
Iceland		100.0		0.0		0.0
Ireland		59.0		26.3		14.7
Italy		29.4		0.4		61.8
Japan	86.1	82.0	3.2	3.1	10.7	14.9
Latvia		42.7		27.4		29.7
Luxembourg		57.4		1.7		40.9
Netherlands	3.2	0.9	0.5	0.1	96.3	99.0
New Zealand		60.8		17.8		21.4
Norway	99.1	99.6	0.8	0.3	0.0	0.1
Portugal	100.0	99.2	0.0	0.0	0.0	0.8
Slovakia		0.5		33.5		65.9
Spain						
Sweden	96.8	96.3	1.5	0.0	1.7	3.7
Switzerland		77.6		0.1		19.2
United Kingdom	18.0	14.9	17.0	8.4	65.0	76.7
United States	28.0	25.2	2.7	1.8	69.3	73.0

Energy - Fuel combustion all types of fuel

Total CO_2 emissions from fuel combustion 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	265,220	267,477	270,003	273,139	276,695	288,689	298,498	305,943	322,086	326,378
Austria	46,685	51,068	46,162	45,827	46,933	48,704	50,028	50,906	50,174	50,658
Belgium									117,170	111,175
Bulgaria										44,513
Canada	421,613	411,468	425,723	422,945	436,057	447,878	459,857	471,074	480,525	491,410
Czech Republic										117,501
Denmark	51,676	61,873	56,382	58,104	61,983	58,924	72,153	62,374	58,232	54,561
Estonia										16,425
Finland	53,893	53,070	51,259	52,035	58,331	55,882	61,220	59,815	57,404	56,781
France	355,945	381,154	374,696	354,007	348,976	355,365	370,381	363,863	384,549	379,591
Germany	986,832	951,137	902,918	893,006	877,157	877,107	899,777	868,049	862,099	832,036
Greece	76,474	76,395	78,054	78,177	80,047	79,778	82,012	86,503	91,235	90,471
Hungary										56,490
Iceland										1,930
Ireland										39,603
Italy									427,801	429,759
Japan	1,052,782	1,072,706	1,085,118	1,064,565	1,133,429	1,138,556	1,153,570	1,150,775	1,109,504	1,147,945
Latvia									8,051	7,385
Luxembourg										4,740
Netherlands	158,536	164,860	163,430	165,890	166,750	174,224	182,021	178,266	177,395	170,619
New Zealand										26,623
Norway	26,366									31,728
Portugal	39,558	41,373	45,290	44,003	44,534	47,260	45,688	47,359	50,584	52,449
Slovakia										40,783
Spain	205,673	213,404	223,785	211,499	222,031	232,254	220,255	236,250	245,598	256,801
Sweden	51,278	52,196	50,434	50,281	54,360	53,390	57,791	52,114	53,311	51,722
Switzerland	39,673	41,854	41,846	39,611	38,789	39,764	40,554	39,894	41,140	41,104
United Kingdom	556,554	565,039	551,387	537,695	531,563	525,044	543,636	520,790	523,367	509,917
United States	4,835,688	4,782,409	4,881,065	4,986,700	5,078,407	5,121,263	5,302,961	5,374,913	5,386,762	5,453,088

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										23.1
Austria	9.4	-9.6	-0.7	2.4	3.8	2.7	1.8	-1.4	1.0	8.5
Belgium										
Bulgaria										
Canada	-2.4	3.5	-0.7	3.1	2.7	2.7	2.4	2.0	2.3	16.6
Czech Republic										
Denmark	19.7	-8.9	3.1	6.7	-4.9	22.5	-13.6	-6.6	-6.3	5.6
Estonia										
Finland	-1.5	-3.4	1.5	12.1	-4.2	9.6	-2.3	-4.0	-1.1	5.4
France	7.1	-1.7	-5.5	-1.4	1.8	4.2	-1.8	5.7	-1.3	6.6
Germany	-3.6	-5.1	-1.1	-1.8	0.0	2.6	-3.5	-0.7	-3.5	-15.7
Greece	-0.1	2.2	0.2	2.4	-0.3	2.8	5.5	5.5	-0.8	18.3
Hungary										
Iceland										
Ireland										
Italy									0.5	
Japan	1.9	1.2	-1.9	6.5	0.5	1.3	-0.2	-3.6	3.5	9.0
Latvia										
Luxembourg										
Netherlands							-2.1	-0.5	-3.8	7.6
New Zealand										
Norway										20.3
Portugal	4.6	9.5	-2.8	1.2	6.1	-3.3	3.7	6.8	3.7	32.6
Slovakia										
Spain	3.8	4.9	-5.5	5.0	4.6	-5.2	7.3	4.0	4.6	24.9
Sweden	1.8	-3.4	-0.3	8.1	-1.8	8.2	-9.8	2.3	-3.0	0.9
Switzerland	5.5	0.0	-5.3	-2.1	2.5	2.0	-1.6	3.1	-0.1	3.6
United Kingdom	1.5	-2.4	-2.5	-1.1	-1.2	3.5	-4.2	0.5	-2.6	-8.4
United States	-1.1	2.1	2.2	1.8	0.8	3.5	1.4	0.2	1.2	12.8

Energy - Fuel combustion by fuel type: liquid

Total CO_2 emissions from fuel combustion 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	85,777									98,324
Austria	25,881	28,502	27,231	27,397	28,013	27,662	27,751	29,082	29,673	29,869
Belgium										
Bulgaria										11,882
Canada	210,148	198,318	201,953	203,620	208,960	212,171	216,058	223,046	227,671	231,033
Czech Republic										22,947
Denmark	23,141	24,107	23,660	23,437	24,227	25,360	27,769	26,448	25,897	25,259
Estonia										3,422
Finland	27,386	26,412	26,381	24,707	25,964	25,504	26,083	25,920	26,912	26,837
France	220,843	233,242	233,217	227,140	223,967	229,207	234,159	232,950	237,815	237,232
Germany										
Greece	36,667	38,092	38,039	37,912	38,065	39,580	42,893	43,890	45,508	45,144
Hungary										17,355
Iceland										1,893
Ireland										22,589
Italy									252,706	244,057
Japan	637,993	643,353	656,078	634,654	673,068	669,007	661,738	642,986	630,513	637,777
Latvia									4,209	4,508
Luxembourg										2,580
Netherlands	42,576	28,550	29,830	30,460	30,800	32,030	31,611	30,848	43,891	45,265
New Zealand										13,110
Norway	20,448									23,729
Portugal	28,862	30,217	33,845	31,794	31,898	33,524	32,810	32,810	37,943	39,700
Slovakia										7,833
Spain										
Sweden	40,616	40,546	39,826	39,547	42,962	42,483	44,810	41,916	42,250	41,970
Switzerland										30,895
United Kingdom	208,380	208,401	208,438	208,835	205,268	200,517	205,441	196,386	191,472	183,909
United States	2,056,429	1,999,440	2,050,217	2,064,309	2,112,121	2,098,200	2,175,618	2,188,573	2,230,432	2,294,573

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										14.6
Austria	10.1	-4.5	0.6	2.2	-1.3	0.3	4.8	2.0	0.7	15.4
Belgium										
Bulgaria										
Canada	-5.6	1.8	0.8	2.6	1.5	1.8	3.2	2.1	1.5	9.9
Czech Republic										
Denmark	4.2	-1.9	-0.9	3.4	4.7	9.5	-4.8	-2.1	-2.5	9.2
Estonia										
Finland	-3.6	-0.1	-6.3	5.1	-1.8	2.3	-0.6	3.8	-0.3	-2.0
France	5.6	0.0	-2.6	-1.4	2.3	2.2	-0.5	2.1	-0.2	7.4
Germany										
Greece	3.9	-0.1	-0.3	0.4	4.0	8.4	2.3	3.7	-0.8	23.1
Hungary										
Iceland										
Ireland										
Italy									-3.4	
Japan	0.8	2.0	-3.3	6.1	-0.6	-1.1	-2.8	-1.9	1.2	0.0
Latvia										
Luxembourg										
Netherlands							-2.4	42.3	3.1	6.3
New Zealand										
Norway										16.0
Portugal	4.7	12.0	-6.1	0.3	5.1	-2.1	0.0	15.6	4.6	37.6
Slovakia										
Spain										
Sweden	-0.2	-1.8	-0.7	8.6	-1.1	5.5	-6.5	0.8	-0.7	3.3
Switzerland										
United Kingdom	0.0	0.0	0.2	-1.7	-2.3	2.5	-4.4	-2.5	-3.9	-11.7
United States	-2.8	2.5	0.7	2.3	-0.7	3.7	0.6	1.9	2.9	11.6

Energy - Fuel combustion by fuel type: solid

Total CO_2 emissions from fuel combustion 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	145,707									184,689
Austria	9,553	10,703	6,986	5,820	5,906	6,802	7,139	7,245	5,460	5,565
Belgium										
Bulgaria										27,302
Canada	86,040	89,012	91,474	83,787	87,911	89,788	91,766	98,449	104,158	102,541
Czech Republic										75,969
Denmark	24,267	32,921	27,385	28,710	31,189	25,862	35,546	26,528	22,164	18,809
Estonia										11,630
Finland	15,746	14,916	13,015	14,648	18,444	15,409	19,319	17,928	13,977	14,067
France	53,170	60,883	56,359	42,812	41,155	41,899	45,377	40,494	50,424	43,891
Germany										
Greece	39,524	38,023	39,753	40,056	41,844	40,065	38,973	42,217	44,253	42,727
Hungary										15,317
Iceland										33
Ireland										10,825
Italy									47,303	45,862
Japan	284,414	287,999	283,294	291,500	301,959	313,929	324,629	336,808	325,108	348,409
Latvia									640	520
Luxembourg										575
Netherlands	33,898								33,605	30,459
New Zealand										3,055
Norway	499									582
Portugal	10,693	11,156	11,445	12,209	12,637	13,735	12,878	12,878	11,753	11,687
Slovakia										17,295
Spain										
Sweden	8,080	8,631	8,104	7,729	7,868	7,550	8,599	7,379	7,851	6,826
Switzerland										113
United Kingdom	237,791	237,889	223,620	194,327	182,215	170,497	159,351	141,338	141,213	123,943
United States	1,775,855	1,761,957	1,779,565	1,837,036	1,857,202	1,867,931	1,950,790	2,005,595	2,015,565	2,012,754

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										26.8
Austria	12.0	-34.7	-16.7	1.5	15.2	5.0	1.5	-24.6	1.9	-41.7
Belgium										
Bulgaria										
Canada	3.5	2.8	-8.4	4.9	2.1	2.2	7.3	5.8	-1.6	19.2
Czech Republic										
Denmark	35.7	-16.8	4.8	8.6	-17.1	37.4	-25.4	-16.5	-15.1	-22.5
Estonia										
Finland	-5.3	-12.7	12.5	25.9	-16.5	25.4	-7.2	-22.0	0.6	-10.7
France	14.5	-7.4	-24.0	-3.9	1.8	8.3	-10.8	24.5	-13.0	-17.5
Germany										
Greece	-3.8	4.5	0.8	4.5	-4.3	-2.7	8.3	4.8	-3.4	8.1
Hungary										
Iceland										
Ireland										
Italy									-3.0	
Japan	1.3	-1.6	2.9	3.6	4.0	3.4	3.8	-3.5	7.2	22.5
Latvia										
Luxembourg										
Netherlands									-9.4	-10.1
New Zealand										
Norway										16.6
Portugal	4.3	2.6	6.7	3.5	8.7	-6.2	0.0	-8.7	-0.6	9.3
Slovakia										
Spain										
Sweden	6.8	-6.1	-4.6	1.8	-4.0	13.9	-14.2	6.4	-13.1	-15.5
Switzerland										
United Kingdom	0.0	-6.0	-13.1	-6.2	-6.4	-6.5	-11.3	-0.1	-12.2	-47.9
United States	-0.8	1.0	3.2	1.1	0.6	4.4	2.8	0.5	-0.1	13.3

Energy - Fuel combustion by fuel type: gaseous

Total CO_2 emissions from fuel combustion 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	33,736									43,366
Austria	11,041	11,656	11,736	12,403	12,997	14,219	15,077	14,515	14,989	15,188
Belgium										
Bulgaria										5,329
Canada	123,348	121,981	129,799	133,684	137,441	143,992	150,218	147,918	147,102	156,494
Czech Republic										18,416
Denmark	4,235	4,813	5,306	5,926	6,537	7,673	8,808	9,366	10,136	10,456
Estonia										1,348
Finland	5,087	5,642	5,865	6,112	6,442	6,712	6,961	6,848	8,018	7,929
France	50,500	57,693	57,474	58,763	58,115	58,714	66,203	64,518	69,794	71,266
Germany										
Greece	283	280	262	208	138	133	146	396	1,475	2,599
Hungary										23,319
Iceland										
Ireland										6,108
Italy									117,245	127,925
Japan	100,890	108,058	108,746	111,417	117,747	121,487	127,326	132,377	136,080	144,184
Latvia									1,926	2,337
Luxembourg										1,585
Netherlands	66,920								79,335	78,965
New Zealand										9,396
Norway	5,320									7,287
Portugal								194	887	1,061
Slovakia										13,388
Spain										
Sweden	1,221	1,311	1,470	1,612	1,605	1,627	1,704	1,673	1,676	1,687
Switzerland										5,973
United Kingdom	110,249	118,613	119,164	134,303	143,520	153,412	178,131	182,244	189,781	201,206
United States	1,001,851	1,019,577	1,049,941	1,083,988	1,106,916	1,153,977	1,175,512	1,179,778	1,139,764	1,144,741

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Perentage change from 1990 to 1999
Australia										28.5
Austria	5.6	0.7	5.7	4.8	9.4	6.0	-3.7	3.3	1.3	37.6
Belgium										
Bulgaria										
Canada	-1.1	6.4	3.0	2.8	4.8	4.3	-1.5	-0.6	6.4	26.9
Czech Republic										
Denmark	13.6	10.2	11.7	10.3	17.4	14.8	6.3	8.2	3.2	146.9
Estonia										
Finland	10.9	4.0	4.2	5.4	4.2	3.7	-1.6	17.1	-1.1	55.9
France	14.2	-0.4	2.2	-1.1	1.0	12.8	-2.5	8.2	2.1	41.1
Germany										
Greece	-1.0	-6.5	-20.5	-33.7	-3.5	9.7	171.1	272.2	76.2	818.6
Hungary										
Iceland										
Ireland										
Italy									9.1	
Japan	7.1	0.6	2.5	5.7	3.2	4.8	4.0	2.8	6.0	42.9
Latvia										
Luxembourg										
Netherlands									-0.5	18.0
New Zealand										
Norway										37.0
Portugal									19.6	
Slovakia										
Spain										
Sweden	7.3	12.1	9.7	-0.4	1.3	4.8	-1.8	0.2	0.7	38.1
Switzerland										
United Kingdom	7.6	0.5	12.7	6.9	6.9	16.1	2.3	4.1	6.0	82.5
United States	1.8	3.0	3.2	2.1	4.3	1.9	0.4	-3.4	0.4	14.3

Energy - Fuel combustion by fuel type: biomass

Total CO_2 emissions from fuel combustion 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	16,515	16,642	15,142	16,800	17,619	18,448	18,437	20,275	20,493	20,145
Austria	11,496	10,849	10,873	11,101	13,243	14,479	14,311	13,903	13,426	13,623
Belgium									920	
Bulgaria										2,413
Canada	44,453	45,268	45,387	44,561	48,609	50,967	49,123	53,020	50,022	53,634
Czech Republic										2,776
Denmark	4,312	4,610	4,959	5,098	4,928	5,580	6,071	6,288	6,266	6,281
Estonia										2,282
Finland	18,452	17,691	16,932	19,961	20,985	23,051	22,927	26,524	27,225	28,987
France	37,859	45,267	42,905	42,251	37,077	37,894	39,933	36,405	37,281	36,992
Germany	NE		NE	NE		NE	NE	NE	NE	NE
Greece	2,474	2,474	2,474	2,474	2,612	2,612	4,084	4,093	4,079	4,089
Hungary										1,476
Iceland										17
Ireland										622
Italy										
Japan	34,887	35,825	35,359	35,393	38,708	39,567	39,352	40,585	40,164	41,847
Latvia									4,061	3,547
Luxembourg										71
Netherlands	3,100	2,700	2,600	3,300	3,500	3,600	4,500	5,314	5,350	5,447
New Zealand										3,248
Norway	7,077									7,600
Portugal	12,023	12,227	12,157	11,888	11,493	11,423	11,285	11,285	11,220	11,125
Slovakia										72
Spain	13,934	13,873	13,590	13,440	13,302	13,088	12,948	13,721	13,985	14,226
Sweden	11,361	11,760	12,716	13,577	15,100	15,889	17,713	16,264	16,604	16,709
Switzerland										1,894
United Kingdom	3,850	4,008	4,295	4,447	4,833	5,223	5,477	5,761	6,118	7,000
United States	180,563	179,318	188,276	183,975	191,667	200,488	202,117	194,317	194,762	234,063

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										22.0
Austria	-5.6	0.2	2.1	19.3	9.3	-1.2	-2.8	-3.4	1.5	18.5
Belgium										
Bulgaria										
Canada	1.8	0.3	-1.8	9.1	4.9	-3.6	7.9	-5.7	7.2	20.7
Czech Republic										
Denmark	6.9	7.6	2.8	-3.3	13.2	8.8	3.6	-0.3	0.2	45.7
Estonia										
Finland	-4.1	-4.3	17.9	5.1	9.8	-0.5	15.7	2.6	6.5	57.1
France	19.6	-5.2	-1.5	-12.2	2.2	5.4	-8.8	2.4	-0.8	-2.3
Germany										
Greece	0.0	0.0	0.0	5.6	0.0	56.4	0.2	-0.3	0.2	65.3
Hungary										
Iceland										
Ireland										
Italy										
Japan	2.7	-1.3	0.1	9.4	2.2	-0.5	3.1	-1.0	4.2	19.9
Latvia										
Luxembourg										
Netherlands									1.8	75.7
New Zealand										
Norway										7.4
Portugal	1.7	-0.6	-2.2	-3.3	-0.6	-1.2	0.0	-0.6	-0.8	-7.5
Slovakia										
Spain	-0.4	-2.0	-1.1	-1.0	-1.6	-1.1	6.0	1.9	1.7	2.1
Sweden	3.5	8.1	6.8	11.2	5.2	11.5	-8.2	2.1	0.6	47.1
Switzerland										
United Kingdom	4.1	7.2	3.5	8.7	8.1	4.9	5.2	6.2	14.4	81.8
United States	-0.7	5.0	-2.3	4.2	4.6	0.8	-3.9	0.2	20.2	29.6

Energy - Fuel combustion by fuel type: other fuels

Total CO_2 emissions from fuel combustion 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	0									
Austria	211	207	210	207	17	21	61	64	51	36
Belgium										
Bulgaria										
Canada	2,077	2,157	2,496	1,855	1,745	1,928	1,815	1,661	1,595	1,342
Czech Republic										169
Denmark	32	32	31	31	30	29	30	31	35	37
Estonia										25
Finland	5,674	6,101	5,997	6,569	7,482	8,257	8,857	9,119	8,497	7,948
France	31,433	29,336	27,646	25,292	25,739	25,545	24,642	25,900	26,515	27,203
Germany										
Greece										
Hungary										499
Iceland										4
Ireland										82
Italy									10,547	11,915
Japan	29,485	33,296	37,001	26,994	40,655	34,133	39,878	38,604	17,803	17,575
Latvia										18
Luxembourg										1
Netherlands	15,142	136,310	133,600	135,430	135,950	142,194	150,410	147,418	20,564	15,929
New Zealand										1,063
Norway	100									129
Portugal	3	0				1	0	0	1	1
Slovakia										2,267
Spain										
Sweden	1,360	1,708	1,034	1,393	1,924	1,730	1,783	1,147	1,534	1,240
Switzerland										4,123
United Kingdom	134	136	165	229	561	617	713	822	900	859
United States	1,554	1,435	1,342	1,367	2,168	1,155	1,041	967	1,001	1,021

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria	-1.6	1.2	-1.1	-91.8	25.9	186.2	5.0	-20.2	-30.1	-83.0
Belgium										
Bulgaria										
Canada	3.8	15.7	-25.7	-5.9	10.5	-5.8	-8.5	-4.0	-15.9	-35.4
Czech Republic										
Denmark	-0.5	-1.2	-1.1	-4.9	-1.2	2.7	4.5	12.6	4.1	15.0
Estonia										
Finland	7.5	-1.7	9.5	13.9	10.4	7.3	3.0	-6.8	-6.5	40.1
France	-6.7	-5.8	-8.5	1.8	-0.8	-3.5	5.1	2.4	2.6	-13.5
Germany										
Greece										
Hungary										
Iceland										
Ireland										
Italy									13.0	
Japan	12.9	11.1	-27.0	50.6	-16.0	16.8	-3.2	-53.9	-1.3	-40.4
Latvia										
Luxembourg										
Netherlands							-2.0	-86.1	-22.5	5.2
New Zealand										
Norway										28.1
Portugal	-97.0					-23.4	0.0	28.4	5.5	-81.2
Slovakia										
Spain										
Sweden	25.5	-39.5	34.8	38.1	-10.1	3.1	-35.7	33.8	-19.2	-8.9
Switzerland										
United Kingdom	1.1	21.8	38.7	144.9	9.9	15.6	15.3	9.6	-4.6	540.0
United States	-7.7	-6.5	1.9	58.6	-46.7	-9.8	-7.2	3.6	1.9	-34.3

Energy - Fuel combustion

Contribution (%) of each fuel type to total CO_2 emissions 1990 and 1999

	Liquid fuel		Solid fuel		Gaseous fuel		Other fuels	
	1990	1999	1990	1999	1990	1999	1990	1999
Australia	32.3	30.1	54.9	56.6	12.7	13.3	0.0	0.0
Austria	55.4	59.0	20.5	11.0	23.6	30.0	0.5	0.1
Belgium		0.0		0.0		0.0		0.0
Bulgaria		26.7		61.3		12.0		0.0
Canada	49.8	47.0	20.4	20.9	29.3	31.8	0.5	0.3
Czech Republic		19.5		64.7		15.7		0.1
Denmark	44.8	46.3	47.0	34.5	8.2	19.2	0.1	0.1
Estonia		20.8		70.8		8.2		0.2
Finland	50.8	47.3	29.2	24.8	9.4	14.0	10.5	14.0
France	62.0	62.5	14.9	11.6	14.2	18.8	8.8	7.2
Germany								
Greece	47.9	49.9	51.7	47.2	0.4	2.9	0.0	0.0
Hungary		30.7		27.1		41.3		0.9
Iceland		98.1		1.7		0.0		0.2
Ireland		57.0		27.3		15.4		0.2
Italy		56.8		10.7		29.8		2.8
Japan	60.6	55.6	27.0	30.4	9.6	12.6	2.8	1.5
Latvia		61.0		7.0		31.7		0.2
Luxembourg		54.4		12.1		33.4		0.0
Netherlands	26.9	26.5	21.4	17.9	42.2	46.3	9.6	9.3
New Zealand		49.2		11.5		35.3		4.0
Norway	77.6	74.8	1.9	1.8	20.2	23.0	0.4	0.4
Portugal	73.0	75.7	27.0	22.3	0.0	2.0	0.0	0.0
Slovakia		19.2		42.4		32.8		5.6
Spain								
Sweden	79.2	81.1	15.8	13.2	2.4	3.3	2.7	2.4
Switzerland		75.2		0.3		14.5		10.0
United Kingdom	37.4	36.1	42.7	24.3	19.8	39.5	0.0	0.2
United States	42.5	42.1	36.7	36.9	20.7	21.0	0.0	0.0

Energy - Road transportation: emission factors (1999)

	1.A.3.b Road transportation (CO_2 and N_2O)													
	CO_2 emissions							N_2O emissions						
	Key source	Percentage of national total	Methods and EF used[a]		CO_2 IEF			Key source	Percentage of national total	Methods and EF used[a]		N_2O IEF		
			Methods	EF	IEF in CRF based on	Gasoline	Diesel oil			Methods	EF	IEF in CRF based on	Gasoline	Diesel oil
		(%)				(t/TJ)			(%)				(kg/TJ)	
IPCC default EF[b]					NCV	72.1 (US) 73.0 (Europe)	72.1 (US) 74.0 (Europe)					NCV	3-43 (US) 1-20 (Europe)	1-14 (US) 3-4 (Europe)
Australia	L	12.9	T1, T2	CS	GCV	65.34	69.00			T1, T2	D, CS	GCV	19.38	1.82
Austria	L	21.7	M	CS	NCV	73.50	74.16	L	0.7	M	CS	NCV	16.98	2.52
Belgium														
Bulgaria	L	6.9	T2	C, CS, D	NCV		74.37			T2	C, CS, D	NCV		1.87
Canada	L	17.8	CS	CS	GCV	68.09	70.58	L	0.8	CS	CS	GCV	13.92	2.15
Czech Republic	L	8.1	T1	D	NCV	68.61	73.33			T2	PS	NCV	16.71	3.00
Denmark	L	15.5			NCV	73.00	74.00					NCV	13.50	3.79
Estonia	L	4.6			NCV	68.61	73.33					NCV	0.60	0.60
Finland	L	14.3	CS (M)	CS	NCV	72.76	73.75	L	0.7	CS (M)	CS/M	NCV	12.62	3.70
France	L	23.8	C /CS	C /M /CS	NCV	72.35	74.70	L	0.6	C /CS	C /M /CS	NCV	9.60	3.56
Germany														
Greece	L	12.9	C	C	NCV	68.61	72.79			C	C	NCV	4.70	4.31
Hungary	L	9.9	D	D	NCV	68.61	73.33			D	CS, D	NCV	1.50	0.60
Iceland	L	23.7	T1	D	NCV	68.61	73.33			T1	D	NCV	13.20	2.74
Ireland	L	14.0	T1	CS	NCV	69.96	73.30			T1	C	NCV	12.44	4.11
Italy	L	20.4			NCV	71.00	73.00	L	0.5			NCV	6.60	5.87
Japan	L	17.5	T1, RA, CS	D, CS	NCV					T1, T3, CS	D, CS	NCV	5.03	3.59
Latvia	L	15.7	T1, CS	D	NCV	73.01	73.77			T1, CS	D	NCV	1.57	3.07
Luxembourg					NCV	72.35	72.97					NCV	11.50	3.53
Netherlands	L	13.5			NCV	72.30	73.30	L	0.7			NCV	12.51	10.50
New Zealand[c]	L	13.8	T1	CS/D	GCV	NE	NE						NE	NE
Norway	L	16.6	M, T1, CS/T2	CS	NCV	71.30	73.55	L	0.8	CS, T2, CS/T2	CS, D, C	NCV	18.44	1.95
Portugal	L	21.2	C	C	NCV	71.10	72.45			C	C	NCV	10.16	3.61
Slovakia	L	8.7	M	M	NCV	72.98	73.91			M	M	NCV	9.45	4.20
Spain														
Sweden	L	25.6	CS	CS	NCV	75.52	71.75	L	0.7	CS	CS	NCV	8.81	1.72
Switzerland	L	28.0	CS	CS	NCV	73.90	73.60	L	1.2	CS	CS	NCV	11.98	2.94
United Kingdom	L	18.0	T2	CS	NCV	70.06	72.54	L	0.7	T2/T3	D	NCV	12.26	3.27
United States	L	19.8	T1, T2	CS	GCV	66.60	67.11	L	0.9	T1, T2, M	D, CS, M	GCV	11.52	2.57

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method used or type of emission factor for all subcategories within the category 1.A.3 Transport.

[b] Source of default emission factors: IPCC Guidelines, volume 3, pages 1.70-1.83.

[c] New Zealand did not report activity data and emissions from the use of gasoline and diesel for road transportation. However, activity data, emissions and IEFs were provided for the total transport sector (CO_2 IEF for gasoline = 65.9 t/TJ, CO_2 IEF for diesel oil = 68.0 t/TJ, N_2O IEF for gasoline = 3.0 kg/TJ and N_2O IEF for diesel oil 3.0 kg/TJ).

Energy - Transport (total)

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia		59,219	58,576	60,025	60,758	62,301	64,792	66,831	68,396	68,426	69,503
Austria		13,570	15,059	15,054	15,104	16,163	15,432	15,380	15,830	16,809	17,643
Belgium										23,162	22,611
Bulgaria(b)	12,639										6,212
Canada		145,831	140,612	144,676	147,836	155,251	159,470	163,962	170,373	174,291	179,332
Czech Republic											12,016
Denmark		10,356	10,873	10,993	11,192	11,634	11,765	11,990	12,098	12,419	12,156
Estonia											1,204
Finland		12,475	11,610	11,583	10,963	11,366	11,125	10,994	11,531	12,299	12,734
France		119,156	121,771	126,258	126,280	127,572	129,657	131,182	133,599	135,766	138,822
Germany		162,281	165,953	171,661	176,532	172,899	176,468	176,942	177,689	180,894	186,110
Greece		18,039	19,051	19,251	19,403	19,446	19,435	19,925	20,523	22,149	22,908
Hungary	7,741										9,568
Iceland											819
Ireland											9,734
Italy										120,571	121,165
Japan		204,665	214,152	219,398	221,689	232,679	239,522	246,016	250,350	250,286	253,670
Latvia										2,126	2,087
Luxembourg											1,337
Netherlands		29,095	28,550	29,830	30,460	30,800	32,030	33,821	33,060	33,999	34,700
New Zealand											11,729
Norway		11,077									13,957
Portugal		11,221	11,948	12,931	13,512	13,900	14,459	15,263	16,084	17,585	18,650
Slovakia											4,821
Spain		58,004	60,804	64,695	61,161	65,756	66,747	71,874	72,176	79,637	83,922
Sweden		18,736	18,807	19,032	18,237	18,561	18,993	18,834	18,966	19,481	19,886
Switzerland		14,144	14,668	14,983	13,933	14,117	13,815	13,885	14,462	14,691	15,315
United Kingdom		116,581	116,051	117,504	118,683	119,042	117,939	122,571	123,631	122,767	121,576
United States		1,422,585	1,386,224	1,425,797	1,456,126	1,499,862	1,537,307	1,571,796	1,588,138	1,615,079	1,677,714

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-1.1	2.5	1.2	2.5	4.0	3.1	2.3	0.0	1.6	17.4
Austria	11.0	0.0	0.3	7.0	-4.5	-0.3	2.9	6.2	5.0	30.0
Belgium									-2.4	
Bulgaria										50.9
Canada	-3.6	2.9	2.2	5.0	2.7	2.8	3.9	2.3	2.9	23.0
Czech Republic										
Denmark	5.0	1.1	1.8	3.9	1.1	1.9	0.9	2.7	-2.1	17.4
Estonia										
Finland	-6.9	-0.2	-5.4	3.7	-2.1	-1.2	4.9	6.7	3.5	2.1
France	2.2	3.7	0.0	1.0	1.6	1.2	1.8	1.6	2.3	16.5
Germany	2.3	3.4	2.8	-2.1	2.1	0.3	0.4	1.8	2.9	14.7
Greece	5.6	1.0	0.8	0.2	-0.1	2.5	3.0	7.9	3.4	27.0
Hungary										-23.6
Iceland										
Ireland										
Italy									0.5	
Japan	4.6	2.4	1.0	5.0	2.9	2.7	1.8	0.0	1.4	23.9
Latvia										
Luxembourg										
Netherlands	-1.9	4.5	2.1	1.1	4.0	5.6	-2.3	2.8	2.1	19.3
New Zealand										
Norway										26.0
Portugal	6.5	8.2	4.5	2.9	4.0	5.6	5.4	9.3	6.1	66.2
Slovakia										
Spain	4.8	6.4	-5.5	7.5	1.5	7.7	0.4	10.3	5.4	44.7
Sweden	0.4	1.2	-4.2	1.8	2.3	-0.8	0.7	2.7	2.1	6.1
Switzerland	3.7	2.1	-7.0	1.3	-2.1	0.5	4.2	1.6	4.2	8.3
United Kingdom	-0.5	1.3	1.0	0.3	-0.9	3.9	0.9	-0.7	-1.0	4.3
United States	-2.6	2.9	2.1	3.0	2.5	2.2	1.0	1.7	3.9	17.9

Trends in N_2O emissions 1990 to 1999
Gigagrams

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia		5.3	6.0	7.2	8.1	9.0	9.9	10.6	11.3	11.9	12.6
Austria		1.0	1.3	1.5	1.6	1.8	1.8	1.8	1.8	1.9	1.9
Belgium										3.0	3.1
Bulgaria	0.2										0.1
Canada		20.6	21.0	22.9	25.0	27.5	28.3	28.4	29.0	28.8	29.3
Czech Republic											1.6
Denmark		0.5	0.6	0.7	0.7	0.9	1.0	1.1	1.3	1.4	1.5
Estonia											0.0
Finland		2.0	1.8	1.7	1.8	1.9	1.8	1.9	2.0	2.4	2.3
France		3.9	4.1	4.4	4.9	5.9	6.7	7.7	8.6	9.3	10.2
Germany		10.3	12.3	14.3	16.3	16.3	18.0	18.3	18.3	18.3	18.0
Greece		1.7	1.8	1.8	1.9	1.9	1.9	2.0	2.0	2.1	2.2
Hungary											0.1
Iceland											0.1
Ireland											1.3
Italy										9.2	10.0
Japan		12.9	13.4	13.7	13.7	13.9	14.3	14.5	14.7	14.6	14.9
Latvia										0.2	0.2
Luxembourg											0.1
Netherlands		4.5	6.2	7.2	7.2	7.2	7.4	7.1	7.2	6.2	6.0
New Zealand											0.5
Norway		0.5									1.7
Portugal		0.4	0.5	0.5	0.6	0.8	0.9	1.0	1.1	1.3	1.5
Slovakia											0.5
Spain		2.8	2.9	3.1	3.2	3.8	4.1	4.7	5.1	6.0	6.7
Sweden		1.5	1.4	1.4	1.5	1.5	1.6	1.7	1.8	1.7	1.8
Switzerland		1.0	1.1	1.3	1.4	1.5	1.6	1.7	1.7	2.0	2.1
United Kingdom		4.1	4.3	4.7	5.9	7.4	8.9	10.4	11.9	13.4	14.7
United States		175.2	185.6	198.7	208.1	214.1	215.4	210.6	210.2	207.2	204.4

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	12.9	21.2	12.5	11.2	9.9	7.3	6.3	5.2	5.9	139.3
Austria	23.7	13.1	9.8	12.2	1.9	-1.0	-0.5	4.8	-0.7	79.9
Belgium									2.9	
Bulgaria										46.5
Canada	1.9	8.8	9.5	9.8	3.1	0.1	2.2	-0.6	1.6	42.0
Czech Republic										
Denmark	23.7	16.2	14.4	22.9	12.6	9.9	14.2	8.6	3.4	220.7
Estonia										
Finland	-13.8	-0.7	5.4	2.0	-3.8	7.5	4.1	21.5	-6.0	13.2
France	5.8	7.0	11.2	19.2	15.0	14.2	11.7	8.8	9.6	162.7
Germany	19.4	16.3	14.0	0.0	10.4	1.7	0.0	0.0	-1.6	74.8
Greece	9.9	0.1	2.4	1.8	-1.6	4.0	4.5	4.1	1.7	29.7
Hungary										
Iceland										
Ireland										
Italy									8.6	
Japan	4.1	2.2	-0.4	1.3	3.0	1.3	1.5	-0.3	1.9	15.6
Latvia										
Luxembourg										
Netherlands	36.5	16.1	0.0	0.0	2.8	-3.8	1.0	-13.6	-3.7	31.7
New Zealand										
Norway										273.5
Portugal	7.0	7.6	25.3	18.3	14.6	16.2	14.1	14.8	12.5	235.1
Slovakia										
Spain	5.6	7.2	3.9	15.8	9.5	13.2	9.5	17.1	12.5	143.9
Sweden	-6.9	2.2	5.1	5.0	2.2	5.9	7.1	-3.3	7.2	26.1
Switzerland	15.0	13.8	8.6	9.6	5.5	4.3	3.3	15.5	3.8	112.2
United Kingdom	3.5	10.3	24.1	25.9	19.9	17.2	14.4	12.6	9.8	254.8
United States	6.0	7.1	4.7	2.9	0.6	-2.2	-0.2	-1.4	-1.3	16.7

Energy - Road transportation

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	52,697									62,355
Austria	13,279	14,756	14,749	14,804	15,406	15,125	15,080	15,482	16,422	17,207
Belgium										
Bulgaria									5,151	5,324
Canada	102,812	99,901	102,785	104,974	109,881	112,440	114,246	119,533	120,502	124,086
Czech Republic										11,348
Denmark	9,337	9,765	9,927	10,067	10,575	10,668	10,858	11,049	11,532	11,323
Estonia										909
Finland	11,111	10,823	10,807	10,174	10,515	10,325	10,192	10,701	10,807	10,880
France	111,400	114,125	118,755	118,923	119,806	121,132	122,378	124,716	126,593	129,476
Germany										
Greece	11,873	12,683	12,985	13,284	13,462	13,872	14,509	14,851	15,561	15,845
Hungary										8,568
Iceland										769
Ireland										9,121
Italy									109,371	110,251
Japan	183,535	191,938	196,937	199,003	209,155	215,040	220,753	223,712	224,681	228,373
Latvia										1,749
Luxembourg										1,313
Netherlands	25,374						30,365	29,518	30,233	31,111
New Zealand	7,552	7,641	7,984	8,262	8,816	9,527	9,727	10,067	10,269	10,584
Norway	7,865									9,304
Portugal	9,761	10,470	11,424	12,056	12,534	12,985	13,733	14,628	15,667	16,824
Slovakia									4,580	4,493
Spain	51,313	53,721	56,842	56,289	59,334	60,119	64,023	64,639	71,133	75,080
Sweden	16,871	17,093	17,376	16,669	17,002	17,346	17,267	17,349	17,752	18,073
Switzerland										14,962
United Kingdom	109,039	108,238	109,677	110,944	111,548	110,496	114,787	116,215	115,473	114,560
United States	1,121,391	1,108,311	1,129,327	1,159,402	1,192,291	1,218,330	1,248,784	1,268,145	1,303,237	1,337,967

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										18.33
Austria	11.12	-0.05	0.37	4.06	-1.82	-0.30	2.67	6.07	4.78	29.58
Belgium										
Bulgaria									3.35	
Canada	-2.83	2.89	2.13	4.68	2.33	1.61	4.63	0.81	2.97	20.69
Czech Republic										
Denmark	4.59	1.66	1.41	5.04	0.88	1.79	1.76	4.37	-1.81	21.26
Estonia										
Finland	-2.59	-0.15	-5.86	3.35	-1.80	-1.29	5.00	0.99	0.68	-2.08
France	2.45	4.06	0.14	0.74	1.11	1.03	1.91	1.51	2.28	16.23
Germany										
Greece	6.83	2.38	2.30	1.34	3.04	4.59	2.36	4.78	1.82	33.46
Hungary										
Iceland										
Ireland										
Italy									0.80	
Japan	4.58	2.60	1.05	5.10	2.81	2.66	1.34	0.43	1.64	24.43
Latvia										
Luxembourg										
Netherlands							-2.79	2.42	2.90	22.61
New Zealand	1.18	4.48	3.49	6.71	8.06	2.10	3.50	2.01	3.07	40.15
Norway										18.29
Portugal	7.27	9.11	5.54	3.96	3.60	5.76	6.52	7.11	7.38	72.37
Slovakia										
Spain	4.69	5.81	-0.97	5.41	1.32	6.49	0.96	10.05	5.55	46.32
Sweden	1.31	1.65	-4.07	2.00	2.02	-0.45	0.47	2.32	1.81	7.13
Switzerland										
United Kingdom	-0.73	1.33	1.15	0.55	-0.94	3.88	1.24	-0.64	-0.79	5.06
United States	-1.17	1.90	2.66	2.84	2.18	2.50	1.55	2.77	2.66	19.31

Energy - Road transportation

Trends in N_2O emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	5.09									12.41
Austria	1.02	1.27	1.44	1.58	1.76	1.81	1.80	1.79	1.87	1.86
Belgium										
Bulgaria									0.10	0.10
Canada	11.75	12.94	14.78	16.55	18.36	19.11	18.86	19.10	18.69	18.58
Czech Republic										1.57
Denmark	0.40	0.50	0.59	0.69	0.86	0.97	1.07	1.24	1.36	1.41
Estonia										0.01
Finland	1.34	1.37	1.37	1.45	1.46	1.41	1.55	1.62	1.68	1.75
France	3.79	4.02	4.31	4.81	5.74	6.62	7.58	8.48	9.23	10.12
Germany										
Greece	0.46	0.56	0.64	0.71	0.74	0.80	0.86	0.95	1.00	1.03
Hungary										0.13
Iceland										0.10
Ireland										1.05
Italy									8.79	9.57
Japan	12.16	12.67	12.98	12.96	13.13	13.55	13.72	13.92	13.93	14.27
Latvia										0.05
Luxembourg										0.14
Netherlands	3.80						6.40	6.46	5.47	5.26
New Zealand	0.34	0.35	0.36	0.38	0.40	0.43	0.44	0.45	0.46	0.48
Norway	0.24									1.41
Portugal	0.38	0.41	0.44	0.58	0.69	0.80	0.94	0.94	1.25	1.42
Slovakia									0.38	0.41
Spain	2.40	2.54	2.73	2.97	3.44	3.79	4.29	4.73	5.59	6.33
Sweden	1.00	0.90	0.93	1.00	1.10	1.22	1.29	1.40	1.50	1.58
Switzerland										2.09
United Kingdom	3.11	3.22	3.64	4.83	6.38	7.86	9.39	11.01	12.51	13.85
United States	165.71	176.43	189.38	198.85	204.55	205.90	200.85	200.91	197.99	194.80

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										143.72
Austria	24.22	13.51	9.98	11.32	3.04	-0.95	-0.67	4.83	-0.82	81.93
Belgium										
Bulgaria									5.15	
Canada	10.08	14.27	11.93	10.95	4.10	-1.29	1.25	-2.16	-0.56	58.09
Czech Republic										
Denmark	25.56	18.90	15.24	25.46	13.16	10.20	15.61	9.62	3.75	253.92
Estonia										
Finland	2.28	-0.41	6.20	0.42	-3.10	9.71	4.26	3.89	4.31	30.48
France	6.13	7.19	11.53	19.45	15.30	14.53	11.88	8.91	9.62	167.31
Germany										
Greece	21.04	15.05	10.44	3.95	8.14	7.78	10.13	5.81	2.70	122.99
Hungary										
Iceland										
Ireland										
Italy									8.90	
Japan	4.25	2.39	-0.14	1.34	3.18	1.25	1.50	0.06	2.40	17.36
Latvia										
Luxembourg										
Netherlands							0.96	-15.33	-3.95	38.44
New Zealand										
Norway										493.96
Portugal	7.71	8.74	30.19	20.77	15.34	17.74	0.00	32.30	13.37	275.15
Slovakia									6.77	
Spain	6.07	7.39	8.74	15.79	10.17	13.13	10.34	18.17	13.16	163.77
Sweden	-10.00	3.33	7.53	10.00	10.69	5.75	8.47	7.72	4.69	57.50
Switzerland										
United Kingdom	3.53	13.06	32.62	32.01	23.15	19.50	17.22	13.69	10.71	344.90
United States	6.47	7.34	5.00	2.87	0.66	-2.45	0.03	-1.45	-1.61	17.55

Energy - Domestic aviation and marine transport: emission factors (1999)

	Domestic aviation and marine transport (CO_2)														
	Methods and EF used[a]		IEF in CRF based on	1.A.3.a Civil aviation (domestic)				International aviation transport		1.A.3.d Navigation (domestic)				International marine transport	
				Key source	Percentage of national total	CO_2 IEF		CO_2 IEF		Key source	Percentage of national total	CO_2 IEF		CO_2 IEF	
	Methods	EF				Jet kerosene	Aviation gasoline	Jet kerosene	Aviation gasoline			Residual oil	Gas/diesel oil	Residual oil	Gas/diesel oil
					(%)	(t/TJ)		(t/TJ)			(%)	(t/TJ)		(t/TJ)	
IPCC Default EF[b]			**NCV**			**72.8**	**72.1**	**72.8**	**72.1**			**77.6**	**73**	**77.6**	**75.0-77.6**
Australia	T1, T2	CS	GCV			69.0	67.3	69.0	NA			72.9	69.0	72.9	69.0
Austria	M	CS	NCV			63.1	74.0	63.1					73.7		
Belgium															
Bulgaria	T2	C, CS, D	NCV			70.6	92.3	70.6						81.2	76.1
Canada	CS	CS	GCV	L	1.9	70.1	69.5	70.1	69.5	L	0.7	74.0	70.6	74.0	70.6
Czech Republic	T1	D	NCV			70.8		70.8					73.3		
Denmark			NCV			72.0	73.0	72.0	73.0			78.0	74.0	78.0	74.0
Estonia			NCV			70.8						75.8	73.3	75.8	73.3
Finland	CS (M)	CS	NCV			70.8	72.5	70.8	NO	L	0.7	76.6	73.4	76.6	73.4
France	C /CS	C /M /CS	NCV	L	1.1	71.6		71.6				78.0	75.0	78.0	75.0
Germany															
Greece	C	C	NCV	L	1.4	70.8		70.8		L	2.2	76.6	71.5	76.6	73.3
Hungary	D	D	NCV					70.8					68.6		
Iceland	T1	D	NCV			70.8	68.6	70.8	68.6			76.6	73.3	76.6	73.3
Ireland	T1	CS	NCV	L	0.4	NE	NE	71.3	70.0			76.0	73.3	76.0	73.3
Italy			NCV			70.7	70.9	70.7		L	1.3		75.0	77.6	
Japan	T1, RA, CS	D, CS	NCV	L	0.8	70.7	NO	74.4	NO	L	1.1	NO	72.3	77.9	76.1
Latvia	T1, CS	D	NCV			70.9		NE	NE				72.8	NE	NE
Luxembourg			NCV										70.0		
Netherlands			NCV			73.0		73.0					73.0	73.0	73.0
New Zealand [c]	T1	CS/D	GCV	L	1.0	NE	NE	NE	NE			NE	NE	NE	NE
Norway	M, T1, CS/T2	CS	NCV	L	2.0	73.1	71.3	73.1		L	5.0	78.8	73.6	78.8	73.6
Portugal	C	C	NCV	L	1.5	72.4	71.7	72.4	71.7	L	0.6	76.4	73.7	76.4	73.4
Slovakia	M	M	NCV			NA	IE	NE	NE			NO	75.0	NE	NE
Spain															
Sweden	CS	CS	NCV	L	1.1	73.1	72.3	73.1	72.3	L	0.9	76.2	74.8	76.2	74.6
Switzerland	CS	CS	NCV	L	0.5	73.2	IE	73.2	IE			NO	73.6	NO	NO
United Kingdom	T2	CS	NCV			71.8	70.6	71.8	IE			75.9	72.5	75.9	72.5
United States	T1, T2	CS	GCV	L	2.2	66.5	64.9	66.5	NE	L	1.0	73.9	72.3	73.9	68.6

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method used or type of emission factor for all subcategories within the category 1.A.3 Transport.

[b] Default emission factors (for gas/diesel oil: single value for internal waterways and range for sea-going ships, boats; IPCC Guidelines volume 3, pages 1.89, 1.91).

[c] New Zealand reported aggregate total activity data and emissions data for all fuels used for aviation and marine transport.

Energy - Domestic and international aviation transport: activity data (1999)

	Domestic and international aviation transport												
	Activity data in CRF based on	1.A.3.a Civil aviation (domestic)						International aviation			Total jet kerosene and aviation gasoline		
		Jet kerosene			Aviation gasoline			Jet kerosene					
		CRF	IEA[a]	Difference	CRF	IEA[a]	Difference	CRF	IEA[a]	Difference	CRF	IEA	Difference
		(TJ)		(%)	(TJ)		(%)	(TJ)		(%)	(TJ)		(%)
Australia	GCV	56,267	70,744	25.7	3,358	3,434	2.3	105,330	105,999	0.6	164,955	180,178	9.2
Austria	NCV	1,639	1,739	6.1	93	0		25,577	21,805	-14.7	27,308	23,544	-13.8
Belgium			3,344			90			64,031			67,465	
Bulgaria	NCV	502	2,185	334.9	0	134		4,522	3,032	-32.9	5,024	5,351	6.5
Canada	GCV	184,276	188,870	2.5	3,570	3,575	0.1	43,240	45,836	6.0	231,086	238,281	3.1
Czech Republic	NCV	187	2,898	1449.9		45		7,610	4,949	-35.0	7,797	7,893	1.2
Denmark	NCV	1,979	5,262	165.9	103	134	30.9	32,132	32,952	2.6	34,214	38,348	12.1
Estonia	NCV	949	0		0	45		0	758		949	803	-15.4
Finland	NCV	6,408	6,599	3.0	153	179	17.1	14,946	15,384	2.9	21,507	22,162	3.0
France	NCV	84,753	56,986	-32.8		1,210		192,104	222,950	16.1	276,857	281,146	1.5
Germany			13,867			1,120			289,434			304,421	
Greece	NCV	23,722	15,428	-35.0	0	0		32,016	40,309	25.9	55,738	55,738	0.0
Hungary	NCV	0	0		0	0		8,424	8,963	6.4	8,424	8,963	6.4
Iceland	NCV	394	401	2.0	55	45	-17.8	5,130	5,128	-0.1	5,579	5,574	-0.1
Ireland	NCV	NE	1,159		NE	45		22,692	21,805	-3.9	22,692	23,009	1.4
Italy	NCV	33,488	12,218	-63.5	395	403	2.1	105,581	142,108	34.6	139,464	154,729	10.9
Japan	NCV	145,858	157,180	7.8	NO	538		248,931	266,425	7.0	394,790	424,143	7.4
Latvia	NCV	1,255	0			0		NE	1,293		1,255	1,293	3.0
Luxembourg	NCV	0	0		0	0			14,403			14,403	
Netherlands	NCV	5,747	4,013	-30.2	0	134		137,896	143,089	3.8	143,643	147,237	2.5
New Zealand	GCV	NE	11,611		NE	659		NE	29,075		NE	41,345	
Norway	NCV	15,237	8,249	-45.9	106	0	-100.0	13,346	24,614	84.4	28,689	32,863	14.5
Portugal	NCV	16,124	9,007	-44.1	72	134	87.9	12,025	23,142	92.4	28,221	32,284	14.4
Slovakia	NCV	NA	892		NA	0		NE	0		NA/NE	892	
Spain			72,726			448			109,513			182,687	
Sweden	NCV	10,824	19,976	84.6	59	224	282.5	28,621	20,779	-27.4	39,503	40,979	3.7
Switzerland	NCV	3,483	4,058	16.5	IE	224		61,748	63,362	2.6	65,231	67,644	3.7
United Kingdom	NCV	37,381	176,710	372.7	1,977	1,882	-4.8	355,886	264,998	-25.5	395,244	443,590	12.2
United States	GCV	2,190,067	2,806,548	28.1	41,329	47,181	14.2	916,695	843,079	-8.0	3,148,091	3,696,808	17.4

[a] Data from the International Energy Agency (conversion factors used: 44.59 TJ/kt for jet kerosene and 44.80 TJ/kt for aviation gasoline; source of conversion factors: IPCC Guidelines, volume 3, page 1.23, tables 1-3). For those Parties using GCV, the above conversion factors were increased by 5 per cent.

Energy - Domestic and international marine transport: activity data (1999)

	Activity data in CRF based on	Domestic and international marine transport																	
		1.A.3.d Navigation (domestic)						International marine transport						Total fuel consumption					
		Residual oil			Gas/diesel oil			Residual oil			Gas/diesel oil			Residual oil			Gas/diesel oil		
		CRF	IEA[a]	Difference	CRF	IEA[a]	Difference	CRF	IEA[a]	Difference	CRF	IEA[a]	Difference	CRF	IEA	Difference	CRF	IEA	Difference
		(TJ)		(%)	(TJ)		(%)	(TJ)		(%)	(TJ)		(%)	(TJ)		(%)	(TJ)		(%)
Australia	GCV	7,660	7,554	-1.4	1,492	5,138	244.3	29,640	30,637	3.4	4,210	4,049	-3.8	37,300	38,191	2.4	5,702	9,187	61.1
Austria	NCV	0	0		709	173	-75.6	0	0		0	0		0	0		709	173	-75.6
Belgium			7,475			3,637			158,791			24,698		0	166,266		0	28,335	
Bulgaria	NCV	0	121		103	0		39	40	3.1	294	303	3.2	39	161	312.2	397	303	-23.6
Canada	GCV	29,002	28,485	-1.8	38,022	38,054	0.1	40,282	39,541	-1.8	8,034	8,053	0.2	69,284	68,026	-1.8	46,056	46,107	0.1
Czech Republic	NCV		0		440	0			0			0		0	0		440	0	
Denmark	NCV	1,435	1,407	-2.0	3,751	3,464	-7.7	26,085	28,213	8.2	28,526	26,475	-7.2	27,520	29,620	7.6	32,277	29,939	-7.2
Estonia	NCV	5	0		243	217	-10.9	3,050	5,265	72.6	1,785	2,340	31.1	3,055	5,265	72.3	2,028	2,556	26.1
Finland	NCV	2,111	2,090	-1.0	2,634	3,291	24.9	16,524	16,357	-1.0	6,784	6,500	-4.2	18,635	18,447	-1.0	9,418	9,790	4.0
France	NCV	1,419	322	-77.3	18,978	21,001	10.7	100,691	101,399	0.7	19,425	18,155	-6.5	102,111	101,721	-0.4	38,404	39,156	2.0
Germany			0			12,903			64,826			20,928		0	64,826		0	33,832	
Greece	NCV	23,752	23,752	0.0	13,165	12,514	-4.9	98,548	98,546	0.0	30,591	30,591	0.0	122,300	122,298	0.0	43,756	43,105	-1.5
Hungary	NCV	0	0		30	0		0	0		0	0		0	0		30	0	
Iceland	NCV	1	0		246	260	5.7	94	80	-14.3	2,137	2,123	-0.6	95	80	-15.0	2,383	2,383	0.0
Ireland	NCV	963	924	-4.0	795	779	-2.0	2,052	2,010	-2.0	5,275	5,286	0.2	3,014	2,934	-2.7	6,071	6,066	-0.1
Italy	NCV	0	0		83,636	9,656	-88.5	36,961	65,670	77.7	0	34,404		36,961	65,670	77.7	83,636	44,060	-47.3
Japan	NCV	NO	123,584		6,803	81,534	1098.5	221,250	206,858	-6.5	1,203	10,746	793.0	221,250	330,442	49.4	8,006	92,280	1052.6
Latvia	NCV		0		976	433	-55.6	NE	0		NE	0		NE	0		976	433	-55.6
Luxembourg	NCV	0	0		80	0			0			0		0	0		80	0	
Netherlands	NCV	0	0		11,059	28,578	158.4	472,523	439,116	-7.1	85,791	87,050	1.5	472,523	439,116	-7.1	96,851	115,628	19.4
New Zealand	GCV	NE	0		NE	5,547		NE	8,693		NE	3,640		NE	8,693		NE	9,186	
Norway	NCV	505	482	-4.5	37,927	35,160	-7.3	15,912	15,714	-1.2	20,109	20,235	0.6	16,417	16,197	-1.3	58,036	55,395	-4.6
Portugal	NCV	546	0		6,370	1,645	-74.2	11,014	16,719	51.8	4,989	7,929	58.9	11,560	16,719	44.6	11,360	9,575	-15.7
Slovakia	NCV	NO	0		1,892	0		NE	0		NE	0		NO/NE	0		1,892	0	
Spain			9,244			58,455			195,725			49,700		0	204,969		0	108,155	
Sweden	NCV	1,590	1,447	-9.0	4,633	4,460	-3.7	53,418	53,734	0.6	9,116	9,359	2.7	55,007	55,181	0.3	13,749	13,819	0.5
Switzerland	NCV	NO	0		962	390	-59.5	NO	0		NO	520		NO	0		962	910	-5.4
United Kingdom	NCV	2,914	2,813	-3.5	34,309	39,793	16.0	48,386	47,384	-2.1	36,974	49,873	34.9	51,300	50,197	-2.1	71,283	89,666	25.8
United States	GCV	349,775	717	-99.8	548,756	0		516,692	844,623	63.5	119,065	299,776	151.8	866,467	845,340	-2.4	667,822	299,776	-55.1

[a] Data from the International Energy Agency (conversion factors used: for residual oil 40.19 TJ/kt and for gas/diesel oil 43.33 TJ/kt; source of conversion factors: IPCC Guidelines, volume 3, page 1.23, tables 1-3). For those Parties using GCV, the above conversion factors were increased by 5 per cent.

Energy - Transport: civil aviation

Trends in CO_2 emissions 1990 to 1999

Gigagrams

	Base year [a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia		2,555									4,109
Austria		69	80	84	82	84	92	101	104	124	110
Belgium											
Bulgaria											35
Canada		10,385	9,239	9,426	9,125	9,772	10,527	11,558	12,054	12,582	13,168
Czech Republic											13
Denmark		184	171	168	168	170	175	190	193	172	150
Estonia											67
Finland		403	409	386	374	380	353	380	413	447	465
France		4,541	4,618	4,498	4,368	4,571	5,305	5,726	5,778	6,080	6,068
Germany											
Greece		1,458	1,461	1,524	1,600	1,341	1,215	1,278	1,228	1,149	1,679
Hungary											
Iceland											32
Ireland											NE
Italy										2,240	2,397
Japan		6,843	7,376	7,825	8,270	8,813	9,297	9,221	9,644	10,401	10,308
Latvia										88	89
Luxembourg											
Netherlands		492						300	321	578	420
New Zealand											757
Norway		682									1,121
Portugal		799	840	893	857	837	965	1,033	1,065	1,216	1,173
Slovakia											28
Spain		4,372	4,392	4,923	1,740	2,883	3,308	3,831	4,064	4,688	4,822
Sweden		818	793	758	770	780	814	755	745	784	795
Switzerland											255
United Kingdom		2,158	2,121	2,221	2,281	2,326	2,448	2,550	2,641	2,764	2,822
United States		127,534	117,721	119,723	121,582	124,338	129,402	133,225	138,183	141,591	148,345

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										60.8
Austria	15.3	4.6	-1.9	1.7	10.0	9.6	2.7	20.1	-11.3	58.8
Belgium										
Bulgaria										
Canada	-11.0	2.0	-3.2	7.1	7.7	9.8	4.3	4.4	4.7	26.8
Czech Republic										
Denmark	-7.4	-1.7	-0.1	1.5	3.0	8.2	1.7	-11.0	-12.6	-18.6
Estonia										
Finland	1.5	-5.6	-3.0	1.6	-7.0	7.7	8.6	8.3	4.0	15.4
France	1.7	-2.6	-2.9	4.6	16.1	7.9	0.9	5.2	-0.2	33.6
Germany										
Greece	0.2	4.3	5.0	-16.2	-9.4	5.2	-4.0	-6.4	46.2	15.2
Hungary										
Iceland										
Ireland										
Italy									7.0	
Japan	7.8	6.1	5.7	6.6	5.5	-0.8	4.6	7.9	-0.9	50.6
Latvia										
Luxembourg										
Netherlands							6.9	80.2	-27.4	-14.8
New Zealand										
Norway										64.4
Portugal	5.1	6.4	-4.1	-2.3	15.3	7.1	3.1	14.2	-3.6	46.7
Slovakia										
Spain	0.5	12.1	-64.6	65.7	14.7	15.8	6.1	15.3	2.9	10.3
Sweden	-3.1	-4.4	1.6	1.3	4.4	-7.2	-1.3	5.2	1.5	-2.8
Switzerland										
United Kingdom	-1.7	4.7	2.7	2.0	5.2	4.2	3.6	4.7	2.1	30.7
United States	-7.7	1.7	1.6	2.3	4.1	3.0	3.7	2.5	4.8	16.3

Energy - International bunkers: aviation

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	Base year [a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia		4,345	4,520	4,796	5,199	5,354	5,858	6,312	6,501	7,233	7,268
Austria		941	1,101	1,172	1,143	1,201	1,332	1,471	1,522	1,835	1,615
Belgium										4,571	4,364
Bulgaria	**892**										319
Canada		2,729	2,483	2,685	2,472	2,461	2,604	3,074	2,992	2,878	3,032
Czech Republic											539
Denmark		1,795	1,661	1,719	1,681	1,844	1,890	1,986	2,030	2,181	2,314
Estonia											
Finland		974	917	811	762	802	867	957	965	990	1,058
France		8,618	8,336	9,831	10,244	10,605	10,513	11,240	11,634	12,255	13,753
Germany		11,589	11,367	12,200	12,892		13,880	14,401	15,095	15,442	16,656
Greece		2,452	2,131	1,869	2,907	2,787	2,613	2,503	2,421	1,829	2,266
Hungary											596
Iceland											363
Ireland											1,624
Italy										6,397	7,468
Japan		13,178	13,842	14,102	14,215	14,877	16,826	18,152	19,086	18,302	18,519
Latvia										NE	NE
Luxembourg											1,019
Netherlands		4,450	4,960	5,910	6,500	6,720	7,670	8,300	8,979	9,521	10,066
New Zealand											1,959
Norway		605									975
Portugal		883	872	917	856	900	853	770	792	843	874
Slovakia											
Spain		3,161	3,173	3,557	6,484	5,869	6,211	6,554	7,068	7,478	7,746
Sweden		1,826	1,910	2,133	1,820	1,811	1,849	1,940	1,929	2,103	2,103
Switzerland		3,200	3,100	3,300	3,440	3,550	3,770	3,900	4,050	4,230	4,520
United Kingdom		14,791	14,570	16,121	17,241	17,856	19,012	20,238	21,552	24,122	25,539
United States		46,728	46,682	47,143	47,615	48,327	51,093	52,135	55,899	54,988	60,970

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	4.0	6.1	8.4	3.0	9.4	7.8	3.0	11.3	0.5	67.3
Austria	17.0	6.5	-2.5	5.2	10.8	10.4	3.5	20.6	-12.0	71.6
Belgium									-4.5	
Bulgaria										64.2
Canada	-9.0	8.2	-7.9	-0.5	5.8	18.1	-2.7	-3.8	5.4	11.1
Czech Republic										
Denmark	-7.5	3.5	-2.2	9.7	2.5	5.1	2.2	7.5	6.1	29.0
Estonia										
Finland	-5.9	-11.6	-6.0	5.2	8.1	10.4	0.8	2.6	6.9	8.6
France	-3.3	17.9	4.2	3.5	-0.9	6.9	3.5	5.3	12.2	59.6
Germany	-1.9	7.3	5.7			3.8	4.8	2.3	7.9	43.7
Greece	-13.1	-12.3	55.5	-4.1	-6.2	-4.2	-3.3	-24.4	23.9	-7.6
Hungary										
Iceland										
Ireland										
Italy									16.7	
Japan	5.0	1.9	0.8	4.7	13.1	7.9	5.1	-4.1	1.2	40.5
Latvia										
Luxembourg										
Netherlands	11.5	19.2	10.0	3.4	14.1	8.2	8.2	6.0	5.7	126.2
New Zealand										
Norway										61.3
Portugal	-1.3	5.2	-6.6	5.1	-5.2	-9.7	2.9	6.4	3.6	-1.1
Slovakia										
Spain	0.4	12.1	82.3	-9.5	5.8	5.5	7.8	5.8	3.6	145.1
Sweden	4.6	11.7	-14.7	-0.5	2.1	4.9	-0.6	9.0	0.0	15.2
Switzerland	-3.1	6.5	4.2	3.2	6.2	3.4	3.8	4.4	6.9	41.3
United Kingdom	-1.5	10.6	6.9	3.6	6.5	6.4	6.5	11.9	5.9	72.7
United States	-0.1	1.0	1.0	1.5	5.7	2.0	7.2	-1.6	10.9	30.5

[a] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia		2,223.9									1,438.4
Austria		47.5	42.7	41.7	42.1	51.0	49.4	49.4	57.3	57.944	58.4
Belgium											
Bulgaria	874.0										8.2
Canada		4,732.6	4,935.4	4,787.6	4,187.9	4,351.8	4,064.0	4,158.4	4,215.6	4,826.925	4,831.1
Czech Republic											32.3
Denmark		536.3	634.5	577.4	626.0	589.3	618.6	640.6	563.2	468.368	426.2
Estonia											18.2
Finland		226.8	199.8	211.2	226.8	273.4	264.0	257.8	249.1	256.600	501.3
France		1,908.1	1,709.7	1,713.0	1,816.2	1,963.8	2,014.5	1,864.8	1,905.9	1,885.920	2,039.4
Germany											
Greece		1,824.8	1,851.2	1,899.4	1,738.1	1,830.8	1,743.6	1,493.4	1,812.5	2,793.460	2,760.8
Hungary											2.1
Iceland											18.1
Ireland											131.5
Italy										7,626.000	6,956.0
Japan		13,345.9	13,907.4	13,709.8	13,559.1	13,862.9	14,358.3	15,225.9	16,209.6	14,420.706	14,347.2
Latvia										72.241	71.0
Luxembourg											5.6
Netherlands		877.5						798.0	847.9	816.680	807.3
New Zealand											218.5
Norway		1,917.4									2,829.3
Portugal		486.5	454.8	430.1	431.0	363.3	337.4	340.6	340.6	552.429	511.5
Slovakia											141.9
Spain		1,884.6	2,258.3	2,505.2	2,752.2	3,157.6	2,938.8	3,573.3	2,994.2	3,416.674	3,612.9
Sweden		648.5	525.3	505.7	408.6	394.1	451.7	442.3	506.2	593.140	661.4
Switzerland											70.8
United Kingdom		3,460.9	3,717.5	3,557.1	3,537.5	3,282.1	3,102.4	3,414.5	3,252.2	3,001.376	2,710.0
United States		59,432.8	52,825.4	67,677.9	63,384.5	62,184.4	66,919.6	63,781.3	50,176.9	47,865.475	65,551.7

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										-35.3
Austria	-10.1	-2.4	1.0	21.2	-3.2	0.1	16.0	1.0	0.8	22.9
Belgium										
Bulgaria										99.1
Canada	4.3	-3.0	-12.5	3.9	-6.6	2.3	1.4	14.5	0.1	2.1
Czech Republic										
Denmark	18.3	-9.0	8.4	-5.9	5.0	3.6	-12.1	-16.8	-9.0	-20.5
Estonia										
Finland	-11.9	5.7	7.4	20.5	-3.4	-2.3	-3.4	3.0	95.4	121.0
France	-10.4	0.2	6.0	8.1	2.6	-7.4	2.2	-1.0	8.1	6.9
Germany										
Greece	1.4	2.6	-8.5	5.3	-4.8	-14.3	21.4	54.1	-1.2	51.3
Hungary										
Iceland										
Ireland										
Italy									-8.8	
Japan	4.2	-1.4	-1.1	2.2	3.6	6.0	6.5	-11.0	-0.5	7.5
Latvia										
Luxembourg										
Netherlands							6.2	-3.7	-1.1	-8.0
New Zealand										
Norway										47.6
Portugal	-6.5	-5.4	0.2	-15.7	-7.1	1.0	0.0	62.2	-7.4	5.1
Slovakia										
Spain	19.8	10.9	9.9	14.7	-6.9	21.6	-16.2	14.1	5.7	91.7
Sweden	-19.0	-3.7	-19.2	-3.5	14.6	-2.1	14.4	17.2	11.5	2.0
Switzerland										
United Kingdom	7.4	-4.3	-0.6	-7.2	-5.5	10.1	-4.8	-7.7	-9.7	-21.7
United States	-11.1	28.1	-6.3	-1.9	7.6	-4.7	-21.3	-4.6	36.9	10.3

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia		2,056	1,858	1,789	1,788	1,886	2,675	2,719	2,519	2,240	2,450
Austria		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Belgium										18,159	14,586
Bulgaria	874.0										26
Canada		2,995	3,099	3,181	2,838	3,189	3,312	3,086	3,046	3,776	3,549
Czech Republic											
Denmark		3,095	2,772	2,895	4,312	4,842	5,073	4,820	4,419	4,414	4,146
Estonia											362
Finland		1,800	2,898	2,164	1,695	1,318	1,044	1,181	1,286	1,658	1,764
France		8,137	8,441	8,157	7,860	7,002	7,217	7,568	8,379	9,166	9,311
Germany		7,980	6,735	5,618	7,025		6,533	6,472	6,479	6,479	6,479
Greece		8,028	7,368	8,464	9,869	10,470	11,214	9,864	9,891	11,058	9,838
Hungary											
Iceland											164
Ireland											543
Italy										2,397	3,046
Japan		17,348	18,882	19,669	22,107	22,246	20,164	14,029	17,258	18,384	17,322
Latvia										NE	NE
Luxembourg											
Netherlands		35,560	36,330	36,490	37,780	36,140	36,480	37,200	39,530	39,798	41,143
New Zealand											953
Norway		1,478									2,733
Portugal		1,173	1,191	1,210	987	944	1,021	1,093	1,139	1,180	1,208
Slovakia											
Spain		11,780	12,496	12,655	11,079	10,027	10,296	15,029	18,532	19,546	19,074
Sweden		2,163	2,560	2,920	2,932	3,452	3,394	3,596	4,218	4,855	4,750
Switzerland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
United Kingdom		6,559	6,340	6,640	6,573	6,150	6,599	7,210	8,064	8,788	6,357
United States		67,272	73,337	62,822	52,270	49,690	49,921	50,062	53,889	57,783	46,376

Percentage change relative from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-9.6	-3.8	0.0	5.5	41.8	1.6	-7.3	-11.1	9.4	19.2
Austria										
Belgium									-19.7	
Bulgaria										97.1
Canada	3.5	2.7	-10.8	12.4	3.9	-6.9	-1.3	24.0	-6.0	18.5
Czech Republic										
Denmark	-10.4	4.5	48.9	12.3	4.8	-5.0	-8.3	-0.1	-6.1	33.9
Estonia										
Finland	61.0	-25.3	-21.7	-22.2	-20.8	13.1	8.9	28.9	6.4	-2.0
France	3.7	-3.4	-3.7	-10.9	3.1	4.9	10.7	9.4	1.6	14.4
Germany	-15.6	-16.6	25.0			-0.9	0.1	0.0	0.0	-18.8
Greece	-8.2	14.9	16.6	6.1	7.1	-12.0	0.3	11.8	-11.0	22.5
Hungary										
Iceland										
Ireland										
Italy									27.1	
Japan	8.8	4.2	12.4	0.6	-9.4	-30.4	23.0	6.5	-5.8	-0.1
Latvia										
Luxembourg										
Netherlands	2.2	0.4	3.5	-4.3	0.9	2.0	6.3	0.7	3.4	15.7
New Zealand										
Norway										84.9
Portugal	1.5	1.6	-18.5	-4.3	8.1	7.0	4.2	3.6	2.4	3.0
Slovakia										
Spain	6.1	1.3	-12.4	-9.5	2.7	46.0	23.3	5.5	-2.4	61.9
Sweden	18.4	14.1	0.4	17.7	-1.7	6.0	17.3	15.1	-2.2	119.6
Switzerland										
United Kingdom	-3.3	4.7	-1.0	-6.4	7.3	9.3	11.9	9.0	-27.7	-3.1
United States	9.0	-14.3	-16.8	-4.9	0.5	0.3	7.6	7.2	-19.7	-31.1

[a] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

Energy - Fugitive emissions from fuels: coal mining and handling (1999)

Activity data and emission factors

	1.B.1 Fugitive emissions from solid fuels (CH_4)												
			Methods and EF used[c]		1.B.1.a Coal mining and handling								
	Key source	Percentage of national total	Methods	EF	Activity data					CH_4 IEF			
					CRF			IEA[a]	Difference	Underground mines		Surface mines	
					Underground mines	Surface mines	Total	Total		Mining activities	Post-mining activities	Mining activities	Post-mining activities
		(%)			(Mt)				(%)	(kg/t)			
IPCC Default EF[b]										4.50-16.75	0.60-2.68	0.20-1.34	0-0.13
Australia	L	3.8	T2	CS	77.66	196.22	273.88	291.00	6.3	7.41	0.38	1.36	NA
Austria			C	CS	NO	1.14		1.14				0.01	
Belgium								0.00					
Bulgaria	L	1.5	T1	D	2.71	2.71	5.42	25.30	366.4	11.73	1.68	6.70	0.56
Canada			CS	CS	2.33	85.92	88.26	72.46	-17.9	8.18	IE	0.38	
Czech Republic	L	3.4	T3	CS	14.42	41.52	55.94	59.13	5.7	11.89	1.57	0.77	0.07
Denmark					0.00	0.00	0.00	0.00					
Estonia					5.70	4.99	10.69	10.69	0.0	1.34	0.13	0.20	0.07
Finland			CS	CS	NO	NO		0.00					
France			C	CS	4.23	0.86	5.09	5.09	0.0	26.18		0.83	
Germany								205.13					
Greece			T1	IPCC	NA	62.05	62.05	62.05	0.0	NO	NO	0.77	0.08
Hungary	L	2.2	D	D	6.12	8.57	14.68	14.55	-0.9	11.73	1.68	0.80	0.07
Iceland					NO	NO		0.00					
Ireland			NA	NA	NO	NO		0.00					
Italy						19.00	19.00	0.12	-99.4			0.00	
Japan			T2	CS	3.10	0.59	3.69	3.91	5.9	15.10	0.60	0.77	0.07
Latvia					NO	NO		0.00					
Luxembourg								0.00					
Netherlands					NO	NO		0.00					
New Zealand			T1	CS/D	0.95	2.77	3.90	3.71	-4.8	23.19	1.59	0.77	0.07
Norway			T1	D	0.40		0.40	0.49	21.1	0.54			
Portugal			C+T2	C	0.00	0.00	0.00	0.00					
Slovakia	L	1.1	T1	CS	3.75	NO	3.70	3.75		6.70	0.30	NO	NO
Spain			T2	CS				24.28					
Sweden			CS	CS				0.00					
Switzerland					NO	NO		0.00					
United Kingdom	L	1.0	T2	CS	20.89	15.28	36.16	36.16	0.0	13.45	1.16	0.34	IE
United States	L	0.9	T2,T3	CS	352.75	639.70	992.45	994.36	0.2	5.38	1.58	0.66	0.11

[a] Data from the International Energy Agency (sum of total indigenous production of hard coal and brown coal).

[b] Range of default emission factors for the IPCC tier 1 approach (source: IPCC Guidelines, volume 3, pages 1.105-1.110).

[c] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method used or type of emission factors for all subcategories within the category 1.B.1 Solid fuels.

Energy - Fugitive emissions from fuels: solid fuels

Trends in CH_4 emissions 1990 to 1999

Gigagrams

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia		757.31	760.40	789.77	786.95	758.55	795.82	837.17	807.73	889.34	873.39
Austria		0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Belgium										0.65	0.65
Bulgaria	91.90										56.01
Canada		91.16	99.35	87.35	87.32	84.09	81.58	84.13	78.07	64.96	51.48
Czech Republic											228.96
Denmark		3.30	3.88	3.94	4.74	5.58	6.27	6.27	6.27	3.97	3.32
Estonia											9.74
Finland		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
France		206.26	191.52	199.88	208.50	212.93	211.03	160.81	137.45	133.10	126.55
Germany		1,227.00	1,121.00	1,074.00	920.00	811.00	838.00	740.30	713.00	614.00	572.00
Greece		44.11	44.79	46.79	46.58	48.17	49.03	50.81	50.02	51.75	52.74
Hungary	222.90										89.46
Iceland											NO
Ireland											NO
Italy										2.63	1.77
Japan		107.37	107.43	106.84	101.03	94.19	88.85	87.22	52.55	49.63	49.19
Latvia										NE	NO
Luxembourg											
Netherlands		IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
New Zealand											25.86
Norway		0.16									0.22
Portugal		3.14	3.04	2.84	2.64	1.97					
Slovakia											26.24
Spain		107.62	101.19	101.14	96.74	92.06	93.38	89.58	91.95	85.40	86.77
Sweden		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Switzerland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
United Kingdom		819.20	838.26	803.85	724.34	456.59	504.25	473.63	445.57	372.34	310.88
United States		4,183.70	3,975.39	3,834.90	3,355.84	3,389.85	3,550.02	3,301.04	3,274.14	3,167.64	2,944.20

Percentage change from previous year

		1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia		0.41	3.86	-0.36	-3.61	4.91	5.20	-3.52	10.10	-1.79	15.33
Austria		-11.76	-20.00	0.00	-16.67	-10.00	-11.11	0.00	0.00	0.00	-52.94
Belgium										0.00	
Bulgaria											39.05
Canada		8.99	-12.08	-0.03	-3.70	-2.99	3.13	-7.20	-16.80	-20.74	-43.52
Czech Republic											
Denmark		17.57	1.73	20.12	17.85	12.35	0.00	0.00	-36.69	-16.35	0.73
Estonia											
Finland		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
France		-7.14	4.36	4.32	2.12	-0.89	-23.80	-14.52	-3.17	-4.92	-38.65
Germany		-8.64	-4.19	-14.34	-11.85	3.33	-11.66	-3.69	-13.88	-6.84	-53.38
Greece		1.54	4.47	-0.45	3.42	1.78	3.64	-1.57	3.47	1.92	19.57
Hungary											59.87
Iceland											
Ireland											
Italy										-32.57	
Japan		0.05	-0.55	-5.44	-6.77	-5.68	-1.83	-39.74	-5.57	-0.87	-54.18
Latvia											
Luxembourg											
Netherlands											
New Zealand											
Norway											33.95
Portugal		-3.21	-6.80	-7.02	-25.41						
Slovakia											
Spain		-5.98	-0.05	-4.35	-4.83	1.42	-4.07	2.65	-7.12	1.60	-19.38
Sweden		0.00	-33.33	0.00	100.00	-25.00	0.00	-33.33	50.00	0.00	0.00
Switzerland											
United Kingdom		2.33	-4.10	-9.89	-36.96	10.44	-6.07	-5.92	-16.44	-16.51	-62.05
United States		-4.98	-3.53	-12.49	1.01	4.72	-7.01	-0.81	-3.25	-7.05	-29.63

[a] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

Energy - Fugitive emissions from fuels: oil and natural gas (1999)

	1.B.2 Fugitive emissions from oil and natural gas (CH_4)																	
	Key source	Percentage of national total	Methods and EF used[a]		1.B.2.a Oil						1.B.2.b Natural gas							
					CH_4 IEF						CH_4 IEF							
			Methods	EF	Production		Transport		Refining (R)/ Storage (S)		Production/Processing [b]		Transmission[b]		Distribution[b]		Other leakage[b]	
		(%)			value	unit	value	unit	value	unit	value	unit	value	unit	value	unit	value	unit
IPCC Default EF[c]					300-5,000	kg/PJ	745.00	kg/PJ	90-1,400 (R) 20-250 (S)	kg/PJ	46,000-314,000	kg/PJ	57,000-628,000	kg/PJ	57,000-288,000	kg/PJ	0-384,000	kg/PJ
Australia	L	1.2	T2	CS	210	kg/PJ	745	kg/PJ	1,236	kg/PJ	1,042	kg/PJ	9,282	kg/PJ	355,414	kg/PJ		
Austria			C	CS											698	kg/Mm^3 GAS		
Belgium																		
Bulgaria	L	2.0	T1	D	2,650	kg/PJ	745	kg/PJ	745	kg/PJ	227,000	kg/PJ	500,000	kg/PJ				
Canada	L	5.4	CS	CS	6,876	kg/10^3 km^3					1,704	kg/10^6 m^3	3,212	kg/km	744	kg/km		
Czech Republic			T1, T3	D,CS	5,287	kg/PJ			1,150	kg/PJ	51,940	kg/PJ	2,927	kg/PJ	103,617	kg/PJ		
Denmark											1	kg/10^3 m^3	2	kg/10^3 m^3				
Estonia	L	1.9			4,000	kg/PJ	745	kg/PJ			458,000	kg/PJ	458,000	kg/PJ				
Finland			CS	PS													1,000	kg/t
France			C	CS					66	kg/PJ	709	kg/PJ	71,313	kg/PJ				
Germany			CS	CS														
Greece			C	C	3	kg/GJ									21	kg/TJ		
Hungary	L	7.0	T1	D	2,600	kg/PJ			373	kg/PJ		kg/PJ	458,000	kg/PJ				
Iceland																		
Ireland			T1	CS											98,759	kg/PJ		
Italy	L	1.1			6,403	kg/PJ			22	kg/Gg	5,199	kg/PJ	12,527	kg/PJ	104,632	kg/PJ		
Japan			T1	D	2,650	kg/PJ	NO		880	kg/PJ	49,500	kg/PJ	95,000	kg/PJ	NO		NO	
Latvia	L	2.8											340,000	kg/PJ				
Luxembourg																		
Netherlands	L	1.3	CS	CS					111	kg/PJ	35,867	kg/PJ	1,474	kg/PJ	81,031	kg/PJ		
New Zealand	L	0.9	T1	CS/D									207,195	kg/PJ				
Norway	L	0.9	CS	CS			2,112	kg/PJ										
Portugal			C+T2	C					86,669	kg/Mt			100	kg/TJ				
Slovakia	L	1.4	D	D, CS	2,650	kg/PJ	1	not specified	745	kg/PJ	67,000	kg/PJ	2,000	kg/PJ			120,000	kg/PJ
Spain																		
Sweden			CS	CS													1	kg/TJ
Switzerland	L	0.5	C	CS					1,023	kg/PJ			118,977	kg/PJ				
United Kingdom	L	1.5	T3	CS	652	kg/PJ	74	kg/Gg	3	kg/PJ					119,158	kg/PJ		
United States	L	2.1	M	M	471,106	kg/MM Bbl/yr	2,593	kg/MM Bbl/yr	12,606	kg/MM Bbl/yr	115,840	kg/bill ft^3/yr	99,783	kg/bill ft^3/yr	70,333	kg/bill ft^3/yr		

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factors used for all sub categories within the category 1.B.2 Oil and natural gas.

[b] The units for the implied emission factors (IEF) vary from Party to Party depending on the unit of the activity data used.

[c] Source of default emission factors: IPCC Guidelines, vol. 3, pages 1.119 -1.121. Emission factors (in kg/PJ) for natural gas activities by regions are provided in the table below

	Basis	Western Europe	US & Canada	Former USSR, Central and Eastern Europe	Rest of the world
Fugitive and other maintenance emissions from gas production	Gas produced	15,000-27,000	46,000-84,000	140,000-314,000	46,000-96,000
Emissions from processing, distribution and transmission	Gas produced			288,000-628,000	288,000 (high)
	Gas consumed	72,000-133,000	57,000-118,000		118,000 (low)

	Fugitive emissions from oil and natural gas (CH_4)									
	1.B.2.d Venting and flaring									
	CH_4 IEF									
	Oil		Gas				Combined			
	Venting[a]		Venting[a]		Flaring[a]		Venting[a]		Flaring[a]	
	value	unit	value	unit	value	unit	value	unit	value	unit
IPCC default EF[b]	**1,000-3000**	**kg/PJ**	**6,000-209,000**			**kg/PJ**	**3,000-14,000**			**kg/PJ**
Australia			83,240.18	kg/PJ	NE		NA		10,059	kg/PJ
Austria										
Belgium										
Bulgaria	2,000	kg/PJ	2,000	kg/PJ	NE		NE		NE	
Canada	NA		18,000	kg/PJ	NA		NA		145	kg/10^6 m^3
Czech Republic										
Denmark					0.16	kg/GJ				
Estonia	4,000	kg/PJ	18,000	kg/PJ						
Finland	NE									
France										
Germany										
Greece										
Hungary										
Iceland										
Ireland	NO		NE		NE		NO		NO	
Italy										
Japan	NO		NO		NO		NO		NO	
Latvia										
Luxembourg										
Netherlands										
New Zealand	NA		NA		NA		NA		NA	
Norway					23,999	kg/PJ	924	kg/PJ		
Portugal	340	kg/Mt								
Slovakia										
Spain										
Sweden										
Switzerland	227	kg/PJ								
United Kingdom	IE		IE		IE		IE		310,201	kg/PJ
United States	IE		IE		IE		IE		IE	

	Basis	**Former USSR, Central & Eastern Europe**	**Rest of the world**
Venting & flaring	Gas Produced	6,000-30,000	175,000-209,000

[a] The units for the IEF vary from Party to Party depending on the unit of activity data used.

[b] Source of default emission factors: IPCC Guidelines, volume 3, pages 1.119-1.121. Emission factors (in kg/PJ) for venting & flaring from gas production by regions are provided in the table above.

Energy - Fugitive emissions from fuels: oil and natural gas

Trends in CH_4 emissions from oil and natural gas 1990 to 1999
Gigagrams

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia		327.3	293.6	312.7	272.2	276.5	329.7	306.5	334.7	330.5	285.4
Austria		4.3	4.5	4.4	4.7	4.8	5.2	5.6	5.4	5.5	5.6
Belgium										39.8	39.8
Bulgaria	166.7										72.8
Canada		1,246.7	1,305.4	1,423.8	1,485.7	1,571.8	1,671.2	1,785.2	1,787.1	1,774.3	1,776.1
Czech Republic											28.8
Denmark		9.2	9.9	9.9	9.8	11.4	11.1	11.2	11.5	11.3	12.6
Estonia											17.8
Finland		0.2	0.2	0.2	0.2	0.2	0.2	0.6	0.4	0.6	0.4
France		104.7	112.0	107.1	105.5	97.0	98.6	102.4	93.2	97.1	90.7
Germany		334.0	351.0	389.0	429.0	408.0	359.0	374.3	361.0	359.0	355.0
Greece		0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.7	1.1
Hungary	225.4										289.2
Iceland											
Ireland											4.3
Italy										282.2	280.2
Japan		52.3	57.1	60.5	65.1	67.0	71.4	74.4	77.8	79.2	83.1
Latvia										22.6	14.9
Luxembourg											2.1
Netherlands		179.1	188.1	163.1	158.0	168.5	174.0	177.5	156.5	146.1	144.2
New Zealand											17.7
Norway		13.6									23.4
Portugal		1.7	1.5	1.8	1.7	2.2	2.1	1.9	2.3	3.8	4.1
Slovakia											35.5
Spain		50.0	55.3	58.3	56.5	61.3	71.6	81.5	106.5	113.0	129.7
Sweden		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Switzerland		14.6	14.5	14.2	13.8	13.3	12.8	12.7	12.6	12.5	12.4
United Kingdom		541.0	523.9	521.7	509.2	507.4	502.7	489.2	482.7	474.3	454.7
United States		7,066.5	7,150.4	7,190.7	7,254.7	7,113.2	7,080.2	7,135.5	6,982.7	6,921.8	6,842.9

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-10.3	6.5	-13.0	1.6	19.2	-7.0	9.2	-1.3	-13.6	-12.8
Austria	5.7	-1.8	5.5	2.9	9.2	6.4	-3.6	2.7	2.2	32.3
Belgium									0.0	
Bulgaria										56.3
Canada	4.7	9.1	4.3	5.8	6.3	6.8	0.1	-0.7	0.1	42.5
Czech Republic										
Denmark	7.9	0.5	-1.9	16.6	-2.5	0.5	3.4	-2.3	12.1	37.7
Estonia										
Finland	17.6	0.0	0.0	0.0	0.0	194.0	-30.3	47.1	-41.6	107.1
France	7.0	-4.4	-1.5	-8.1	1.7	3.9	-9.0	4.2	-6.5	-13.4
Germany	5.1	10.8	10.3	-4.9	-12.0	4.3	-3.6	-0.6	-1.1	6.3
Greece	0.0	-12.6	-22.9	-29.7	-11.8	12.2	101.0	230.5	59.2	396.7
Hungary										-28.3
Iceland										
Ireland										
Italy									-0.7	
Japan	9.2	5.9	7.6	2.9	6.6	4.2	4.5	1.9	4.8	58.7
Latvia									-33.9	
Luxembourg										
Netherlands	5.0	-13.3	-3.1	6.6	3.3	2.0	-11.9	-6.6	-1.3	-19.5
New Zealand										
Norway										71.6
Portugal	-8.5	17.6	-4.1	24.8	-4.6	-8.6	20.3	65.5	9.3	144.1
Slovakia										
Spain	10.6	5.5	-3.2	8.6	16.7	13.8	30.7	6.1	14.8	159.4
Sweden										
Switzerland	-0.7	-2.1	-2.8	-3.6	-3.8	-0.8	-0.8	-0.8	-0.8	-15.1
United Kingdom	-3.2	-0.4	-2.4	-0.3	-0.9	-2.7	-1.3	-1.8	-4.1	-16.0
United States	1.2	0.6	0.9	-2.0	-0.5	0.8	-2.1	-0.9	-1.1	-3.2

[a] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

Industrial processes - Mineral products, CO_2 (1999)

	2.A Mineral products														
	Methods and EF used[a]		2.A.1 Cement production							2.A.2 Lime production			2.A.3 Limestone and dolomite use		
					Activity data (production)										
	Methods	EF	Key source	Percentage of national total	Description[b]	CRF	UN[c]	Difference[d]	CO_2 IEF	Key source	Percentage of national total	CO_2 IEF	Key source	Percentage of national total	CO_2 IEF
				%		kt	kt	%	t / t		%	t / t		%	t / t
IPCC default EF[e]									0.499 (cement)			0.79 - 0.91			0.44 -0.48
IPCC default EF[e]									0.507 (clinker)						
Australia	T2	CS			Clinker production	6,369	7,716	21.15	0.52			0.69			0.41
Austria[f]	C, CS	CS	L/T	3.0 / 4.5		3,624	3,768	3.97	0.66			0.37			
Belgium							9,252								
Bulgaria[f]	D	D	L	1.3		1,957	1,740	-11.07	0.52			0.79			0.48
Canada	T1	CS	L	0.9	Cement production	12,604	12,624	0.16	0.5			0.79			0.44
Czech Republic	T1	D	L	1.5	Cement production	4,241	4,236	-0.12	0.5						
Denmark			L/T	1.8 / 2.0		2,428	2,424	-0.16	0.53			0.21			
Estonia			L	1.6		645	360	-44.17	0.5			0.79			
Finland	D	PS/D	L/T	0.8/1.0	Cement production	1,310	1,164	-11.14	0.47	L	0.7	0.79			
France[f]	C	CS	L/T	1.5 / 2.5		15,990	18,444	15.35	0.5			0.44			
Greece	C	C	L/T	5.9 / 3.1	Cement production	14,700	13,908	-5.39	0.5			0.79			
Hungary	D	D	L	1.6	Clinker production	2,831	2,976	5.14	0.5			0.79			0.44
Iceland	D	D	L	1.8	Cement production	134			0.44						
Ireland[f]	D	D	L	1.7	Clinker production	2,250	2,000	-11.11	0.5			0.75			
Italy[f]			L	3.4	Cement production	36,827	35,512	-3.57	0.5			0.15			
Japan	D	D				IE	80,196		IE			IE	L / T	3.8 / 4.0	0.43
Latvia[f]	T1	D			Cement production	C	366		0.5			0.79			0.44
Luxembourg															
Netherlands[f]					Clinker production	800	3,300	312.50	0.47						
New Zealand[f]	T1	CS				1,077	976	-9.41	0.49			0.68			
Norway[f]	D	CS	L/T	1.6 / 1.6		C	1,690								
Portugal[f]	D+C	D+C	L	4.7	Cement production	9,340	9,780	4.71	0.4						0.32
Slovakia[f]	D	D	L	2.4		3,020	3,072	1.72	0.41			0.79	L	3.4	0.44
Spain[f]	CS,C,D	CS,C,D					27,860								
Sweden[f]	CS	CS	L/T	1.7 / 2.1	Use of limestone	3,109	2,372	-23.71	0.4			0.77			
Switzerland[f]	C	C	L	3.9	Cement production	3,500	4,000	14.29	0.59			0.37			
United Kingdom[f]	T2	D	L	1.0	Clinker production	11,816	15,000	26.95	0.52			0.44			0.44
United States	D,CS	D,CS			Clinker production	77,152	106,932	38.60	0.52			0.68			0.44

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method used or type of emission factor for all subcategories within the category 2.A Mineral products.

[b] The CRF requests Parties to specify the activity data used (e.g. cement or clinker) for estimating the emissions from cement production.

[c] Cement production from Monthly Bulletin of Statistics, Department of Economic and Social Affairs, Statistics Division, United Nations, New York, volume LV, no.3 , March 2001.

[d] As the UN data given in this table are for cement production, the comparisons with the CRF data specified as clinker are likely to differ.

[e] Source of default emission factors: IPCC Guidelines, volume 3, pages 2.6, 2.9 and 2.10.

[f] Data for 1999 data were not available from the United Nations, 1998 data were used here.

Industrial processes - Mineral products

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	4,828	4,503	4,389	4,598	5,238	5,123	5,147	5,078	5,470	5,401
Austria	3,803	3,676	3,745	3,572	3,709	3,068	3,065	3,140	3,055	2,947
Belgium								5,200	5,627	5,661
Bulgaria	4,264	2,472	1,979	1,746	1,917	2,328	2,446	2,044	1,410	1,878
Canada	8,161	6,981	6,636	6,875	7,507	7,691	8,034	8,184	8,365	8,666
Czech Republic									2,661	2,362
Denmark	1,005	1,178	1,300	1,311	1,318	1,311	1,388	1,539	1,436	1,402
Estonia										347
Finland	1,175	1,037	937	793	836	836	863	947	921	1,114
France	13,016	12,443	11,348	10,632	10,938	10,686	10,454	10,186	10,792	10,371
Greece	6,984	6,979	7,022	7,253	7,046	7,386	7,579	7,635	7,566	7,566
Hungary	3,568	1,265	1,118	1,267	1,397	1,438	1,548	1,587	1,971	2,053
Iceland	50	47	44	38	36	36	40	45	52	59
Ireland	941	924	962	932	1,085	1,068	1,080	1,190	1,192	1,279
Italy	21,305	21,211	21,586	17,939	17,407	17,949	17,665	17,857	18,743	19,414
Japan	55,418	57,055	57,643	57,150	57,913	57,909	57,626	56,135	50,967	49,997
Latvia	563	584	286	89	154	127	185	153	236	161
Luxembourg										520
Netherlands	747	700	750	1,050	1,050	1,130	900	1,087	1,048	1,075
New Zealand	448	437	501	553	566	586	581	599	574	635
Norway	683	629	688	874	886	922	915	983	926	920
Portugal	3,426	3,522	3,456	3,638	3,695	3,908	3,855	3,855	4,273	4,392
Slovakia	3,882	2,945	3,161	3,093	3,249	3,408	3,249	3,354	3,505	3,548
Spain	14,289	13,756	12,542	11,878	13,835	14,809	14,482	15,298	16,502	17,928
Sweden	1,765	1,622	1,522	1,537	1,629	1,801	1,709	1,642	1,645	1,590
Switzerland									2,071	2,100
United Kingdom	9,555	8,160	7,619	7,664	8,449	8,554	8,787	9,616	9,631	9,136
United States	53,777	52,479	52,774	54,370	57,321	60,948	62,153	64,770	65,571	65,829

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-6.7	-2.5	4.8	13.9	-2.2	0.5	-1.3	7.7	-1.3	11.9
Austria	-3.3	1.9	-4.6	3.8	-17.3	-0.1	2.4	-2.7	-3.5	-22.5
Belgium								8.2	0.6	
Bulgaria	-42.0	-20.0	-11.8	9.8	21.5	5.0	-16.4	-31.0	33.2	-55.9
Canada	-14.5	-4.9	3.6	9.2	2.5	4.5	1.9	2.2	3.6	6.2
Czech Republic									-11.2	
Denmark	17.2	10.4	0.8	0.5	-0.5	5.9	10.9	-6.7	-2.4	39.4
Estonia										
Finland	-11.8	-9.6	-15.4	5.4	0.0	3.1	9.8	-2.7	20.9	-5.2
France	-4.4	-8.8	-6.3	2.9	-2.3	-2.2	-2.6	5.9	-3.9	-20.3
Greece	-0.1	0.6	3.3	-2.9	4.8	2.6	0.7	-0.9	0.0	8.3
Hungary	-64.6	-11.6	13.3	10.3	2.9	7.6	2.6	24.2	4.1	-42.5
Iceland	-7.0	-6.0	-13.3	-6.3	1.0	10.7	11.4	16.9	13.4	17.2
Ireland	-1.9	4.1	-3.1	16.4	-1.6	1.2	10.2	0.2	7.3	35.9
Italy	-0.4	1.8	-16.9	-3.0	3.1	-1.6	1.1	5.0	3.6	-8.9
Japan	3.0	1.0	-0.9	1.3	0.0	-0.5	-2.6	-9.2	-1.9	-9.8
Latvia	3.7	-51.0	-68.8	72.6	-17.5	45.8	-17.2	54.0		
Luxembourg										
Netherlands	-6.3	7.1	40.0	0.0	7.6	-20.4	20.8	-3.6	2.6	44.0
New Zealand	-2.5	14.5	10.5	2.3	3.5	-0.9	3.1	-4.1	10.6	41.6
Norway	-8.0	9.5	27.0	1.4	4.1	-0.9	7.5	-5.8	-0.7	34.7
Portugal	2.8	-1.9	5.3	1.5	5.8	-1.3	0.0	10.8	2.8	28.2
Slovakia	-24.1	7.3	-2.1	5.0	4.9	-4.7	3.2	4.5	1.2	-8.6
Spain	-3.7	-8.8	-5.3	16.5	7.0	-2.2	5.6	7.9	8.6	25.5
Sweden	-8.1	-6.2	1.0	6.0	10.6	-5.1	-3.9	0.2	-3.4	-9.9
Switzerland									1.4	
United Kingdom	-14.6	-6.6	0.6	10.2	1.2	2.7	9.4	0.2	-5.1	-4.4
United States	-2.4	0.6	3.0	5.4	6.3	2.0	4.2	1.2	0.4	22.4

Industrial processes - Mineral products: cement production

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	3,168	2,900	2,735	2,831	3,181	3,163	3,002	2,944	3,228	3,299
Austria	3,088	3,043	3,212	3,070	3,191	2,498	2,496	2,576	2,491	2,376
Belgium								3,398	3,710	3,410
Bulgaria									869	1,018
Canada	5,873	4,686	4,299	4,697	5,293	5,361	5,794	5,868	6,062	6,302
Czech Republic									2,430	2,114
Denmark	883	1,087	1,194	1,205	1,199	1,203	1,282	1,426	1,333	1,295
Estonia										321
Finland	777	633	534	394	407	428	460	543	581	618
France	10,427	9,902	8,908	8,191	8,366	8,233	8,042	7,733	8,281	7,995
Greece	6,760	6,770	6,849	7,004	6,780	7,129	7,328	7,278	7,328	7,328
Hungary									1,499	1,415
Iceland										59
Ireland									1,000	1,125
Italy									17,756	18,413
Japan	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Latvia									183	C
Luxembourg										
Netherlands	NE	NE	NE		368		251	376	376	376
New Zealand	367	343	405	461	487	503	503	503	479	528
Norway	653								882	876
Portugal	3,024	3,069	2,969	3,125	3,221	3,367	3,381	3,381	3,665	3,759
Slovakia									1,182	1,241
Spain	12,534	11,944	10,655	10,120	11,738	12,622	12,367	13,017	14,096	15,544
Sweden	1,366	1,221	1,168	1,169	1,195	1,399	1,313	1,192	1,224	1,230
Switzerland									2,036	2,065
United Kingdom	6,829	5,611	5,107	5,172	5,961	5,883	6,006	6,281	6,401	6,113
United States	33,278	32,535	32,792	34,624	36,087	36,847	37,079	38,323	39,218	39,896

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-8.5	-5.7	3.5	12.3	-0.6	-5.1	-1.9	9.6	2.2	4.1
Austria	-1.5	5.6	-4.4	3.9	-21.7	-0.1	3.2	-3.3	-4.6	-23.1
Belgium								9.2	-8.1	
Bulgaria									17.2	
Canada	-20.2	-8.3	9.3	12.7	1.3	8.1	1.3	3.3	4.0	7.3
Czech Republic									-13.0	
Denmark	23.2	9.9	0.9	-0.6	0.4	6.6	11.2	-6.5	-2.9	46.7
Estonia										
Finland	-18.6	-15.6	-26.2	3.3	5.0	7.5	18.1	7.0	6.3	-20.6
France	-5.0	-10.0	-8.0	2.1	-1.6	-2.3	-3.8	7.1	-3.5	-23.3
Greece	0.1	1.2	2.3	-3.2	5.1	2.8	-0.7	0.7	0.0	8.4
Hungary									-5.6	
Iceland										
Ireland									12.5	
Italy										
Japan										
Latvia										
Luxembourg										
Netherlands										
New Zealand	-6.4	18.1	13.7	5.6	3.4	-0.1	0.1	-4.9	10.3	44.0
Norway									-0.7	34.2
Portugal	1.5	-3.2	5.3	3.1	4.5	0.4	0.0	8.4	2.6	24.3
Slovakia									5.0	
Spain	-4.7	-10.8	-5.0	16.0	7.5	-2.0	5.3	8.3	10.3	24.0
Sweden	-10.6	-4.3	0.1	2.2	17.1	-6.1	-9.2	2.7	0.5	-9.9
Switzerland									1.4	
United Kingdom	-17.8	-9.0	1.3	15.3	-1.3	2.1	4.6	1.9	-4.5	-10.5
United States	-2.2	0.8	5.6	4.2	2.1	0.6	3.4	2.3	1.7	19.9

Trends in CO_2 implied emission factors 1990 to 1999
Tonnes per tonne

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Austria	0.66	0.63	0.67	0.63	0.67	0.65	0.66	0.66	0.66	0.66
Belgium										
Bulgaria									0.50	0.52
Canada	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Czech Republic									0.50	0.50
Denmark	0.55	0.54	0.54	0.54	0.53	0.53	0.53	0.53	0.53	0.53
Estonia										0.50
Finland	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
France	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Greece	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Hungary									0.50	0.50
Iceland										0.44
Ireland									0.50	0.50
Italy									0.50	0.50
Japan	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Latvia									0.50	0.50
Luxembourg										
Netherlands					0.43		0.43	0.54	0.47	0.47
New Zealand	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.49	0.50	0.49
Norway										
Portugal	0.42	0.41	0.41	0.41	0.42	0.42	0.40	0.40	0.40	0.40
Slovakia									0.41	0.41
Spain										
Sweden	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Switzerland									0.59	0.59
United Kingdom	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
United States	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Austria	-4.4	5.6	-5.1	6.0	-2.9	1.5	-0.7	0.0	0.0	-0.7
Belgium										
Bulgaria									4.4	
Canada	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Czech Republic									0.0	
Denmark	-0.2	-0.9	-0.4	-0.5	-1.0	0.2	0.0	-0.5	1.1	-2.1
Estonia										
Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
France	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Greece	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hungary									0.0	
Iceland										
Ireland									0.0	
Italy									0.0	
Japan										
Latvia									0.0	
Luxembourg										
Netherlands							26.1	-13.0	0.0	
New Zealand	0.0	0.0	0.0	0.0	0.0	0.0	-3.3	1.6	-2.2	-3.9
Norway										
Portugal	-2.2	-1.1	0.2	1.8	1.0	-4.0	0.0	0.0	0.0	-4.3
Slovakia									0.0	
Spain										
Sweden	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Switzerland									0.0	
United Kingdom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
United States	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Industrial processes - Chemical industry, CO_2 and N_2O (1999)

	2.B Chemical industry																				
	Methods and EF used[a]		CO_2							Methods and EF used[a]		N_2O									
			2.B.1 Ammonia production									2.B.2 Nitric acid production							2.B.3 Adipic acid production		
					Activity data (production)									Activity data (production)							
	Method	EF	Key source	Percentage of national total	CRF (1999) b	CRF (1997 or 1998) b	UN (1997 or 1998) b,c	Difference	CO_2 IEF	Methods	EF	Key source	Percentage of national total	CRF (1999) b	CRF (1998) b	U.N. (1998) b,c	Difference	N_2O IEF	Key source	Percentage of national total	N_2O IEF
				%	kt	kt	kt	%	t / t				%	kt		kt	%	t / t		%	t / t
IPCC default EF[d]									1.5 - 1.6									0.002 - 0.009			0.264 - 0.3
Australia	NE	NA			NE		450			T1	D			398				0.006			
Austria	C	PS	L	0.6	266				1.8	C	PS			513	505			0.001			
Belgium							287														
Bulgaria	T1b	D			378		527		0.9	D	D	L	0.9	394	521	521	0.06	0.006			
Canada	T1	CS			4889	4737	4,737	0.00	0.8	NA	NA			1007	935	935	-0.05	0.003	T	11.50	0.30
Czech Republic	IE				350		324			T2	PS	L	0.7	455	533	433	-18.69	0.006			
Denmark					0	0	1,449							0	0	13					
Estonia			L	1.1	145		175		1.5					0							
Finland	NO	NO			NO	NO	0			D	PS	L/T	1.7 / 1.7	453	452			0.009			
France	C	CS	L	0.5	1746	1823	1,508	-17.30	1.6	C	CS/ PS	L/T	0.7 / 4.1	2750	2760			0.005	L/T	0.8 / 14.0	0.07
Greece	C	C			NA					C	C			406	406			0.005			
Hungary	D	D	L	0.6	331		293		1.5	D	D			0	1						
Iceland	D	D					9			CS	CS										
Ireland	D,T1a	D	L	1.4	410		465		2.3	D	CS	L	1.2	260	260			0.010			
Italy					451		445		1.0					432	480			0.007	L	1.1	0.30
Japan	D	CS			C	C	1,689		NE	D	CS, PS			631	631	631	0.03	0.003	T	2.6	0.03
Latvia					NO									NO							NO
Luxembourg																					
Netherlands							2,500					L/T	4.9 / 2.3								
New Zealand	T1	CS			163	163	80	-50.98	0.0	T1				NA	NA						
Norway	D	CS,D	L/T	0.6 / 5.3	C	C	279			CS3	PS	L/T	3.3								
Portugal [e]	MB+D+C	D+C	T	4.0	143	143	251	75.35	1.3	D+C	D+C	L /T	0.8 / 1.0	244	244			0.008			
Slovakia							311			D	CS	L	0.8	441	420			0.000			
Spain	C,D	C,D					579			C	C					465					
Sweden	CS	CS					0			C	CS	L/T	1.1 / 1.0			90					
Switzerland	C	C								C	C	L	0.2	65	65			0.005			
United Kingdom	T1	CS			42	35	642	1714.79	26.3	PS	CS	L	0.5	2438	2610			0.004	T	7.20	0.01
United States	D	D			17200	16761	14,700	-12.29	1.5	D	CS,PS			8165	8423	8,423	0.00	0.008	T	2.10	0.03

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 2.B Chemical industry.

[b] As UN data for 1999 were not available at the time of preparation of this synthesis and assessment report, for the comparisons of UN and CRF data in this table, data for the years 1998 (or 1997) from the CRF are provided together with the respective UN data for those years (1999 CRF data are given in a separate column as well). For the following countries 1997 data for ammonia were used, as 1998 UN data were not available: Australia, Iceland, Ireland, Italy, Netherlands, New Zealand, Norway, Sweden and United Kingdom.

[c] Source of data: 1998 Industrial Commodity Statistics Yearbook, Production statistics 1989-1998, Department of Economic and Social Affairs, Statistics Division, United Nations, New York 2000.

[d] Source of default emission factors: IPCC Guidelines, volume 3, pages 2.16, 2.18 and 2.19.

[e] Mass balance is indicated by MB.

Industrial processes - chemical industry: ammonia production

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Austria	396	408	371	403	381	468	465	457	501	472
Belgium								653	638	638
Bulgaria									454	326
Canada	3,127	3,219	3,317	3,562	3,700	4,051	4,128	4,142	3,898	4,049
Czech Republic										
Denmark										
Estonia										218
Finland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
France	3,007	3,036	2,666	2,810	2,822	2,826	2,966	2,889	2,844	2,723
Greece	470	383	251	251		251	251	251	150	NO
Hungary									10	497
Iceland										
Ireland									1,058	943
Italy									497	451
Japan	3,377	3,327	3,356	3,183	3,391	3,328	3,453	3,366	2,989	3,236
Latvia									NO	NO
Luxembourg										
Netherlands	IE	IE	IE	IE	IE	NO	IE	IE	IE	IE
New Zealand	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Norway	646								500	358
Portugal	569	448	335	281	190	190	190	190	190	190
Slovakia										IE
Spain	550	624	540	400	505	505	519	546	512	487
Sweden										
Switzerland										NO
United Kingdom	1,358	1,358	1,379	1,379	1,379	1,379	1,379	888	1,111	1,108
United States	23,138	23,364	24,391	23,399	24,316	23,682	24,390	24,346	25,141	25,799

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria	3.0	-9.1	8.6	-5.3	22.8	-0.6	-1.8	9.7	-5.8	19.2
Belgium								-2.3	0.0	
Bulgaria									-28.2	
Canada	2.9	3.1	7.4	3.9	9.5	1.9	0.3	-5.9	3.9	29.5
Czech Republic										
Denmark										
Estonia										
Finland										
France	0.9	-12.2	5.4	0.4	0.2	5.0	-2.6	-1.5	-4.3	-9.4
Greece	-18.3	-34.5	0.0			0.0	0.0	-40.3		
Hungary									5092.5	
Iceland										
Ireland									-10.9	
Italy									-9.4	
Japan	-1.5	0.9	-5.1	6.5	-1.8	3.8	-2.5	-11.2	8.3	-4.2
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway									-28.4	-44.6
Portugal	-21.2	-25.4	-15.9	-32.3	0.0	0.0	0.0	0.0	0.0	-66.5
Slovakia										
Spain	13.6	-13.5	-25.9	26.2	0.1	2.7	5.2	-6.2	-5.0	-11.4
Sweden										
Switzerland										
United Kingdom	0.0	1.5	0.0	0.0	0.0	0.0	-35.6	25.0	-0.3	-18.5
United States	1.0	4.4	-4.1	3.9	-2.6	3.0	-0.2	3.3	2.6	11.5

Trends in CO_2 implied emission factors 1990 to 1999
Tonnes per tonne

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia										
Austria	1.5	1.6	1.4	1.5	1.5	1.8	1.8	1.8	1.9	1.8
Belgium										
Bulgaria									0.9	0.9
Canada	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8
Czech Republic										
Denmark										
Estonia										1.5
Finland										
France	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Greece	1.5	1.5		1.5						
Hungary									1.5	1.5
Iceland										
Ireland									2.3	2.3
Italy									1.0	1.0
Japan	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal	3.1	2.4	2.7	2.5	2.7	1.0	1.3	1.3	1.3	1.3
Slovakia										
Spain										
Sweden										
Switzerland										
United Kingdom	31.7	31.2	31.5	31.5	31.5	31.5	31.5	25.1	28.6	26.3
United States	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria	3.0	-9.1	8.6	-5.3	22.8	-0.6	-1.8	9.7	-8.1	16.3
Belgium										
Bulgaria									0.0	
Canada	4.2	0.0	-2.3	2.0	-0.6	1.3	-1.7	-5.0	0.6	-1.7
Czech Republic										
Denmark										
Estonia										
Finland										
France	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Greece	0.0									
Hungary									0.0	
Iceland										
Ireland									0.0	
Italy									0.0	
Japan										
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal	-20.7	12.0	-6.9	6.3	-62.5	31.3	0.0	0.0	0.0	-56.7
Slovakia										
Spain										
Sweden										
Switzerland										
United Kingdom	-1.6	0.7	0.0	0.0	0.0	0.0	-20.2	14.0	-8.2	-17.2
United States	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Industrial processes - chemical industry: nitric acid production

Trends in N_2O emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	1.6	1.5	1.8	1.6	1.4	1.4	1.6	1.6	1.7	2.2
Austria	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.6	0.6
Belgium								10.6	3.9	
Bulgaria									3.1	2.4
Canada	2.5	2.5	2.5	2.5	2.5	2.5	2.6	2.5	2.5	2.5
Czech Republic									3.6	3.0
Denmark										
Estonia										0.0
Finland	5.1	4.5	4.0	4.2	4.4	4.5	4.5	4.5	4.3	4.3
France	25.6	22.4	18.3	13.8	13.0	13.6	14.2	13.3	13.0	12.9
Greece	2.3	1.9	2.0	1.9	1.8	1.8	2.1	1.8	1.8	1.8
Hungary									0.0	0.0
Iceland										
Ireland									2.6	2.6
Italy									3.2	2.9
Japan	2.5	2.5	2.5	2.4	2.5	2.5	2.3	2.3	2.2	2.2
Latvia									NO	NO
Luxembourg										
Netherlands	31.5	32.3	30.4	30.0	31.6		31.7	35.0	36.0	36.1
New Zealand	NA	NA	NA	NA	NA	NA				
Norway	6.7								5.4	6.1
Portugal	1.9	1.9	2.0	1.6	1.2	2.0	2.0	2.0	2.0	2.0
Slovakia									0.2	0.2
Spain	9.3	8.3	7.1	5.9	7.0	7.4	7.9	7.5	7.0	7.6
Sweden	2.6	2.5	2.5	2.5	2.3	2.3	2.2	2.2	2.4	2.4
Switzerland									0.3	0.3
United Kingdom	13.3	13.5	13.7	13.8	14.2	9.9	10.2	9.7	11.1	9.6
United States	57.6	57.5	59.0	59.9	63.2	64.2	66.8	68.5	67.4	65.3

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-6.6	21.2	-12.6	-13.1	0.7	11.4	0.0	5.8	32.6	35.3
Austria	0.9	-9.3	5.8	-2.1	-3.6	2.4	-1.3	3.2	1.5	-3.2
Belgium								-63.6		
Bulgaria									-24.4	
Canada	-1.4	1.3	0.1	-1.5	2.2	1.3	-0.8	-1.9	1.9	1.1
Czech Republic										
Denmark										
Estonia										
Finland	-12.1	-10.5	3.9	3.5	3.3	0.0	0.6	-5.8	0.3	-16.9
France	-12.4	-18.3	-24.5	-6.0	4.4	4.4	-6.0	-2.6	-0.4	-49.6
Greece	-17.6	4.6	-5.0	-2.8	-0.5	14.2	-12.0	-0.2	0.2	-20.4
Hungary										
Iceland										
Ireland									0.0	
Italy									-10.0	
Japan	-0.7	0.1	-1.3	2.5	-1.5	-5.0	-1.0	-5.8	0.4	-11.9
Latvia										
Luxembourg										
Netherlands	2.5	-5.9	-1.3	5.3			10.3	2.9	0.4	14.7
New Zealand										
Norway									11.2	-8.9
Portugal	0.0	0.8	-16.5	-24.9	59.2	0.0	0.0	0.0	0.0	0.6
Slovakia									-13.7	
Spain	-10.4	-14.9	-17.3	19.1	5.6	6.6	-5.4	-6.1	8.3	-18.6
Sweden	-4.8	0.0	0.0	-9.0	0.4	-4.0	-1.2	12.7	0.0	-7.0
Switzerland									0.0	
United Kingdom	1.1	1.8	0.4	3.3	-30.2	2.8	-5.4	15.2	-13.6	-27.8
United States	-0.1	2.6	1.5	1.4	4.1	4.1	2.5	-1.6	-3.1	13.5

Industrial processes - chemical industry: adipic acid production

Trends in N_2O emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	NO									NO
Austria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belgium									0.0	
Bulgaria									NO	NO
Canada	34.6	32.3	32.1	29.3	35.4	34.6	37.0	31.9	16.3	5.6
Czech Republic										NO
Denmark										
Estonia										0.0
Finland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
France	57.5	57.5	57.0	53.9	56.6	57.9	56.7	59.2	31.4	14.7
Greece										
Hungary										0.0
Iceland										
Ireland									NO	NO
Italy									18.6	18.6
Japan	21.5	19.4	19.1	18.7	21.5	21.3	24.2	25.8	22.3	2.5
Latvia									NO	NO
Luxembourg										
Netherlands	NO		NO	NO	NO		NO	NO	NO	NO
New Zealand										
Norway										
Portugal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slovakia										NO
Spain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sweden										
Switzerland										NO
United Kingdom	81.1	75.0	57.9	47.2	57.2	51.3	55.2	57.3	48.3	2.1
United States	59.0	61.9	56.9	61.5	65.5	65.6	67.1	55.2	23.4	28.9

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada	-6.7	-0.5	-8.8	20.8	-2.2	6.9	-13.8	-48.8	-65.5	-83.7
Czech Republic										
Denmark										
Estonia										
Finland										
France	0.0	-1.0	-5.3	4.9	2.2	-1.9	4.4	-47.0	-53.2	-74.5
Greece										
Hungary										
Iceland										
Ireland										
Italy									0.0	
Japan	-9.6	-1.4	-2.0	14.9	-1.0	13.8	6.5	-13.7	-88.6	-88.1
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia										
Spain										
Sweden										
Switzerland										
United Kingdom	-7.5	-22.9	-18.3	21.1	-10.3	7.6	3.8	-15.8	-95.6	-97.4
United States	4.9	-8.2	8.1	6.5	0.2	2.3	-17.7	-57.6	23.5	-51.0

Trends in N_2O implied emission factors 1990 to 1999
Tonnes per tonne

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada			0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Czech Republic										
Denmark										
Estonia										
Finland										
France	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.29	0.17	0.07
Greece										
Hungary										
Iceland										
Ireland										
Italy									0.30	0.30
Japan	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.03
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia										
Spain										
Sweden										
Switzerland										
United Kingdom	0.31	0.28	0.28	0.30	0.33	0.33	0.36	0.37	0.29	0.01
United States	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.06	0.03	0.03

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Czech Republic										
Denmark										
Estonia										
Finland										
France	0.0	0.0	0.0	0.0	0.0	0.0	-8.6	-40.6	-56.0	-76.1
Greece										
Hungary										
Iceland										
Ireland										
Italy									0.0	
Japan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-90.0	-90.0
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia										
Spain										
Sweden										
Switzerland										
United Kingdom	-8.0	0.0	8.5	9.2	0.2	8.9	0.9	-20.5	-94.9	-95.2
United States	0.0	0.0	0.0	0.0	0.0	0.0	-20.1	-57.9	-2.7	-67.3

Industrial processes - Metal production, CO_2 (1999)

	2.C Metal production																					
	Methods and EF used [a]		2.C.1 Iron & steel [b]													2.C.3 Aluminium production						
	Methods	EF	Key source	Percentage of national total	CO_2 IEF	2.C.1.1 Steel					2.C.1.2 Pig iron					Key source	Percentage of national total	Activity data (production)				CO_2 IEF
						Activity data (production)				CO_2 IEF	Activity data (production)				CO_2 IEF							
						CRF (1998) [c]	CRF (1999)	UN[d]	Difference		CRF (1998)[c]	CRF (1999)	UN [d]	Difference				CRF (1998)[c]	CRF (1999)	UN [d]	Difference	
				%	t / t	kt	kt	kt	%	t / t	kt	kt	kt	%	t / t		%	kt	kt	kt	%	t / t
IPCC default EF[e]					1.5 - 1.6																	1.5 - 1.8
Australia [f g]	T2	CS					7,674	8,088		NA		NA	7956						1686	1718	1.9	1.5
Austria [h]	C	CS, PS	L/T	10.7 / 1.9			4,752	5,208	9.6	1.8		4752	3912	-17.68				C	C	94		
Belgium								10,908					8436									
Bulgaria [f g]	D	D	L	2.1		2237.807	2,032	2,352	5.1	0.8	1390.233	1152	1512	8.76					4			1.7
Canada [f g]	CS	CS	L	1.2		NA	NA	15,804			NA	NA	9012			L	1.0		2401	2390	-0.5	1.6
Czech Republic	IE						5,454	5,616	3.0			4008	4020	0.30					NO			
Denmark [f]								792				0							0			
Estonia																			0			
Finland	NO	NO					NA	3,960				NA	2952						NO			
France [f h]	C	CS	L/T	0.5 / 1.3		20125	19,801	20,124	0.0	0.1		13932	13560	-2.67	0.09			421	452	424	0.7	1.6
Greece	C	C					NA	960				NA							C	161		
Hungary	T1b	D						1,920					1272						89			1.8
Iceland	D	D					NO					NO				L	10.7		222			1.6
Ireland	NA	NA						336														
Italy [h]							24,780	24,732	-0.2	0.0		10665	10620	-0.42				187	187	187	0.1	1.6
Japan							IE			IE		IE			IE				NE			NE
Latvia	T1	D					C/IE					NO							NO			
Luxembourg [f]								2,472					0									
Netherlands [h]								6,072					5304							366		
New Zealand [f h]	T1	CS	L	2.7	2.0	739.715	759	700	-5.4	2.0		NE						318	328	996	213.4	1.6
Norway [g h]	D, CS3	D, PS									C	C	1092			L	3.2	965	496	1058	9.7	3.6
Portugal	D+C	D+C			0.4		IE	1,032				NO	384						18			1.8
Slovakia [f h]	IE						NA	3,384				NA							NA	115		
Spain [h]	C	C						14,892					4056							360		
Sweden [h]	CS	CS	L/T	2.9 / 12.2				5,052				103	3816	3615.68	0.47733			51	51	96	87.2	3.7
Switzerland [f h]	C	C				760	765	1,000	31.6	0.1								**27**	35	32	18.9	1.6
United Kingdom [h]	T2	CS					3,590	16,416	357.3	0.0		12139	12012	-1.05				**258**	272	258	-0.2	1.6
United States	D	D,CS	L/T	1.1 / 4.7			IE	107,400				44900	51000	13.59	1.6				3779	3779	0.0	1.5

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category 2.C Metal production.

[b] CO_2 emission estimates from Sinter (2.C.1.3) were not reported by any Party; CO_2 emission estimates from coke (2.C.1.4) were reported by only Canada, Sweden and the United Kingdom.

[c] As UN data for 1999 were not available for all Parties for the comparisons of UN and CRF data in this table, data for the years 1998 from the CRF are provided along with the respective UN data for 1998. For the Parties where 1998 UN data were used the respective CRF data for 1998 were included for those Parties that reported data for 1998.

[d] Source of data: Monthly Bulletin of Statistics, Department of Economic and Social Affairs, Statistics Division, United Nations, New York, Vol.LV, No.3 , March 2001 and 1998 Industrial Commodity Statistics Yearbook, Production statistics 1989-1998, Department of Economic and Social Affairs, Statistics Division, United Nations, New York 2000.

[e] Source of default emission factors: IPCC Guidelines, Volume 3, pages 2.28 and 2.33.

[f] UN steel data is for 1998 not 1999.

[g] UN pig iron data is for 1998 not 1999.

[h] UN aluminium data is for 1998 not 1999.

Industrial processes - Metal production: iron and steel

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Austria	8,461	8,041	6,949	7,254	7,771	8,585	8,084	9,107	8,385	8,456
Belgium								1,500	1,616	1,498
Bulgaria									1,837	1,668
Canada	7,585	8,904	9,084	8,760	8,091	8,440	8,289	8,100	8,316	8,501
Czech Republic										
Denmark										
Estonia										
Finland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
France	4,009	3,020	2,581	2,490	3,275	4,014	2,783	3,306	3,160	2,720
Greece										
Hungary										
Iceland										NO
Ireland									NE	NE
Italy									997	962
Japan	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Latvia									IE	IE
Luxembourg										
Netherlands	IE				IE		IE	IE	IE	IE
New Zealand										1,508
Norway	170									194
Portugal	15	16	20	22	21	17	15	15	20	22
Slovakia										
Spain	690	664	634	675	707	659	604	716	776	777
	1,105	1,726	1,938	2,044	2,093	2,237	2,332	2,242	2,053	2,021
Switzerland									75	75
United Kingdom	2,760	1,794	1,781	1,880	2,287	2,222	2,802	1,728	1,255	2,815
United States	87,600	70,560	75,840	77,120	79,040	81,440	79,040	79,360	77,120	71,840

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria	-5.0	-13.6	4.4	7.1	10.5	-5.8	12.7	-7.9	0.9	-0.1
Belgium								7.7	-7.3	
Bulgaria									-9.2	
Canada	17.4	2.0	-3.6	-7.6	4.3	-1.8	-2.3	2.7	2.2	12.1
Czech Republic										
Denmark										
Estonia										
Finland										
France	-24.7	-14.6	-3.5	31.6	22.6	-30.7	18.8	-4.4	-13.9	-32.1
Greece										
Hungary										
Iceland										
Ireland										
Italy									-3.5	
Japan										
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										13.8
Portugal	4.4	25.9	9.9	-3.7	-21.3	-11.1	0.0	32.7	12.3	45.2
Slovakia										
Spain	-3.7	-4.5	6.4	4.7	-6.9	-8.3	18.7	8.3	0.1	12.7
Sweden	56.1	12.3	5.5	2.4	6.9	4.3	-3.9	-8.4	-1.5	82.8
Switzerland									0.0	
United Kingdom	-35.0	-0.7	5.6	21.7	-2.9	26.1	-38.3	-27.4	124.3	2.0
United States	-19.5	7.5	1.7	2.5	3.0	-2.9	0.4	-2.8	-6.8	-18.0

Industrial processes - Metal production

Trends in CO_2 implied emission factors 1990 to 1999
Tonnes per tonne

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia										0.00
Austria										
Belgium										
Bulgaria										
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France										
Greece										
Hungary										
Iceland										
Ireland										
Italy										
Japan	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Latvia										
Luxembourg										
Netherlands										
New Zealand	1.94		2.07			1.82	1.89	1.85	1.96	1.99
Norway										
Portugal	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04
Slovakia										
Spain										
Sweden										
Switzerland										
United Kingdom										
United States										

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France										
Greece										
Hungary										
Iceland										
Ireland										
Italy										
Japan										
Latvia										
Luxembourg										
Netherlands										
New Zealand						3.8	-2.1	6.2	1.4	2.4
Norway										
Portugal	-0.9	-24.9	10.4	-9.5	4.5	0.9	0.0	-15.6	-5.0	-37.1
Slovakia										
Spain										
Sweden										
Switzerland										
United Kingdom										
United States										

Industrial processes - Metal production: aluminium

Trends in CO_2 emissions 1990 to 1999
Gigagrams

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	1,827	1,822	1,922	2,039	2,039	1,895	1,963	2,060	2,353	2,497
Austria	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Belgium										
Bulgaria									11	7
Canada	2,636	3,014	3,213	3,768	3,677	3,545	3,726	3,794	3,817	3,919
Czech Republic										
Denmark										
Estonia										
Finland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
France	541	458	668	682	615	583	608	639	673	723
Greece	232	236	237	229	214	203	203	206	226	248
Hungary									171	159
Iceland										347
Ireland									NE	NE
Italy									290	290
Japan	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Latvia									NO	NO
Luxembourg										
Netherlands	IE				IE		IE	IE		IE
New Zealand	458	455	423	467	468	470	493	504	541	535
Norway	1,560									1,781
Portugal	17	15	22	21	21	26	27	27	30	32
Slovakia										IE
Spain	677	675	682	679	651	688	688	558	558	564
Sweden	179	180	135	162	161	174	184	184	187	188
Switzerland									43	56
United Kingdom	450	456	380	371	359	369	372	384	401	422
United States	5,951	6,058	5,942	5,432	4,850	4,961	5,258	5,296	5,458	5,555

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-0.3	5.5	6.1	0.0	-7.1	3.6	4.9	14.2	6.1	36.7
Austria										
Belgium										
Bulgaria									-37.3	
Canada	14.3	6.6	17.3	-2.4	-3.6	5.1	1.8	0.6	2.7	48.7
Czech Republic										
Denmark										
Estonia										
Finland										
France	-15.4	46.0	2.0	-9.9	-5.1	4.3	5.1	5.4	7.4	33.7
Greece	1.8	0.5	-3.6	-6.5	-5.2	0.0	1.3	10.1	9.5	6.9
Hungary									-6.6	
Iceland										
Ireland										
Italy									0.1	
Japan										
Latvia										
Luxembourg										
Netherlands										
New Zealand	-0.6	-7.0	10.2	0.2	0.5	4.9	2.2	7.4	-1.2	16.8
Norway										14.2
Portugal	-13.6	49.6	-2.0	-2.0	23.5	2.9	0.0	13.7	6.0	90.0
Slovakia										
Spain	-0.3	1.0	-0.3	-4.2	5.7	0.0	-19.0	0.2	1.0	-16.6
Sweden	0.2	-25.0	20.5	-0.8	8.0	6.1	-0.5	2.1	0.6	5.1
Switzerland									30.2	
United Kingdom	1.3	-16.7	-2.3	-3.3	2.9	0.9	3.2	4.3	5.3	-6.3
United States	1.8	-1.9	-8.6	-10.7	2.3	6.0	0.7	3.1	1.8	-6.6

Industrial processes - Metal production: aluminium

Trends in CO_2 implied emission factors 1990 to 1999
Tonnes per tonne

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Austria										
Belgium										
Bulgaria									1.7	1.7
Canada	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Czech Republic										
Denmark										
Estonia										
Finland										
France	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Greece										
Hungary									1.9	1.8
Iceland										1.6
Ireland										
Italy									1.6	1.6
Japan	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Latvia										
Luxembourg										
Netherlands										
New Zealand	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.7	1.6
Norway	1.8									3.6
Portugal	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Slovakia										
Spain										
Sweden	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Switzerland									1.6	1.6
United Kingdom	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
United States	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-0.1	0.1	-0.1	-0.1	0.0	-0.2	0.0	0.1	0.3	0.1
Austria										
Belgium										
Bulgaria									0.0	
Canada	-1.7	-0.4	-0.9	-0.1	0.0	0.0	-0.1	0.1	0.0	-3.0
Czech Republic										
Denmark										
Estonia										
Finland										
France	-3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.6
Greece										
Hungary										
Iceland										
Ireland										
Italy									0.0	
Japan										
Latvia										
Luxembourg										
Netherlands										
New Zealand	0.0	-0.1	-0.1	-0.1	0.0	0.1	-6.4	5.1	-4.3	-6.0
Norway										99.5
Portugal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slovakia										
Spain										
Sweden	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Switzerland									0.4	
United Kingdom	0.0	0.2	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
United States	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Industrial processes - Metal production: PFC and SF_6 emissions (1999)

	2.C Metal production (PFCs and SF_6)																		
	2.C. Metal production - PFCs											2.C. Metal production - SF_6							
	Methods and EF used[a]		2.C.3 Aluminium production - PFCs									Methods and EF used [b]		2.C.4.2 SF_6 used in magnesium foundries					
					Activity data (Aluminium production)				IEF		Ratio[f]					Activity data			
	Methods	EF	Key source	Percentage of national total	CRF (1998)[c]	CRF (1999)[c,d]	UN[e]	Difference	CF_4	C_2F_6	IEF CF_4 / IEF C_2F_6	Methods	EF	Key source	Percentage of national total	Description	Value	SF_6-IEF	Actual emissions SF_6[h]
				%	kt	kt	kt	%	kg / t	kg / t					%		t	kg/t	t
IPCC default EF[g]									0.02 - 1.19	0.001 - 0.14								1000[g]	
Australia	T1c	CS	T	8.1		1686	1718	1.9	0.08	0.008	10.00	T2	CS			SF_6 consumption	0.15	1000	0.2
Austria[i]					C	C	94							T	1.3	Magnesium	C		0.2
Belgium																	NO		NO
Bulgaria	D	D				4			1.40	100.000	0.01	NE	NE						
Canada			L/T	0.9 / 0.7		2401	2390	-0.5	0.35	0.030	11.83			T	1.8	Point Source SF_6 Data from Magnesium Foundries	NA		70.0
Czech Republic						NO										Production			
Denmark						0													0.7
Estonia						0													
Finland	NO	NO				NO						T2	NA			SF_6 consumption	C		C
France[i]			T	1.2	420.77	452	424		0.35	0.035	9.81					SF_6 consumption	47.5	1000	47.5
Greece			T	2.1		C	161									SF_6 consumption	NE		NE
Hungary	T1b	D	L	0.6		89			0.85	0.085	10.00	D	D			NE	NE		NE
Iceland	CS	CS	L	4.1		222			0.08	0.009	9.00								
Ireland	NA	NA										NA	NA			NO	NO		NO
Italy[i]					187	187	187	0.1	0.06	0.006	10.00								
Japan						NE			NE	NE							NE		NE
Latvia						NO										NE	NO		NO
Luxembourg																			
Netherlands[i]			L	1.1			366												
New Zealand[i]	CS	PS				328	996		0.03	0.003	8.99	T1	PS			SF_6 consumption	0.12	1000	0.1
Norway[i]			L	2.0		496	1058							L	1.3				30.0
Portugal	D	D				18													
Slovakia[i]						NA	115		0.01	0.001	10.00						NA		NA
Spain[i]							360												
Sweden	T2	PS	T	1.7	51.121	51	96	87.2				T2	CS			SF_6 consumption	1.3	1000	1.3
Switzerland[i]	T1c	M				35	32					T1c	M						0.5
United Kingdom[i]	T2/PS	CS			258.397	272	258	-0.2	0.11			T2/PS	CS			SF_6 consumption	30	1000	30.0
United States[j]	CS	PS	T	2.1		3779	3779	0.0	0.37	0.031	11.95	CS	CS			Primary and secondary production and casting activity	C		255.2

Note

IEF for SF_6 used in aluminium foundries has not been reported by any Party. This category has therefore not been included in this table.

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method used or type of emission factor for PFCs for all subcategories within the category 2.C. Metal production.

[b] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method used or type of emission factor for SF_6 for all subcategories within the category 2.C. Metal production.

[c] As UN data for 1999 were not available for all Parties for the comparisons of UN and CRF data in this table, data for the years 1998 from the CRF are provided together with the respective UN data for 1998. For the Parties where 1998 UN data were used, the respective CRF data for 1998 was included for those Parties reporting data for 1998.

[d] This column includes aluminium production data provided for CF_4 and C_2F_6 in tables 2 (II). C, E of the CRF, complemented by that provided for CO_2 (Italy and Switzerland).

[e] Source of data: Monthly Bulletin of Statistics, Department of Economic and Social Affairs, Statistics Division, United Nations, New York, volume LV, no.3, March 2001, and 1998 Industrial Commodity Statistics Yearbook, Production statistics 1989-1998, Department of Economic and Social Affairs, Statistics Division, United Nations, New York 2000.

[f] For Greece, Italy, Spain and Switzerland, ratio of emissions is given.

[g] Source of default emission factors: IPCC Guidelines, volume 3, page 2.35.

[h] IPCC Guidelines state that emissions equal consumption (IPCC Guidelines, volume 3, page 2.39).

[i] UN aluminium data are for 1998 not 1999.

[j] The production data for aluminium provided by the United States for CF_4 was by a factor of 1000 lower than that provided for CO_2, due to different units in the CRF. This has been corrected here.

Industrial processes - Metal production: aluminium

Trends in actual CF_4 emissions 1990 to 1999
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	655	655	481	429	276	193	173	153	191	135
Austria	129	130	75	0	0	0	0	0	0	0
Belgium						NO	NO	NO	NO	NO
Bulgaria									9	6
Canada	814	865	905	1,017	945	827	808	820	828	850
Czech Republic										
Denmark										
Estonia										
Finland	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
France	309	220	187	128	103	89	87	93	121	157
Greece	50	42	30	17	11	11	10	8	7	4
Hungary									79	76
Iceland										18
Ireland									NO	NO
Italy									11	11
Japan	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Latvia									NO	NO
Luxembourg										
Netherlands	301	301	258	260	228	223	247	261	296	308
New Zealand	80	86	85	30	31	24	24	28	8	10
Norway										164
Portugal	NE					20	20	20	20	20
Slovakia										2
Spain	114	108	108	109	107	108	103	106	100	91
Sweden	59	57	55	53	51	51	44	40	39	43
Switzerland									7	2
United Kingdom	300	230	110	70	60	55	44	35	33	31
United States	2,575	2,310	2,181	1,892	1,560	1,535	1,591	1,488	1,392	1,381

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	0.1	-26.6	-10.8	-35.7	-30.1	-10.4	-11.6	24.6	-29.3	-79.4
Austria	0.4	-42.3								
Belgium										
Bulgaria									-37.3	
Canada	6.3	4.6	12.4	-7.0	-12.6	-2.3	1.5	1.0	2.7	4.4
Czech Republic										
Denmark										
Estonia										
Finland										
France	-28.8	-15.0	-31.6	-19.5	-13.6	-2.2	6.9	30.1	29.8	-49.2
Greece	-14.2	-29.7	-41.5	-36.6	-5.2	-4.7	-20.5	-8.3	-40.9	-91.3
Hungary									-4.0	
Iceland										
Ireland										
Italy									0.1	
Japan										
Latvia										
Luxembourg										
Netherlands	0.0	-14.3	0.8	-12.3	-2.2	10.8	5.7	13.4	4.1	2.3
New Zealand	7.9	-2.1	-64.1	0.9	-20.6	0.0	14.4	-70.0	18.8	-87.6
Norway										
Portugal						0.0	0.0	0.0	0.0	
Slovakia										
Spain	-5.1	-0.7	1.1	-1.4	0.6	-4.6	2.6	-5.7	-8.5	-20.2
Sweden	-3.1	-3.2	-3.3	-3.4	-1.4	-13.2	-8.6	-3.1	10.0	-26.9
Switzerland									-78.4	
United Kingdom	-23.3	-52.2	-36.4	-14.3	-8.3	-20.0	-20.5	-5.7	-6.1	-89.7
United States	-10.3	-5.6	-13.3	-17.5	-1.6	3.7	-6.5	-6.4	-0.8	-46.4

Consistency check

The following check has been performed in order to verify the consistency of the data provided in various CRF tables (1999):

Activity data reported in different tables of the CRF:

Aluminum production			
	for CO_2	**for CF_4**	**for C_2F_6**
CRF table:	**2(I)A-G**	**2(II)C,E**	**2(II)C,E**
	kt	**t**	**t**
Australia	1,686	1,686,000	1,686,000
Austria	C	NO	NO
Bulgaria	4	4,192	6
Canada	2,401	2,401,389	2,401,389
Czech Republic	NO		
Denmark	0		
Estonia	0		
Finland	NO	NO	NO
France	452	451,927	451,927
Greece	C	C	C
Hungary	89	88,546	88,546
Iceland	222	222,014	222,014

Aluminum production			
	for CO_2	**for CF_4**	**for C_2F_6**
CRF table:	**2(I)A-G**	**2(II)C,E**	**2(II)C,E**
	kt	**t**	**t**
Ireland		NO	NO
Italy	187	187,200	187,200
Japan	NE		
Latvia	NO	NO	NO
New Zealand	328	327,800	327,800
Norway	496		
Portugal	18		
Slovakia	NA	109,200	109,200
Sweden	51		
Switzerland	35		
United Kingdom	272	272,211	272,211
United States	3,779	3,779,000	3,779,000

Industrial processes - Production of halocarbons and SF_6 (1999)

	2.E Production of halocarbons and SF_6										
	2.E Production of halocarbons and SF_6 - HFCs							2.E Production of halocarbons and SF_6 - PFCs		2.E Production of Halocarbons and SF_6 - SF_6	
	Methods and EF used[a]		2.E.1 By-product emissions, production of HCFC-22					Methods and EF used[a]		Methods and EF used	
	Methods	EF	Key source	Percentage of national total	Activity data (HCFC-22 production)		IEF	Method	EF	Method	EF
					CRF	International[b]	CF_4				
				%	t	t	kg / t				
IPCC default EF[c]							40				
Australia	NA	NA			NO			NA	NA	NA	NA
Austria					NO						
Belgium											
Bulgaria	NE	NE						NE	NE	NE	NE
Canada	NA	NA			NO			NA	NA	NA	NA
Czech Republic	NO							NO		NO	
Denmark											
Estonia											
Finland	NO	NO			NO	x		NO	NO	NO	NO
France	CS	CS	T	1.7	NA			CS	CS		
Greece	T1	D	L/T	3.0 / 13.5	C			CS	CS		
Hungary						x					
Iceland											
Ireland	NA	NA			NE			NA	NA	NA	NA
Italy						x					
Japan	CS	CS						CS	CS	CS	CS
Latvia					NO	x					
Luxembourg											
Netherlands			L / T	3.2 / 5.3							
New Zealand					NA	x					
Norway	-	-									
Portugal											
Slovakia	NO	NO			NO			NO	NO	NO	NO
Spain	T1	T2				x		T3	T3		
Sweden											
Switzerland											
United Kingdom[d]	T2/PS	CS			IE	x		T2/PS	CS	NO	NO
United States	M	M	T	1.5	C	x		M	M	CS	CS

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for HFCs for all subcategories within the category 2.E. Production of halocarbons and SF_6.

[b] An 'X' in this column indicates that an estimate of aggregated production of HCFCs for 1998 is available from the Secretariat of the Montreal Protocol. Usually HFC-23 occurs only during the production of HCFC-22.

[c] Source of default emission factors: IPCC Guidelines, volume 3, page 2.35.

[d] The United Kingdom reported aggregated HFC emissions from 2.E.1 Production and 2.E.2 Fugitive. Under that category, activity data were 40,610 t for 1999 and the implied emission factor was 4.48.

<u>Industrial processes - Production of halocarbons and SF_6 (1999)</u>
<u>By-product emissions: production of HCFC-22</u>

Trends in HFC-23 emissions 1990 to 1999
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	NO									NO
Austria										
Belgium										
Bulgaria										
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France	166	103	63	39	24	15	10	10	19	28
Greece	80	95	78	137	183	278	320	338	320	320
Hungary										
Iceland										
Ireland									NE	NE
Italy										
Japan [a]	NE	NE	NE	NE	NE	1,450	1,333	1,256	1,178	1,205
Latvia	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Luxembourg										
Netherlands	436	412	388	433	536	536	573	573	631	631
New Zealand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Norway										
Portugal										
Slovakia										
Spain	247	220	245	193	332	478	524	530	466	558
Sweden										
Switzerland										NO
United Kingdom [b]										
United States	2,974	2,632	2,974	2,726	2,692	2,316	2,667	2,573	3,419	2,598

[a] Japan provided estimates in tonnes of CO_2 equivalent in table 2(II)s1 of the CRF. Data presented in this table were obtained by dividing those estimates by the corresponding GWP for HFC-23 (11700).
[b] The United Kingdom provided only aggregated HFC emissions from 2.E.1 By-product emissions and 2.E.2 Fugitive emissions.

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France	-38.0	-38.8	-38.1	-38.5	-37.5	-33.3	0.0	90.0	47.4	-83.1
Greece	18.4	-17.9	76.9	33.4	51.7	15.2	5.7	-5.5	0.0	300.4
Hungary										
Iceland										
Ireland										
Italy										
Japan						-8.1	-5.8	-6.2	2.3	
Latvia										
Luxembourg										
Netherlands	-5.5	-5.8	11.6	23.8	0.0	7.0	0.0	10.1	0.0	44.8
New Zealand										
Norway										
Portugal										
Slovakia										
Spain	-11.0	11.5	-21.3	72.0	43.9	9.8	1.1	-12.1	19.7	125.6
Sweden										
Switzerland										
United Kingdom										
United States	-11.5	13.0	-8.3	-1.3	-14.0	15.1	-3.5	32.9	-24.0	-12.6

Industrial processes - HFC emissions from consumption of halocarbons and SF_6 (1999)

2.F. Consumption of halocarbons and SF_6 - HFCs

	Method and EF used[a]		HFC-23			HFC-32			HFC-41			HFC-43-10mee		
	Method	EF	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A
			Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.		
Australia	NE	NA	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	
Austria	CS	CS	304.2	5.5	54.9	6.5	0.6	10.9						
Belgium									NO			NO		
Bulgaria	T1a	D	7.4			0.2								
Canada	T2	D	1.7	1.6	1.0	0.4	0.1	3.0						
Czech Republic	D		4.7			0.6								
Denmark							3.9	0.0						
Estonia														
Finland	T2&T1b	D	3.0	3.0	1.0	7.2	5.6	1.3						
France	CS/ T2	CS		62.6	0.0		2.6	0.0					81.9	
Greece														
Hungary	T1a, D	CS												
Iceland	T1	D				0.0								
Ireland	NA	NA	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE
Italy				24.8	0.0		22.0	0.0						
Japan	CS	CS	18,064.8	5,293.9		288.0	IE		NE	IE		NE	IE	
Latvia			NE	NO		NE	NO		NE	NO		NE	NO	
Luxembourg														
Netherlands	T2/CS													
New Zealand	T1a		NA	NA		NE	4.8		NA	NA	NA	NA	NA	
Norway	T2	CS	0.8	0.8	1.0	4.2	0.4	10.0						
Portugal														
Slovakia	D	D; CS	0.5	0.6	0.9	0.3	0.1	4.1						
Spain	T1,T2	T1,T2		184.3	0.0									
Sweden	T2, T1b	D, CS		0.5	0.0	20.6	0.4	51.1						
Switzerland	T2	M	1.2	NO		9.1	1.8	5.0	NO	NO	NO	0.3	NO	
United Kingdom	T2	D/CS					IE			IE			IE	
United States	M	M	3,419.4	288.8	11.8	367.7	11.3	32.5	46511.6	9444.7	4.9			

	HFC-125			HFC-134			HFC-134a			HFC-152A		
	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A
	Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.		
Australia	NE	NE	NE	NE	NE		NE	NE	NE	NE	NE	NE
Austria	601.6	45.3	13.3				95.9	782.6	0.1	1.3	0.1	13.6
Belgium	139.7	24.2	5.8	NO			1,014.0	456.4	2.2	0.5	2.9	0.2
Bulgaria	20.2						73.8			0.2		
Canada	39.2	118.0	0.3				1,720.4	679.5	2.5	2.6	4.4	0.6
Czech Republic	91.9						185.1			0.4		
Denmark		121.7	0.0					344.1	0.0		5.4	0.0
Estonia												
Finland	275.1	96.2	2.9				292.0	164.5	1.8	2.8	3.8	0.7
France		470.2	0.0					2,812.6	0.0			
Greece												
Hungary	30.8	12.9	2.4				277.2	120.6	2.3			
Iceland	23.5						8.2			0.1		
Ireland	NE	NE	NE	NE	NE	NE	NE	NE		NE	NE	NE
Italy	260.4	252.3	1.0				3,367.0	2,325.8	1.4			
Japan	1,540.0	IE		NE	IE		18,398.9	IE		1.1	IE	
Latvia	NE	NO		NE	NO		NE	NO		NE	NO	
Luxembourg												
Netherlands	543.2	124.6	4.4				1,366.3	984.4	1.4			
New Zealand	NE	29.1		NA	NA		NE	133.5		NE	0.2	
Norway	221.5	55.6	4.0				357.0	65.3	5.5	6.8	0.8	8.1
Portugal												
Slovakia	10.0	2.1	4.7				102.4	57.8	1.8	0.5	0.1	5.6
Spain		83.1	0.0					2,146.1	0.0			
Sweden	250.0	13.2	19.0				742.6	328.7	2.3	-0.1	18.7	0.0
Switzerland	178.6	50.9	3.5	NO	NO		485.9	243.2	2.0	0.4	0.8	0.4
United Kingdom		IE			IE			IE			IE	
United States	21,199.1	3,608.5	5.9				82,518.6	39,442.0	2.1			

2.F. Consumption of halocarbons and SF_6 - HFCs

	HFC-143			HFC-143a			HFC-227ea		
	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A
	Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.		
Australia	NE	NE	NE	NE	NE	NE	NE	NE	NE
Austria				480.8	36.0	13.4	21.8	0.3	67.3
Belgium	NO			268.6	43.2	6.2			
Bulgaria	0.9								
Canada				47.2	113.7	0.4	3.1		
Czech Republic				126.1					
Denmark				146.2					
Estonia									
Finland				303.5	43.8	6.9	29.7	10.7	2.8
France					730.9	0.0		13.5	0.0
Greece									
Hungary				49.9	20.7	2.4			
Iceland				27.6					
Ireland	NE	NE	NE	NE	NE	NE	NE	NE	NE
Italy				266.0	235.5	1.1	40.6		
Japan	NE	IE		429.4	IE		NE	IE	
Latvia	NE	NO		NE	NO		NO	NO	
Luxembourg									
Netherlands	50.7				159.6	0.0	57.0	48.6	1.2
New Zealand	NA	NA	NA	NE	41.8		NE	0.4	
Norway				267.9	56.0	4.8	0.6	0.5	1.3
Portugal									
Slovakia				14.1	3.1	4.6		2.3	0.0
Spain					130.8	0.0		24.3	0.0
Sweden				269.0	13.9	19.3	3.2	2.2	1.5
Switzerland	NO	NO	NO	212.7	66.7	3.2			
United Kingdom			IE		IE			IE	
United States				24,882.7	2,567.7	9.7			

	HFC-236fa			HFC-245ca			Total		
	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A
	Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.		
Australia	NE	NE	NE	NE	NE	NE	NE	NE	
Austria							1,512.1	870.5	1.7
Belgium	NO			NO			1,422.9	526.7	2.7
Bulgaria							102.7		
Canada							1,814.5	917.4	2.0
Czech Republic	3.2						411.9		
Denmark							146.2	475.0	0.3
Estonia									
Finland							913.4	327.6	2.8
France								4,174.2	0.0
Greece									
Hungary							357.9	154.3	2.3
Iceland							59.4		
Ireland	NE	NE	NE	NE	NE		NE	NE	
Italy							3,934.0	2,860.3	1.4
Japan	NE	IE		NE	IE		38,722.2	5,293.9	0.1
Latvia	NO	NO		NO					
Luxembourg									
Netherlands							2,017.2	1,317.2	1.5
New Zealand	NA			NA				209.9	0.0
Norway							858.7	179.5	4.8
Portugal									
Slovakia							127.8	66.0	1.9
Spain		0.9						2,569.5	0.0
Sweden							1,285.3	377.5	3.4
Switzerland	NO	NO	NO	NO	NO	NO	888.0	363.4	2.4
United Kingdom		IE			IE			IE	
United States	2,446.0	1,342.2	1.8				181,345.0	56,705.2	3.2

Key souces - HFCs, PFCs, SF_6 [b, c]

	ODS substitutes (HFCs and PFCs)		Fugitive emissions (prod. halocarbons and SF_6)		PFCs, HFCs, SF_6 (semiconductor manufacturing)	
	Key source	Percentage of national total	Key source	Percentage of national total	Key source	Percentage of national total
		%		%		%
Australia						
Austria	L/T	1.1 / 4.7			T	1.5
Belgium						
Bulgaria						
Canada						
Czech Republic						
Denmark	L	0.9				
Estonia						
Finland	T	2.3				
France	L	0.8	T	0.5	T	0.5
Greece						
Hungary						
Iceland						
Ireland						
Italy	L	0.5				
Japan	L	0.8				
Latvia						
Luxembourg						
Netherlands						
New Zealand						
Norway	T	2.5				
Portugal						
Slovakia						
Spain						
Sweden	L/T	0.5 / 5.1				
Switzerland	L	0.7				
United Kingdom	L/T	0.7 / 1.5				
United States	L/T	0.7 / 8.4				

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all HFCs for all subcategories within the category 2.F. Consumption of halocarbons and SF6.
[b] Key source assessments here refer to categories including HFCs, PFCs and SF_6 rather than by individual gas species.
[c] The percentage refers to the actual emissions where available; otherwise to potential emissions.

Industrial processes - PFC and SF_6 emissions from consumption of halocarbons and SF_6 (1999)

2.F. Consumption of halocarbons and SF_6 - PFCs [a]

	Method and EF used [b]		CF_4			C_2F_6			C_3F_8		
	Method	EF	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A
			Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.		
Australia	NE	NA	NE	NE	NE	NE	NE	NE	NE	NE	NE
Austria	CS	CS		9.74			15.58				
Belgium			NO								
Bulgaria	NE	NE									
Canada	T2	PS	5.46	3.12	1.75	29.49	11.75	2.51	18.88	1.67	11.32
Czech Republic	D		0.39						2.31		
Denmark										30.10	
Estonia											
Finland	T2&T1b/T1a	D/NA	0.77	0.77	1.00	0.06	0.06	1.00	25.35	25.35	1.00
France	CS/ T2	CS		167.59			359.79			0.02	
Greece											
Hungary	T1a	CS									
Iceland											
Ireland	NA	NA	NE	NE	NE	NE	NE		NE	NE	
Italy				40.94			47.42				
Japan*	CS	CS	2,710.50	9,770.20		5,989.20	IE		378.00	IE	
Latvia			NO	NO		NO	NO		NO	NO	
Luxembourg											
Netherlands[c]											
New Zealand	T1a		NA	NA	NA	NA	NA		NE	NE	
Norway									7.00	0.39	18.10
Portugal											
Slovakia	D	D; CS		2.59							
Spain	T1,T2	T1,T2								27.86	
Sweden	T2, T1b	CS	3.25	0.78	4.17	11.04	6.81	1.62			
Switzerland	T2	M	2.60	2.69	0.97	22.08	11.69	1.89	0.07	1.94	0.04
United Kingdom	T2	D/CS					IE			IE	
United States	M	M	61.68	3.52	17.51		6,800.00				

	C_4F_{10}			c-C_4F_8			C_5F_{12}			C_6F_{14}			Total		
	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A	P 2.F.(p)	A 2.F.(a)	Ratio P/A
	Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.		
Australia	NE	NE		NE	NE		NE	NE		NE	NE				
Austria														25.32	
Belgium	NO			NO			NO			NO					
Bulgaria															
Canada	0.12	0.00	340.00	0.00	0.07	0.01	0.15	0.08	1.85	2.23	2.42	0.92	56.34	19.12	2.95
Czech Republic													2.70		
Denmark														30.10	
Estonia															
Finland										2.38	2.38	1.00	28.55	28.55	1.00
France											134.72			662.11	
Greece															
Hungary										26.64	13.32	2.00	26.64	13.32	2.00
Iceland															
Ireland	NE	NE		NE	NE		NE	NE		NE	NE				
Italy					0.15									88.52	
Japan*	NE	IE		849.12	IE		7,470.00	IE		NE	IE		17,396.82	9,770.20	0.56
Latvia	NO	NO		NO	NO		NO	NO		NO	NO				
Luxembourg															
Netherlands[c]				CBI	118.36									118.36	
New Zealand		NA			NA			NA			NA				
Norway													7.00	0.39	18.10
Portugal															
Slovakia														2.59	
Spain		1.99												29.85	
Sweden													14.29	7.59	1.88
Switzerland	NO	NO		NO	NO		NO	NO		NO	NO		24.75	16.33	1.52
United Kingdom		IE			IE			IE			IE				
United States													61.68	6,803.52	0.01

[a] An assessment of key sources is provided in a separate table presented together with the table on HFC emissions from consumption of halocarbons and SF_6

[b] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all PFCs for all subcategories within the category 2.F.consumption of halocarbons and SF_6

[c] The Netherlands reported aggregated emissions of all PFCs for the industrial processes sector. These aggregated emissions are a key source.

2.F. Consumption of halocarbons and SF_6 - SF_6 [a]

	Method and EF used [b]		P	A	
	Method	EF	2.F.(p)	2.F.(a)	Ratio P/A
			Gg CO_2 equ.		
Australia	NE	NA	NE	NE	NE
Austria	CS	CS	8,875.84	707.68	12.54
Belgium			478.00	2,485,600.00	0.00
Bulgaria	NE	NE			
Canada	T3	PS			
Czech Republic	D		110.85		
Denmark				48.04	
Estonia					
Finland	T2&T1b/T1a	D/NA	29.16	32.33	0.90
France	CS/ T2	CS		1,275.40	
Greece					
Hungary	D	CS	177.34	101.20	1.75
Iceland	D	D			
Ireland	NA	NA	NE	NE	NE
Italy			3,465.50	385.85	8.98
Japan	CS	CS	34,057.50	6,823.50	0.20
Latvia			0.09	NO	
Luxembourg					
Netherlands			CBI	136.71	
New Zealand	CS		68.12	30.45	2.24
Norway				57.46	
Portugal	D	D		0.99	
Slovakia	D	D; CS		12.68	
Spain	T1,T2	T1,T2		224.54	
Sweden	T2, T1b	CS	466.05	65.25	7.14
Switzerland	T2	M	478.17	101.41	4.72
United Kingdom	T2	CS	2,729.53	597.17	4.57
United States	CS	CS	67,142.94	25,700.00	2.61

Industrial processes - Consumption of halocarbons and SF_6 (HFCs)

Trends in actual HFC-134a emissions 1990 to 1999
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Austria	1	2	3	5	7	414	458	509	568	602
Belgium									351	351
Bulgaria										
Canada						285	543	406	523	523
Czech Republic										
Denmark			2	20	37	70	135	146	231	265
Estonia										
Finland					5	15	38	89	92	127
France					118	523	1,174	1,708	1,887	2,164
Greece										
Hungary										93
Iceland										
Ireland										NE
Italy									554	1,789
Japan	NE	NE	NE	NE	NE	IE	IE	IE	IE	IE
Latvia										NO
Luxembourg										
Netherlands					63	177	392	608	704	757
New Zealand										103
Norway										50
Portugal										
Slovakia										44
Spain						2	168	437	993	1,651
Sweden	1	2	3	13	34	68	97	160	202	253
Switzerland										187
United Kingdom										
United States	564	564	626	2,885	6,284	14,345	18,962	23,478	26,854	30,340

Note
The trend in HFC-134a emissions is presented here, since HFC-134a is the most commonly used HFC.

Percentagechange from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria	57.51	47.87	45.96	46.18	6,059.60	10.49	11.17	11.54	6.05	44,374.05
Belgium									0.00	
Bulgaria										
Canada						90.74	-25.30	28.87	0.00	
Czech Republic										
Denmark			706.45	84.79	88.26	93.92	8.00	58.85	14.33	
Estonia										
Finland					208.02	158.80	136.59	2.56	38.08	
France					344.50	124.35	45.45	10.46	14.68	
Greece										
Hungary										
Iceland										
Ireland										
Italy									222.87	
Japan										
Latvia										
Luxembourg										
Netherlands					180.63	121.89	54.88	15.90	7.53	
New Zealand										
Norway										
Portugal										
Slovakia										
Spain						10,254.01	160.28	127.46	66.24	
Sweden	118.60	64.36	309.06	170.33	100.09	41.30	65.22	26.78	24.95	29,300.00
Switzerland										
United Kingdom										
United States	0.00	11.06	360.46	117.84	128.27	32.18	23.81	14.38	12.98	5,278.46

Industrial processes - Consumption of halocarbons and SF_6 (SF_6)

Trends in actual SF_6 emissions 1990 to 1999
Tonnes

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Austria	11.06	16.97	19.75	22.83	27.61	30.61	26.59	33.43	33.08	29.61
Belgium									8.63	8.63
Bulgaria										
Canada										
Czech Republic										
Denmark	0.50	1.25	2.42	3.65	3.21	2.99	2.15	2.46	1.79	2.01
Estonia										
Finland	2.97	2.00	1.36	1.10	1.10	0.58	0.58	0.67	0.49	1.35
France	44.34	45.23	46.15	47.14	48.22	49.32	52.39	54.75	53.15	53.36
Greece										
Hungary										4.23
Iceland										
Ireland										NE
Italy									15.59	16.14
Japan	NE	NE	NE	NE	NE	503.01	543.86	496.00	448.56	285.50
Latvia										0.09
Luxembourg										
Netherlands	6.05		4.45	4.60	6.19	7.30	6.71	7.61	5.54	5.72
New Zealand										1.27
Norway										2.40
Portugal						0.04	0.04	0.04	0.04	0.04
Slovakia										0.53
Spain	3.25	3.50	3.60	3.75	4.11	4.96	5.31	6.31	7.33	9.40
Sweden	3.40	3.44	3.42	2.95	2.95	4.00	3.01	4.41	2.56	2.73
Switzerland										4.24
United Kingdom	10.30	12.48	14.84	17.20	19.40	22.43	23.16	22.83	23.95	24.99
United States	857.74	901.26	944.77	988.28	1,031.80	1,075.31	1,075.31	1,075.31	1,075.31	1,075.31

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria	53.43	16.37	15.58	20.96	10.86	-13.14	25.71	-1.02	-10.50	167.66
Belgium									0.00	
Bulgaria										
Canada										
Czech Republic										
Denmark	150.00	93.68	50.64	-12.06	-6.70	-28.07	14.22	-27.30	12.48	302.00
Estonia										
Finland	-32.76	-32.05	-19.07	-0.25	-46.85	0.00	15.33	-26.46	173.66	-54.50
France	2.01	2.03	2.16	2.28	2.29	6.23	4.50	-2.93	0.41	20.36
Greece										
Hungary										
Iceland										
Ireland										
Italy									3.54	
Japan						8.12	-8.80	-9.56	-36.35	
Latvia										
Luxembourg										
Netherlands			3.37	34.57	17.93	-8.08	13.41	-27.20	3.25	-5.45
New Zealand										
Norway										
Portugal						2.15	0.00	4.24	2.04	
Slovakia										
Spain	7.47	2.83	4.28	9.49	20.68	7.25	18.67	16.16	28.26	188.72
Sweden	1.18	-0.58	-13.74	0.00	35.59	-24.75	46.51	-41.95	6.64	-19.71
Switzerland										
United Kingdom	21.14	18.97	15.84	12.84	15.58	3.26	-1.42	4.91	4.34	142.59
United States	5.07	4.83	4.61	4.40	4.22	0.00	0.00	0.00	0.00	25.37

Industrial processes: Activity data from international sources

Aluminium production in thousands of metric tons (1998)

Source	Monthly Bulletin of Statistics			ICS 1998[a]	
	Type	Monthly average	in 1998	Primary	Total
Australia	A	134.8	1,617.6	1,617.6	1,721.6
Austria	B	7.8	93.6	0.0	126.4
Belgium					0.0
Bulgaria					
Canada	A	197.8	2,373.6	2,374.1	2,485.1
Czech Republic					
Finland					
Greece	A	12.2	146.4	146.4	146.4
Hungary	A	2.8	33.6	92.2	92.2
Ireland					
Italy	A	15.5	186.0	187.0	689.6
Japan	A	25.8	309.6	51.4	1,206.8
Latvia					
Lithuania					
Netherlands	A+B	34.4	412.8	263.7	365.7
New Zealand	A	26.5	318.0	317.5	325.5
Norway	A+B	88.2	1,058.4	995.5	1,057.9
Slovakia				114.9	120.7
Spain	A	29.9	358.8	360.4	570.4
Sweden				95.7	122.7
Switzerland				32.1	47.2
United Kingdom	A	21.5	258.0	258.4	533.2
United States	A	309.4	3,712.8	3,713.0	7,153.0
	Type A: primary (virgin) aluminium from domestic and imported ores. Type B: secondary, i.e. derived from scrap.			Unwrought primary	Unwrought total

Total HFC-134a sales by region (metric tons)

Year	Northern hemisphere 30-90 degrees north (plus fugitive emissions)	0-30 degrees north	Southern hemisphere 0-90 degrees south	TOTAL
1990	189	-----	-----	189
1991	2,197	1	-----	2,198
1992	6,343	47	14	6,404
1993	25,955	287	284	26,526
1994	46,726	2,507	1,167	50,400
1995	67,020	4,744	2,005	73,769
1996	75,148	5,876	2,650	83,674
1997	92,257	5,668	4,012	101,937
1998	98,174	8,351	5,710	112,235
1999	117,784	9,578	6,300	133,662
TOTAL	**531,793**	**37,059**	**22,142**	**590,994**

Source: AFEAS (www.afeas.org)

Aluminium production in thousands of metric tons (1998)

	HFC-134a
1990	189
1991	2,198
1992	6,404
1993	26,526
1994	50,400
1995	73,769
1996	83,674
1997	101,937
1998	112,235
1999	133,662

Source: AFEAS (www.afeas.org)

Monthly Bulletin of Statistics, United Nations Statistics Division, vol. LIV, no. 12, December 2000, ST/ESA/STAT/SER.Q/336.
1998 Industrial Commodity Statistics Yearbook, Production statistics 1989-1998, Department of Economic and Social Affairs, Statistics Division, United Nations, New York, 2000.

[a] For a comparison of aluminium production data as reported in the CRF by Parties please refer to table Industrial processes - PFC and SF_6 emissions from metal production (1999).

Solvent and other product use, CO_2, N_2O and NMVOC (1999)

	Solvent and other product use																
	Methods and EF used, CO_2		Methods and EF used, N_2O		3. A Paint application						3. B. Degreasing and dry cleaning					
					CO_2			N_2O			CO_2			N_2O		
	Method	EF	Method	EF	Key source	Percentage of national total	CO_2 IEF	Key source	Percentage of national total	N_2O IEF	Key source	Percentage of national total	CO_2 IEF	Key source	Percentage of national total	N_2O IEF
						%	t / t		%	t / t		%	t / t		%	t / t
Australia	NE	NE	NE	NE			0.000			0.000						
Austria	C, CS	CS	CS	CS			2.649									
Belgium																
Bulgaria	NE	NE	NE	NE												
Canada	NA	NA	CS	CS												
Czech Republic	C	C, CS	D	D			1.356						2.534			
Denmark																
Estonia																
Finland	NO	NO	CS	CS												
France	C	CS					2.961						2.423			
Greece	C	C					0.003						0.001			
Hungary	CS	CS					0.311						0.063			
Iceland																
Ireland	CS, C	CS, C	NA	NA												
Italy							0.737						2.454			
Japan			CS	CS			NO			NO			NO			NO
Latvia	T1	D					NO			NO			NO			NO
Luxembourg																
Netherlands	CS	CS	CS	CS												
New Zealand							NE			NE			NE			NO
Norway	M	CS	CS				3.000						3.000			
Portugal	MB						0.756						3.117			
Slovakia			NO	NO												
Spain			CS	CS												
Sweden	CS	CS														
Switzerland	CS	CS	CS	CS			NO			NO			NO			NO
United Kingdom	T2	CS	NE													
United States	NE	NE	NE	NE												

3. Agriculture

Agriculture - Enteric fermentation, CH_4 (1999)

	4.A Enteric fermentation (CH_4)																
	Methods and EF used[a]		Key source	Per centage of national total	4.A.1 Cattle					4.A.3 Sheep				4.A.8 Swine			
					Activity data (population size)			Dairy cattle	Non-dairy cattle	Activity data (population size)			CH_4 IEF	Activity data (population size)			CH_4 IEF
	Methods	EF			CRF	FAO[b]	Difference	CH_4 IEF		CRF	FAO[b]	Difference	kg CH_4/ head/yr	CRF	FAO[b]	Difference	kg CH_4/ head/yr
				%	(1,000 head)		%	kg CH_4/head/yr		(1,000 head)		%		(1,000 head)		%	
IPCC default EF[c]								56 - 118[d]	44 - 56[d]				8				1.5
Australia	CS	CS	LT	12.4	26,693	26,578	-0.4	107.2	74.5	115,925	115,456	-0.4	6.6	2,685	2,626	-2.2	1.1
Austria	C	CS	LT	3.4	2,153	2,172	0.9	92.0	38.0	352	361	2.4	8.0	2,570	3,810	48.2	1.5
Belgium[e]						3,186											
Bulgaria	T1	D	L	2.2	677	671	-0.8	81.0	56.0	2,661	2,774	4.2	8.0	1,617	1,721	6.4	1.5
Canada	T1	D	L	2.6	13,675	12,902	-5.7	99.6	54.1	433	649	49.9	13.3	12,317	12,409	0.7	1.5
Czech Republic	T2	CS	L	1.3	1,657	1,657	0.0	68.2	23.6	86	86	0.1	5.0	4,001	4,001	0.0	3.4
Denmark			LT	3.7	1,887	1,887	0.0	104.0	37.0	69	143	107.7	8.0	9,305	11,626	24.9	1.5
Estonia			L	2.0	267	308	15.0	81.0	56.0	31	31	-0.3	8.0	286	326	14.2	1.5
Finland	T2	CS/D	LT	2.0	1,087	1,087	0.0	107.6	42.1	107	107	0.0	8.0	1,351	1,351	0.0	1.5
France	C	CS	LT	5.1	20,532	20,265	-1.3	82.0	50.5	10,169	10,240	0.7	6.0	7,107	14,682	106.6	1.0
Germany	CS	CS	L	2.0													
Greece	T1	D	LT	2.5	600	577	-3.8	81.0	56.0	9,195	8,756	-4.8	8.0	1,424	933	-34.5	1.5
Hungary	D	D	L	1.9	857	873	1.9	100.0	48.0	934	909	-2.7	8.0	5,335	5,479	2.7	1.5
Iceland	D	D	L	6.7	75	75	0.0	100.0	48.0	491	491	0.0	8.0	4	43	994.1	1.5
Ireland	D	CS, D	L	15.5	7,216	7,093	-1.7	100.0	50.0	6,756	5,624	-16.8	8.0	1,786	1,801	0.8	1.5
Italy			L	2.5	7,261	7,150	-1.5	117.6	53.6	11,089	10,770	-2.9	8.0	8,290	8,225	-0.8	1.5
Japan	D	CS			4,589	4,658	1.5	90.3	54.1	16	12	-26.4	4.1	9,823	9,879	0.6	1.1
Latvia[f]	T1	D	L	5.2	378,000	434	-99.9	*81.0*	*56.0*	27,000	27	-99.9	*8.0*	405,000	421	-99.9	*1.5*
Luxembourg[e]			L	5.5		*3,186*											
Netherlands	cattle 90: T2; rest: T1	cattle: CS; rest: D	LT	3.0	4,206	4,206	0.0	81.3	46.5	1,401	1,401	0.0	8.0	13,567	13,418	-1.1	1.5
New Zealand	T1	CS	L	38.3	9,034	8,960	-0.8	76.8	67.5	45,754	45,680	-0.2	15.1	372	369	-0.8	NE
Norway	T1	D	LT	3.5	1,033	1,042	0.8	100.0	48.0	2,715	2,400	-11.6	8.0	631	690	9.3	1.5
Portugal	T1	D	LT	3.0	1,255	1,267	1.0	100.0	48.0	3,472	5,850	68.5	8.0	2,254	2,341	3.8	1.5
Slovakia	T1,T2; CS	D; CS	L	2.2	570	705	23.6	96.0	56.0	340	326	-4.1	8.0	1,562	1,593	2.0	1.5
Spain	T1,T2	T1,T2	L	3.5		5,965					23,751				22,597		
Sweden	T1, CS	D, CS	LT	4.4	1,713	1,713	0.0	154.0	49.1	438	437	-0.2	8.0	2,114	2,115	0.0	1.6
Switzerland	CS	CS	L	4.6	1,609	1,609	0.0	98.9	43.2	424	424	-0.1	6.8	1,453	1,452	-0.1	1.0
United Kingdom	T2	D/CS	LT	2.9	11,423	11,423	0.0	93.9	45.7	44,656	44,656	0.0	4.7	7,284	7,284	0.0	1.5
United States of America	M, T1	M, D	LT	1.9	103,058	99,115	-3.8	94.7	68.0	7,215	7,235	0.3	8.0	60,310	62,206	3.1	1.5
Average								95.5	50.8				7.9				1.5
Maximum								154.0	74.5				15.1				3.4
Minimum								68.2	23.6				4.1				1.0

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for the various livestock types within the category CH_4 from 4.A Enteric fermentation.

[b] Source of international statistics: FAO, http://apps.fao.org: then click in "Agriculture" and then, in "Live Animals".

[c] Source of default emission factors: IPCC Guidelines, volume 3, Tables 4-3 and 4-4 (pages 4.10 - 4.11).

[d] For dairy and non-dairy cattle, default emission factors (in kg CH_4 / head/ yr) are provided by regions as shown below (see footnote c for source reference):

	North America	Western Europe	Eastern Europe	Oceania	Asia
Dairy cattle	118	100	81	68	56
Non-dairy cattle	47	48	56	53	44

[e] In the FAO statistics, Belgium and Luxembourg are aggregated.

[f] Information on methods and emission factors used was provided for the agriculture sector as a whole, not for the source category.

Agriculture - Enteric fermentation

Trends in CH_4 emissions 1990 to 1999
Gigagrams

	Base year [a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	3,065	3,065	3,072	3,021	2,962	2,902	2,876	2,865	2,881	2,876	2,869
Austria	154	154	151	144	142	141	135	133	131	131	128
Belgium										212	210
Bulgaria	193	180	165	135	104	87	82	79	76	82	83
Canada	762	762	769	789	795	834	861	867	875	855	849
Czech Republic [c]										86	85
Denmark	150	150	149	146	148	143	143	142	138	138	128
Estonia											19
Finland	87	87	83	81	81	81	76	76	77	75	74
France	1,431	1,431	1,405	1,370	1,355	1,352	1,359	1,358	1,341	1,330	1,331
Germany	1,248	1,248	1,103	1,043	1,024	1,024	1,018	1,016	983	970	949
Greece	142	142	140	139	139	139	140	142	144	145	145
Hungary	157	126	122	105	90	85	84	82	79	81	80
Iceland	11	11	11	10	10	10	10	10	10	10	10
Ireland	453	453	457	458	460	462	468	477	488	494	483
Italy	648	648	658	630	618	626	637	629	640	638	638
Japan	345	345	350	351	348	344	339	335	331	328	324
Latvia	98	98	95	79	49	41	39	37	35	32	28
Luxembourg											16
Netherlands	402	402	412	401	393	382	377	365	353	339	332
New Zealand	1,474	1,474	1,441	1,418	1,416	1,422	1,420	1,406	1,395	1,396	1,398
Norway	87	87	87	89	88	91	92	92	93	94	94
Portugal	124	124	126	121	119	119	119	118	118	116	115
Slovakia	116	116	101	87	74	69	71	68	62	56	54
Spain	589	589	577	580	591	578	575	620	624	623	638
Sweden	153	153	148	154	155	155	152	152	152	149	147
Switzerland [b]	130	130	132	131	130	127	128	126	124	120	118
United Kingdom	913	913	900	900	900	907	897	905	893	895	892
United States	6,166	6,166	6,143	6,289	6,160	6,447	6,492	6,295	6,172	6,072	6,057
Average	764	762	752	747	734	743	744	736	729	679	631
Maximum	6,166	6,166	6,143	6,289	6,160	6,447	6,492	6,295	6,172	6,072	6,057
Minimum	11	11	11	10	10	10	10	10	10	10	10

[a] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).
[b] Calculated as average of three years.
[c] Values other than for 1999 were taken from the 2000 submission, as no trend tables were provided and no recalculations were reported in the 2001 submission.

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	0.2	-1.7	-1.9	-2.0	-0.9	-0.4	0.5	-0.2	-0.2	-6.4
Austria	-2.1	-4.6	-1.8	-0.8	-3.8	-1.8	-1.1	-0.4	-2.1	-17.2
Belgium									-1.3	
Bulgaria	-8.4	-17.9	-23.0	-16.3	-5.5	-4.0	-4.1	7.7	1.4	-57.0
Canada	1.0	2.6	0.8	4.8	3.3	0.7	1.0	-2.2	-0.8	11.4
Czech Republic									-0.8	
Denmark	-1.0	-1.5	1.2	-3.7	-0.1	-0.1	-3.1	0.1	-7.3	-14.8
Estonia										
Finland	-4.8	-2.3	0.1	-0.2	-5.9	0.4	1.1	-2.3	-1.7	-14.8
France	-1.9	-2.5	-1.1	-0.2	0.5	0.0	-1.3	-0.9	0.1	-7.0
Germany	-11.6	-5.4	-1.8	0.0	-0.6	-0.2	-3.2	-1.3	-2.2	-24.0
Greece	-1.2	-0.6	-0.2	0.4	0.5	1.1	1.4	0.9	0.0	2.3
Hungary	-2.7	-14.0	-13.9	-5.8	-2.0	-2.0	-3.7	2.8	-1.3	-48.9
Iceland	-1.5	-2.9	-0.8	0.4	-2.6	0.9	1.1	0.9	-1.1	-5.4
Ireland	0.9	0.1	0.5	0.5	1.2	2.1	2.2	1.2	-2.2	6.7
Italy	1.6	-4.3	-1.9	1.3	1.7	-1.2	1.7	-0.3	0.1	-1.5
Japan	1.2	0.3	-0.7	-1.2	-1.4	-1.2	-1.1	-1.1	-1.2	-6.2
Latvia	-3.5	-16.2	-38.3	-17.0	-3.2	-5.6	-6.4	-8.8	-13.1	-71.9
Luxembourg										
Netherlands	2.5	-2.7	-2.0	-2.8	-1.4	-3.0	-3.5	-3.8	-2.2	-17.4
New Zealand	-2.3	-1.6	-0.1	0.4	-0.1	-1.0	-0.8	0.1	0.1	-5.1
Norway	0.5	1.8	-1.2	3.9	1.0	0.4	0.2	1.7	0.0	8.6
Portugal	1.7	-4.0	-1.9	-0.2	0.3	-1.1	0.0	-1.1	-1.1	-7.2
Slovakia	-13.3	-13.9	-14.8	-6.4	2.3	-4.2	-8.1	-10.2	-4.3	-53.9
Spain	-2.1	0.4	2.0	-2.2	-0.5	7.8	0.6	-0.1	2.4	8.3
Sweden	-3.1	3.8	0.9	-0.2	-2.2	0.1	0.2	-2.4	-1.2	-4.2
Switzerland	1.1	-0.8	-0.6	-1.9	0.3	-1.3	-1.5	-3.0	-2.4	-9.7
United Kingdom	-1.4	-0.1	0.0	0.8	-1.1	0.9	-1.3	0.2	-0.3	-2.3
United States	-0.4	2.4	-2.1	4.7	0.7	-3.0	-2.0	-1.6	-0.2	-1.8

Agriculture - Enteric fermentation: dairy cattle

Trends in CH_4 emissions 1990 to 1999
Gigagrams

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia [b]	263.5	261.5	262.1	271.3	280.8	292.0	302.1	315.4	322.9	336.8
Austria	83.2	80.6	77.4	76.2	74.5	65.0	64.2	66.3	67.0	64.2
Belgium [a b]								198.2	204.6	201.9
Bulgaria										34.5
Canada	196.4	190.0	186.9	179.4	180.3	181.1	181.4	175.6	173.1	165.7
Czech Republic [b]									43.9	43.8
Denmark	78.3	77.1	74.0	74.3	72.8	73.1	72.9	69.7	69.6	66.6
Estonia										11.2
Finland	47.6	43.7	42.1	42.3	42.3	41.0	40.5	41.2	40.5	40.1
France	639.6	616.5	589.3	575.5	572.8	571.4	569.2	561.4	555.0	552.6
Germany										
Greece	20.0	19.6	19.3	19.1	18.9	18.7	19.1	19.2	19.4	19.4
Hungary [b]									40.7	39.9
Iceland									3.2	2.8
Ireland [b]									129.2	127.8
Italy									241.1	247.7
Japan	182.5	182.7	181.2	177.6	174.1	171.4	169.4	166.6	163.2	159.7
Latvia									19.6	16.7
Luxembourg										
Netherlands	290.7						262.2	252.1	247.8	241.6
New Zealand [b]	262.6	266.1	272.7	285.9	301.7	314.7	323.2	330.2	334.1	341.7
Norway	33.8									35.0
Portugal	40.3	40.4	38.1	37.5	35.6	36.4	36.2	36.2	35.5	35.1
Slovakia [b]									26.1	26.3
Spain [a]	351.0	345.6	337.2	336.0	346.4	357.2	379.1	376.8	383.4	395.5
Sweden	88.7	81.3	81.0	80.9	78.4	74.2	71.8	72.1	69.1	69.1
Switzerland [b]									73.1	71.7
United Kingdom	295.9	288.8	285.2	285.8	291.4	283.5	284.6	280.8	278.6	280.6
United States	1,368.9	1,370.0	1,367.6	1,307.1	1,307.0	1,308.4	1,240.6	1,239.7	1,234.2	1,245.2
Average	265.2	276.0	272.4	267.8	269.8	270.6	267.8	262.6	199.0	180.5
Maximum	1,368.9	1,370.0	1,367.6	1,307.1	1,307.0	1,308.4	1,240.6	1,239.7	1,234.2	1,245.2
Minimum	20.0	19.6	19.3	19.1	18.9	18.7	19.1	19.2	3.2	2.8

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-0.8	0.2	3.5	3.5	4.0	3.5	4.4	2.4	4.3	27.8
Austria	-3.1	-3.9	-1.6	-2.2	-12.8	-1.3	3.3	1.2	-4.2	-22.8
Belgium								3.2	-1.3	
Bulgaria										
Canada	-3.3	-1.6	-4.0	0.5	0.4	0.2	-3.2	-1.4	-4.3	-15.7
Czech Republic									-0.3	
Denmark	-1.5	-4.0	0.3	-2.0	0.4	-0.3	-4.3	-0.2	-4.3	-15.0
Estonia										
Finland	-8.2	-3.7	0.6	-0.1	-3.1	-1.2	1.7	-1.5	-1.2	-15.8
France	-3.6	-4.4	-2.3	-0.5	-0.2	-0.4	-1.4	-1.1	-0.4	-13.6
Germany										
Greece	-2.0	-1.4	-0.9	-1.2	-1.0	2.3	0.6	0.8	0.0	-3.0
Hungary									-2.0	
Iceland									-12.3	
Ireland									-1.1	
Italy									2.7	
Japan	0.1	-0.8	-2.0	-2.0	-1.6	-1.2	-1.7	-2.0	-2.2	-12.5
Latvia									-14.9	
Luxembourg										
Netherlands							-3.8	-1.7	-2.5	-16.9
New Zealand	1.3	2.5	4.8	5.5	4.3	2.7	2.2	1.2	2.3	30.1
Norway										3.6
Portugal	0.2	-5.7	-1.6	-5.1	2.2	-0.5	0.0	-1.9	-1.1	-12.9
Slovakia									0.7	
Spain	-1.5	-2.4	-0.4	3.1	3.1	6.1	-0.6	1.8	3.1	12.7
Sweden	-8.3	-0.4	-0.2	-3.0	-5.3	-3.3	0.4	-4.1	0.0	-22.0
Switzerland									-2.0	
United Kingdom	-2.4	-1.3	0.2	2.0	-2.7	0.4	-1.4	-0.8	0.7	-5.2
United States	0.1	-0.2	-4.4	0.0	0.1	-5.2	-0.1	-0.4	0.9	-9.0

[a] For Belgium and Spain the values included in this table refer to "cattle" as a whole, as disaggregated data for dairy and non-dairy cattle emissions were not provided.

[b] The following data are from the 2000 inventory submission: Australia (1991-1998), Belgium (1997), Czech Republic (1998), Hungary (1998), Ireland (1998), New Zealand (1990-1998), Slovakia (1998) and Switzerland (1998).

Trends in CH_4 implied emission factors 1990 to 1999
kg/head/yr

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia [a]	102.7	103.4	104.5	105.6	106.0	106.5	106.5	107.0	107.1	107.2
Austria	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0	92.0
Belgium										
Bulgaria										81.0
Canada	98.7	98.4	98.2	98.8	99.1	99.1	99.1	99.3	99.3	99.6
Czech Republic [a]									68.2	68.2
Denmark	104.0	104.0	104.0	104.0	104.0	104.0	104.0	104.0	104.0	104.0
Estonia										81.0
Finland	97.1	98.0	98.2	99.2	101.5	102.8	103.2	105.3	105.8	107.6
France	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0
Germany										
Greece	81.0	81.0	81.0	81.2	81.0	81.0	81.0	81.0	81.0	81.0
Hungary										100.0
Iceland									100.0	100.0
Ireland [a]									100.0	100.0
Italy										117.6
Japan	88.2	88.2	88.1	88.2	88.6	89.0	89.4	89.7	90.0	90.3
Latvia									81.0	81.0
Luxembourg										
Netherlands	80.6						80.0	80.0	80.9	81.3
New Zealand [a]	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8
Norway	100.0									100.0
Portugal	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Slovakia [a]									92.0	96.0
Spain										
Sweden	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0
Switzerland [a]									99.2	98.9
United Kingdom	87.6	87.4	88.3	88.3	89.1	89.5	89.1	91.3	92.8	93.9
United States	96.8	97.5	98.7	94.6	95.7	96.1	91.9	93.0	93.6	94.7
Average	96.1	97.1	97.4	97.3	97.7	97.9	96.4	96.8	95.0	95.5
Maximum	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0	154.0
Minimum	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	68.2	68.2

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	0.7	1.0	1.1	0.4	0.5	0.1	0.5	0.0	0.1	4.4
Austria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belgium										
Bulgaria										
Canada	-0.3	-0.3	0.6	0.3	0.0	0.0	0.1	0.0	0.3	0.9
Czech Republic									0.0	
Denmark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Estonia										
Finland	0.9	0.2	1.0	2.3	1.3	0.4	2.0	0.5	1.6	10.7
France	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Germany										
Greece	0.0	0.0	0.2	-0.2	0.0	0.0	0.0	0.0	0.0	0.0
Hungary										
Iceland									0.0	
Ireland									0.0	
Italy										
Japan	0.0	0.0	0.1	0.4	0.5	0.4	0.3	0.4	0.3	2.4
Latvia									0.0	
Luxembourg										
Netherlands							0.0	1.1	0.4	0.9
New Zealand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Norway										0.0
Portugal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slovakia									4.3	
Spain										
Sweden	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Switzerland									-0.4	
United Kingdom	-0.2	1.0	0.0	0.9	0.4	-0.4	2.5	1.7	1.1	7.2
United States	0.7	1.2	-4.1	1.1	0.5	-4.4	1.2	0.7	1.1	-2.1

[a] The following data are from the 2000 inventory submission: Australia (1991-1998), Czech Republic (1998), Ireland (1998), New Zealand (1990-1998), Slovakia (1998) and Switzerland (1998).

Agriculture - Enteric fermentation: non-dairy cattle

Trends in CH_4 emissions 1990 to 1999
Gigagrams

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia [b]	1,664.1	1,700.7	1,713.8	1,720.9	1,720.4	1,735.4	1,744.7	1,761.6	1,765.7	1,755.0
Austria	63.8	63.0	59.2	57.2	57.7	61.5	59.8	56.1	54.8	55.3
Belgium[a]										
Bulgaria										14.0
Canada	537.7	551.0	573.5	587.1	624.3	649.7	652.6	667.7	649.9	650.3
Czech Republic [b]									24.7	24.0
Denmark	55.6	54.8	54.7	54.8	52.0	51.4	51.5	49.4	48.4	46.1
Estonia										7.2
Finland	35.5	35.3	35.0	34.8	34.6	30.7	31.5	31.5	30.6	30.1
France	703.2	701.7	695.1	694.8	695.4	703.7	705.8	697.3	692.5	696.5
Germany										
Greece	21.3	20.4	19.7	19.4	19.4	19.6	19.9	20.0	20.2	20.2
Hungary [b]									22.4	22.0
Iceland									2.0	2.2
Ireland [b]									304.6	296.9
Italy									283.3	276.5
Japan	149.6	154.0	157.0	158.2	157.7	156.0	154.2	153.3	152.9	152.6
Latvia									10.8	9.6
Luxembourg										
Netherlands	74.9						66.1	63.0	59.2	57.4
New Zealand [b]	312.0	315.5	321.6	331.6	338.3	336.7	325.4	314.3	308.4	309.5
Norway	30.1									32.8
Portugal	46.7	48.6	46.3	45.5	46.1	46.1	45.6	45.6	43.8	43.4
Slovakia [b]									23.6	16.6
Spain[a]										
Sweden	48.6	51.1	56.7	57.6	59.7	61.1	63.4	63.6	63.4	62.1
Switzerland [b]									38.9	38.2
United Kingdom	396.1	391.3	393.1	391.0	393.4	394.2	403.7	392.0	388.4	385.5
United States	4,511.0	4,484.9	4,628.5	4,564.8	4,850.7	4,902.5	4,781.3	4,657.7	4,561.4	4,544.0
Average	576.7	659.4	673.4	670.6	696.1	703.7	650.4	640.9	434.1	381.9
Maximum	4,511.0	4,484.9	4,628.5	4,564.8	4,850.7	4,902.5	4,781.3	4,657.7	4,561.4	4,544.0
Minimum	21.3	20.4	19.7	19.4	19.4	19.6	19.9	20.0	2.0	2.2

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	2.2	0.8	0.4	0.0	0.9	0.5	1.0	0.2	-0.6	5.5
Austria	-1.3	-6.0	-3.4	0.9	6.6	-2.8	-6.2	-2.3	0.8	-13.4
Belgium										
Bulgaria										
Canada	2.5	4.1	2.4	6.3	4.1	0.5	2.3	-2.7	0.1	20.9
Czech Republic									-3.0	
Denmark	-1.5	-0.1	0.2	-5.1	-1.2	0.3	-4.2	-1.9	-4.7	-17.0
Estonia										
Finland	-0.6	-0.9	-0.6	-0.5	-11.4	2.6	0.2	-3.0	-1.7	-15.4
France	-0.2	-0.9	-0.1	0.1	1.2	0.3	-1.2	-0.7	0.6	-0.9
Germany										
Greece	-4.5	-3.1	-1.6	0.2	0.7	1.7	0.7	0.7	0.0	-5.3
Hungary									-1.7	
Iceland									8.4	
Ireland									-2.5	
Italy									-2.4	
Japan	3.0	1.9	0.8	-0.3	-1.1	-1.1	-0.6	-0.3	-0.2	2.0
Latvia									-10.4	
Luxembourg										
Netherlands							-4.6	-6.0	-3.1	-23.4
New Zealand	1.1	1.9	3.1	2.0	-0.5	-3.3	-3.4	-1.9	0.4	-0.8
Norway										9.0
Portugal	4.1	-4.7	-1.7	1.4	-0.1	-1.1	0.0	-3.9	-0.9	-7.0
Slovakia									-29.7	
Spain										
Sweden	5.1	11.0	1.6	3.6	2.4	3.7	0.4	-0.3	-2.1	27.8
Switzerland									-1.9	
United Kingdom	-1.2	0.5	-0.5	0.6	0.2	2.4	-2.9	-0.9	-0.7	-2.7
United States	-0.6	3.2	-1.4	6.3	1.1	-2.5	-2.6	-2.1	-0.4	0.7

[a] Belgium and Spain provided emission estimates for "cattle" as a whole, without disaggregating into dairy and non-dairy cattle. Estimates from these Parties were included in the table on dairy cattle.
[b] The following data are from the 2000 inventory submission: Australia (1991-1998), Czech Republic (1998), Hungary (1998), Ireland (1998), New Zealand (1990-1998), Slovakia (1998) and Switzerland (1998).

Trends in CH_4 implied emission factors 1990 to 1999
kg/head/yr

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia [a]	75.0	75.1	75.2	75.3	74.9	74.5	74.2	74.3	74.2	74.5
Austria	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Belgium										
Bulgaria										56.0
Canada	54.3	54.4	54.4	54.5	54.6	54.6	54.5	54.3	54.3	54.1
Czech Republic [a]									23.6	23.6
Denmark	37.4	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0
Estonia										56.0
Finland	40.9	40.9	41.4	42.1	42.4	40.9	41.8	41.9	41.7	42.1
France	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5
Germany										
Greece	56.0	56.0	56.0	55.9	56.0	56.0	56.0	56.0	56.0	56.0
Hungary										48.0
Iceland									48.0	48.0
Ireland [a]									50.0	50.0
Italy										53.6
Japan	53.4	53.4	53.4	53.4	53.5	53.7	53.8	53.8	53.9	54.1
Latvia									56.0	56.0
Luxembourg										
Netherlands	56.8						51.8	50.0	48.5	46.5
New Zealand [a]	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5
Norway	48.0									48.0
Portugal	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0	48.0
Slovakia [a]									56.0	56.0
Spain										
Sweden	42.6	43.4	45.4	44.9	45.3	47.2	47.9	48.5	49.2	49.1
Switzerland [a]									43.0	43.2
United Kingdom	44.9	45.0	45.2	45.4	45.3	45.4	45.6	45.8	45.7	45.7
United States	71.5	71.7	71.6	70.9	70.3	70.2	69.5	69.1	69.1	68.0
Average	52.3	52.4	52.6	52.6	52.6	52.6	52.6	52.5	50.5	50.8
Maximum	75.0	75.1	75.2	75.3	74.9	74.5	74.2	74.3	74.2	74.5
Minimum	37.4	37.0	37.0	37.0	37.0	37.0	37.0	37.0	23.6	23.6

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	0.1	0.2	0.1	-0.5	-0.5	-0.4	0.1	-0.1	0.4	-0.6
Austria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belgium										
Bulgaria										
Canada	0.1	0.0	0.2	0.3	0.0	-0.3	-0.4	0.1	-0.3	-0.3
Czech Republic									0.0	
Denmark	-1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1
Estonia										
Finland	0.0	1.3	1.7	0.6	-3.5	2.1	0.4	-0.7	1.0	3.0
France	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Germany										
Greece	0.0	0.0	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Hungary										
Iceland									0.0	
Ireland									0.0	
Italy										
Japan	-0.1	0.0	0.0	0.3	0.2	0.2	0.1	0.2	0.3	1.3
Latvia									0.0	
Luxembourg										
Netherlands							-3.6	-3.1	-3.9	-18.0
New Zealand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Norway										0.0
Portugal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slovakia									0.0	
Spain										
Sweden	1.9	4.7	-1.2	0.9	4.2	1.4	1.3	1.5	-0.1	15.4
Switzerland									0.4	
United Kingdom	0.1	0.5	0.4	-0.2	0.2	0.6	0.3	-0.2	0.0	1.7
United States	0.2	-0.1	-1.0	-0.8	-0.1	-1.1	-0.6	0.0	-1.6	-4.9

[a] The following data are from the 2000 inventory submission: Australia (1991-1998), Czech Republic (1998), Ireland (1998), New Zealand (1990-1998), Slovakia (1998) and Switzerland (1998).

Agriculture - Enteric fermentation: sheep and swine
Sheep

Trends in CH_4 emissions 1990 to 1999
Gigagrams

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia [a]	1,124.5	1,097.4	1,032.0	957.2	890.1	838.1	808.4	793.1	786.9	766.5
Austria	2.5	2.6	2.5	2.7	2.7	2.9	3.0	3.1	2.9	2.8
Belgium [a]								0.8	0.9	0.9
Bulgaria										21.3
Canada	5.7	6.0	6.2	6.3	5.6	5.7	6.0	5.8	5.8	5.8
Czech Republic [a]									0.5	0.4
Denmark	1.3	1.5	1.5	1.3	1.2	1.2	1.4	1.1	1.2	0.6
Estonia										0.2
Finland	0.8	0.9	0.9	1.0	1.0	1.3	1.2	1.2	1.0	0.9
France	69.3	67.1	65.8	64.7	64.0	63.6	63.0	62.1	61.7	61.0
Germany										
Greece	69.5	69.4	69.5	69.8	70.3	70.8	71.6	72.8	73.6	73.6
Hungary [a]									7.8	7.5
Iceland										3.9
Ireland [a]									55.6	54.1
Italy									87.2	88.7
Japan	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Latvia									0.2	0.2
Luxembourg										
Netherlands	13.6						13.0	11.7	11.2	11.2
New Zealand [a]	853.6	814.4	781.1	757.3	740.5	727.0	714.1	702.0	696.7	690.9
Norway	17.8									21.7
Portugal	26.9	27.0	26.8	26.4	27.3	27.4	27.0	27.0	28.2	27.8
Slovakia [a]									2.6	2.7
Spain	189.2	183.9	193.7	206.1	181.5	167.8	188.8	195.6	190.4	188.6
Sweden	3.2	3.4	3.6	3.8	3.9	3.7	3.8	3.5	3.4	3.5
Switzerland [a]									2.9	2.9
United Kingdom	205.2	204.0	204.9	205.7	204.6	202.1	199.5	201.8	209.5	209.7
United States	90.9	89.4	86.4	81.6	78.6	71.9	67.7	64.1	62.5	57.7
Average	167.1	183.4	176.8	170.3	162.2	156.0	144.6	134.1	99.7	85.4
Maximum	1,124.5	1,097.4	1,032.0	957.2	890.1	838.1	808.4	793.1	786.9	766.5
Minimum	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-2.4	-6.0	-7.3	-7.0	-5.8	-3.5	-1.9	-0.8	-2.6	-31.8
Austria	5.4	-4.3	7.0	2.5	6.8	4.3	0.7	-6.0	-2.4	13.9
Belgium								10.6	-4.4	
Bulgaria										
Canada	5.6	2.2	2.0	-10.2	1.7	3.9	-2.6	0.6	-1.2	1.1
Czech Republic									-8.5	
Denmark	18.8	-3.5	-13.5	-7.9	0.2	17.2	-16.3	9.6	-55.9	-56.6
Estonia										
Finland	3.3	1.6	11.1	0.6	31.0	-5.7	0.4	-14.5	-16.9	3.2
France	-3.1	-1.9	-1.7	-1.1	-0.6	-1.0	-1.5	-0.6	-1.1	-12.0
Germany										
Greece	-0.2	0.2	0.4	0.8	0.7	1.1	1.6	1.1	0.0	5.8
Hungary									-3.9	
Iceland										
Ireland									-2.8	
Italy									1.8	
Japan	-3.9	-6.2	-8.9	-10.8	-13.0	-10.0	-5.6	0.0	0.0	-45.8
Latvia									-6.9	
Luxembourg										
Netherlands							-9.8	-4.9	0.5	-17.6
New Zealand	-4.6	-4.1	-3.0	-2.2	-1.8	-1.8	-1.7	-0.8	-0.8	-19.1
Norway										21.7
Portugal	0.6	-0.9	-1.3	3.4	0.4	-1.4	0.0	4.1	-1.4	3.3
Slovakia									4.3	
Spain	-2.8	5.3	6.4	-11.9	-7.5	12.5	3.6	-2.7	-0.9	-0.3
Sweden	3.2	6.7	5.4	2.8	-4.8	1.7	-5.8	-4.8	4.0	7.9
Switzerland									-1.0	
United Kingdom	-0.6	0.5	0.4	-0.5	-1.2	-1.3	1.2	3.8	0.1	2.2
United States	-1.6	-3.4	-5.5	-3.7	-8.6	-5.8	-5.2	-2.5	-7.7	-36.5

[a] The following data are from the 2000 inventory submission: Australia (1991-1998), Belgium (1997), Czech Republic (1998), Hungary (1998), Ireland (1998), New Zealand (1990-1998), Slovakia (1998), Switzerland (1998).

Trends in CH4 implied emission factors, 1990 to 1999 (kg/head/yr)

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia [a]	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Austria	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Belgium										
Bulgaria										
Canada	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9
Czech Republic [a]										
Denmark	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Estonia										
Finland	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
France	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Germany										
Greece	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Hungary										
Iceland										
Ireland [a]										
Italy										
Japan	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Latvia										
Luxembourg										
Netherlands	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
New Zealand [a]	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1
Norway	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Portugal	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Slovakia [a]										
Spain										
Sweden	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Switzerland [a]										
United Kingdom	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
United States	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Average	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Maximum	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1
Minimum	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1

Percentge change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Austria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belgium										
Bulgaria										
Canada	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Czech Republic									#DIV/0!	
Denmark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Estonia										
Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
France	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Germany										
Greece	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hungary										
Iceland										
Ireland									#DIV/0!	
Italy										
Japan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Latvia									#DIV/0!	
Luxembourg										
Netherlands							0.0	0.0	0.0	0.0
New Zealand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Norway										0.0
Portugal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slovakia									#DIV/0!	
Spain										
Sweden	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Switzerland									#DIV/0!	
United Kingdom	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
United States	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[a] The following data are from the 2000 inventory submission: Australia (1991-1998), Czech Republic (1998), Ireland (1998), New Zealand (1990-1998), Slovakia (1998), Switzerland (1998).

Agriculture - Enteric fermentation: sheep and swine

Swine

Trends in CH_4 emissions 1990 to 1999

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia [a]	2.9	2.9	2.9	3.0	3.0	2.9	2.8	2.9	2.9	2.9
Austria	3.8	3.8	3.9	4.2	4.1	4.1	4.1	4.1	4.3	3.9
Belgium [a]								5.5	6.0	6.0
Bulgaria										2.4
Canada	15.3	15.5	16.1	16.1	16.9	17.9	18.1	17.4	18.2	18.5
Czech Republic [a]									13.6	13.6
Denmark	14.2	14.7	15.7	17.4	16.4	16.6	16.3	17.1	18.1	14.0
Estonia										0.4
Finland	2.1	2.0	1.9	1.9	1.9	2.1	2.1	2.2	2.1	2.0
France	6.1	6.1	6.4	6.7	6.7	6.8	7.1	7.1	7.1	7.1
Germany										
Greece	1.5	1.5	1.5	1.5	1.5	1.5	1.7	1.9	2.1	2.1
Hungary [a]									8.2	8.0
Iceland									0.005	0.01
Ireland [a]									2.6	2.7
Italy									12.4	12.4
Japan	12.5	12.1	11.8	11.6	11.2	11.0	10.8	10.8	10.8	10.8
Latvia									0.6	0.6
Luxembourg										
Netherlands	20.9						21.6	22.8	20.2	20.4
New Zealand [a]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Norway	1.1									0.9
Portugal	4.0	3.8	3.8	3.4	3.6	3.6	3.5	3.5	3.5	3.4
Slovakia									2.4	2.3
Spain	23.9	25.6	27.3	27.3	27.4	27.2	27.9	29.2	29.1	33.5
Sweden	3.4	3.4	3.5	3.7	3.7	3.6	4.2	4.1	3.9	3.4
Switzerland [a]									1.6	1.5
United Kingdom	11.3	11.5	11.6	11.8	11.8	11.4	11.4	12.1	12.2	10.9
United States	80.9	84.7	87.8	87.0	89.9	88.3	84.3	88.1	93.1	89.1
Minimum	13.6	14.4	14.9	15.0	15.3	15.2	15.4	15.3	12.0	10.5
Maximum	80.9	84.7	87.8	87.0	89.9	88.3	84.3	88.1	93.1	89.1
Minimum	1.1	1.5	1.5	1.5	1.5	1.5	1.7	1.9	0.005	0.01

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-1.2	-0.3	2.4	0.0	-1.7	-2.7	1.4	1.7	0.7	0.1
Austria	-1.2	1.9	9.8	-2.1	-0.2	-1.7	0.6	4.2	-9.6	0.6
Belgium								9.5	1.0	
Bulgaria										
Canada	1.3	3.7	0.2	4.8	6.0	1.1	-3.8	4.8	1.3	20.6
Czech Republic									0.1	
Denmark	3.0	6.9	10.6	-5.6	1.5	-2.2	5.0	6.3	-23.1	-2.0
Estonia										
Finland	-3.6	-3.5	-1.9	2.0	7.9	-0.3	5.1	-4.5	-3.5	-3.1
France	0.3	4.7	3.8	0.4	1.7	3.7	0.1	0.7	-0.4	16.0
Germany										
Greece	0.1	0.6	-0.1	0.5	-0.9	14.6	12.0	11.4	0.0	43.3
Hungary									-2.6	
Iceland									25.3	
Ireland									1.6	
Italy									0.4	
Japan	-3.0	-2.2	-2.3	-2.7	-2.6	-1.2	-0.2	-0.1	-0.4	-13.7
Latvia									-3.8	
Luxembourg										
Netherlands							5.5	-11.5	0.9	-2.6
New Zealand										
Norway										-11.1
Portugal	-3.8	-0.7	-11.1	6.7	-0.6	-2.4	0.0	-0.1	-3.7	-15.4
Slovakia									-2.0	
Spain	6.9	6.7	-0.1	0.6	-1.0	2.5	5.0	-0.5	15.2	40.1
Sweden	-0.9	2.7	7.1	0.0	-1.7	15.1	-1.5	-5.2	-13.7	-0.6
Switzerland									-2.3	
United Kingdom	1.9	0.2	1.9	0.5	-3.4	-0.5	6.4	0.7	-10.4	-3.5
United States	4.7	3.6	-0.9	3.3	-1.8	-4.5	4.5	5.6	-4.2	10.1

[a] The following data are from the 2000 inventory submission: Australia (1991-1998), Belgium (1997), Czech Republic (1998), Hungary (1998), Ireland (1998), New Zealand (1990-1998), Slovakia (1998), Switzerland (1998).

Trends in CH_4 implied emission factors 1990 to 1999

kg/head/yr

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia [a]	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Austria	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Belgium										
Bulgaria										1.5
Canada	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Czech Republic [a]									3.4	3.4
Denmark	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Estonia										1.5
Finland	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
France	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Germany										
Greece	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Hungary										1.5
Iceland									1.5	1.5
Ireland [a]									1.5	1.5
Italy										1.5
Japan	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Latvia									1.5	1.5
Luxembourg										
Netherlands	1.5						1.5	1.5	1.5	1.5
New Zealand										NE
Norway	1.5									1.5
Portugal	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Slovakia [a]									1.5	1.5
Spain										
Sweden	1.5	1.5	1.5	1.6	1.6	1.6	1.8	1.8	1.7	1.6
Switzerland [a]									1.0	1.0
United Kingdom	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
United States	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Average	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5
Maximum	1.5	1.5	1.5	1.6	1.6	1.6	1.8	1.8	3.4	3.4
Minimum	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.46	-0.79
Austria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Belgium										
Bulgaria										
Canada	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Czech Republic									0.00	
Denmark	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Estonia										
Finland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
France	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Germany										
Greece	0.05	0.00	-0.81	0.77	0.02	0.00	0.01	-0.03	0.00	0.01
Hungary										
Iceland									0.00	
Ireland									0.06	
Italy										
Japan	0.00	0.00	-0.09	0.09	0.00	0.00	-0.09	0.00	0.00	-0.09
Latvia									0.00	
Luxembourg										
Netherlands							0.11	0.02	-0.01	-0.13
New Zealand										
Norway										0.00
Portugal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Slovakia									-0.05	
Spain										
Sweden	1.84	-0.74	7.18	-2.19	-1.02	13.38	-1.66	-2.49	-6.72	6.38
Switzerland									0.00	
United Kingdom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
United States	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[a] The following data are from the 2000 inventory submission: Australia (1991-1998), Czech Republic (1998), Ireland (1998), Slovakia (1998), Switzerland (1998).

Agriculture - Manure management: emissions of CH_4 (1999)

	4.B Manure management (CH_4)							
	Methods and EF used[a]		Key source	Percentage of national total	4.B.1 Cattle		4.B.3 Sheep	4.B.8 Swine
					Dairy cattle	Non-dairy cattle		
	Methods	EF			CH_4 IEF			
				%	kg CH_4/head/yr			
IPCC default EF[b]					6 to 81[b]	1 to 38[b]	0.19 to 0.37[b]	3 to 20[b]
Australia	CS	CS, D		0.4	8.03	0.03		18.08
Austria	C	CS	L	0.7	8.70	4.30	0.22	4.30
Belgium								
Bulgaria	T1, T2	D, CS		0.8	18.27	12.21	0.28	9.95
Canada	T1	D	L	0.7	36.00	1.00	0.32	10.00
Czech Republic	T2	CS		0.5	3.29	1.01	0.23	7.87
Denmark			L	1.2	21.80	1.60	0.46	2.54
Estonia				0.7	19.00	13.00	0.16	7.00
Finland	T2	CS/D		0.3	7.47	2.28	0.19	3.37
France	CS/ T2	CS	L	0.7	5.85	3.48	0.28	7.62
Germany	CS	CS	L	1.1				
Greece	T1	D		0.5	19.00	13.00	0.28	7.00
Hungary	D	D	L	0.8	14.00	6.00	0.19	4.00
Iceland	D	D		0.6	14.00	6.00	0.19	3.00
Ireland	D	CS, D	L	2.2	15.90	6.40		5.40
Italy			L	0.7	20.05	11.82	0.19	7.88
Japan	D, CS	D, CS			8.68	3.23	0.28	0.30
Latvia[c]	*T1*	*D*		0.7	6.00	4.00	0.19	4.00
Luxembourg								
Netherlands	CS	CS (=D,corrected)	L	0.8	7.01	12.68	0.49	3.25
New Zealand	T1	CS		0.5	0.89	0.91	0.18	NE
Norway	T2	D, CS		0.6	14.41	8.59	0.63	2.00
Portugal	T2	D (CS)	LT	3.8	25.73	1.88	1.60	54.85
Slovakia	D; CS	D; CS		0.4	6.00	4.00	0.19	4.00
Spain	T1,T2	T1,T2	L	2.1				
Sweden	T1, T2	D, CS		0.4	11.52	1.85	0.19	2.32
Switzerland	CS	CS	L	0.7	13.94	3.38	0.13	3.54
United Kingdom	T2	D/CS		0.4	10.56	4.48	0.11	3.00
United States	M	M	T	0.5	45.53	1.77	0.26	12.07
Average					14.46	5.16	0.31	7.81
Maximum					45.53	13.00	1.60	54.85
Minimum					0.89	0.03	0.11	0.30

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for the various livestock types within the category CH_4 from 4.B Manure management.

[b] Source of default emission factors: IPCC Guidelines, volume 3, tables 4-5 and 4-6 (pages 4.12 to 4.13). Default emission factors are provided according to climate regions (cool, temperate, warm), as shown in box 1.

[c] Information on methods and emission factors used was provided for the agriculture sector as a whole, not for the source category.

Box 1. Default IPCC default emission factors according to climate regions[b]

	Dairy cattle			Non-dairy cattle			Swine		
	cool	**temperate**	**warm**	**cool**	**temperate**	**warm**	**cool**	**temperate**	**warm**
North America	36	54	76	1	2	3	10	14	18
Western Europe	14	44	81	6	20	38	3	10	19
Eastern Europe	6	19	33	4	13	23	4	7	11
Oceania	31	32	33	5	6	7	20	20	20
Asia	7	16	27	1	1	2	1	4	7

	Sheep		
	cool	**temperate**	**warm**
Developed countries	0.19	0.28	0.37

Agriculture - Manure management: emission of N_2O (1999)

	4.B Manure management (N_2O)												
	Methods and EF used[a]		Key source	Percentage of national total	Animal waste management systems (AWMS)				N - excretion rates				
	Methods	EF			Anaerobic lagoons 4.B.10	Liquid systems 4.B.11	Solid storage and dry lot 4.B.12	Other 4.B.13	Dairy cattle 4.B.1.1	Non-dairy Cattle 4.B.1.2	Swine 4.B.8	Sheep 4.B.3	Poultry 4.B.9
					N_2O IEF								
				%	kg N_2O-N / kg N				kg N / head / yr				
IPCC default EF[b]					**0.001 (<0.002)[b]**	**0.001 (<0.001)[b]**	**0.02 (0.005-0.03)[b]**	**0.005[b]**	**60 to 100[c]**	**40 to 70[c]**	**16 to 20[c]**	**12 to 20[c]**	**0.6[c]**
Australia	CS	D		0.1	0.0009	0.0009	0.0190	0.0048	115.62	41.23	9.47	6.48	NA
Austria									NE	NE	NE	NE	NE
Belgium													
Bulgaria	D	D		0.6	0.0010	0.0010	0.0200	0.0050	70.00	50.00	20.00	16.00	0.60
Canada	T1	D		0.6		1,589.8871	53,998.7421	9,984.7122	70.50	56.40	15.00	6.80	0.45
Czech Republic	D	D		0.3		0.0010	0.0200	0.0050	100.00	70.00	20.00	20.00	1.00
Denmark				0.6									
Estonia				0.0		0.0010	0.0200	0.0050	0.07	0.05	0.02	0.02	0.001
Finland	D	D/CS	T	0.5		0.0010	0.0200		96.00	35.02	9.60	16.20	0.40
France	T2	T2	L	0.6		0.0007	0.0119	0.0019	100.00	70.00	20.00	20.00	0.60
Germany	NE												
Greece	T1	D		0.1		0.0010	0.0200	0.0050	70.00	50.00	16.00	12.00	0.60
Hungary	D	D		0.6	0.0010	0.0010	0.0200	0.0050	0.07	0.05	0.02	0.02	0.00
Iceland									0.07	0.02	0.02	0.00	0.00
Ireland	D	CS, D		1.1	0.0010	0.0010	0.0200		92.50	50.00	12.00	8.00	0.60
Italy			L	0.7		1.0000	1.0000	1.0000	111.09	46.49	14.22	16.20	0.57
Japan	D	CS			0.0000	0.0000	0.0000	2,674.9377	0.19	0.37	0.10	NE	0.00
Latvia[d]	*T1*	*D*	L	1.4	0.0010	0.0010	0.0200	0.0050	70.00	50.00	20.00	16.00	0.60
Luxembourg													
Netherlands	CS	CS		0.1				0.0011					
New Zealand				0.2	0.0010		0.0200	0.0050	86.70	63.10	16.00	11.80	0.60
Norway	D	D, CS											
Portugal	T2	D (CS)	L	1.6	0.0032	0.0028	0.0216		108.07	54.03	17.05	40.93	0.74
Slovakia	D; CS	D; CS		1.0		0.0010	0.0200		90.00	56.00	20.00	16.00	0.60
Spain	T1,T2	T1,T2	L	4.2									
Sweden			LT	0.9		0.0010	0.0200		118.00	41.59	8.64	5.76	0.40
Switzerland			L	0.8		0.0010	0.0200		109.10			16.00	0.52
United Kingdom	T1	D/CS		0.3		0.0010	0.0200	0.0049	109.51	48.55	10.05	6.85	0.70
United States	M	M		0.3	0.0055	0.0062	0.0169	0.0143	84.14	48.12	7.14	4.14	0.45
Average					0.00163	83.73209	2700.00358	844.04746	76.26811	41.55100	11.76653	11.95993	0.47130
Maximum					0.00552	1589.88707	53998.74211	9984.71224	118.00000	70.00000	20.00000	40.93495	1.00000
Minimum					0.00000	0.00000	0.00000	0.00109	0.07000	0.02400	0.01500	0.00152	0.00055

Notes:

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category N_2O from 4.B Manure management.

[b] Source of default emission factors: IPCC Guidelines, volume 3, table 4-22 (page 4-104). See also IPCC Good Practice Guidance, table 4.12 (page 4.43).

[c] Source of default N excretion rates: IPCC Guidelines, volume 3, table 4-20 page 4.99. Default values are provided by regions as shown below:

	North America	Western Europe	Eastern Europe	Oceania	Asia
Dairy cattle	100		70	80	60
Non-dairy cattle	70		50	60	40
Sheep	16	20	16	20	12
Swine	20			16	
Poultry	0.6				

[d] Information on methods and emission factors used was provided for the agriculture sector as a whole, not for the source category.

Agriculture - Agricultural soils: emission of N_2O (1999)

	4.D. Agricultural soils (N_2O)																		
	Methods and EF used[a]		4.D.1 Direct soil emissions								4.D.2 Animal production			4.D.3 Indirect soil emissions					
					Synthetic fertilizers		Animal wastes applied to soils	N-fixing crops	Crop residue	Cultivation of histosols			Pasture range and paddock (grazing)			Atmospheric deposition		Nitrogen reaching and run-off	
					Activity data	N_2O IEF	N_2O IEF												
	Methods	EF	Key source[b]	Percentage of national total[b]	Use of synthetic fertilizers						Key source	Percentage of national total	N_2O IEF	key source	Percentage of national total	Activity data	N_2O IEF	Activity data	N_2O IEF
				%	kgN / yr	kg N_2O-N / kg N		kg N_2O-N / kg dry biomass[c]		kg N_2O-N / ha			kg N_2O-N / kg N			kg N / year	kg N_2O-N / kg N	kg N/year	kg N_2O-N / kg N
IPCC default EF[c]						0.0125 (0.0025 - 0.0225)[c]				5, 10 (2-15)[d]			0.02 (0.005-0.03)[e]				0.01 (0.002-0.2)[f]		0.025 (0.002-0.12)[f]
Australia	CS	CS	LT	2.6	890,588,667	0.01250	0.01800			0.29000	LT	0.9	0.0043			NE		NE	
Austria[b]	CS	CS	L	1.3	NE											NE		NE	
Belgium																			
Bulgaria	NE	NE	L	16.9	105,640,873	0.0100	0.0046	0.0287	0.0000	5.0000	L	1.0	0.0200	L	1.6	44,200,274	0.01000	83,907,222	0.02500
Canada	T1	D	LT	3.4	1,624,411	11.2500	0.0092	0.0018	0.0002	5.0000		0.4	0.0200	LT	1.0	382,030,175	0.01000	57,304,526	0.17815
Czech Republic	D	D	L	1.9	182,638,800	0.0125	0.0125	0.0125	0.0125	4.8807		0.2	0.0200	L	1.4	67,460,740	0.01000	131,630,910	0.02500
Denmark			LT	6.8	256,900,000	0.0123	0.0090			4.9996		0.3	0.0186	LT	3.8	75,882,000	0.01000	196,000,000	0.02500
Estonia			L	1.0	17,905,500	0.0125	0.0125	0.0008	0.0002			0.0	0.0200			2,468,962	0.01000	6,687,694	0.02500
Finland	D	D/CS	LT	3.4	161,723,800	0.0125	0.0125	0.0125	0.0125	8.0000		0.3	0.0200	LT	0.8	27,507,783	0.01000	37,242,863	0.02500
France[k]	T2	T2	LT	5.1	2,505,254,406	0.0113	0.0096	0.0008	0.0001		L	1.1	0.0200	L	3.3			1,413,998,532	0.02596
Germany[b]	CS	CS	L	2.5															
Greece	T1	D	LT	1.8	306,354,000	0.0113	0.9569	0.0300			LT	3.0	0.0200						
Hungary	D	D	L	9.1	235,800,000	0.0125	0.0125	0.0125	0.0000	2.0000		0.5	0.0200	L	2.3	64,599,220	0.01000	136,198,830	0.02500
Iceland	D	D	L	4.5	14,126,661	0.0200	2.0000									NE		NE	
Ireland	D	CS, D	L	4.7	425,642,276	0.0125	0.0124				L	4.7	0.0200	L	1.5	102,923,110	0.00991	39,516,345	0.02506
Italy			L	1.8	759,486,480	0.0125	0.0125	0.0125	0.0125	5.0000		0.4	1.0000	L	1.4	2,660,101	1.00000	13,139,904	1.00000
Japan	D	CS			342,374,283	0.0059	NE	NE	NE	NE			NE			NE	NE	NE	NE
Latvia[j]	*T1*	*D*	L	5.8	17,100,000	0.0125	0.0125	0.0125	0.0125	5.0000		0.4	0.0200	L	1.8	7,177,472	0.01000	13,331,208	0.02500
Luxembourg																			
Netherlands	CS	CS	LT	2.3	392,420,000	0.0110	0.0195	0.0098				0.5	0.0160						
New Zealand	D	CS/D	L	2.5	161,437,500	0.0125	0.0125	0.0007	0.0002	4.9836	L	7.7	0.0100	L	5.3	277,325,000	0.01000	221,446,875	0.02500
Norway	D	D, CS	LT	3.3	106,017,000	0.0119	0.0099			5.0000		0.3	0.0194	L	0.9	18,527,885	0.01000	35,192,505	0.02500
Portugal	D	D	LT	2.0	147,053,190	0.0113	0.0150	0.0016			LT	2.1	0.0000	LT	2.2	35,301	0.01000	126,088	0.02500
Slovakia[h]	D; CS	D; CS	L	3.1	65,393,000	0.0113	0.0080	0.0125	0.0125			0.1	0.0200			24,836,188	0.00100	11,593,243	0.02500
Spain[b]	T1	T1	L	4.9															
Sweden	D, C	CS	LT	3.2	179,200,000	0.0079	0.0250	0.0006	0.0001	3.2488	LT	0.7	0.0166			41,641,406	0.00200	74,169,000	0.00250
Switzerland					57,058,000	0.0125	0.0125	0.0004	0.0000	5.0000			0.0200			52,135,692	0.01005	38,596,561	0.02546
United Kingdom	T1a/T1b	D	L	2.1	1,283,053,500	0.0125	0.0125	0.0003	0.0002	500.0000	L	0.8	0.0200	L	1.4	338,669,888	0.01000	609,245,641	0.02500
United States	D	D	LT	2.6	11,424,051,753	0.0112	0.0100	0.0004	0.1887	8.0000	T	0.6	0.0200	L	1.2	2,581,620,005	0.01000	5,561,702,210	0.02500
Average						0.4801	0.1400	0.0084	0.0168	37.7602			0.0620				0.0641		0.0833
Maximum						11.2500	2.0000	0.0300	0.1887	500.0000			1.0000				1.0000		1.0000
Minimum						0.0059	0.0046	0.0003	0.0000	0.2900			0.0000				0.0010		0.0025

[a] Information on methods and emission factors is included in this table as reported by Parties. It may not reflect the actual method or type of emission factor used for all subcategories within the category N_2O from 4.D Agricultural soils.

[b] Information on key sources and the percentage of national total refers to subcategory 4.D.1 Direct soil emissions, except for Austria, Germany and Spain, where the information refers to the entire category 4.D Agricultural soils.

[c] Source of default emission factors: IPCC Guidelines, volume 3; table 4-18, page 4.89. (See also Good Practice Guidance, table 4-17, page 4.60.) It should be noted that for the sub-sources N-fixing crops and crop residue the IPCC default emission factors are not directly comparable to the N2O implied emission factors because of the use of different units; the unit of default emission factors is kg N2O-N/kg N, while in the CRF the unit relates to the amount of dry biomass (kg N2O-N/kg dry biomass).

[d] For cultivation of histosols the two default values refer to temperate and tropical, respectively. The values in parenthesis indicate the range. It should be noted that default emission factors for histosols have been updated from 5 to 8 and from 10 to 16 for temperate and tropical, respectively (table 4.17, page 4.60 of IPCC Good Practice Guidance).

[e] Source of default emission factor: IPCC Guidelines, volume 3, table 4-22, page 4.104 (Pasture range and paddock). See also IPCC Good Practice Guidance, table 4.12, page 4.43.

[f] Source of default emission factor: IPCC Guidelines, volume 3, table 4-23, page 4.105 (Default Emission Factors for Indirect Emissions). See also Good Practice Guidance, table 4.12, page 4.43.

[h] Slovakia reported in IEF for N-fixing crops and crop residue in the unit kg N_2O-N/kg N.

[j] Information on methods and emission factors used was provided for the agriculture sector as a whole, not for the source category.

[k] France: indirect emissions: using 1998 inventory submitted in 2001.

Agriculture - Agricultural soils (1999)

Parameters (fractions) used to estimate N_2O emissions in the agricultural soils category (direct and indirect emissions)

	FracBURN	FracFUEL	FracGRAZ	FracNCRBF	FracNCRO	FracR	FracGASF	FracGASM	FracLEACH
	kg N/kg crop-N	kg N/ kg N excreted		kg N/ kg of dry biomass	kg N/ kg of dry biomass	kg N/ kg crop-N	NH_3-N + NO_x-N/ kg of synth fert. N applied	NH_3-N + NOx-N/ kg of N excreted	kg N / kg of fertilizer or manure N
IPCC defaults EF [a]	***0.25***	***no default*** [b]	***no default***	***0.03***	***0.015***	***0.45***	***0.1***	***0.2***	***0.3 (0.1 - 0.8)***
Australia	NA	NA	NA	NA	NA	NA	NA	NA	NA
Austria									
Belgium									
Bulgaria	0.1000	0.0000	0.0200	0.0300	0.0150	0.1000	0.1000	0.2000	0.3000
Canada	0.0000	0.0000	0.0000	0.0300	0.0150	0.4500	0.1000	0.2000	0.3000
Czech Republic									
Denmark	0.0000	0.0000					0.0200	0.2830	
Estonia	0.9000	0.0000	0.2000	0.0150	0.0300	0.5500	0.1000	0.2000	0.3000
Finland	NZ	0.0000	0.2367	0.0151	0.0415	0.4324	0.0060	0.3100	0.1500
France									
Germany									
Greece	0.1000	0.0000		0.0300	0.0150	0.5000	0.1000	0.2000	
Hungary	0.2500	0.2500	0.2000	0.0150	0.0300	0.4500	0.1000	0.2000	0.3000
Iceland									
Ireland	NO	NO	0.6500	NA	NA	NA	0.0380	0.1700	0.0400
Italy	0.1000	0.0000	0.2500	0.0300	0.0150	0.4500	0.1000	0.2000	0.3000
Japan									
Latvia	NO	NO	0.0200	0.0300	0.0150	0.4500	0.1000	0.2000	0.3000
Luxembourg									
Netherlands									
New Zealand	0.0500	0.0000		0.0300	0.0150	0.4500	0.1000	0.2000	0.1500
Norway	0.0000	NO	0.2308	NE	NE	NE	0.0458	0.2000	0.1800
Portugal	0.4409	0.0000	0.5120	0.0040	0.0200	0.5652	0.1000	0.1148	0.3029
Slovakia			0.0570				0.1000	0.3000	0.0739
Spain									
Sweden	0.0000	0.0000	0.3725	0.0100	0.0200	0.1910	0.0078	0.3686	0.2225
Switzerland	0.0000	0.0000	0.1275				0.0750	0.3403	0.2000
United Kingdom	0.0000	0.0000	0.4790	0.0300	0.0150	0.4500	0.1000	0.2000	0.3000
United States	NA	NO	0.01 - 0.92	0.0300	0.0048 - 0.023	0.0000	0.1000	0.2000	0.3000

Abbreviations of fractions:

FracFUEL	Fraction of livestock N excretion in excrements burned for fuel
FracGRAZ	Fraction of livestock N excreted and deposited onto soil during grazing
FracNCRBF	Fraction of N in non-N-fixing crop
FracNCRO	Fraction of N in N-fixing crop
FracR	Fraction of crop residue removed from the field as crop
FracBURN	Fraction of crop residue burned
FracGASF	Fraction of synthetic fertilizer N applied to soils which volatizes as NH_3 and Nox
FracGASM	Fraction livestock N excretion that volatizes as NH_3 and NOx
FracLEACH	Fraction of N input to soils which is lost through leaching and runoff

[a] Source of IPCC default fractions: IPCC Guidelines, volume 3, tables 4-19 and 4-24, pages 4.94 and 4.106. (See also IPCC Good Practice Guidance, table 4.19, page 4.74.)

[b] Countries are recommended to obtain country-specific data. All Parties providing a numerical value reported "0" for this parameter.

Agriculture - Agricultural soils

Trends in N_2O emissions 1990 to 1999
Gigagrams

Party	base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	46.9	46.9	47.3	46.9	47.7	48.0	47.1	46.7	49.7	52.3	54.6
Austria	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Belgium										11.3	11.3
Bulgaria	53.9	54.0	49.2	41.9	37.8	36.3	37.0	35.6	35.6	33.7	48.8
Canada	88.3	88.3	86.0	87.4	90.9	96.0	97.9	103.5	103.6	105.2	107.6
Czech Republic [b]										15.9	15.7
Denmark	31.6	31.6	30.8	28.8	29.0	28.1	27.9	27.0	25.9	26.1	26.0
Estonia											1.0
Finland	14.1	14.1	13.1	11.8	12.1	12.0	12.3	11.9	11.6	11.4	11.0
France	170.6	170.6	168.2	163.1	158.7	160.3	161.7	164.2	166.5	166.2	165.0
Germany	85.0	85.0	78.0	74.0	73.0	77.0	76.6	76.0	77.0	80.0	79.0
Greece	20.7	20.7	20.5	19.5	19.2	19.3	18.5	18.8	19.0	19.0	19.1
Hungary	4.6	4.1	1.7	1.6	1.5	1.8	1.6	1.7	1.7	32.9	33.2
Iceland	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.5
Ireland	20.8	20.8	20.8	20.5	21.0	21.6	22.2	22.5	21.7	23.0	22.9
Italy	65.2	65.2	68.1	68.6	69.4	68.6	67.4	66.1	68.7	68.4	68.9
Japan	3.8	3.8	3.6	3.6	3.5	3.5	3.3	3.1	3.1	3.1	3.1
Latvia	9.7	9.7	7.0	6.5	4.5	3.8	3.2	3.1	3.2	2.8	2.9
Luxembourg											
Netherlands	21.5	21.5	22.2	25.5	25.4	25.6	26.8	26.8	25.3	24.5	25.0
New Zealand	36.8	36.8	36.4	36.4	36.8	37.3	37.4	37.2	37.2	37.3	38.3
Norway	8.6	8.6	8.6	8.3	8.5	8.3	8.5	8.4	8.4	8.4	8.3
Portugal	14.8	14.8	15.9	15.5	15.2	15.2	15.4	15.4	15.4	16.0	16.1
Slovakia	12.6	12.6	10.2	8.9	7.3	6.7	7.0	7.0	7.1	6.8	6.0
Spain	58.2	58.2	57.6	53.9	46.6	53.5	50.9	61.1	55.3	56.6	59.6
Sweden	12.2	12.2	11.7	11.4	11.9	12.1	11.9	11.9	12.3	12.3	11.7
Switzerland	7.8	7.8	7.7	7.6	7.6	7.5	7.3	7.3	7.1	7.1	7.0
United Kingdom	95.1	95.1	94.6	89.2	87.5	89.9	90.4	90.9	93.9	93.4	90.3
United States	867.7	867.7	876.8	902.2	887.0	959.4	920.5	950.3	967.2	968.7	962.2
Average	70.2	70.2	69.6	69.5	68.2	71.8	70.3	72.0	72.8	69.9	67.8
Maximum	867.7	867.7	876.8	902.2	887.0	959.4	920.5	950.3	967.2	968.7	962.2
Minimum	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.5

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	0.8	-0.8	1.7	0.6	-1.8	-1.0	6.5	5.3	4.4	16.4
Austria	0.3	0.3	0.3	-1.0	-1.0	0.0	0.0	0.0	0.0	-1.2
Belgium									-0.2	
Bulgaria	-8.8	-14.8	-9.8	-3.9	1.8	-3.7	0.0	-5.5	45.0	-9.4
Canada	-2.6	1.7	4.0	5.6	2.0	5.6	0.1	1.5	2.3	22.0
Czech Republic									-1.5	
Denmark	-2.4	-6.7	0.8	-3.1	-0.7	-3.4	-3.8	0.8	-0.6	-17.8
Estonia										
Finland	-7.3	-9.5	2.2	-0.4	2.2	-3.2	-2.4	-2.2	-3.4	-22.1
France	-1.4	-3.1	-2.7	1.0	0.9	1.5	1.4	-0.2	-0.7	-3.3
Germany	-8.2	-5.1	-1.4	5.5	-0.5	-0.8	1.3	3.9	-1.3	-7.1
Greece	-0.6	-5.1	-1.5	0.5	-4.1	1.6	1.2	0.0	0.0	-7.8
Hungary	-59.0	-3.0	-10.4	23.3	-10.6	4.3	-0.4	1,865.9	0.8	697.5
Iceland	-2.9	-10.0	4.4	0.7	-1.6	3.1	-11.0	3.7	29.7	11.5
Ireland	0.2	-1.5	2.3	2.8	2.9	1.3	-3.4	5.7	-0.4	10.1
Italy	4.3	0.8	1.2	-1.2	-1.7	-1.9	3.9	-0.4	0.6	5.5
Japan	-5.8	-0.1	-0.3	-1.7	-6.3	-4.3	-0.6	0.5	0.8	-16.8
Latvia	-27.6	-7.5	-30.9	-15.1	-15.4	-2.8	1.2	-12.0	4.0	-70.1
Luxembourg										
Netherlands	3.1	14.9	-0.4	0.8	4.7	0.0	-5.7	-3.1	2.2	16.2
New Zealand	-1.1	0.0	1.2	1.2	0.3	-0.5	0.1	0.2	2.7	3.9
Norway	0.1	-3.4	2.3	-2.1	2.0	-1.8	0.7	0.4	-1.5	-3.3
Portugal	7.2	-2.8	-1.7	0.3	1.1	0.0	0.0	3.7	0.5	8.3
Slovakia	-18.9	-12.4	-18.5	-7.6	4.4	-0.1	0.5	-3.7	-12.2	-52.6
Spain	-1.1	-6.4	-13.5	14.8	-4.9	20.0	-9.4	2.3	5.3	2.4
Sweden	-4.1	-2.6	4.3	1.5	-1.7	0.3	2.6	0.0	-4.8	-4.6
Switzerland	-0.7	-1.1	-0.8	-1.2	-1.6	-1.1	-1.8	-1.2	-1.4	-10.3
United Kingdom	-0.5	-5.8	-1.9	2.7	0.6	0.5	3.3	-0.5	-3.4	-5.1
United States	1.0	2.9	-1.7	8.2	-4.1	3.2	1.8	0.2	-0.7	10.9

[a] Base year refers to 1990, except for the following Parties with economies in transition wich, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).
[b] Values other than for 1999 were taken from the 2000 submission, as no trend tables were provided and no recalculations were reported in the 2001 submission.

Agriculture - Agricultural soils: CO_2 emissions/removals[a]

Trends in CO_2 emissions[b] 1990 to 1999

Gigagrams

	4.D Agricultural soils - CO_2													
	Methods and emission factors used		Key sources	Percentage of national total	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Methods	EF		%										
Australia	NA	NA			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Austria	NE	NE			NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Belgium														
Bulgaria	NE	NE												
Canada	CS	CS	T	0.03	7,255	6,652	5,777	4,662	4,224	3,166	1,784	1,241	713	177
Czech Republic	NE													
Denmark														
Estonia														
Finland	D	D/CS	LT	2.64	3,215	2,815	2,321	2,230	2,069	1,726	1,825	2,065	2,031	2,016
France														
Germany	NE				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Greece														
Hungary														
Iceland	CS	D			4.2	4.1	4.2	4.6	4.2	4.5	4.7	4.4	4.9	5.2
Ireland	NA	NA												IE
Italy														
Japan	-	-			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Latvia														
Luxembourg														
Netherlands	NE				IE									
New Zealand														
Norway	CS	CS	T	0.23	217								170	129
Portugal					NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Slovakia														
Spain														
Sweden														
Switzerland					NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
United Kingdom	IE	IE			IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
United States	IE	IE			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] According to the IPCC Guidelines (volume 3. Reference Manual, pp. 4.2, 4.87), CO_2 emissions from agricultural soils are to be included under Land-use change and forestry (LUCF). At the same time, the Summary Report 7A (volume 1. Reporting Instructions, tables 27) allows for reporting CO_2 emissions or removals from agricultural soils, either in the Agriculture sector, under 4.D. Agricultural soils or in the Land-use change and forestry sector under 5.D. Emissions and removals from soil. Parties may choose either way to report emissions or removals from this source in the common reporting format, but the way they have chosen to report should be clearly indicated, by inserting explanatory comments to the corresponding cells of Summary 1.A and Summary 1.B. (See footnote 4 of Summary 1.As 2 of the CRF.)

[b] This part of the table displays information as reported by Parties in table Summary 1.A of the CRF under the column CO_2 emissions or in the trend table of the CRF (table 10s1). Information as reported under the column CO_2 removals of table Summary 1.A is not included here, as numerical information was not available for any Party.

Agriculture - Rice cultivation

Rice cultivation (CH_4)

	4.C Rice cultivation (CH_4)					
	Methods and emission factors used		Key source	Percentage of national total	4.C.1 Irrigated: Continuously flooded	4.C.1 Irrigated: Intermittently flooded - single aeration
	Methods	EF		%	CH_4 IEF (g CH_4 / m^2)	CH_4 IEF (g CH_4 / m^2)
Australia	CS	CS, D			22.50	
Austria						
Belgium						
Bulgaria	D	D			40.00	
Canada	NA	NA				
Czech Republic	NO					
Denmark						
Estonia						
Finland	NO	NO				
France	C	CS			36.00	
Germany	NO					
Greece	T1	D			0.29	
Hungary	D	D				20.00
Iceland						
Ireland	NA	NA				
Italy					34.00	
Japan	CS	CS			NO	18.13
Latvia						
Luxembourg						
Netherlands	NO					
New Zealand						
Norway	-	-				
Portugal	D	D (CS)	T	0.21	36.00	
Slovakia	NO	NO				
Spain	CS	CS				
Sweden						
Switzerland						
United Kingdom	NO					
United States	D	CS			32.43	

Trends in CH_4 emissions 1990 to 1999

Gigagrams

Party	base year [a]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia		23.4	24.9	25.5	28.5	28.9	30.9	33.4	34.3	34.3	31.8
Austria											
Belgium											
Bulgaria	5.6	4.2	3.3	1.8	1.2	0.3	0.6	1.0	1.5	1.3	0.9
Canada											
Czech Republic											
Denmark											
Estonia											
Finland											
France		8.6	8.9	9.9	10.7	11.3	10.5	9.5	9.1	8.3	7.7
Germany		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Greece		4.8	4.3	4.3	5.9	6.8	7.6	8.4	8.6	7.6	7.6
Hungary	3.70	3.10	3.76	2.09	2.09	2.09	2.09	1.25	0.92	0.57	0.45
Iceland											
Ireland											NO
Italy		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.8	75.1
Japan		372.6	373.5	377.9	388.0	388.8	379.1	363.7	344.8	333.4	322.5
Latvia											NO
Luxembourg											
Netherlands		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
New Zealand		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Norway											
Portugal		12.0	12.0	7.6	4.8	8.3	7.8	8.1	8.1	8.1	8.1
Slovakia											
Spain		10.8	11.2	10.3	5.7	8.0	6.5	12.6	13.6	13.5	13.5
Sweden		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Switzerland		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
United Kingdom		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
United States		414.4	403.9	458.5	416.4	485.3	452.2	418.8	454.8	480.5	509.2

[a] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	6.8	2.3	11.7	1.3	7.0	8.1	2.7	0.2	-7.3	36.3
Austria										
Belgium										
Bulgaria	-22.5	-44.8	-31.1	-73.5	66.9	88.8	45.6	-13.9	-31.2	-78.8
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France	4.4	11.1	7.6	5.5	-6.4	-9.7	-4.7	-8.9	-6.3	-9.4
Germany										
Greece	-10.3	-0.4	37.6	14.8	12.4	10.7	2.7	-12.6	0.0	57.7
Hungary	21.3	-44.4	0.0	0.0	0.0	-40.2	-26.4	-38.0	-20.8	-87.8
Iceland										
Ireland										
Italy										
Japan	0.3	1.2	2.7	0.2	-2.5	-4.1	-5.2	-3.3	-3.3	-13.4
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal	0.7	-36.9	-37.5	75.2	-6.4	3.4	0.0	0.0	0.0	-32.7
Slovakia										
Spain	3.7	-8.6	-44.2	39.2	-18.3	93.0	8.1	-0.8	-0.5	24.0
Sweden										
Switzerland										
United Kingdom										
United States	-2.5	13.5	-9.2	16.6	-6.8	-7.4	8.6	5.7	6.0	22.9

Consistency checks performed in the agriculture sector

The following checks have been performed in order to verify the consistency of the data provided in various CRF tables (1999).
All consistency checks described below have been performed on 1999 inventory data.
Note that only Parties providing numerical information, and for which differences in the data or any other inconsistencies were found, have been included in the tables below.

1. Comparison of activity data (livestock population size) reported in tables 4.A and 4.B(a). This comparison was made for dairy and non-dairy cattle, swine and sheep.

	Dairy cattle			Non-dairy cattle			Swine			Sheep			Poultry		
	Table 4.A	Table 4.B(a)		Table 4.A	Table 4.B(a)		Table 4.A	Table 4.B(a)		Table 4.A	Table 4.B(a)		Table 4.A	Table 4.B(a)	
	4.A.1.1	4.B.1.1		4.A.1.2	4.B.1.2		4.A.8	4.B.8		4.A.3	4.B.3		4.A.9	4.B.9	
	Population size		Difference	Population size		Difference	Population size		Difference	Population size		Difference	Population size		Difference
	1,000 head		%	1,000 head		%	1,000 head		%	1,000 head		%	1,000 head		%
Denmark	640	640	0.0	1,247	1,247	0.0	9,305	9,305	0.0	69	69	0.0	0	19,645	-100.0
France	6,739	6,739	0.0	13,793	13,793	0.0	7,107	7,107	0.0	10,169	10,169	0.0		328,577	-
Japan	1,769	1,769	0.0	2,820	2,820	0.0	9,823	9,823	0.0	16	16	0.0	NA	297,286	
United States	13,148.3	13,025.9	0.9	66,812.02	90,031.60	-25.8	59,407.00	60,309.90	-1.5	7,215.00	7,215.00	0.0	NE	2,007,516.73	

Some minor insconsistency: Australia (camels & lamas).
Bulgaria reported different population size data for non-dairy cattle in table 4.B(b) as compared to data reported in tables 4.A and 4.B(a).

2. Comparison of total nitrogen (N) (kg N/yr) reported for Pasture range and paddock in table 4.B(b) with N excretion on Pasture range and paddock reported under category 4.D.2, Animal production, in table 4.D.

	Pasture range and paddock			
	N excretion			
	Table 4.B(b)	Table 4.D	Difference	
			A - B	(B-A)/A*100
	kg N / yr	kg N / yr	kg N / yr	%
	A	B	C	D
Australia	2,046,978,183	2,100,719,744	-53,741,562	2.63
Canada	107	275,674,932	-275,674,825	257,640,023.26
Czech Republic [a]	31,808,000	31,809,564	-1,564	0.00
Denmark		27,930,000	*no data reported in table 4B(b)*	
France	1,613,386,486	588,817,602	1,024,568,884	-63.50
Greece	383,051,000	383,052,000	-1,000	0.00
Italy		4,522,597	*no data reported in table 4B(b)*	
Latvia	0.04	5,019,682	-5,019,682	12,727,272,627.27
Netherlands		133,400,000	*no data reported in table 4B(b)*	
Norway		20,501,417	*no data reported in table 4B(b)*	
Sweden		57,424,489	*no data reported in table 4B(b)*	
United States	4,245,539,653	4,245,622,897	-83,244	0.00

[a] For the Czech Republic, activity data from table 4B(b) had to be converted into kg N/yr, as data were reported in t N/yr.

3. Comparison of data provided in table 4.B(b) per livestock type:
Multiplication of livestock population size with the corresponding nitrogen (N) excretion rate (in kg/head/yr) compared to the sum of N excretion from all animal waste management systems (AWMS)

This comparison has been performed for dairy cattle, non-dairy cattle and sheep based on 1999 inventory data.
Note that only Parties providing numerical information, and for which differences in the data or any other inconsistencies were found have been included in the tables below.

Party	Population size * N excretion	Sum N excretion all AWMS	Difference (B-A)/A*100
	kt	kt	%
	A	B	C
Dairy cattle			
Canada	117.28	0.0001	-100.00
Czech Republic[a]	64.20	48.79	-24.00
Estonia	0.01	0.97	9900.00
Greece	16.73	13.72	-18.00
Hungary	27.93	27,650.70	98900.00
Italy	233.97	2.77	-98.82
Latvia	14,420,000	14,275.80	-99.90
Slovakia	24.66	24.61	-0.20
Sweden	52.98	32.66	-38.36
United Kingdom	327,338.24	261,870.59	-20.00
Non-dairy cattle			
Australia	970.92	950.28	-2.13
Canada	677.43	0.00	-100.00
Czech Republic[a]	71.05	85.75	20.68
Estonia	0.01	0.64	9900.00
France	966	956	-1.00
Greece	18.02	14.78	-18.00
Hungary	0.02	22.90	99900.00
Italy	239.64	2.97	-98.76
Latvia	8,600.00	8.60	-99.90
Slovakia	16.58	21.85	31.83
Sweden	52.57	30.10	-42.74
United Kingdom	409.48	327.58	-20.00
Sheep			
Canada	2.94	0.00	-100.00
Czech Republic[a]	1.72	1.72	-0.06
Estonia	0.00	0.05	9900.00
France	203	669	228.70
Hungary	0.01	14.94	99900.00
Italy	179.64	0.36	-99.80
Latvia	432.00	0.43	-99.90
Slovakia	5.44	6.19	13.75
Sweden	2.52	1.26	-50.00
United Kingdom	305.88	244.70	-20.00

[a] With regard to some of the data to be reported in table 4.B(b) of he CRF, the Czech Republic did not report data in the units required by the CRF. In these cases, data were reconverted to CRF units in order to facilitate data comparison across Parties.

4. Land-use change and forestry

1. Methods and emission factors used and provision of activity data (land-use change and forestry)

1.1 CO_2 emissions and removals

Party	5.A Changes in forest and other woody biomass ctocks			5.B Forest/grassland conversion			5.C Abandonment of lands			5.D CO_2 emissions/removals from soils			5.E Others		
	Methods	EF	Provision of activity data in CRF or NIR*	Methods	EF	Provision of activity data in CRF or NIR	Methods	EF	Provision of activity data in CRF or NIR	Methods	EF	Provision of activity data in CRF or NIR	Methods	EF	Provision of activity data in CRF or NIR
Australia	CS	CS	NIR	CS	CS	NIR	CS	CS	no	CS	CS	NIR	CS	CS	NIR
Austria	D	CS	CRF			no			no			no			no
Belgium			no			no			no			no			no
Bulgaria	CS	CS	CRF	NE	NE	no	NE	NE	no	NE	NE	no	NE	NE	no
Canada	CS/D	CS	CRF	CS/D	CS	CRF	D	CS	CRF	CS/D	CS	CRF	CS	CS	NIR
Czech Republic	CS	CS	CRF	no		no	no		no	NE		no			no
Denmark			NIR			no			no			no			no
Estonia			CRF			CRF	np	np	CRF			CRF			no
Finland	CS	CS	NIR	no	no	no	no	no	no	D	D	no			no
France	CS	CS	CRF	*CS*	*CS*	CRF	CS	CS	NIR	CS	CS	NIR			no
Greece			CRF			CRF			no			CRF			no
Hungary	D	D	CRF	D	D	CRF			no	D	D	CRF			no
Iceland			no			no			no			no			no
Ireland	D	CS	CRF	NA	NA	no	NA	NA	no	D	D	CRF	NA	NA	no
Italy			CRF			CRF			CRF			CRF			no
Japan	D	D, CS	CRF	D	D, CS	no			no			no			no
Latvia	T1	D	CRF			no			no	T1	D	CRF			no
Luxembourg			no			no			no			no			no
Netherlands	T1	CS	NIR	*NE*		no	NE		no	NE		no	no		no
New Zealand	CS/M	CS/M	NIR	CS/D	CS/D	NIR	NE	NE	no	NE	NE	no			no
Norway	CS	D, CS	NIR			no			no			no			no
Portugal	D	D	no	D	D	no			no			no			no
Slovakia	D; CS	D; CS	CRF	D; CS	D; CS	CRF	D; CS	D; CS	CRF	D; CS	D; CS	CRF			no
Spain	CS		NIR			no			no			no			no
Sweden	D	CS	NIR			no			no	D, CS	CS	CRF			no
Switzerland	CS	CS	CRF			no			no			no			no
United Kingdom	M	M	NIR	no	no	no	NE	NE	no	D/CS/M	CS/CS/CS	NIR	CS	CS	NIR
United States	CS	CS	NIR	IE	IE	no	IE	IE	no	CS, D	CS, D	NIR	CS	CS	NIR

* If activity data are reported in the CRF, this does not necessarily mean that they are not reported in the NIR.

2. Changes in forest and other woody biomass stocks (5.A)**

2.1 Temperate forests

Average annual growth rates (t dm/ha/yr) and implied carbon uptake factors (t C/ha/yr)

Party	Species as specified by parties	Temperate forests							
		Plantations		Commercial evergreen		Commercial deciduous		Other	
		Average annual growth rate	Implied carbon uptake	Average annual growth rate	Implied carbon uptake factor	Average annual growth rate	Implied carbon uptake factor	Average annual growth rate	Implied carbon uptake factor
		t dm/ha/yr	t C/ha/yr	t dm/ha/yr	t C/ha/yr	t dm/ha/yr	t C/ha/yr	t dm/ha/yr	t C/ha/yr
Default [a]		***(4,0-6,0)***							
Australia									
Austria				4.91	2.41	5.15	2.49		
Belgium									
Bulgaria				different	1.10	different	0.95		
Canada								1.26	0.63
Czech Republic [b]				4.51	2.03	4.51	2.03		
Denmark									
Estonia									
Finland									
France		5.21	2.61	10,884,000	0.28	7,864,000	0.30		
Greece	Fir			0.84	0.42				
	Red Fir			5.90	2.95				
	Pine sp.			0.71	0.36				
	Other			1.26	0.63				
	Dris					1.58	0.79		
	Oxia					0.27	0.14		
	Other					1.26	0.63		
Hungary		3.80	0.00	3.80	1.71	4.20	1.89	3.50	0.00
		2.90	0.00						
Iceland									
Ireland				5.92	3.31	2.20	1.29		
Italy								5.08	1.40
Japan									
Latvia				5.76	0.50	5.83	0.50	0.95	0.50
Luxembourg									
Netherlands									
New Zealand									
Norway									
Portugal									
Slovakia	Abies alba							2.69	1.35
	Acer sp.							3.16	1.55
	Alnus sp.							1.76	0.86
	Betulus sp.							1.01	0.50
	Breeding poplars							2.42	1.18
	Carpinus betulus							2.40	1.18
	Fagus sylvatica							4.42	2.16
	Fraxinus excelsior							3.22	1.58
	Larix dedicua							2.58	1.29
	Other bradleaves							1.64	0.81
	Other coniferous							1.10	0.55
	Picea abies							2.55	1.28
	Pinus sp.							2.39	1.20
	Populus sp.							2.69	1.32
	Quercus cerris							3.74	1.83
	Quercus ruber., petr.							3.89	1.90
	Robinia pseudo ac.							2.76	1.35
	Salix sp.							2.65	1.30
	Tilia sp.							1.93	0.95
	Ulmus sp.							2.99	1.47
Spain									
Sweden									
Switzerland				5.06	2.53	7.33	3.66		
United Kingdom									
United States									
Minimum		2.90	0.00	0.71	0.28	0.27	0.14	0.95	0.00
Maximum		5.21	2.61	10,884,000.00	3.31	7,864,000.00	3.66	5.08	2.16
Average		3.97	0.87	989,458.06	1.52	786,403.23	1.33	2.62	1.17

** Tropical and boreal forest data were excluded from this table since only France reported on tropical forests (AAGR=8.34) and Estonia for boreal forests (AAGR=4.28) (AAGR = Annual Average Growth Rate).

[a] IPCC default values (taken from volume 2: workbook, table 5.3; Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories).

[b] Czech Republic reported evergreen & broadleaf in one category.

3. Changes in forest and other woody biomass stocks (5.A)
Temperate forests
Trends in area of forest/biomass stocks (ha) and average annual growth rates (t dm/ha/yr)

3.1 Temperate forests - Plantations
Area of forest/biomass stocks; average annual growth rate (per year)

Party	Specie (as reported by Parties)	IPCC default growth rate	Base year		Plantations																			
					1990		1991		1992		1993		1994		1995		1996		1997		1998		1999	
			Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate
			k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr
France			14,851	6.24	14,851	6.24															14884	6.67	14955	5.21

Note
This table includes only one Party, as no other Party provided numercal information for temperate forests plantations in its CRF.

3.2 Temperate forests - Commercial: evergreen and deciduous
Area of forest/biomass stocks; average annual growth rate (per year)

Party	evergreen/ deciduous[3]	IPCC default growth rate	Base year[1,2]		Commercial: evergreen and deciduous																				Statistics by party growth rate t dm/ha/yr		
					1990		1991		1992		1993		1994		1995		1996		1997		1998		1999				
			Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	min	max	average
			k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr			
Australia																											
Austria	Evg		2561.35867	**5.95**	2561.35867	5.95	2554.5	5.47	2547.775	4.77	2540.95342	4.81	2534.112	5.17	2534.112	4.91	2534.112	4.91	2534.112	4.91	2534.112	4.91	2534.112	4.91	4.77	5.95	5.07
	Dec		776.64133	**6.22**	776.64133	6.22	786.92325	5.73	797.225	4.99	807.54658	5.04	817.888	5.41	817.888	5.15	817.888	5.15	817.888	5.15	817.888	5.15	817.888	5.15	4.99	6.22	5.31
Belgium																											
Bulgaria	Evg																					different	1135.867	different			
	Dec																					different	2234.2	different			
Canada																											
Czech Republic																											
Denmark																											
Estonia																											
Finland																											
France	Evg		19197	**10,700,000**	19197	10,700,000															19568	10,884,000	19568	10,884,000	10700000.00	10884000.00	10822666.67
	Dec		16039	**9,470,000**	16039	9,470,000															13091	7,864,000	13091	7,864,000	7864000.00	9470000.00	8399333.33
Greece	Evg-Fir			**0.84**		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84		0.84	0.84	0.84	0.84
	Evg-Red Fir			**5.90**		5.90		5.90		5.90		5.90		5.90		5.90		5.90		5.90		5.90		5.90	5.90	5.90	5.90
	Evg-Pine sp.			**0.71**		0.71		0.71		0.71		0.71		0.71		0.71		0.71		0.71		0.71		0.71	0.71	0.71	0.71
	Evg-Other			**1.26**		1.26		1.26		1.26		1.26		1.26		1.26		1.26		1.26		1.26		1.26	1.26	1.26	1.26
	Dec-Dris			**0.27**		0.27		0.27		0.27		0.27		0.27		0.27		0.27		0.27		0.27		0.27	0.27	0.27	0.27
	Dec-Pcia			**1.58**		1.58		1.58		1.58		1.58		1.58		1.58		1.58		1.58		1.58		1.58	1.58	1.58	1.58
	Dec-Other			**1.26**		1.26		1.26		1.26		1.26		1.26		1.26		1.26		1.26		1.26		1.26	1.26	1.26	1.26
Hungary	Evg																					3.80	244.564	3.80	3.80	3.80	3.80
	Dec																						1474.291	4.20	4.20	4.20	4.20
Iceland																											
Ireland	Evg																					5.92	543.583	5.92	5.92	5.92	5.92
	Dec																					2.20	106.108	2.20	2.20	2.20	2.20
Italy																											
Japan																											
Latvia	Evg																						1582.5	5.76	5.76	5.76	5.76
	Dec																						1145.5	5.83	5.83	5.83	5.83
Luxembourg																											
Netherlands																											
New Zealand																											
Norway																											
Portugal																											
Slovakia																											
Spain																											
Sweden	Dec																					7.24			7.24	7.24	7.24
Switzerland	Evg																					4762	789	5.06	5.06	4762.00	2383.53
	Dec																					2810	325	7.33	7.33	2810.00	1408.67
United Kingdom																											
United States																											
Minimum				**0.27**	**776.64**	**0.27**	**786.92**	**0.27**	**797.23**	**0.27**	**807.55**	**0.27**	**817.89**	**0.27**	**817.89**	**0.27**	**817.89**	**0.27**	**817.89**	**0.27**	**817.89**	**0.27**	**106.11**	**0.27**			
Maximum				**10,700,000.00**	**19,197.00**	**10,700,000.00**	**2,554.50**	**5.90**	**2,547.78**	**5.90**	**2,540.95**	**5.90**	**2,534.11**	**5.90**	**2,534.11**	**5.90**	**2,534.11**	**5.90**	**2,534.11**	**5.90**	**19,568.00**	**10,884,000.00**	**19,568.00**	**10,884,000.00**			
Average				**2.67**	**1,669.00**	**2.67**	**1,670.71**	**2.56**	**1,672.50**	**2.40**	**1,674.25**	**2.41**	**1,676.00**	**2.49**	**1,676.00**	**2.43**	**1,676.00**	**2.43**	**1,676.00**	**2.43**	**1,676.00**	**507.54**	**1,077.72**	**3.65**			

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

[3] Evg. for Evergreen; Dec. for Deciduous. Taken from 2000 submission.

3.1.1 Annual change of average annual growth rate, t dm/ha/yr (Temperate forests: Plantations)

Party	Other									
	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
France								-	-1.5	-16.5

3.2.1 Annual change of average annual growth rate, t dm/ha/yr (Temperate forests/commercial: Evergreen and deciduous)

Party	Other									
	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria	0.00	-0.70	0.04	0.35	-0.25	0.00	0.00	0.00	0.00	-17.4
	-0.49	-0.73	0.05	0.37	-0.26	0.00	0.00	0.00	0.00	-17.2
Belgium										
Bulgaria										
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France								-	0.0	1.7
								-	0.0	-17.0
Greece	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hungary								-	0.0	
Iceland										
Ireland									0.0	
									0.0	
Italy										
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia										
Spain										
Sweden										
Switzerland									-4756.9	
									-2802.7	
United Kingdom										
United States										

3.3 Temperate forests - Other
Area of forest/biomass stocks; average annual growth rate (per year)

Party	Species as reported by Parties	IPCC default growth rate	Base year[1,2]		Temperate forests: Other 1990		1991		1992		1993		1994		1995		1996		1997		1998		1999		Statistics by party growth rate t dm/ha/yr		
			Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	Area	Growth rate	min	max	average
			k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr	k ha	t dm/ha/yr			
Australia																											
Austria																											
Belgium																											
Bulgaria																											
Canada	Other		122,840	1	122,840	1	122,840	1	122,840	1	122,840	1	122,840	1	122,840	1	122,840	1	122,840	1	122,840	1	122,840	1	1.26	1.26	1.26
Czech Republic	Other																							5	4.51	4.51	4.51
Denmark																											
Estonia																											
Finland																											
France																											
Greece			3,154		3,154		3,154		3,154		3,154		3,154		3,154		3,154		3,154		3,154		3,154				
Hungary	Other																							3	2.90	2.90	2.90
	Other																							4	3.80	3.80	3.80
Iceland																											
Ireland																											
Italy	Other																				6,581	5	6,589	5	5.06	5.08	5.07
Japan	Other		25,336	33	25,336	33	25,306	33	125,994	2	25,259	39	25,243	39	25,285	39	NE	NE	NE	NE	NE	NE	NE	NE	2.00	39.20	30.93
Latvia	Other																							1	0.95	0.95	0.95
Luxembourg																											
Netherlands			347		347								347		347												
New Zealand																											
Norway																											
Portugal																											
Slovakia	Other																					4			3.84	3.84	3.84
	Abies alba																						80.61	2.69	2.69	2.69	2.69
	Acer sp.																						34.55	3.16	3.16	3.16	3.16
	Alnus sp.																						11.52	1.76	1.76	1.76	1.76
	Betulus sp.																						24.95	1.01	1.01	1.01	1.01
	Breeding poplars																						11.52	2.42	2.42	2.42	2.42
	Carpinus betulus																						109.69	2.40	2.40	2.40	2.40
	Fagus sylvatica																						594.34	4.42	4.42	4.42	4.42
	Fraxinus excelsior																						24.95	3.22	3.22	3.22	3.22
	Larix decidua																						44.14	2.58	2.58	2.58	2.58
	Other coniferous																						5.76	1.10	1.10	1.10	1.10
	Other broadleaf																						19.19	1.64	1.64	1.64	1.64
	Picea abies																						513.50	2.55	2.55	2.55	2.55
	Pinus sp.																						126.70	2.39	2.39	2.39	2.39
	Populus sp.																						7.70	2.69	2.69	2.69	2.69
	Quecus robur, petr.																						220.72	3.89	3.89	3.89	3.89
	Quercus cerris																						47.98	3.74	3.74	3.74	3.74
	Robinia pseudoac.																						34.55	2.76	2.76	2.76	2.76
	Salix sp.																						1.92	2.65	2.65	2.65	2.65
	Tilia sp.																						5.76	1.93	1.93	1.93	1.93
	Ulmus sp.																						1.92	2.99	2.99	2.99	2.99
Spain																											
Sweden																											
Switzerland																											
United Kingdom																											
United States																											
Minimum			347.00	1.26	347.00	1.26	3,154.00	1.26	3,154.00	1.26	3,154.00	1.26	347.00	1.26	347.00	1.26	3,154.00	1.26	3,154.00	1.26	3,154.00	1.26	1.92	0.95			
Maximum			122,839.58	33.08	122,839.58	33.08	122,839.58	32.90	125,993.58	2.00	122,839.58	39.20	122,839.58	39.20	122,839.58	39.20	122,839.58	1.26	122,839.58	1.26	122,839.58	5.06	122,839.58	5.08			
Average			37,919.05	17.17	37,919.05	17.17	50,433.04	17.08	83,995.72	1.63	50,417.67	20.23	37,895.85	20.23	37,906.43	20.23	62,996.79	1.26	62,996.79	1.26	44,191.59	3.39	5,848.03	2.71			

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

4. Changes in forest and other woody biomass stocks (5.A): CO_2 emissions and removals

4.1 Trends in gross CO_2 emissions

Gg CO_2/yr

Party	Base year[1,2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	statistics by party: min	max	average
Australia[3]	**46,751.5**	46,751	47,266	46,968	47,356	48,331	49,427	50,403	51,197	51,781	52,764	46,751	52,764	49,224
Austria														
Belgium									1,506	4,668	4,668	1,506	4,668	3,614
Bulgaria[1]										6,091	5,716	5,716	6,091	5,904
Canada	**222,195.3**	222,195	219,184	234,686	242,811	252,230	259,721	262,351	264,361	258,425	258,468	219,184	264,361	247,443
Czech Republic										15,287	16,048	15,287	16,048	15,667
Denmark														
Estonia											5,752	5,752	5,752	5,752
Finland	**72,141.3**	72,141	58,630	66,657	70,425	80,557	83,129	76,969	85,934	90,424	90,447	58,630	90,447	77,531
France	**66,167.0**	66,167	72,645	68,433	65,184	64,640	67,622	68,131	68,101	70,066	70,066	64,640	72,645	68,106
Greece	**3,831.7**	3,832	3,831	3,657	3,721	3,923	3,228	3,503	3,585	2,824	3,986	2,824	3,986	3,609
Hungary[2]										5,460	5,559	5,460	5,559	5,510
Iceland														
Ireland														
Italy														
Japan														
Latvia											NO			
Luxembourg														
Netherlands														
New Zealand [3]														
Norway														
Portugal														
Slovakia										8,551	9,171	8,551	9,171	8,861
Spain														
Sweden														
Switzerland														
United Kingdom														
United States														
Minimum	**3,831.7**	3,831.7	3,830.5	3,656.9	3,720.8	3,923.4	3,227.9	3,503.1	1,506.3	2,823.9	3,986.1			
Maximum	**222,195.3**	222,195.3	219,183.9	234,685.7	242,811.5	252,229.6	259,721.2	262,351.5	264,360.9	258,425.4	258,468.5			
Average	**82,217.4**	82,217.4	80,311.0	84,080.0	85,899.6	89,936.3	92,625.5	92,271.5	79,114.0	51,357.7	47,513.2			

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	percentage change from 1990 to 1999
Australia	1.1	-0.6	0.8	2.1	2.3	2.0	1.6	1.1	1.9	12.9
Austria										
Belgium										
Bulgaria									-6.2	
Canada	-1.4	7.1	3.5	3.9	3.0	1.0	0.8	-2.2	0.0	16.3
Czech Republic									5.0	
Denmark										
Estonia										
Finland	-18.7	13.7	5.7	14.4	3.2	-7.4	11.6	5.2	0.0	25.4
France	9.8	-5.8	-4.7	-0.8	4.6	0.8	0.0	2.9	0.0	5.9
Greece	0.0	-4.5	1.7	5.4	-17.7	8.5	2.3	-21.2	41.2	4.0
Hungary									1.8	
Iceland										
Ireland										
Italy										
Japan										
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia									7.3	
Spain										
Sweden										
Switzerland										
United Kingdom										
United States										

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

[3] Taken from 2000 submission.

4.2 Trends in gross CO_2 removals

Gg CO_2/yr

Party	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	min	max	average
Australia[3]	**-71,349.9**	-71,350	-71,343	-71,343	-71,343	-71,343	-71,865	-72,386	-72,908	-73,430	-75,833	-75,833	-71,343	-72,314
Austria	**-9,214.8**	-9,215	-13,504	-8,656	-8,982	-7,862	-7,254	-5,385	-7,633	-7,633	-7,633	-13,504	-5,385	-8,376
Belgium										-6,513	-6,513	-6,513	-6,513	-6,513
Bulgaria[1]										-12,324	-12,324	-12,324	-12,324	-12,324
Canada	**-290,264.3**	-290,264	-290,231	-290,261	-290,294	-290,323	-290,363	-290,396	-289,582	-289,494	-289,410	-290,396	-289,410	-290,062
Czech Republic										-19,044	-19,449	-19,449	-19,044	-19,247
Denmark	**-916.0**	-916	-918	-921	-924	-928	-931	-941	-951	-964	-976	-976	-916	-937
Estonia											-12,245	-12,245	-12,245	-12,245
Finland	**-95,939.1**	-95,939	-96,837	-98,550	-99,542	-97,817	-97,817	-98,001	-98,571	-100,137	-101,268	-101,268	-95,939	-98,448
France	**-141,497.0**	-141,497	-144,665	-145,311	-146,690	-147,464	-148,871	-151,126	-151,981	-153,814	-154,927	-154,927	-141,497	-148,635
Greece	**-4,004.9**	-4,005	-4,005	-4,005	-4,005	-4,005	-4,005	-4,005	-4,005	-4,005	-4,005	-4,005	-4,005	-4,005
Hungary[2]										-11,562	-11,750	-11,750	-11,562	-11,656
Iceland												0	0	
Ireland	**-5,381.4**	-5,381	-5,484	-5,685	-5,880	-6,098	-6,330	-6,532	-6,695	-6,872	-7,097	-7,097	-5,381	-6,205
Italy	**-25,106.8**	-25,107	-24,913	-24,169	-24,733	-24,060	-24,366	-24,940	-25,314	-24,969	-25,315	-25,315	-24,060	-24,789
Japan	-84,461.2	-84,461	-84,751	-86,456	-90,979	-94,445	-97,618	NE	NE	NE	NE	-97,618	-84,461	-89,785
Latvia	**-10,960.0**	-10,960	-10,960	-10,960	-10,960	-10,960	-10,600	-10,600	-10,600	-10,600	-10,758	-10,960	-10,600	-10,796
Luxembourg												0	0	
Netherlands	**-1,500.0**	-1,500	-1,600	-1,600	-1,600	-1,700	-1,700	-1,700	-1,700	-1,700	-1,700	-1,700	-1,500	-1,650
New Zealand [3]	**-22,307.0**	-22,307	-21,495	-20,003	-18,570	-18,166	-18,060	-18,548	-19,946	-21,831	-23,245	-23,245	-18,060	-20,217
Norway	**-9,590.0**	-9,590	-11,700	-13,250	-13,510	-15,680	-13,640	-17,611	-16,499	-17,588	-17,742	-17,742	-9,590	-14,681
Portugal	**-2,082.0**	-2,082	-2,206	-2,331	-2,455	-2,580	-2,704	-2,717	-2,717	-2,744	-2,758	-2,758	-2,082	-2,529
Slovakia										-8,487	-9,980	-9,980	-8,487	-9,233
Spain	**-29,252.2**	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252
Sweden	**-24,100.0**	-24,100	-33,100	-27,100	-33,100	-30,100	-25,100	-26,100	-31,100	-28,100	-28,100	-33,100	-24,100	-28,600
Switzerland	**-3,188.0**	-3,188	-3,257	-3,355	-4,325	-4,340	-4,310	-4,460	-4,636	-4,570	-4,226	-4,636	-3,188	-4,067
United Kingdom	**-7,304.0**	-7,304	-7,396	-7,671	-7,982	-8,191	-8,518	-8,426	-8,316	-8,184	-8,122	-8,518	-7,304	-8,011
United States	**-750,200.0**	-750,200	-738,100	-711,300	-712,300	-719,000	-711,600	-716,000	-718,700	-712,500	-720,900	-750,200	-711,300	-721,060
Minimum	**-750,200.0**	-750,200	-738,100	-711,300	-712,300	-719,000	-711,600	-716,000	-718,700	-712,500	-720,900			
Maximum	**-916.0**	-916	-918	-921	-924	-928	-931	-941	-951	-964	-976			
Average	**-79,430.9**	-79,431	-79,786	-78,109	-78,871	-79,216	-78,745	-78,375	-79,006	-64,847	-63,421			

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987

[3] Taken from 2000 submission.

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	0.0	0.0	0.0	0.0	0.7	0.7	0.7	0.7	3.3	6.3
Austria	46.5	-35.9	3.8	-12.5	-7.7	-25.8	41.7	0.0	0.0	-17.2
Belgium									0.0	
Bulgaria									0.0	
Canada	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	-0.3
Czech Republic									2.1	
Denmark	0.2	0.3	0.3	0.4	0.3	1.1	1.1	1.4	1.2	6.6
Estonia										
Finland	0.9	1.8	1.0	-1.7	0.0	0.2	0.6	1.6	1.1	5.6
France	2.2	0.4	0.9	0.5	1.0	1.5	0.6	1.2	0.7	9.5
Greece	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hungary									1.6	
Iceland										
Ireland	1.9	3.7	3.4	3.7	3.8	3.2	2.5	2.6	3.3	31.9
Italy	-0.8	-3.0	2.3	-2.7	1.3	2.4	1.5	-1.4	1.4	0.8
Japan	0.3	2.0	5.2	3.8	3.4					
Latvia	0.0	0.0	0.0	0.0	-3.3	0.0	0.0	0.0	1.5	-1.8
Luxembourg										
Netherlands	6.7	0.0	0.0	6.3	0.0	0.0	0.0	0.0	0.0	13.3
New Zealand	-3.6	-6.9	-7.2	-2.2	-0.6	2.7	7.5	9.5	6.5	4.2
Norway	22.0	13.2	2.0	16.1	-13.0	29.1	-6.3	6.6	0.9	85.0
Portugal	6.0	5.6	5.3	5.1	4.8	0.5	0.0	1.0	0.5	32.4
Slovakia										
Spain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sweden	37.3	-18.1	22.1	-9.1	-16.6	4.0	19.2	-9.6	0.0	16.6
Switzerland	2.2	3.0	28.9	0.3	-0.7	3.5	3.9	-1.4	-7.5	32.6
United Kingdom	1.3	3.7	4.1	2.6	4.0	-1.1	-1.3	-1.6	-0.8	11.2
United States	-1.6	-3.6	0.1	0.9	-1.0	0.6	0.4	-0.9	1.2	-3.9

4.3 Trends in net CO_2 emissions/removals

Gg CO_2/yr

Party	Base year [1,2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	min	max	average
Australia [3]	**-24,598**	-24,598	-24,084	-24,544	-24,155	-23,173	-22,380	-22,432	-22,485	-22,327	-23,069	-24,598	-22,327	-23,325
Austria	**-9,215**	-9,215	-13,504	-8,656	-8,982	-7,862	-7,254	-5,385	-7,633	-7,633	-7,633	-13,504	-5,385	-8,376
Belgium										-1,845	-1,845	-1,845	-1,845	-1,845
Bulgaria[2]	**-4,657**	-5,801	-7,880	-7,636	-7,022	-6,974	-7,520	-7,190	-5,852	-6,233	-6,608	-7,880	-5,801	-6,871
Canada	**-68,069**	-68,069	-71,047	-55,575	-47,482	-38,093	-30,642	-28,045	-25,221	-31,069	-30,942	-71,047	-25,221	-42,619
Czech Republic										3,757	-3,401	-3,401	3,757	178
Denmark	**-916**	-916	-918	-921	-924	-928	-931	-941	-951	-964	-976	-976	-916	-937
Estonia											-6,493	-6,493	-6,493	-6,493
Finland	**-23,798**	-23,798	-38,207	-31,894	-29,116	-17,259	-14,687	-21,032	-12,637	-9,713	-10,821	-38,207	-9,713	-20,916
France	**-75,330**	-75,330	-72,020	-76,878	-81,506	-82,824	-81,249	-82,995	-83,880	-83,748	-84,861	-84,861	-72,020	-80,529
Greece	**-173**	-173	-174	-348	-284	-81	-777	-502	-420	-1,181	-19	-1,181	-19	-396
Hungary[3]	**-3,097**	-4,467	-4,747	-5,336	-6,194	-6,271	-6,200	-5,421	-5,703	-6,102	-6,191	-6,271	-4,467	-5,663
Japan	**230,629**	230,629	226,899	228,645	233,205	236,705	239,910	NE	NE	NE	NE	226,899	239,910	232,665
Iceland														
Ireland	**-5,381**	-5,381	-5,484	-5,685	-5,880	-6,098	-6,330	-6,532	-6,695	-6,872	-7,097	-7,097	-5,381	-6,205
Italy	**-25,107**	-25,107	-24,913	-24,169	-24,733	-24,060	-24,366	-24,940	-25,314	-24,969	-25,315	-25,315	-24,060	-24,789
Latvia	**-10,960**	-10,960	-10,960	-10,960	-10,960	-10,960	-10,600	-10,600	-10,600	-10,600	-10,758	-10,960	-10,600	-10,796
Luxembourg											-295	-295	-295	-295
Netherlands	**-1,500**	-1,500	-1,600	-1,600	-1,600	-1,700	-1,700	-1,700	-1,700	-1,700	-1,700	-1,700	-1,500	-1,650
New Zealand [3]	**-22,307**	-22,307	-21,495	-20,003	-18,570	-18,166	-18,060	-18,548	-19,946	-21,831	-23,245	-23,245	-18,060	-20,217
Norway	**-9,590**	-9,590	-11,700	-13,250	-13,510	-15,680	-13,640	-17,611	-16,499	-17,588	-17,742	-17,742	-9,590	-14,681
Portugal	**-2,082**	-2,082	-2,206	-2,331	-2,455	-2,580	-2,704	-2,717	-2,717	-2,744	-2,758	-2,758	-2,082	-2,529
Slovakia	**-401**	-401	-401	-401	-401	-1,056	-1,056	-2,149	-2,245	64	-809	-2,245	64	-885
Spain	**-29,252**	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252
Sweden	**-24,100**	-24,100	-33,100	-27,100	-33,100	-30,100	-25,100	-26,100	-31,100	-28,100	-28,100	-33,100	-24,100	-28,600
Switzerland	**-3,188**	-3,188	-3,257	-3,355	-4,325	-4,340	-4,310	-4,460	-4,636	-4,570	-4,226	-4,636	-3,188	-4,067
United Kingdom	**-7,304**	-7,304	-7,396	-7,671	-7,982	-8,191	-8,518	-8,426	-8,316	-8,184	-8,122	-8,518	-7,304	-8,011
United States	**-750,200**	-750,200	-738,100	-711,300	-712,300	-719,000	-711,600	-716,000	-718,700	-712,500	-720,900	-750,200	-711,300	-721,060
min	**-750,200**	**-750,200**	**-738,100**	**-711,300**	**-712,300**	**-719,000**	**-711,600**	**-716,000**	**-718,700**	**-712,500**	**-720,900**			
max	**230,629**	**230,629**	**226,899**	**228,645**	**233,205**	**236,705**	**239,910**	**-502**	**-420**	**3,757**	**-19**			
average	**-37,852**	**-37,961**	**-38,937**	**-36,531**	**-36,414**	**-35,563**	**-34,303**	**-47,408**	**-47,386**	**-43,163**	**-40,891**			

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

[3] Taken from 2000 submission.

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	-2.1	1.9	-1.6	-4.1	-3.4	0.2	0.2	-0.7	3.3
Austria	46.5	-35.9	3.8	-12.5	-7.7	-25.8	41.7	0.0	0.0
Belgium									
Bulgaria	35.8	-3.1	-8.0	-0.7	7.8	-4.4	-18.6	6.5	6.0
Canada	4.4	-21.8	-14.6	-19.8	-19.6	-8.5	-10.1	23.2	-0.4
Czech Republic									-190.5
Denmark	0.2	0.3	0.3	0.4	0.3	1.1	1.1	1.4	1.2
Estonia									
Finland	60.5	-16.5	-8.7	-40.7	-14.9	43.2	-39.9	-23.1	11.4
France	-4.4	6.7	6.0	1.6	-1.9	2.1	1.1	-0.2	1.3
Greece	0.6	99.6	-18.4	-71.3	853.5	-35.4	-16.3	181.2	-98.4
Hungary	6.3	12.4	16.1	1.2	-1.1	-12.6	5.2	7.0	1.5
Japan	-1.6	0.8	2.0	1.5	1.4				
Iceland									
Ireland	1.9	3.7	3.4	3.7	3.8	3.2	2.5	2.6	3.3
Italy	-0.8	-3.0	2.3	-2.7	1.3	2.4	1.5	-1.4	1.4
Latvia	0.0	0.0	0.0	0.0	-3.3	0.0	0.0	0.0	1.5
Luxembourg									
Netherlands	6.7	0.0	0.0	6.3	0.0	0.0	0.0	0.0	0.0
New Zealand	-3.6	-6.9	-7.2	-2.2	-0.6	2.7	7.5	9.5	6.5
Norway	22.0	13.2	2.0	16.1	-13.0	29.1	-6.3	6.6	0.9
Portugal	6.0	5.6	5.3	5.1	4.8	0.5	0.0	1.0	0.5
Slovakia	0.0	0.0	0.0	163.5	0.0	103.5	4.4	-102.8	-1,373.5
Spain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sweden	37.3	-18.1	22.1	-9.1	-16.6	4.0	19.2	-9.6	0.0
Switzerland	2.2	3.0	28.9	0.3	-0.7	3.5	3.9	-1.4	-7.5
United Kingdom	1.3	3.7	4.1	2.6	4.0	-1.1	-1.3	-1.6	-0.8
United States	-1.6	-3.6	0.1	0.9	-1.0	0.6	0.4	-0.9	1.2

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	-2.1	-0.2	-1.8	-5.8	-9.0	-8.8	-8.6	-9.2	-6.2
Austria	46.5	-6.1	-2.5	-14.7	-21.3	-41.6	-17.2	-17.2	-17.2
Belgium									
Bulgaria	69.2	64.0	50.8	49.8	61.5	54.4	25.7	33.8	41.9
Canada	4.4	-18.4	-30.2	-44.0	-55.0	-58.8	-62.9	-54.4	-54.5
Czech Republic									
Denmark	0.2	0.5	0.9	1.3	1.6	2.7	3.8	5.2	6.6
Estonia									
Finland	60.5	34.0	22.3	-27.5	-38.3	-11.6	-46.9	-59.2	-54.5
France	-4.4	2.1	8.2	9.9	7.9	10.2	11.4	11.2	12.7
Greece	0.6	100.9	64.0	-53.0	348.5	189.7	142.4	581.8	-89.1
Hungary	53.3	72.3	100.0	102.5	100.2	75.0	84.1	97.0	99.9
Japan	-1.6	-0.9	1.1	2.6	4.0				
Iceland									
Ireland	1.9	5.6	9.3	13.3	17.6	21.4	24.4	27.7	31.9
Italy	-0.8	-3.7	-1.5	-4.2	-3.0	-0.7	0.8	-0.5	0.8
Latvia	0.0	0.0	0.0	0.0	-3.3	-3.3	-3.3	-3.3	-1.8
Luxembourg									
Netherlands	6.7	6.7	6.7	13.3	13.3	13.3	13.3	13.3	13.3
New Zealand	-3.6	-10.3	-16.8	-18.6	-19.0	-16.9	-10.6	-2.1	4.2
Norway	22.0	38.2	40.9	63.5	42.2	83.6	72.0	83.4	85.0
Portugal	6.0	12.0	17.9	23.9	29.9	30.5	30.5	31.8	32.4
Slovakia	0.0	0.0	0.0	163.5	163.5	436.1	459.9	-115.8	101.7
Spain	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sweden	37.3	12.4	37.3	24.9	4.1	8.3	29.0	16.6	16.6
Switzerland	2.2	5.2	35.7	36.1	35.2	39.9	45.4	43.4	32.6
United Kingdom	1.3	5.0	9.3	12.1	16.6	15.4	13.9	12.0	11.2
United States	-1.6	-5.2	-5.1	-4.2	-5.1	-4.6	-4.2	-5.0	-3.9

5. Forest/grassland conversion (5.B)
Average annual net loss of biomass

5.1 Tropical ecosystems

Party	Original natural ecosystem: Tropical, wet/very moist — On- & off-site burning: Area converted annually	On- & off-site burning: Average annual net loss of biomass	On- & off-site burning: Annual net loss of biomass	Decay: Average area converted	Decay: Average annual net loss of biomass	Decay: Annual net loss of biomass	Difference in annual net loss of biomass
	kha/yr	t dm/ha/yr	kt dm/yr	kha/yr	t dm/ha/yr	kt dm/yr	**t dm/ha/yr**
***Default* [1]**		***(225-300)***			***(225-300)***		
France	0.80	285.0	228.0				-

[1] Taken from table 5-6 (Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2: workbook).

Note

This table includes only one Party, as no other Party provided numerical information in its CRF regarding temperate forests plantations.

5.2 Temperate ecosystems

Original natural ecosystem: Temperate - coniferous

	On- & off-site burning: Area converted annually	On- & off-site burning: Average annual net loss of biomass	On- & off-site burning: Annual net loss of biomass	Decay: Average area converted	Decay: Average annual net loss of biomass	Decay: Annual net loss of biomass	Difference in annual net loss of biomass
	kha/yr	t dm/ha/yr	kt dm/yr	kha/yr	t dm/ha/yr	kt dm/yr	**t dm/ha/yr**
***Default* [1]**		***(220-295)***			***(220-295)***		
Australia							
Austria							
Belgium							
Bulgaria							
Canada							
Czech Republic							
Denmark							
Estonia							
Finland							
France							
Greece	3.20	33.9	108.34	0.00	na		
Hungary	135.70	1.0	135.70	114.20	114.20	13041.64	-113.2
Iceland							
Ireland							
Italy	4.83	9.4	45.51				
Japan							
Latvia							
Luxembourg							
Netherlands							
New Zealand							
Norway							
Portugal							
Slovakia	NA		853.29	NA	NA		
Spain							
Sweden							
Switzerland							
United Kingdom							
United States							
Minimum	3.20	1.00	45.51	0.00	114.20	13,041.64	-113.20
Maximum	135.70	33.86	853.29	114.20	114.20	13,041.64	-113.20
Average	47.91	14.76	285.71	57.10	114.20	13,041.64	-113.20

Original natural ecosystem: Temperate - broadleaf

	On- & off-site burning: Area converted annually	On- & off-site burning: Average annual net loss of biomass	On- & off-site burning: Annual net loss of biomass	Decay: Average area converted	Decay: Average annual net loss of biomass	Decay: Annual net loss of biomass	Difference in annual net loss of biomass
	kha/yr	t dm/ha/yr	kt dm/yr	kha/yr	t dm/ha/yr	kt dm/yr	**t dm/ha/yr**
***Default* [1]**		***(175-250)***			***(175-250)***		
Australia							
Austria							
Belgium							
Bulgaria							
Canada							
Czech Republic							
Denmark							
Estonia							
Finland							
France				6,488.10	0.25	1,611.90	-0.2
Greece	1.20	19.7	23.66				
Hungary	673.60	1.0	673.60				
Iceland							
Ireland							
Italy	3.28	9.4	30.71		11.00		-1.6
Japan							
Latvia							
Luxembourg							
Netherlands							
New Zealand							
Norway							
Portugal							
Slovakia			1,179.60				
Spain							
Sweden							
Switzerland							
United Kingdom							
United States							
Minimum	1.20	1.00	23.66	6,488.10	0.25	1,611.90	-1.62
Maximum	673.60	19.72	1,179.60	6,488.10	11.00	1,611.90	-0.25
Average	226.03	10.03	476.89	6,488.10	5.62	1,611.90	-0.94

Original natural ecosystem: Temperate - mixed broadleaf / coniferous

	On- & off-site burning: Area converted annually	On- & off-site burning: Average annual net loss of biomass	On- & off-site burning: Annual net loss of biomass	Decay: Average area converted	Decay: Average annual net loss of biomass	Decay: Annual net loss of biomass	Difference in annual net loss of biomass
	kha/yr	t dm/ha/yr	kt dm/yr	kha/yr	t dm/ha/yr	kt dm/yr	**t dm/ha/yr**
***Default* [1]**		***(175-295)***			***(175-295)***		
Australia							
Austria							
Belgium							
Bulgaria							
Canada	16.00	102.3	1637.00	NE	NE		
Czech Republic							
Denmark							
Estonia							
Finland							
France	80.10	81.2	6,508.00	80.10	81.00	6,488.10	0.2
Greece	8.40	19.7	165.66		na		
Hungary							
Iceland							
Ireland							
Italy	23.71	11.0	260.73				
Japan							
Latvia							
Luxembourg							
Netherlands							
New Zealand							
Norway							
Portugal							
Slovakia							
Spain							
Sweden							
Switzerland							
United Kingdom							
United States							
Minimum	8.40	11.00	165.66	80.10	81.00	6488.10	0.25
Maximum	80.10	102.31	6508.00	80.10	81.00	6488.10	0.25
Average	32.05	53.57	2142.85	80.10	81.00	6488.10	0.25

[1] Taken from table 5-6 (Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2: workbook).

5.3 Grasslands

Party	Original natural ecosystem: Grasslands — On- & off-site burning: Area converted annually	On- & off-site burning: Average annual net loss of biomass	On- & off-site burning: Annual net loss of biomass	Decay: Average area converted	Decay: Average annual net loss of biomass	Decay: Annual net loss of biomass	Difference in annual net loss of biomass
	kha/yr	t dm/ha/yr	kt dm/yr	kha/yr	t dm/ha/yr	kt dm/yr	**t dm/ha/yr**
***Default* [1]**							
Canada	65.2	1.1	70.0	NE	NE		-
Greece	2.40		na			0.0	-
Hungary	8.20	-1.0	-8.20	6.25	-6.25	-39.1	5.3
Minimum	2.4	-1.0	-8.2	6.3	-6.3	-39.1	
Maximum	65.2	1.1	70.0	6.3	-6.3	0.0	
Average	25.3	0.0	30.9	6.3	-6.3	-19.5	

5.4 Boreal: mixed broadleaf / coniferous

	Original natural ecosystem: Boreal, mixed coniferous/broadealf — On- & off-site burning: Area converted annually	On- & off-site burning: Average annual net loss of biomass	On- & off-site burning: Annual net loss of biomass	Decay: Average area converted	Decay: Average annual net loss of biomass	Decay: Annual net loss of biomass	Difference in annual net loss of biomass
	kha/yr	*t dm/ha/yr*	*kt dm/yr*	*kha/yr*	*t dm/ha/yr*	*kt dm/yr*	***t dm/ha/yr***
***Default* [1]**		***(40-87)***			***(40-87)***		
Canada	10.80	39.9	431.00	NE	NE		-
Estonia	0.06	144.8	8.69	0.42	60.82	25.5	84.0
Finland				0	0	0.0	
Minimum	0.06	39.91	8.69	0.00	0.00	0.00	
Maximum	10.80	144.80	431.00	0.42	60.82	25.54	
Average	5.43	92.35	219.84	0.21	30.41	12.77	

6. Forest/grassland conversion (5.B)
Temperate forests (including coniferous, broadleaf, mixed coniferous/broadleaf)
Trends in area converted annually, kha/yr

Area converted annually (kha/yr)

Party	Type [3]	Biomass end point [4]	Base year [1,2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia			0.0										
Austria	Brd	Oosb	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
	Con	Oosb	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
Belgium			0.0										
Bulgaria													
Canada	Brd	Oosb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Brd	Dec	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Con	Oosb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Con	Dec	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Czech Republic			0.0										
Denmark			0.0										
Estonia			0.0										
Finland			0.0										
France			0.0										
Greece	Brd	Oosb	5.0	4.98	1.81	3.83	7.22	7.76	1.17	1.86	1.10	12.50	1.20
	Brd	Dec	0.0						na	na	na	na	na
	Con	Oosb	13.6	13.61	1.21	19.45	12.33	8.59	4.89	4.09	4.90	33.50	3.20
	Con	Dec	0.0				ne		na	na	na	na	na
Hungary	Brd	Oosb										673.60	673.60
	Brd	Dec										803.10	803.10
	Con	Oosb										135.70	135.70
	Con	Dec										114.20	114.20
Iceland													
Ireland	Brd	Oosb	0.0									NE	NE
	Brd	Dec	0.0									NE	NE
	Con	Oosb	0.0									NE	NE
	Con	Dec	0.0									NE	NE
Italy	Brd	Oosb	0.0									12.01	3.28
	Con	Oosb	0.0									11.62	4.83
Latvia			0.0										
Luxembourg			0.0										
Netherlands			0.0										
New Zealand			0.0										
Norway			0.0										
Portugal			0.0										
Slovakia	Brd	Oosb	0.0									NA	NA
	Brd	Dec	0.0										NA
	Con	Oosb	0.0									NA	NA
	Con	Dec	0.0										NA
Spain			0.0										
Sweden			0.0										
Switzerland			0.0										
United Kingdom			0.0										
United States	Brd	Oosb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Brd	Dce	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Con	Oosb	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Con	Dec	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Percentage change from previous year and base year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France										
Greece	-63.7	111.6	88.5	7.5	-84.9	59.0	-40.9	1036.4	-90.4	-75.9
Hungary									0.0	
Iceland										
Ireland										
Italy									-72.7	
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia										
Spain										
Sweden										
Switzerland										
United Kingdom										
United States										

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

[3] Con- and off-site burning on for coniferous; Brd for boradleaf; Mix for mixed coniferous and broadleaf (also for mixed evergreen and broadleaf).

[4] Oosb, for On- and Off-site biomass burning; Dec, for biomass left to decay.

7. Forest/grassland conversion (5.B)
Trends in CO_2 emissions
Gigagrams

Party	Base year [1,2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	min	max	average
Australia	**98,752**	98,752	71,739	68,541	65,678	63,131	62,038	64,153	62,484	68,731	68,060	62038.24	98751.65	69330.61
Austria														
Belgium														
Bulgaria														
Canada	**1,419**	1,419	1,393	1,420	1,699	2,056	2,381	2,840	3,694	3,924	4,154	1393	4154	2498
Czech Republic														
Denmark														
Estonia											35	35.12	35.12	35.12
Finland														
France	**11,710**	11,710	11,710	11,987	12,066	12,165	12,343	12,343	12,540	12,540	12,540	11710	12540	12194.4
Greece	**1,423**	1,423	609	2,277	1,721	1,403	660	684	656	3,682	552	552.42	3682.2	1366.631
Hungary		NA	1,509	1,514	1,497	1,452	1,403	1,490	1,498	1,488	1,488	1402.52	1513.93	1481.882
Iceland														
Ireland											NO			
Japan	**579.15**	579.15	907.83	914.76	921.69	928.62	942.48	NE	NE	NE	NE	579.15	942.48	865.755
Italy	**2,152**	2,152	1,256	820	1,751	1,076	790	422	803	1,192	995	422.0505	2152.252	1125.868
Latvia											NO			
Luxembourg														
Netherlands	**NO**	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO			
New Zealand	**669**	669	1,015	1,586	2,094	2,331	1,753	1,930	1,732	872	1,127	669.236	2330.768	1510.919
Norway	**0**													
Portugal	**-1,912**	-1,912	-1,913	-1,914	-1,914	-1,915	-1,916	-1,921	-1,921	-1,930	-1,934	-1934.4	-1912	-1918.94
Slovakia	**141**	141	141	141	141	126	126	111	111	131	265	110.6	265.33	143.313
Spain														
Sweden														
Switzerland											NO			
United Kingdom														
United States														
Minimum	**-1,912.00**	**-1,912.00**	**-1,912.80**	**-1,913.60**	**-1,914.40**	**-1,915.20**	**-1,916.00**	**-1,920.60**	**-1,920.60**	**-1,929.80**	**-1,934.40**			
Maximum	98,751.65	98,751.65	71,738.58	68,541.29	65,677.56	63,130.84	62,038.24	64,152.57	62,484.05	68,730.83	68,060.48			
Average	11,493.26	12,770.29	8,836.51	8,728.73	8,565.35	8,275.28	8,052.09	9,116.95	9,066.39	10,070.00	8,728.24			

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	-27.4	-4.5	-4.2	-3.9	-1.7	3.4	-2.6	10.0	-1.0	-31.1
Austria										
Belgium										
Bulgaria										
Canada	-1.8	1.9	19.6	21.0	15.8	19.3	30.1	6.2	5.9	192.7
Czech Republic										
Denmark										
Estonia										
Finland										
France	0.0	2.4	0.7	0.8	1.5	0.0	1.6	0.0	0.0	7.1
Greece	-57.2	274.2	-24.4	-18.5	-53.0	3.6	-4.1	461.4	-85.0	-61.2
Hungary		0.3	-1.1	-3.0	-3.4	6.3	0.5	-0.7	0.0	
Iceland										
Ireland										
Japan	56.8	0.8	0.8	0.8	1.5					
Italy	-41.7	-34.7	113.6	-38.6	-26.5	-46.6	90.4	48.4	-16.5	-53.8
Latvia										
Luxembourg										
Netherlands										
New Zealand	51.6	56.3	32.1	11.3	-24.8	10.1	-10.3	-49.7	29.2	68.3
Norway										
Portugal	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.5	0.2	1.2
Slovakia	0.0	0.0	0.0	-10.2	0.0	-11.9	-0.6	18.4	102.7	88.7
Spain										
Sweden										
Switzerland										
United Kingdom										
United States										

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

8. Abandonment of managed lands (5.C)

Annual above-ground biomass growth rate (t dm/ha/yr) and rate of biomass C uptake (t C/ha/yr)

8.1 Temperate forest - above ground biomass

Party	Temperate: Mixed coniferous / broadleaf						Temperate, broadleaf						Temperate, coniferous					
	Annual rate of biomass growth		C fraction of biomass		Rate of biomass C uptake		Annual rate of biomass growth		C fraction of biomass		Rate of biomass C uptake		Annual rate of biomass growth		C fraction of biomass		Rate of biomass C uptake	
	<20 yrs t dm/ha/yr	> 20 yrs t dm/ha/yr	<20 yrs	> 20 yrs	<20 yrs t C/ha/yr	> 20 yrs t C/ha/yr	<20 yrs t dm/ha/yr	> 20 yrs t dm/ha/yr	<20 yrs	> 20 yrs	<20 yrs t C/ha/yr	> 20 yrs t C/ha/yr	<20 yrs t dm/ha/yr	> 20 yrs t dm/ha/yr	<20 yrs	> 20 yrs	<20 yrs t C/ha/yr	> 20 yrs t C/ha/yr
Default [1]	*(2.0-3.0)*	*(2.0-3.0)*					*(2.0)*	*(2.0)*					*(3.0)*	*(3.0)*				
Australia																		
Austria																		
Belgium																		
Bulgaria																		
Canada	0.95	0.95	0.50	0.50	0.48	0.48												
Czech Republic																		
Denmark																		
Estonia																		
Finland																		
France																		
Greece																		
Hungary																		
Iceland																		
Ireland																		
Italy	2.00		0.50		0.00	0.00	2.00		0.50		0.00	0.00	2.00		0.50		0.00	0.00
Japan																		
Latvia																		
Luxembourg																		
Netherlands																		
New Zealand																		
Norway																		
Portugal																		
Slovakia							1.50	2.50	0.50	0.50	0.75	1.25	1.00	2.00	0.49	0.49	0.49	0.98
Spain																		
Sweden																		
Switzerland																		
United Kingdom																		
United States																		
Minimum	0.95	0.95	0.50	0.50	0.00	0.00	1.50	2.50	0.50	0.50	0.00	0.00	1.00	2.00	0.49	0.49	0.00	0.00
Maximum	2.00	0.95	0.50	0.50	0.48	0.48	2.00	2.50	0.50	0.50	0.75	1.25	2.00	2.00	0.50	0.49	0.49	0.98
Average	1.48	0.95	0.50	0.50	0.24	0.24	1.75	2.50	0.50	0.50	0.38	0.63	1.50	2.00	0.50	0.49	0.25	0.49

[1] Taken from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2. Workbook.

8.2 Boreal forests and grasslands**

Party	Boreal, mixed broadleaf / coniferous						Grasslands					
	Annual rate of aboveground biomass growth		C fraction of aboveground biomass		Rate of aboveground biomass C uptake		Annual rate of aboveground biomass growth		C fraction of aboveground biomass		Rate of aboveground biomass C uptake	
	<20 yrs t dm/ha/yr	> 20 yrs t dm/ha/yr	<20 yrs	> 20 yrs	<20 yrs t C/ha/yr	> 20 yrs t C/ha/yr	<20 yrs t dm/ha/yr	> 20 yrs t dm/ha/yr	<20 yrs	> 20 yrs	<20 yrs t C/ha/yr	> 20 yrs t C/ha/yr
Default [1]	*(0,7-2,0)*	*(0,7-6,4)*										
Australia												
Austria												
Belgium												
Bulgaria												
Canada	0.21	0.21	0.50	0.50	0.10	0.11			0.50	0.50	0.00	0.00
Czech Republic												
Denmark												
Estonia	4.28	4.28	0.45	0.45	1.93	0.00						
Finland												
France												
Greece												
Hungary												
Iceland												
Ireland												
japan												
Italy												
Latvia												
Luxembourg												
Netherlands												
New Zealand												
Norway												
Portugal												
Slovakia												
Spain												
Sweden												
Switzerland												
United Kingdom												
United States												

[1] Taken from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2. Workbook.

** Tropical forests were omitted from the present table given that no party reported data.

9. Abandonment of managed lands (5.C)

9.1 CO_2 removals, trends, Gg CO_2/yr

Party	Base year [1,2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia											
Austria											
Belgium											
Bulgaria[1]											
Canada	**-3,245.00**	-3,245	-3,304	-3,271	-3,242	-3,216	-3,183	-3,157	-3,913	-3,913	-4,103
Czech Republic											
Denmark											
Estonia											-2,296
Finland											
France	**-48.00**	-48	-48	-48	-48	-48	-48	-48	-48	-48	-48
Greece											
Hungary[2]											
Iceland											
Ireland											NO
Japan											
Italy	**-74.10**	-74	-114	-123	-142	-144	-150	-152	-153	-153	-154
Latvia											NO
Luxembourg											
Netherlands	**NO**	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
New Zealand											
Norway											
Portugal											
Slovakia	**-1,351.50**	-1,352	-1,352	-1,352	-1,352	-1,371	-1,371	-1,391	-1,405	-1,407	-1,415
Spain											
Sweden											
Switzerland											IE
United Kingdom											
United States											
Minimum	**-3,245.00**	**-3,245**	**-3,304**	**-3,271**	**-3,242**	**-3,216**	**-3,183**	**-3,157**	**-3,913**	**-3,913**	**-4,103**
Maximum	**-48.00**	**-48**	**-48**	**-48**	**-48**	**-48**	**-48**	**-48**	**-48**	**-48**	**-48**
Average	**-1,179.65**	**-1,180**	**-1,204**	**-1,198**	**-1,196**	**-1,195**	**-1,188**	**-1,187**	**-1,380**	**-1,380**	**-1,603**

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada	1.8	-1.0	-0.9	-0.8	-1.0	-0.8	23.9	0.0	4.9	26.4
Czech Republic										
Denmark										
Estonia										
Finland										
France	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Greece										
Hungary										
Iceland										
Ireland										
Japan										
Italy	54.5	7.1	16.2	0.9	4.5	1.1	0.6	0.0	1.1	108.3
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia	0.0	0.0	0.0	1.4	0.0	1.4	1.0	0.1	0.6	4.7
Spain										
Sweden										
Switzerland										
United Kingdom										
United States										

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

9. Abandonment of managed lands (5.C)

9.2 Area trends for total area abandoned

Kha (first twenty years)*

Party	Category[1]	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Canada	Brdl/conif (temp)	883.5	884	781	718	656	593	531	469	853	869	886
	Mix/brdl (boreal)	130.5	131	113	102	93	83	73	63	129	132	136
	Grasslands	300.5	301	264	242	221	199	178	156	290	296	303
Estonia	Mix/brdl (boreal)											325
Slovakia	Broadleaf (temp)											153
	Coniferous (temp)											160
	Brdl/conif (temp)											NO
Minimum		130.5	131	113	102	93	83	73	63	129	132	136
Maximum		883.5	884	781	718	656	593	531	469	853	869	886
Average		438.17	438	386	354	323	292	261	229	424	432	327

* Only parties reporting data under this category were included in the table.

[1] Brdl: Broadleaf, Conif: coniferous.

Percentage change from previous year*

Party	Category[1]	1991	1992	1993	1994	1995	1996	1997	1998	1999
Canada	Brdl/conif (temp)	-11.7	-8.1	-8.6	-9.5	-10.5	-11.7	81.8	1.9	2.0
	Mix/brdl (boreal)	-13.8	-9.3	-8.8	-11.3	-11.5	-13.7	104.0	2.7	2.7
	Grasslands	-12.1	-8.3	-8.9	-9.8	-10.6	-12.4	85.9	2.1	2.4
Estonia	Mix/brdl (boreal)									
Slovakia	Broadleaf (temp)									
	Coniferous (temp)									
	Brdl/conif (temp)									

* Only parties reporting data under this category were included in the table.

[1] Brdl: Broadleaf, Conif: coniferous.

10. CO_2 emissions and removals from soils (5.D)

10.1 Cultivation of mineral soils

Party	Average annual rate of soil C uptake/removal, T C/ha/yr					
	High activity	Low activity	Sandy	Volcanic	Wetland	Other
Default						
Australia						
Austria						
Belgium						
Bulgaria						
Canada						
Czech Republic						
Denmark						
Estonia	-0.100	-0.317	0.143			
Finland	-0.054	-0.054	-0.014			
France						
Greece	2.313	2.313		0.000	0.000	
Hungary						
Iceland						
Ireland						
Japan						
Italy						
Latvia						
Luxembourg						
Netherlands						
New Zealand						
Norway						
Portugal						
Slovakia						
Spain						
Sweden						
Switzerland						
United Kingdom						
United States						
Minimum	-0.10	-0.32	-0.01			
Maximum	2.31	2.31	0.14			
Average	0.72	0.65	0.06			

10.2 Cultivation of organic soils

Party	Annual loss rate, Mg C/ha/yr						Histosol cultivation	
	Cool temperate		Warm temperate		Tropical		Table 4.D.	Table 5.D.
	Upland crops	Pasture/ forest	Upland crops	Pasture/ forest	Upland crops	Pasture/ forest	ha	ha
Default	(1.0)	(0,25)	(10.0)	(2,5)	(20.0)	(5.0)		
Australia							46,085.5	
Austria							NE	NO
Belgium								
Bulgaria							4,804.7	
Canada							29.8	IE
Czech Republic							1.7	
Denmark							18.4	
Estonia		4.302						1.9
Finland	1.202	1.103					303.0	303.0
France								
Greece	0.000	0.000	0.000	0.000	0.000	0.000		na
Hungary			10.000	5.441			6,194.6	6.5
Iceland							NO	
Ireland							NE	NO
Japan								
Italy			0.073	0.123			9.0	23,672.2
Latvia	1.000						129.6	24.8
Luxembourg								
Netherlands								
New Zealand							166.0	
Norway							175.0	
Portugal							NE	
Slovakia							4.9	NO
Spain								
Sweden	5.441	2.813					247.0	250.0
Switzerland							7.0	NE
United Kingdom							0.4	
United States							973.3	NA
Minimum	0.00	0.00	0.00					
Maximum	5.44	4.30	10.00					
Average	1.91	2.05	3.36					

9.3 Liming of agricultural soils

Party	C conversion factor	
	Limestone	Dolomite
Default		
Australia		
Austria		
Belgium		
Bulgaria		
Canada		
Czech Republic		
Denmark		
Estonia		
Finland	0.120	0.130
France		
Greece		
Hungary	0.120	
Iceland		
Ireland		
Japan		
Italy		
Latvia		
Luxembourg		
Netherlands		
New Zealand		
Norway		
Portugal		
Slovakia	0.120	0.122
Spain		
Sweden	0.120	0.122
Switzerland		
United Kingdom		
United States		
Minimum	0.12	0.12
Maximum	0.12	0.13
Average	0.12	0.12

11. CO_2 Emissions and removals from soils (5.D)

11.1 CO_2 net emission/removal

11.1.1 Trends, Gg CO_2/yr

Party	Base year [1,2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Statistics by Party		
												Min	max	avg
Australia	-4,224	-4,224	-4,224	-4,224	-4,224	-4,224	-4,224	-4,224	-4,224	-4,224	-4,224	-4,224	-4,224	-4,224
Austria														
Belgium														
Bulgaria														
Canada	3,525	3,525	3,776	3,137	2,841	2,630	2,391	2,636	5,270	1,254	5,262	1,254	1,254	1,254
Czech Republic														
Denmark														
Estonia											646	646	646	646
Finland														
France	4,051	4,051	3,870	3,693	3,623	3,212	3,803	3,503	3,298	3,232	3,374	3,212	3,212	3,212
Greece						-169	-253	-253	-508	-84	-339	-508	-508	-508
Hungary										203	203	203	203	203
Iceland														
Ireland	361	361	309	309	294	374	416	467	423	379	362	294	294	294
Italy	2,808	2,808	7,280	6,614	7,347	7,672	7,866	7,815	9,645	8,634	8,374	2,808	2,808	2,808
Japan														
Latvia	134	134	134	85	92	114	116	104	92	92	93	85	85	85
Luxembourg														
Netherlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE			
New Zealand	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE			
Norway														
Portugal														
Slovakia	-814	-814	-814	-814	-814	-934	-934	-804	-547	-592	-669	-934	-934	-934
Spain	0	0	0	0	0	0	0	0	0	0	0			
Sweden	3,808	3,808	3,772	3,747	3,768	3,795	3,807	3,831	3,812	3,769	3,795	3,747	3,747	3,747
Switzerland	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	NE			
United Kingdom	13,287	13,287	13,482	13,263	11,906	10,817	10,422	10,729	10,514	10,753	10,346	10,346	10,346	10,346
United States	-291,900	-291,900	-291,200	-569,067	-296,600	-295,900	-295,400	-295,400	-253,800	-262,100	-261,800	-569,067	-569,067	-569,067
Minimum	-291,900	-291,900	-291,200	-569,067	-296,600	-295,900	-295,400	-295,400	-253,800	-262,100	-261,800			
Maximum	13,287	13,287	13,482	13,263	11,906	10,817	10,422	10,729	10,514	10,753	10,346			
Average	-24,451	-24,451	-23,965	-49,387	-24,706	-22,718	-22,666	-22,633	-18,835	-18,360	-16,755			

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	To base year
Australia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Austria										
Belgium										
Bulgaria										
Canada	7.1	-16.9	-9.4	-7.4	-9.1	10.3	99.9	-76.2	319.4	49.3
Czech Republic										
Denmark										
Estonia										
Finland										
France	-4.5	-4.6	-1.9	-11.3	18.4	-7.9	-5.9	-2.0	4.4	-16.7
Greece										
Hungary										
Iceland										
Ireland	-14.6	0.2	-4.9	27.1	11.3	12.3	-9.4	-10.5	-4.4	0.3
Italy	159.3	-9.1	11.1	4.4	2.5	-0.6	23.4	-10.5	-3.0	198.2
Japan										
Latvia	0.0	-36.6	8.2	23.9	1.8	-10.7	-11.7	0.0	1.8	-30.5
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia	0.0	0.0	0.0	14.6	0.0	-13.9	-32.0	8.3	13.0	-17.8
Spain										
Sweden	-0.9	-0.7	0.6	0.7	0.3	0.6	-0.5	-1.1	0.7	-0.4
Switzerland										
United Kingdom	1.5	-1.6	-10.2	-9.1	-3.7	3.0	-2.0	2.3	-3.8	-22.1
United States	-0.2	95.4	-47.9	-0.2	-0.2	0.0	-14.1	3.3	-0.1	-10.3

11.2 Cultivation of mineral soils

11.2.1 Trends of net CO_2 emission/removals

Party	Base year [1,2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Statistics by Party		
Australia	NA	NA									NA	Min	max	avg
Austria														
Belgium														
Bulgaria														
Canada														
Czech Republic														
Denmark														
Estonia											616	616	616	616
Finland											-2	-2	-2	-2
France														
Greece							-253	-253	-508	-84	-339	-508	-508	-508
Hungary														
Iceland														
Ireland											NE			
Italy										8,634	8,374	8,374	8,374	8,374
Latvia														
Luxembourg														
Netherlands														
New Zealand														
Norway														
Portugal														
Slovakia											-669	-669	-669	-669
Spain														
Sweden														
Switzerland											NE			
United Kingdom	14186.61	14,187	14,145	13,880	13,231	13,439	12,810	12,843	12,316	12,106	12,102	12,102	12,102	12,102
United States	-71900.00	-71,900	-71,900	-71,900	-100,100	-100,100	-100,100	-100,100	-100,100	-109,300	-109,300	-109,300	-109,300	-109,300
Minimum	-71900.0	-71,900	-71,900	-71,900	-100,100	-100,100	-100,100	-100,100	-100,100	-109,300	-109,300			
Maximum	14186.6	14,187	14,145	13,880	13,231	13,439	12,810	12,843	12,316	12,106	12,102			
Average	-28856.7	-28,857	-28,878	-29,010	-43,434	-43,331	-29,181	-29,170	-29,431	-22,161	-12,745			

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France										
Greece						0.0	100.7	-83.4	302.2	
Hungary										
Iceland										
Ireland										
Italy									-3.0	
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia										
Spain										
Sweden										
Switzerland										
United Kingdom	-0.3	-1.9	-4.7	1.6	-4.7	0.3	-4.1	-1.7	0.0	-14.7
United States	0.0	0.0	39.2	0.0	0.0	0.0	0.0	9.2	0.0	52.0

11.3 Cultivation of organic soils

11.3.1 Net CO_2 emission/removal trends, Gg CO_2/yr

Party	Base year [1,2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Statistics by Party		
												Min	max	avg
Australia	NA	NA									NA			
Austria														
Belgium														
Bulgaria														
Canada										-3,868		-3,868	-3,868	-3,868
Czech Republic														
Denmark														
Estonia											30			
Finland											352,099	352,099	352,099	352,099
France														
Greece						-169						-169	-169	-169
Hungary											189	189	189	189
Iceland														
Ireland											NE			
Italy														
Latvia											91	91	91	91
Luxembourg														
Netherlands														
New Zealand														
Norway														
Portugal														
Slovakia														
Spain														
Sweden	3638.25	3,638	3,638	3,638	3,638	3,638	3,638	3,638	3,638	3,638	3,638	3,638	3,638	3,638
Switzerland											NE			
United Kingdom														
United States	22000.00	22,000	22,000	22,000	22,400	22,400	22,400	22,400	22,400	22,400	22,400	22,000	22,000	22,000
Minimum	3638.3	3,638	3,638	3,638	3,638	-169	3,638	3,638	3,638	-3,868	30			
Maximum	22000.0	22,000	22,000	22,000	22,400	22,400	22,400	22,400	22,400	22,400	352,099			
Average	12819.1	12,819	12,819	12,819	13,019	8,623	13,019	13,019	13,019	7,390	63,075			

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France										
Greece					-100.0					
Hungary										
Iceland										
Ireland										
Italy										
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia										
Spain										
Sweden	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Switzerland										
United Kingdom										
United States	0.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	1.8

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

11.4 Liming of agricultural soils

11.4.1 Net CO_2 emission/removal trends

Gg CO2/yr

Party	Base year [1,2]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Statistics by Party		
												Min	max	avg
Australia	NA	NA									NA			
Austria														
Belgium														
Bulgaria														
Canada										-139		-139	-139	-139
Czech Republic														
Denmark														
Estonia														
Finland											119,483	119,483	119,483	119,483
France														
Greece														
Hungary											15	15	15	15
Iceland														
Ireland											362	362	362	362
Italy														
Latvia											2	2	2	2
Luxembourg														
Netherlands														
New Zealand														
Norway														
Portugal														
Slovakia											0			
Spain														
Sweden	169.79	170	134	109	130	156	169	193	174	131	156	109	109	109
Switzerland											NO			
United Kingdom	1430.45	1,430	1,772	1,810	1,130	1,270	1,529	1,515	1,346	1,027	859	859	859	859
United States	9500.00	9,500	10,200	9,000	7,700	8,400	8,900	8,900	8,700	9,600	9,900	7,700	7,700	7,700
Minimum	169.8	170	134	109	130	156	169	193	174	-139	0.4			
Maximum	9500.0	9,500	10,200	9,000	7,700	8,400	8,900	8,900	8,700	9,600	119,483			
Average	3700.1	3,700	4,035	3,639	2,987	3,275	3,533	3,536	3,407	2,655	16,347			

Percentage change from previous year

Party	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada										
Czech Republic										
Denmark										
Estonia										
Finland										
France										
Greece										
Hungary										
Iceland										
Ireland										
Italy										
Latvia										
Luxembourg										
Netherlands										
New Zealand										
Norway										
Portugal										
Slovakia										
Spain										
Sweden	-21.0	-19.0	19.3	20.6	8.1	14.0	-9.6	-24.9	19.6	-7.9
Switzerland										
United Kingdom	23.9	2.1	-37.5	12.3	20.4	-0.9	-11.1	-23.7	-16.3	-39.9
United States	7.4	-11.8	-14.4	9.1	6.0	0.0	-2.2	10.3	3.1	4.2

[1,2] Base year refers to 1990, except for the following Parties with economies in transition which, in accordance with decision 9/CP.2, use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).

12. CO_2 Area trends of emissions from mineral soils in mha (5.D)

Party	Category	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Estonia	High act.											0.40
	Low act.											0.53
	Sandy											0.28
	High act.	**0.28**	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.26
	Low act.	**1.06**	1.06	1.01	1.01	1.00	1.00	1.01	1.01	0.99	0.99	0.98
Finland	Sandy	**0.85**	0.85	0.82	0.81	0.80	0.81	0.81	0.81	0.80	0.80	0.79
Greece	High act.						0.02	0.03	0.03	0.06	0.01	0.04
Hungary	High act.											3.16
	Low act.											2.75
	Wetland											1.54
	Volcanic											0.02
	Sandy											0.94
Minimum		**0.28**	0.28	0.27	0.27	0.27	0.02	0.03	0.03	0.06	0.01	0.02
Maximum		**1.06**	1.06	1.01	1.01	1.00	1.00	1.01	1.01	0.99	0.99	3.16
Average		**0.73**	0.73	0.70	0.70	0.69	0.53	0.53	0.53	0.53	0.52	1.08

Percentage change from previous year

Party	Category	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Estonia	High act.										
	Low act.										
	Sandy										
	High act.	-4.0	-0.3	-1.2	0.5	0.3	0.4	-1.8	-0.4	-0.4	-89.10
	Low act.	-4.0	-0.3	-1.2	0.5	0.3	0.4	-1.8	-0.4	-0.4	-89.15
Finland	Sandy	-4.0	-0.3	-1.2	0.5	0.3	0.4	-1.8	-0.4	-0.4	-89.13
Greece	High act.					50.0	0.0	100.0	-83.3	300.0	
Hungary	High act.										
	Low act.										
	Wetland										
	Volcanic										
	Sandy										

13. CO_2 Emissions and removals from others (5.E)

Add as many rows as sources are reported per Party

13.1 Net emission/removal of greenhouse gases in gigagrams, trends**

Party	Specification[3]	gas	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	Prescribed burning and wildfire in forests	CH_4	58	58									53
	"	CO	1,706	1,706									1,569
	"	N_2O	1	1									1
	"	NOx	44	44									40
Belgium	Not specified		0										-3,360
Canada	Anthropogenic fires outside wood production forest	CO_2	4,872	4,872	4,710	6,358	7,191	2,053	11,407	2,106	1,115	8,346	5,351
	"	CH_4	9	9	9	12	13	4	21	4	2	15	10
	"	NO_2	1	1	1	1	1	0	2	0	0	1	1
	Other anthropogenic fires in the wood production forest	CH_4	11	11	18	10	23	73	83	22	7	43	31
	"	NO_2	1	1	1	1	2	6	7	2	1	3	2
	Prescribed burning	CH_4	47	47	60	46	42	16	12	13	13	13	17
	"	NO_2	2	2	2	2	2	1	0	1	1	1	1
United Kingdom	Changes in crop biomass	CO_2	-1,100	-1,100	-1,100	-1,100	-1,100	-1,100	-1,100	-1,100	-1,100	-1,100	-1,100
	Peat extraction	CO_2	792	792	803	792	781	889	950	869	815	704	821
	Lowland drainage	CO_2	1,650	1,650	1,613	1,577	1,540	1,503	1,467	1,430	1,393	1,357	1,320
	Upland drainage	CO_2	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467	1,467
United States	Land yard trimming	CO_2	-17,800	-17,800	-17,500	-17,100	-15,300	-13,600	-12,000	-10,000	-9,400	-8,800	-7,700

** Only parties reporting net emissions/removals under sector 5.E were included in this table.

Percentage change from previous year

Party	Specification[3]	gas	1991	1992	1993	1994	1995	1996	1997	1998	1999	To base year
Australia	Prescribed burning and wildfire in forests	CH_4										-8
	"	CO										-8
	"	N_2O										-8
	"	NOx										-8
Belgium	Not specified											
Canada	Anthropogenic fires outside wood production forest	CO_2	-3	35	13	-71	456	-82	-47	649	-36	10
	"	CH_4	-3	35	13	-71	456	-82	-47	649	-36	10
	"	NO_2	-3	35	13	-71	456	-82	-47	649	-36	10
	Other anthropogenic fires in the wood production forest	CH_4	70	-45	127	220	13	-74	-66	483	-28	184
	"	NO_2	70	-45	127	220	13	-74	-66	483	-28	184
	Prescribed burning	CH_4	29	-23	-10	-62	-24	9	0	0	26	-64
	"	NO_2	29	-23	-10	-62	-24	9	0	0	26	-64
United Kingdom	Changes in crop biomass	CO_2	0	0	0	0	0	0	0	0	0	0
	Peat extraction	CO_2	1	-1	-1	14	7	-9	-6	-14	17	4
	Lowland drainage	CO_2	-2	-2	-2	-2	-2	-3	-3	-3	-3	-20
	Upland drainage	CO_2	0	0	0	0	0	0	0	0	0	0
United States	Land yard trimming	CO_2	-2	-2	-11	-11	-12	-17	-6	-6	-13	-57
	"	N_2O										-8
	"	N_2O										-8

** Only Parties reporting net emissions/removals under sector 5.E were included in this table.

5. Waste

Waste - Solid waste disposal on land, waste-water handling and waste incineration (1999)

	6. Waste																								
	Activity data		6.A Solid waste disposal on land							6.B Waste-water handling												6.C Waste incineration			
			CH_4							CH_4									N_2O from human sewage			CO_2 from non-biogenic waste			
	Population (million)		Methods and EF used		Key source	Percentage of national total	Emissions per capita[c]	CH_4 IEF		Methods and EF used		Key source	Percentage of national total	Emissions per capita[c]	CH_4 IEF Domestic/ commercial		CH_4 IEF Industrial		Emissions per capita[c]	N_2O IEF		Methods and EF used		Key source[b]	percent of national total	IEF
	CRF	IEA[a]	Methods	EF				Managed	Unmanaged	Methods[h]	EF				Waste-water	Sludge	Waste-water	Sludge				Methods	EF			
						%	kg	t/t	t/t				%	kg	kg / kg DC				kg	kg N_2O -N/kg sewage N						kg/t
IPCC default EF[d]																				*0.01 (0.002-0.12)*					
Australia	19	19.0	T2	M	L/T	3.0/2.4	37	0.06		T2	D			3.48	NE	NE	NE	NE	NE	NE	T2	CS			
Austria	8	8.1	CS	CS	L/T	5.58/6.68	26	0.06		C	CS			1.78							C	CS			2904.0
Belgium		10.2					12							0.03					0.00						2916.0*
Bulgaria	8	8.2	D	D,CS	L	5.3	24	0.07		D	D,CS	L	1.00	4.49	0.063	0.0625	0.038	0.04	0.03	0.010	NE	NE			
Canada	30	30.5	T1	CS	L	3.1	34			CS	CS			0.62					0.10		CS	CS			
Czech Republic		10.3	T1, T3	CS		1.2	8	0.05		D	D, CS			2.85	0.098	0.024	0.011	0.02	0.06	25.003					3500.0
Denmark		5.3			L	2.0	10	0.04																	
Estonia		1.4			L	5.2	34					L	1.41	9.25	0.120		0.12								
Finland	5	5.2	D	D/CS	L	2.1	15	0.05		D	D/CS			0.31	0.006		0.001		0.05		NO	NO			
France	61	60.3	CS/ T2	CS/ T2	L	3.3	13	0.03		C	CS			0.22					0.34		C	CS/ PS			
Greece	11	10.5	T1	D	L	2.7	15	0.04	0.044	T1	D			0.74	0.250				NE	NE					
Hungary	10	10.1	CS	CS, D	L	2.5	10	0.03		D, CS	CS, D	L	1.29	5.29	0.250		0.25				CS	CS	L	0.69	
Iceland		0.3	CS	CS	L	1.4	8	0.01		D	CS			0.07											956.4
Ireland	4	3.7	D	CS, D	L	2.3	19	0.07		NA	NA			0.00							NA	NA			
Italy	58	57.6			L	1.7	7	0.02				L	0.50	2.40			0.25								855.0
Japan		126.7	M, CS	CS	L	0.6	3	0.37	NO	CS	CS			0.06	0.000	NE	NE	NE	NE	NE	CS	CS	L, T	1.8	2565.6
Latvia	2	2.4			L	11.0	24	0.00	0			L	1.14	2.48			0		0.10	0.010					
Luxembourg		0.4					6							0.50					0.05						
Netherlands	16	15.8			L	3.9	27	0.09						0.24					0.04		NO (IE)				
New Zealand	4	3.8	D/CS	D	L	3.2	31	0.03		D/CS	D/CS			1.79					0.13			NE			NE
Norway		4.5	M4	CS	L	7.0	42	0.12		-	-			0.09					0.75						
Portugal	10	10.0	D	D (CS)	L/T	7.69/4.9	29	0.01	0.047	D	D (CS)	L	0.62	2.24	0.103	0.0565	3E-04		0.15	0.020	MB				1117.8
Slovakia	5	5.4	T1	D, CS	L	1.9	9			T1	D; CS	L	1.61	7.43	0.253	0.3043	0.025	0.18	0.01		IE	IE			
Spain		39.4	T2	T2	L		18			D	D			1.40					0.00		C	C			
Sweden	NE	8.9	T2	D, CS	L	3.0	12	0.06						NE	NE	NE	NE	NE	NE						
Switzerland	7	7.1	CS	CS	L	2.4	9			CS	CS			0.22					0.01		CS	CS	L	2.40	530.4
United Kingdom	60	59.5	M	CS	L	3.2	12	9.05		M	CS			0.61					0.05	0.067	T2	CS			
United States	273	273.0	M	M	L	3.6	37	28.87		D	D			2.13	0.090				0.10	0.009	CS	CS	T	1.14	2806.3**

Notes

MB: mass balance (used by Portugal).

For Switzerland, CO_2 emissions from SWDL and N_2O emissions from waste incineration are also key sources, contributing about 0.25% and 0.44% respectively to national total emissions.

* This value of IEF is provided for incineration of corps. Austria provided two more IEFs in this category: IEF for incineration of waste oil and IEF for incineration of municipal solid waste.

** This value of IEF is provided for incineration of plastics. The United States of America provided four more IEFs for incineration of different types of waste in this category.

Waste - Solid waste disposal on land

Trends in CH_4 emissions per capita* 1990 to 1999
(kg CH_4 per capita and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	37.96	38.41	38.39	38.88	38.29	36.87	36.63	36.77	35.84	36.64
Austria	33.55	32.44	31.79	30.59	29.76	28.95	28.33	27.35	26.07	26.03
Belgium									12.95	12.36
Bulgaria	80.50	87.60	83.97	77.14	48.08	47.58	42.67	38.70	34.42	23.84
Canada	31.75	32.44	32.68	32.99	33.00	32.74	32.78	33.20	33.60	34.13
Czech Republic										7.93
Denmark	12.40	12.37	12.53	12.47	12.57	11.99	11.81	11.19	10.45	9.93
Estonia										33.82
Finland	34.76	32.09	29.30	25.53	22.15	21.46	19.46	17.65	15.90	14.94
France	15.04	15.93	16.78	17.37	17.92	18.57	18.29	15.08	14.69	12.99
Greece	11.40	11.62	11.92	12.30	12.72	13.13	13.53	13.82	14.31	14.88
Hungary		6.60	6.58	6.62	6.67	6.66	6.69	6.71	7.16	10.14
Iceland	7.10	7.12	6.67	7.10	7.57	8.03	8.63	8.64	7.37	7.70
Ireland	24.21	24.50	24.94	24.98	25.14	25.24	25.25	23.95	20.46	19.31
Italy	7.68	7.78	6.93	7.07	8.01	8.16	8.14	8.06	7.88	7.50
Japan	3.14	3.04	2.96	2.92	2.91	2.92	2.88	2.84	2.84	2.80
Latvia	7.27	8.50	8.86	9.27	9.76	10.16	10.48	10.97	21.67	23.90
Luxembourg										6.10
Netherlands	37.60	36.90	35.58	34.15	32.84	30.98	30.71	29.72	28.31	27.10
New Zealand	40.63	39.23	36.92	38.30	37.85	35.82	35.36	32.42	31.37	30.81
Norway	42.85	43.22	42.89	43.50	43.60	44.00	44.38	44.01	42.97	42.13
Portugal	26.78	27.16	27.52	27.81	28.15	28.26	28.58	28.52	28.68	29.12
Slovakia	9.52	9.52	9.47	9.43	9.40	9.55	11.16	9.48	8.50	8.62
Spain	10.61	11.31	11.81	12.82	13.76	14.20	15.58	16.65	17.61	18.45
Sweden	14.21	14.35	14.32	13.74	13.05	12.94	12.76	12.57	12.29	11.54
Switzerland	9.97	9.58	9.46	9.45	9.29	9.20	9.02	8.86	8.71	8.52
United Kingdom	19.41	18.68	17.77	16.88	16.18	15.56	14.83	14.00	13.07	12.03
United States	41.40	41.00	41.07	41.02	40.70	40.33	39.30	38.87	37.80	37.44

* Emissions per capita have been calculated using population data from the International Energy Agency.

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	1.2	-0.1	1.3	-1.5	-3.7	-0.7	0.4	-2.5	2.2	-3.5
Austria	-3.3	-2.0	-3.8	-2.7	-2.7	-2.1	-3.5	-4.7	-0.2	-22.4
Belgium									-4.6	
Bulgaria	8.8	-4.1	-8.1	-37.7	-1.0	-10.3	-9.3	-11.1	-30.7	-70.4
Canada	2.2	0.7	0.9	0.0	-0.8	0.1	1.3	1.2	1.6	7.5
Czech Republic										
Denmark	-0.2	1.3	-0.5	0.8	-4.6	-1.5	-5.2	-6.6	-5.0	-19.9
Estonia										
Finland	-7.7	-8.7	-12.9	-13.2	-3.1	-9.3	-9.3	-9.9	-6.0	-57.0
France	5.9	5.3	3.5	3.2	3.6	-1.5	-17.6	-2.6	-11.6	-13.6
Greece	1.9	2.6	3.2	3.4	3.2	3.0	2.1	3.5	4.0	30.5
Hungary		-0.3	0.6	0.8		0.5	0.3	6.7	41.6	
Iceland	0.3	-6.3	6.4	6.6	6.1	7.5	0.1	-14.7	4.5	8.5
Ireland	1.2	1.8	0.2	0.6	0.4	0.0	-5.1	-14.6	-5.6	-20.2
Italy	1.3	-11.0	2.0	13.4	1.9	-0.3	-0.9	-2.2	-4.9	-2.3
Japan	-3.2	-2.6	-1.4	-0.3	0.3	-1.4	-1.4	0.0	-1.4	-10.8
Latvia	16.9	4.3	4.6	5.4	4.0	3.2	4.7	97.5	10.3	228.9
Luxembourg										
Netherlands	-1.9	-3.6	-4.0	-3.8	-5.7	-0.9	-3.2	-4.7	-4.3	-27.9
New Zealand	-3.4	-5.9	3.8	-1.2	-5.4	-1.3	-8.3	-3.2	-1.8	-24.2
Norway	0.9	-0.8	1.4	0.2	0.9	0.9	-0.8	-2.4	-2.0	-1.7
Portugal	1.4	1.3	1.1	1.2	0.4	1.1	-0.2	0.6	1.5	8.7
Slovakia	0.0	-0.6	-0.4	-0.4	1.6	16.9	-15.1	-10.3	1.4	-9.5
Spain	6.6	4.4	8.6	7.3	3.2	9.7	6.9	5.8	4.8	73.9
Sweden	1.0	-0.2	-4.1	-5.0	-0.8	-1.4	-1.5	-2.2	-6.1	-18.8
Switzerland	-3.9	-1.3	0.0	-1.7	-0.9	-2.0	-1.8	-1.7	-2.1	-14.5
United Kingdom	-3.8	-4.9	-5.0	-4.1	-3.8	-4.7	-5.6	-6.6	-8.0	-38.0
United States	-1.0	0.2	-0.1	-0.8	-0.9	-2.6	-1.1	-2.8	-1.0	-9.6

Waste - Waste-water handling

Trends in CH_4 emissions per capita* 1990 to 1999
(kg CH_4 per capita and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	3.47	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48	3.48
Austria	1.78	1.77	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78
Belgium									0.03	0.03
Bulgaria	18.78	15.19	14.05	12.97	10.44	16.74	23.92	10.24	9.44	4.49
Canada	0.61	0.61	0.61	0.61	0.61	0.61	0.62	0.62	0.62	0.62
Czech Republic										2.85
Denmark										
Estonia										9.25
Finland	0.34	0.31	0.30	0.31	0.32	0.32	0.31	0.30	0.31	0.31
France	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.22
Greece	0.71	0.71	0.71	0.71	0.71	0.72	0.72	0.73	0.74	0.74
Hungary		18.29	18.22	18.23	18.23	18.22	18.17	18.28	5.87	5.29
Iceland	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.06	0.06
Ireland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Italy	1.98	1.99	2.01	2.01	2.09	2.14	2.35	2.22	2.24	2.40
Japan	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06
Latvia										2.48
Luxembourg	0.50									
Netherlands	0.42	0.42	0.42	0.41	0.33	0.10	0.04	0.08	0.24	0.24
New Zealand	1.83	1.77	1.78	1.84	1.84	1.80	1.80	1.80	1.78	1.79
Norway	0.09	0.09	0.09	0.09	0.09	0.09	0.07	0.09	0.09	0.09
Portugal	1.95	2.03	2.12	2.20	2.20	2.21	2.22	2.23	2.22	2.24
Slovakia	9.13	8.62	8.23	7.50	7.55	7.50	7.55	7.27	7.35	7.43
Spain	1.13	1.16	1.17	1.19	1.26	1.29	1.31	1.36	1.39	1.40
Sweden	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Switzerland	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.22	0.22	0.22
United Kingdom	0.58	0.54	0.60	0.59	0.62	0.59	0.60	0.61	0.63	0.61
United States	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.14	2.15	2.13

* Emissions per capita have been calculated using population data from the International Energy Agency.

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Austria	-0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belgium									0.0	
Bulgaria	-19.1	-7.5	-7.7	-19.5	60.3	42.9	-57.2	-7.8	-52.4	-76.1
Canada	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	1.6
Czech Republic										
Denmark										
Estonia										
Finland	-8.8	-3.2	3.3	3.2	0.0	-3.1	-3.2	3.3	0.0	-8.8
France	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	-4.3	0.0
Greece	0.0	0.0	0.0	0.0	1.4	0.0	1.4	1.4	0.0	4.2
Hungary		-0.4	0.1	0.0	-0.1	-0.3	0.6	-67.9	-9.9	-71.1
Iceland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0	0.0	200.0
Ireland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Italy	0.5	1.0	0.0	4.0	2.4	9.8	-5.5	0.9	7.1	21.2
Japan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	20.0
Latvia										
Luxembourg										
Netherlands	0.0	0.0	-2.4	-19.5	-69.7	-60.0	100.0	200.0	0.0	-42.9
New Zealand	-3.5	0.6	3.5	-0.2	-2.2	0.0	0.0	-0.8	0.4	-2.4
Norway	0.0	0.0	0.0	0.0	0.0	-22.2	28.6	0.0	0.0	0.0
Portugal	4.1	4.4	3.8	0.0	0.5	0.5	0.5	-0.4	0.9	14.9
Slovakia	-5.6	-4.5	-8.9	0.7	-0.7	0.7	-3.7	1.1	1.1	-18.6
Spain	2.7	0.9	1.7	5.9	2.4	1.6	3.8	2.2	0.7	23.9
Sweden										
Switzerland	-1.2	0.7	2.9	0.9	1.1	1.6	1.7	1.7	-0.4	9.3
United Kingdom	-6.9	11.1	-1.7	5.1	-4.8	1.7	1.7	3.3	-3.2	5.2
United States	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	-0.9	0.0

Waste - Waste-water handling

Trends in N_2O emissions per capita* 1990 to 1999
(kg N_2O per capita and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Australia	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Austria										
Belgium										0.0002
Bulgaria										0.029
Canada	0.100	0.100	0.100	0.100	0.100	0.100	0.101	0.101	0.109	0.101
Czech Republic										0.063
Denmark										
Estonia										
Finland	0.070	0.068	0.065	0.061	0.061	0.061	0.058	0.056	0.054	0.050
France	0.032	0.032	0.033	0.033	0.034	0.034	0.034	0.034	0.035	0.034
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Hungary	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iceland	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ireland	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Italy										
Japan	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Latvia	0.101	0.101	0.101	0.101	0.101	0.101	0.101	0.101	0.100	0.101
Luxembourg										0.005
Netherlands	0.033	0.033	0.033	0.033	0.033	0.032	0.036	0.036	0.034	0.032
New Zealand	0.131	0.125	0.124	0.129	0.127	0.126	0.127	0.125	0.124	0.126
Norway	0.069									0.074
Portugal	0.136	0.142	0.149	0.155	0.155	0.156	0.157	0.158	0.157	0.159
Slovakia										0.011
Spain									0.000	0.000
Sweden	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Switzerland	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010
United Kingdom	0.058	0.057	0.057	0.057	0.057	0.058	0.060	0.059	0.059	0.058
United States	0.092	0.093	0.093	0.095	0.096	0.101	0.095	0.096	0.097	0.097

* Emissions per capita have been calculated using population data from the International Energy Agency.

Percentage change from previous year

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Percentage change from 1990 to 1999
Australia										
Austria										
Belgium										
Bulgaria										
Canada	-0.11	-0.07	-0.38	0.31	-0.20	0.84	-0.11	8.35	-7.69	0.29
Czech Republic										
Denmark										
Estonia										
Finland	-3.24	-3.52	-6.62	-0.39	-0.39	-3.60	-3.52	-3.64	-7.41	-28.23
France	0.51	1.52	0.50	1.98	0.49	-0.97	2.44	0.48	-0.47	6.60
Greece										
Hungary										
Iceland										
Ireland										
Italy										
Japan										
Latvia	-0.08	0.10	-0.36	0.01	0.01	0.41	0.01	-0.71	0.78	0.16
Luxembourg										
Netherlands	0.00	0.00	0.00	0.00	-3.03	12.50	0.00	-5.56	-5.88	-3.03
New Zealand	-4.27	-1.13	4.33	-1.42	-1.41	0.80	-1.33	-0.79	1.56	-3.82
Norway										7.25
Portugal	4.41	4.93	4.03	0.00	0.65	0.64	0.64	-0.63	1.27	16.91
Slovakia										
Spain										
Sweden										
Switzerland	0.00	0.00	0.00	0.00	0.00	0.00	11.11	0.00	0.00	11.11
United Kingdom	-1.72	0.00	0.00	0.00	1.75	3.45	-1.67	0.00	-1.69	0.00
United States	1.09	0.00	2.15	1.05	5.21	-5.94	1.05	1.04	0.00	4.93

III. SECTION II

PRELIMINARY FINDINGS ON INDIVIDUAL NATIONAL GHG INVENTORIES

AUSTRALIA

General

Common reporting format (CRF) and national inventory report (NIR)

Australia provided inventory data for the years 1990 and 1999 using the CRF, which included all requested tables. In addition summary tables for the years 1991-1998 were provided in a separate file. The CRF was accompanied by an NIR that includes worksheets with activity data, emission factors and other parameters used for the calculation of emission estimates. The NIR contains methodology supplements to previously published workbooks for stationary combustion, fugitive fuel emissions, transport and non-CO_2 gases for savanna and agricultural residue burning. Indicators were used throughout all tables of the CRF.

Consistency of information between CRF and NIR

The data that were provided using the CRF in electronic format were reproduced in the NIR. No inconsistencies were found between the CRF data and activity data and emission estimates in the worksheets that were incorporated in the NIR.

Time series consistency

Emissions and activity data trends do not indicate any major deviations. However, where notable annual fluctuations were identified for specific sectors, they are indicated under the sector-by-sector comments below. In addition, the NIR summarized greenhouse gas macroindicators (per capita, per GDP, and per energy delivered) for the time series 1990-1999. Macroindicator trends generally follow trends in emissions or, in cases where they deviate, such as decreasing emissions per GDP, the NIR provides an explanation (i.e., economic activity grew at a greater rate than emissions over the time series 1990-1999).
Since changes in emission estimates as reported in the recalculation tables were relatively small for the years 1991 to 1998, for the purpose of this report, data from the 2000 submission for that period were used for analysis of trends, where needed (e.g. trends in IEF, activity data and other). In such cases, small inconsistencies in the trends could have occurred.

Comparison with previous submissions

Australia provided recalculated estimates (tables 8 (a)) and explanatory information for these recalculations (tables 8 (b)) for the years 1990 to 1998.
The effect of the recalculations (as reported in the CRF tables) was an increase of approximately 0.1 per cent in the total CO_2 equivalent emissions in the base year (both including and excluding land-use change and forestry). For 1998, the effect of the recalculations was 1.1% including LUCF and –0.4% (excluding LUCF). A large individual category decrease for “forest and grassland conversion” (-20%) and increase for “other” under LUCF (+1,394%) are due to moving regrowth from cleared land sink to the “forest and grassland conversion” category. This change has been noted in the CRF recalculation table (Table 8b) with explanatory text. In many parts of the NIR it is stated that the category of “forest and grassland conversion” is not included in the formal trend analysis due to changing methodologies and uncertainty in the estimates.

QA/QC and verification procedures

The NIR indicates that much of the inventory was compiled using data collected in national surveys conducted according to statistical principles. Where this is supplemented by data from other sources, checks on the accuracy of the information were conducted as far as practicable. These checks are comparable to IPCC Good Practice Guidance Tier 2 QA/QC checks.

During compilation of the inventory, checks for transcription errors and computational errors were conducted, including comparisons with previous year's inventories and additional data sets where these were available. Checks focused on source categories that contribute substantially to the annual total or the trend in emissions over time.

Key sources

Australia did not perform any quantitative key source classification. It is evident in the NIR that certain categories have been prioritized for such efforts as uncertainty analysis and QA/QC, but those categories do not appear to be identified through either a level or trend key source analysis. ***Australia explained that a key source analysis was conducted but the results were not presented in the NIR. Such an analysis will be provided in the 2002 submission.***

Uncertainty estimates

The NIR 2001 includes a more rigorous treatment of uncertainties in emission estimates for key sources (based on quantitative analysis for many of the key sources) than has previously been included. An indication of the quantified level of uncertainty for several sectors was provided in the NIR using Monte Carlo simulation analysis, as recommended in the IPCC Good Practice Guidance.

Sector-by-sector findings

ENERGY

Reference approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 0.5 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data

Energy data have been given on a gross calorific value basis. This means that the IEFs should be about 5 per cent lower for liquids and solids and about 10 per cent lower for gaseous fuels compared to other countries. After grossing up the IEA data, the Australian reference approach energy data are 1.8 per cent different from those reported to the IEA. Liquid fuels are higher by 6.1 per cent and gas by 4.8 per cent. Solid fuels are lower by 2.9 per cent. Specific differences include:

- Crude oil production and imports are higher in the CRF.
- NGL production is lower in the CRF.
- Natural gas consumption is higher in the CRF. This could be due to the calorific value that was used.

Australia explained that the data used to compile the energy sector inventory form the basis of the data provided to the IEA. It is difficult to check the data as Australia is unable to locate a table in Section I which provides the IEA statistics being discussed.

Key sources

Fuel combustion

GHG emissions from fuel combustion were based on fuel consumption data expressed in GCV. Hence the IEFs are about 5 per cent lower for solid and liquid fuels and about 9-10 per cent lower for gaseous fuels than they would have been if the data were based on NCV.

1.A.a.1.c. Manufacturing of solids fuels and other energy industries

- The value of the CO_2 IEF for solid fuels dropped by 11.7 per cent between 1990 (62.4 t/TJ) and 1999 (55.1 t/TJ)

Australia explained that solid fuel consumption in 1A1c is dominated by consumption of coal and coal by-products in coke ovens. The ratio of coal to coal by-products consumption changed from 1:1 in 1990 to 1:1.8 in 1999. Therefore the fall in the IEF is underpinned by a relative rise in the consumption of coal by-products (CO_2 EF = 37 Gg/PJ), at the expense of coal (CO_2 EF = 90 Gg/PJ).

1.A.2 *Manufacturing industries and construction - gaseous fuels*

- The value of the CO_2 IEF in 1999 (50.8 t/TJ) is the highest across Parties that use GCV as the basis for their energy data.

Australia commented that this is a reflection of the EF for natural gas. The EF is calculated annually based on detailed information on the composition of natural gas.

1.A.4 Other sectors - liquid fuels (commercial/institutional)

- The value of the CO_2 IEF in 1999 (61.6 t/TJ) is the lowest across the Parties that use GCV as the basis for their energy data.

Australia explained that LPG is the dominant fuel consumed in the commercial/ residential sector. LPG has a lower EF (59.4 Gg/PJ) than other liquid fuels such as ADO (69.7 Gg/PJ) and fuel oil (73.6 Gg/PJ). Other Parties may rely on greater use of fuel oil for heating within this sector.

Fugitive emissions

1.B.1.a Coal mining and handling

- The value of the CH_4 IEF for underground mines - post-mining activities in 1999 (0.38 kg/t) is lower compared to the lowest default value of the IPCC (0.6 kg/t).

Australia explained that the CH_4 IEF has been calculated based on total underground mine production, which includes Class A (gassy mines) and Class B (non-gassy mines). However the Australian methodology, based on two mine measurement studies, assumes that post-mining emissions are only associated with black coal mined in underground Class A mines. If the CH_4 IEF were calculated using post-mining activity from Class A mines only, then it would increase to 0.77.

- The value of the CH_4 IEF for surface mines increased by 8 per cent between 1990 (1.26 kg/t) and 1999 (1.36 kg/t)

Australia explained that the Australian methodology for calculating CH_4 for surface mines is based on a mine measurement study, which assigns different CH_4 EFs for coal mined in different States. Therefore changes in the production mix between States over time will alter the IEF.

- The value of the CH_4 IEF for the aggregated underground mines dropped by 25 per cent between 1990 (10.5 kg/t) and 1999 (7.8 kg/t).

Australia explained that the ratio of Class A mines (gassy) to Class B (non-gassy) declined from 60:40 in 1990 to ~50:50 in 1999. Therefore, the reduction in relative Class A mine production over time has resulted in a decline in CH_4 emissions per unit of underground mine production.

1.B.2.a.i,vi Oil

- CO_2 emissions from exploration were reported but activity data were reported as “NA”.

Australia explained that exploration is not readily quantifiable as an activity. Emissions are supplied direct from industry (Australian Petroleum Exploration and Production Industry)(APPEA)).

- The value of the CH_4 IEF for production dropped by 50 per cent between 1990 (426 kg/PJ) and 1999 (210 kg/PJ).

Australia explained that activity data are supplied by ABARE. Emission estimates are supplied direct from industry (APPEA).

- The value of the CO_2 IEF for refining/storage dropped by 50 per cent between 1990 (268,975 kg/PJ) and 1999 (138,250 kg/PJ).

Australia explained that CO_2 emissions from refining/storage are dominated by oil refinery flaring. However activity from oil refinery flaring forms only a small portion of the overall activity

data for refining/storage. Therefore the fall in oil refinery flaring activity since 1990 acts to strongly reduce the overall CH_4 IEF for refining/storage

- The value of the CH_4 IEF for refining/storage dropped by 20 per cent between 1990 (1,569 kg/PJ) and 1999 (1,236 kg/PJ).

Australia explained that the CH_4 IEF for refining/storage has fallen since 1990 due to a corresponding fall in the oil refinery flaring component, which is associated with a higher CH_4 emission intensity.

1.B.2.b.i, ii, iii Natural gas

- CO_2 emissions from production/processing and other leakage were reported as "NE".

Australia stated that no data were available – see CRF Table 9 s1

- The value of the CO_2 IEF for transmission of natural gas increased by 32 per cent between 1990 (406 kg/PJ) and 1999 (538 kg/PJ).

Australia explained that the Australian methodology scales gas transmission CO_2 emissions against pipeline transmission length. The pipeline length increased by 85 per cent from 1990 to 1999, but the activity data (PJ) only increased by 28 per cent. Therefore, an increase in the IEF is produced over time.

- CH_4 emissions from other leakage were reported as "NE".

Australia stated that no data were available – see CRF Table 9 s1

- The value of the CH_4 IEF for distribution in 1999 (355,414 kg/PJ) is outside the IPCC default EF range and decreased from a value of 477,099 kg/PJ in 1990.

Australia explained that emissions are based on estimates for unaccounted gas from state distribution systems. The ratio of emissions to unaccounted gas has been established by two Australian based studies. The decrease in the CH_4 IEF from 1990 to 1999 arises due to activity data decreasing 6 per cent during this period; however the unaccounted gas decreased by 35 per cent.

- The value of the CH_4 IEF for production/processing in 1999 (1,042 kg/PJ) is outside the IPCC default EF range and decreased from a value of 1,881 kg/PJ in 1990.

Australia commented that the activity data were supplied by ABARE and the emission data sourced direct from industry (APPEA).

- The value of the CH_4 IEF for transmission in 1999 (9,282 kg/PJ) is outside the IPCC default EF range and increased from a value of 6,416 kg/PJ in 1990.

Australia explained that, similar to CO_2 emissions (see above comment), the Australian methodology scales gas transmission CH_4 emissions against pipeline transmission length. The pipeline length increased by 85 per cent from 1990 to 1999, but the activity data (PJ) only increased by 28 per cent. Therefore, an increase in the IEF is produced over time.

1.B.2.c Flaring (.i, ii)

- Activity data and CO_2 emissions were reported as "NE".

Australia explained that values are reported as combined oil and gas (1B2c, flaring iii). In future the individual sources will be reported as IE.

Non-key sources

1.A.Fuel combustion - biomass

- The value of the CH_4 IEF in 1999 (377.8 kg/TJ) is the highest across the Parties that use GCV as the basis for their energy data.

Australia explained that biomass combustion is dominated by use of wood heaters within the residential sector. The combustion of wood and wood waste within the residential sector has a very high CH_4 EF of 1,228.4 Mg/PJ, and therefore distorts the CH_4 IEF for biomass across all sectors.

1.A.3.a Civil aviation (domestic)

The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (26 per cent).

Australia explained that jet kerosene used in military transport is reported under 1A5, other. Inclusion of these activity data brings total jet kerosene to 70.32 PJ, which is comparable with the IEA figure.

INDUSTRIAL PROCESSES

Key sources

2.C.3. Aluminium production – PFCs

- Actual C_2F_6 emissions decreased from 1990 (61.8 t) to 1997 (15.3 t), increased from 1997 to 1998 (19.07t) by 24.6%, and then decreased again from 1998 to 1999 by 29.3%. From 1990 to 1999 overall emissions decreased by 79%.
  Australia explained that a new pot line was brought into production in 1998. This increased the average emission factor across all smelters.

Non-key sources

2.A.1. Cement production – CO_2

- CO_2 IEF (0.518 t/t) is slightly higher compared to most Parties and a little higher than the IPCC Guidelines default value. If referring to clinker production, the value is within the range in the IPCC Good Practice Guidance (Table 3.1, numbers up to 0.526 t/t). Activity data are 21% lower than the United Nations data. Although the latter data refer to cement and the CRF data refer to clinker production, the reported discrepancy is high.
  Australia explained that the implied emission factor is derived from clinker production not cement production. Both mineral addition and cement extender use (fly ash and ground granulated blast furnace slag) have been increasing over the last 10 years. The threshold level of extender use is considered to be around 25%. The clinker production data are of high quality.

2.F Consumption of halocarbons and SF_6 - HFCs, PFCs

- The Party indicated that emissions were not calculated because “available data are unreliable”. It was explained that the requirement for emissions data for synthetic gases is relatively recent compared to the other major greenhouse gases and that mechanisms have not been put in place for the gathering of statistics on synthetic gases. However, priority has been placed on the development of a comprehensive data gathering arrangement for synthetic gases.
  Australia explained that research in this area is ongoing; industry cooperation is essential and remains the greatest impediment to improvements.

2.B.1. Ammonia production

- Emissions were reported as NE as data were not available.
  Australia explained that data are now available and emissions will be included in the 2002 submission.

SOLVENT AND OTHER PRODUCT USE

N_2O emissions from “other” were reported as NE as data were not available. For degreasing and dry cleaning, emissions were reported as not applicable.

AGRICULTURE

Australia did not provide emissions estimates for N_2O under 4.D.3, indirect emissions from agricultural soils (NE reported).
Australia explained that emissions from atmospheric deposition are included in the estimate of emissions from soil disturbance (reported under cultivation of histosols). Nitrogen leaching and run-off are NE. Australia further noted that atmospheric deposition would be reported as IE in the 2002 submission.

Key sources
4.A. Enteric fermentation - CH_4 emissions

- CH_4-IEF. IEFs for dairy and non-dairy cattle (107.2 and 74.5 kg CH_4/head/yr, respectively) were higher than the other Parties' values (the value for non-dairy cattle being the highest among reporting Parties) and also higher than the IPCC default values for Oceania (68 and 53 kg CH_4/head/yr, respectively).
  In its responses to review stages of the 2000 inventory submission, Australia explained the differences between the national derived emission factors and the IPCC default values.
- CH_4-IEF. IEFs for sheep and swine were among the lowest values compared to those of other reporting Parties and lower than the IPCC defaults (6.6 versus 8 for sheep and 1.1 versus 1.5 kg CH_4/hd/yr for swine).
  Australia explained that country-specific tier 2 methodologies are used to estimate the emissions from sheep and swine. The IPCC default emission factors, which, according to Australia, the majority of other Parties appear to be using, do not take into account the difference in emissions of animals of different ages and sizes.
- Trends in IEF. CH_4-IEF for dairy cattle increased by 4.4% from 1990 to 1999 (from 102.7 to 107.1 kg CH_4/head/yr).
  In its responses to review stages of the 2000 inventory submission, Australia explained this increase as a consequence of increased average milk production since 1990.
- Trends in activity data and emissions. Large annual changes in emissions and activity data for those livestock types that have relatively small activity data (buffaloes, camels and llamas, deer, goats, horses, mules and asses, ostriches/emus, other).
  In its responses to review stages of the 2000 inventory submission, Australia explained that those animal classes are minor sources of emissions and have not been a priority for effort on methodology and data improvement; thus activity data estimates for these livestock types are highly uncertain.
- Trend in activity data emissions. Sheep population size and CH_4 emissions decreased by 32% from 1990 to 1999.
  Australia explained that the reduction in sheep numbers was due largely to an economic downturn in the industry following removal of a wool-price support scheme.

4.D. Agricultural soils – direct N_2O emissions (4.D.1)

- N_2O -IEF. IEF for synthetic fertilizers equals IPCC default (the Party reported the use of country- specific emission factors for this category).
- N_2O -IEF. IEF for animal wastes was among the higher values among reporting Parties.
  Australia explained that the country-specific emissions factor was derived from a review of available literature looking at emissions from the application of manure.
- N_2O -IEF. IEF from cultivation of histosols was largely the lowest value among the reporting Parties and compared to the IPCC defaults (lower by a factor of 10).
  In its responses to review stages of the 2000 inventory submission, Australia explained that that this is due to the fact of reporting estimates for "soil disturbance" under this subcategory, a category that does not exist within the IPCC methodology.
- Trends in emissions. Direct N_2O emissions increased by 30% between 1990 and 1999.

Australia explained that this trend was due to increased application of synthetic fertilizers and animal wastes.

4.D. Agricultural soils – animal production N_2O emissions (4.D.2.)

- N_2O -IEF. IEF for pasture range and paddock was the lowest value among the reporting Parties (0.0043 kg N_2O-N/kg N).
  In its responses to review stages of the 2000 inventory submission, Australia explained this low IEF as being due to nationally derived emission factors.
- Activity data. Activity data for the year 1999 (N excretion for pasture range and paddock (kg N-yr)) reported in table 4.D are 2.6 per cent higher than the total N excretion for pasture range and paddock reported in table 4.B(b).
  Australia explained this as being due to accidentally having left out the nitrogen excreted in the pasture range and paddock for the 'other' livestock classes (goats, horses, deer etc) in table 4.B(b).

4.E. Prescribed burning of savannas – CH_4 and N_2O emissions

- Ecological zones. Areas reported for some ecological zones (territories for Australia) changed significantly from 1990 to 1999: -65% for NSW, -61% for Tas, 28% for WA, -45% for SA, -80% for Vic and +74% for NT.
  Australia explained that the area of land burnt is based on a ten-year average; limited pre-1990 data are available for some States. A high level of uncertainty is associated with the earlier estimates of area burnt. More recent statistics are based on satellite imagery.
- Emission trends. CH_4 and N_2O emissions increased by 38% from 1990 to 1999.
  An increase of 13 per cent between 1997 and 1998 was explained by Australia in its response to previous review stages, as being the consequence of fires during the 1997 El Nino event.
  Australia referred to its NIR, where these trends are discussed (i.e. due to increased rice production, application of fertilizers, savanna burning).

Non-key sources

4.B. Manure management – CH_4 and N_2O emissions (4.B(a) and 4.B(b))

- CH_4-IEF. IEFs for dairy and non-dairy cattle (8.0 and 0.03 kg CH_4/hd/yr) were among the lowest values among reporting Parties, and significantly lower than IPCC defaults for Oceania, even if cool conditions are taken into account (31 and 5 CH_4/hd/yr, respectively). For non-dairy cattle the IEF is lower by a factor of 100 compared to the defaults and those of other Parties.
  In its responses to review stages of the 2000 inventory submission, Australia explained that, for dairy cattle, differences are due to the lower MCF used, while for non-dairy cattle, this difference in IEF is mainly due to the fact that the Australian methodology assumes no CH_4 emissions from range-kept beef cattle.
- CH_4-IEF. IEF for sheep was 0, due to CH_4 emissions being reported as 0.
  The Party explained that the Australian methodology assumes no emissions from range-kept animals, and that, in response to a recent expert review, Australia would report these emissions as NE for the 2002 submission.
- N excretion rates. Rates for dairy cattle, sheep and swine differ significantly from IPCC defaults (Australia reported the use of default emission factors and country-specific methodology). For dairy cattle, the N excretion rate was almost the highest value among reporting Parties; while rates for swine and sheep were far below the default IPCC range.
  In its responses to review stages of the 2000 inventory submission, Australia explained these differences as being due to a mass balance approach methodology used for cattle and sheep, while for swine, excretion rates are based on national industry information. The assessment of the cause for the difference with values given in table 4-20 of the IPCC Guidelines was considered to be not possible according to the Party.
- Trends in CH_4-IEF. CH_4-IEF for dairy cattle increased by 6.4% from 1990 to 1999. CH_4-IEF for non-dairy cattle doubled from 1990 to 1999 (increase of 113.2%).

Australia explained, that, for dairy cattle, this trend is due to the amount of waste per animal having increased due to the higher intakes associated with the increase in milk production. For non-dairy cattle this trend is due to increased numbers of feedlot cattle. The IEF is calculated using the total non-dairy animal numbers. This includes range-kept animals for which no emissions of CH_4 are assumed.

- Trends in N-excretion rate. Increase of 7.4% from 1990 to 1999 for dairy cattle.
  Australia explained that, for dairy cattle, the amount of waste per animal has increased due to the higher intakes associated with the increase in milk production.
- Trend in emissions. Total N_2O emissions from manure management increased by 90% from 1990 to 1999, with some large annual changes (>10%) within that period.
  Australia explained this by the increase in feedlot cattle and poultry over this period.

4.C. Rice cultivation – CH_4 emissions

- CH_4-IEF. IEF was relatively low (22.5 g $CH_4/m^2/yr$) compared to the other Parties reporting CH_4 emissions from continuously flooded rice cultivation.
  Australia explained that the emission factor used is included in the IPCC Guidelines. This emission factor is similar to the IPCC default seasonally integrated value of 20.
- Trend in activity data and emissions. Harvested area and CH_4 emissions increased by 36% from 1990 to 1999.

4.F. Field burning of agricultural residues – CH_4 and N_2O emissions

- Trend in emissions. CH_4 emissions increased by 32% from 1990 to 1999 and N_2O emissions increased by 16.1% in the same period.
  Australia explained this by the increase in areas of crops and hence biomass burnt.

LAND-USE CHANGE AND FORESTRY

Overview

- Australia used country-specific methods and emission factors to estimate CO_2 emissions and removals under 5.A. (Changes in Forest and Other Woody Biomass Stocks) for temperate other forests, managed native forest and plantations, under 5.B. (Forest and Grassland Conversion), and under 5.D. (CO_2 emissions/removals from Soils) for pasture improvement and minimum tillage.
- Country-specific methods were also applied to estimate non-CO_2 gas emissions from 5.B. and 5.E.
- The activity data are included in Part B of NIR. A reference is provided at NIR (Australian Methodology for the Estimation of Greenhouse Gases and Sinks, Land Use Change and Forestry, Workbook from Carbon Dioxide from the Biosphere, Workbook 4.2. and the Supplements published with the 1996 and 1997 Inventories NGGIC 1998 and 1999).
- Net CO_2 emissions showed a change of 41.1% between the reference year and 1999.
- Large annual percentage changes were found: -37.9 for 1990/91 and +17.9% for 1997/98.
- Decrease in net emissions is due to decrease in gross emissions (-16.8% for the period 1990/99).
- Non-CO_2 gas emissions decreased significantly from 1990 to 1991 (-36% for CH_4 and –27.4% for N_2O) and increased significantly from 1997 to 1998 (14.9% for CH_4 and 10.5% for N_2O); the other gases (CO and NO_X) showed similar trends.
  Australia commented that these trends are largely driven by the changes in the Forest and Grassland Conversion emission estimate.

5.A. Changes in forest and other woody biomass stocks

- No activity data and emission factors were provided as Table 5.A. was not reported. However, Part B of NGGI-LUCF 2001 included a range from 0.35 to 8.65 t dm/ha for annual growth rate for aboveground biomass (the lowest for “medium sparse” and the highest for “broadleaf plantation”).

- Average annual growth rate of aboveground biomass (0.35 to 8.65 t dm/ha/yr) values were rather low compared to IPCC defaults for forest plantations in tropical and temperate conditions; the lowest and highest Australian values were the extreme values of the group of values reported by the Parties for temperate forest plantations.
  Australia commented that the lower values in the range relate to managed native forests, while the higher values of 7.10 and 8.65 t dm/ha/yr relate to plantation species.

5.B. Forest and grassland conversion

- CO_2 emissions in this category decreased by 31.1% from 1990 to 1999 (*The Party has explained that this drop in emissions was due to a significant drop in the currently available estimates of the rate of land clearing between 1990 and 1991).*
- Non-CO_2 gas emissions (CH_4 and N_2O) changed significantly from 1990 to 1991 (-47.2%), then remained unchanged from 1991 to 1994; other large annual changes were: +13.2% for 1995/96 and +22.1% for 1997/98.
  The Party explained that these trends are an artefact of the methodology and the available data. An average rate of clearing obtained from two satellite images from several years apart was used to estimate emissions from burning between 1991 and 1995.
- Country reports CO_2 emissions from 1990 to 1999 from forest/grassland conversion, but does not present the area converted annually. Percentage year-to-year changes do not vary much between 1992 and 1997 (between 1.7 and 4.5). More significant changes between 1990/1991 (-27.4) and 1997/1998 (+10.0).
  Australia commented that data on the area converted annually are provided in the LUCF appendix tables of the NIR, which are modified IPCC worksheets. Apparent trends may be an artefact of the methodology. The Party stated that emissions from this source category were excluded from the formal trends analysis in the NIR because of the high uncertainty in both the absolute and trends in emissions.

5.D. CO_2 emissions/removals from soils

- The same value (-4,223.5 GgCO2) was reported for each year of the time series. *(The Party explained that this estimate is highly uncertain and relies on limited data; data to modify this estimate are not available).*

WASTE

Key sources

6.A Solid waste disposal on land - CH_4

- DOC for managed waste disposal on land was not estimated (reported as NA). The country used the default IPCC value for MSW disposed to SWDS equal to 1.0.
  The Party confirmed that DOC degraded is not applicable to the Australian methodology.

AUSTRIA

General

Common reporting format (CRF) and national inventory report (NIR)

Austria provided inventory data for the years 1990 to 1999 using the CRF and included almost all requested tables. Indicators were appropriately used, even though Austria did not complete Table 9, which should give an indication as to why these keys were used. Table 7 (overview table) was not provided either.

A NIR was submitted that provides discussion on inventory results and the national system for the inventory compilation.

Consistency of information between CRF and NIR

There was no inconsistency identified in the data provided in the CRF tables and the NIR.

Time series consistency

Reported trends in the NIR are consistent with emission levels and reported changes in activity data over the time series for source sectors.

Comparison with previous submissions

Austria indicated in the NIR that emission data reported in the 2001 submission (for 1990 to 1999) were revised with updated data. Recalculation tables of the CRF were not provided. However, Sections 3.4-3.8 of the NIR do provide substantial data on the percentage changes and time series changes due to recalculations. Also, the estimated recalculation difference reported for the 1998 inventory year in the NIR compares well with an independent estimate prepared by the secretariat using the CRF data (-1.4% compared to –1.5%, respectively). The difference is due to fact that the NIR estimate does not include LUCF.

QA/QC and verification procedures

The NIR described a systematic QA/QC plan that is scheduled to be fully implemented by June 2001. As described it would be fully compatible with the IPCC Good Practice Guidance for QA/QC. At this point, however, there are no results reported for implementation of the plan, either in the NIR or in the CRF Table 7, Overview Table, which was not completed.

Key source analysis

Austria performed a key source analysis following the Tier 1 IPCC Good Practice Guidance for key source determination. With the exception of CH_4 from manure management, the results of Austria's key source determination was consistent with the independent key source analysis performed by the secretariat.

Uncertainty estimates

The NIR described a comprehensive, quantified uncertainty analysis performed on the Austrian inventory for the years 1990-1997. The analysis followed IPCC Good Practice Guidance, using key source determination to prioritize sources for uncertainty analysis. The results show overall uncertainty for the inventory for three gases (CO_2, CH_4, and N_2O) but do not show the uncertainty estimates for individual source categories or how they were combined for the total inventory uncertainty estimate. There is, however, a referenced report (Winiwater and Rypdal, 2001) for the study that produced the estimates.

<u>Sector-by-sector findings</u>

ENERGY

Reference approach

Comparison of the reference approach with the national approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 0.8 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with International data

Although the Austrian reference approach energy data are only 2.7 per cent different from those reported by the IEA, this masks many fairly large differences. The CRF is 2.9 per cent higher for liquid fuels and 5.8 per cent higher for solid fuels. Specific differences include:

- It is not clear what has been included in crude oil. Even if natural gas liquids have been included, this still does not explain all the difference.

Austria explained that in the CRF NGLs are included in crude oil

- Gasoline stock changes have opposite signs in the two data sets.

Austria commented that in order to explain the differences between the CRF and IEA data the detailed IEA statistics used by the review team are needed.

- It is not clear what has been included in jet kerosene exports. It seems that CRF international bunkers have been included in exports.

Austria confirmed this finding.

- Gas diesel imports in the CRF are 124,474 TJ and the IEA shows 108,030 TJ.

Austria commented that in order to explain the differences between the CRF and IEA data the detailed IEA statistics used by the review team are needed.

- It appears that bitumen and lubricants have been included with “other oil” in the CRF.

Austria confirmed this finding.

- It is not clear where the refinery feedstocks have been included.

Austria explained that in the CRF refinery feedstocks are included in the oil based products there are used for (gasoline, diesel, jet kerosene, gas oil, ...).

- Other bituminous coal seems to be reported as coking coal, but this still does not account for all of the difference.

Austria confirmed the finding that other bituminous coal is reported as coking coal.

- Lignite imports are 2176 TJ in the CRF and the IEA shows 143 TJ.
- It is not clear where the imports of BKB and patent fuel have been included.

Austria explained that imports of BKB and patent fuel are included in lignite.

Most of the above questions are also applicable to the 1990 data where the CRF data are 2.1 per cent higher than the IEA data. The growth rate of overall apparent consumption between 1990 and 1999 is very similar in the two data sets. The CRF rate is 9.9 per cent and the IEA 9.2 per cent.

Key sources

<u>*Fuel combustion*</u>

1.A.1 Energy industries - liquid fuels

- The value of the CO_2 IEF in 1999 (40.1t/TJ) is the lowest across the reporting Parties. This appears to be due to the non-inclusion of CO_2 emissions from petroleum refining in the total for liquid fuels for energy industries (reported as “IE”, but it is not clear where it was included). The value of this IEF varied considerably from 1994 to 1999 (from a value of 42.1t/TJ in 1994, it dropped to 30.2 t/TJ in 1996 and then increased to 40.1 t/TJ in 1999).

Austria confirmed this finding. It further explained that emissions from petroleum refining are included in category 1 B 2 a. Activity data of refinery fuel consumption are reported under category 1 A 1 b. This results in the low IEF for CO_2.

- The value of the CO_2 IEF in 1999 (79.23 t/TJ) for public electricity and heat production is the highest reported by Parties.

Austria confirmed this finding. It further explained that the CO_2 IEF is taken from the national study Energiebericht 1996 der Österreichischen Bundesregierung [L006/1996]. A chemical analysis performed by the main residual oil supplier OMV [Fax P032] even results in an EF of 81,25 t CO_2 / TJ for residual oil with a sulphur content of > 1 per cent.

1.A.1 Energy industries - solid fuels: Activity data and emissions from the subcategory Manufacture of solid fuels and other energy industries were not reported.
Austria confirmed this finding. It explained that for coke ovens, emissions are reported under Category 2 C 1 Iron and steel production. The coking coal needed for fuel transformation to coke-oven coke is not reported in the national approach. No other solid fuel consumption from this sector is given in the national energy balance.

1.A.1 Energy industries - gaseous fuels: Activity data and emissions from the petroleum refining subcategory were not reported.
Austria confirmed this finding. It further explained that no gaseous energy consumption was reported by the Association of the Austrian Petroleum Industry.

1.A.2 Manufacturing industries and construction - solid fuels: The value of the CO_2 IEF for 1999 (7.35 t/TJ) is the lowest among the reporting Parties. This appears to be due to the non- inclusion of CO_2 emissions from iron and steel in the total for solid fuels for manufacturing industries and construction (reported as "IE", but it is not clear where it was included).
Austria explained that CO_2 emissions of sector 1 A 2 a Iron and steel are reported under category 2 C 1 Iron and steel production.

1.A.4 Other sectors - gaseous fuels: Activity data and emissions from the agriculture/forestry/fisheries subcategory were not reported.
Austria explained that activity data and emissions from the stationary sources of category 1 A 4 c Agriculture/forestry/fisheries are included in the categories 1 A 4 a Commercial / institutional and 1 A 4 b Residential. Activity data and emissions from agricultural off-road traffic (SNAP 0806 and 0807) are reported in category 1 A 4 c-liquid fuels.

1.A.4 Other sectors - solid fuels: Activity data and emissions from the agriculture/forestry/fisheries subcategory were not reported.
The above explanation from Austria is also applicable for this finding.

<u>*Fugitive emissions*</u>
1.B.2.a vi Oil: CH_4 emissions from Other were reported as "NE"

Non-key sources
1.A Fuel combustion - biomass: The value of the CO_2 IEF for energy industries and for manufacturing industries and construction in 1999 (109.9 t/TJ) is the highest among the reporting Parties.
Austria confirmed this finding. It explained that the carbon content of biomass was selected regarding in accordance with the IPCC Guidelines 1996 rev, page 1.6: C-Content of Biomass = 29.9 kg /GJ, which implies an emission factor of 110 t CO_2 / TJ.

1.A.4 Other sectors – biomass: The value of the CH_4 IEF in 1999 (115.9 kg/TJ) decreased by 14 per cent compared to its 1990 level (134.4 kg/TJ).

Austria confirmed this finding. It explained that the decrease of the share of biomass burned in single ovens compared to the overall consumption in the commercial and residential sector implies a decrease of the IEF for CH_4 from 1990 on.

1.A.3.b Road transportation

- The value of the CH_4 IEF for gasoline in 1999 (17.3kg/TJ) decreased by 37 per cent compared to its 1990 level (27.2 kg/TJ).
- The value of the CH_4IEF for diesel oil in 1999 (1.4 kg/TJ) decreased by 60 per cent compared to its 1990 level (3.4 kg/TJ).

1.A Fuel combustion - *liquid fuels:* The value of the CH_4 IEF in 1999 (4.5 kg/TJ) is the lowest reported by Parties.
Austria explained that the detailed CH_4 emission factors used are shown in the NIR.
1 A 1 Energy industries - liquid fuels: IEF CH_4 is low because of missing CH_4 emissions from oil refinery.
1 A 2 Manufacturing industries: 0,2 kg/TJ for light fuel oil. 2,0 kg/TJ for heavy fuel oil.
IPCC default emission factor 2 kg CH_4 /TJ for oil.
1 A 3 Transport: The CH_4 IEF seems to be in the range of IPCC default factors.
1 A 4 Other sectors: CH_4: 0.2 - 0.25 kg /TJ for gas oil. IPCC default emission factor 10 kg /TJ for oil.

1.A.3.a Civil aviation – jet kerosene: The value of the CO_2 IEF in 1999 (63.1 t/TJ) is the lowest among the reporting Parties and is lower by 13 per cent compared to its 1998 level (72.7 t/TJ).
Austria explained that the activity data reported for 1999 for civil aviation are too high. This is caused by an error of conversion. Emission calculations are based on correct activity data, which are lower than the reported activity data. This implies the low IEF of 63.1 t CO_2 / TJ for the year 1999. Reported activity data: 1639 TJ. Correct activity data: 1424 TJ.

1.A.3.d Navigation (domestic): The activity data for gas/diesel oil reported in the CRF are higher compared to the data published by the IEA (75.6 per cent).

1.B.2.a.iv Fugitive fuel emissions – Oil: CH_4 emissions from refining/storage and other were reported as "NE".
Austria confirmed this finding. It explained that no CH_4 emissions were reported under this category due to lack of information and resources.

1.B.2.b i Fugitive fuel emissions - *natural gas:* CH_4 emissions from production/processing were reported as "NE".
Austria confirmed this finding. It further explained that no CH_4 emissions were reported under this category due to lack of information and resources.

Bunker fuels
International aviation: The activity data for jet kerosene reported in the CRF are higher compared to the data published by the IEA (15 per cent).
See explanation provided by Austria under 1.A.3.a Civil aviation – jet kerosene.
Reported activity data: 25 577 TJ. Correct activity data: 22 228 TJ.

INDUSTRIAL PROCESSES

Key sources

2.C.1. Iron and steel production

CO_2 IEF for crude steel of 1.78 t/t is high compared to other Parties and higher than IPCC default value of 1.6 t/t.

Austria explained that CO_2 emissions are reported directly from industry and thus represent plant-specific data. With the directly reported CO_2 emission and activity data from industry, an annual CO_2 emission rate of 1.78 t/t was calculated. The production data contain the amount of raw steel. Not included is the amount of steel produced in electric steel plants. The total amount of reported CO_2 emissions includes process-related CO_2 emissions from sinter plants, blast furnaces and basic oxygen steel plant. Included also are pyrogen emissions from the sinter plants, coke oven, rolling mills and energy supply. For the calculation of pyrogen CO_2 emissions from fuel burning, emission factors from the literature are used.

- A noticeable difference is reported between available production data and United Nations data (+9.6%) and an even larger difference is reported between the CRF pig iron production data and United Nations data (–17.7%).

2.A.1. Cement production

IEF for CO_2 (0.66t/t) is the highest among reporting Parties and higher than the IPCC default (0.499 for cement and 0.52 for clinker) and no specification was made as to whether data refer to cement or clinker production. This observation was previously made during the synthesis and assessment of the 2000 submissions. The Party explained that the IPCC emission factor considers only CO_2 emissions from the calcination process; the Austrian emission factor considers total CO_2 emissions from cement production (emissions from the use of fossil fuels (pyrogen CO_2) and emissions from calcination) and therefore the emission factor is higher than the IPCC default value.

Austria explained that in the CRF table (table 2(I).A-G, sectoral background data for industrial processes) the implied emission factor for CO_2 of 0.66 t/t refers to cement production (the specification being made in the table itself).

- CO_2 emissions dropped by 21.7% from 1994 to 1995, while implied emission factors varied -3% in the same period.

  It was explained that CO_2 emissions from 1994 to 1995 dropped by 21.7 % because cement production dropped by nearly 20 % in that period.

2.F Consumption of halocarbons and SF_6 – SF_6 and HFCs

- The potential emissions of HFC-134a are less than the actual emissions, making the ratio of potential to actual emissions less than 1.

  The potential to actual emissions ratio for many HFCs (other than HFC-134a) and for SF_6 were high compared to those of other Parties.

  Austria explained that HFC-23 and HFC-227ea are used for fire extinguishers. Consumption data were obtained directly from the producers of fire extinguishers. The annual potential emissions correspond to the annual consumption of halocarbons plus the potential emissions from the previous year. The actual emissions were calculated and are only about 1.5 % different from the annual potential emission.

  HFC-152a is used for XPS/PU plates. In Austria the consumption per head of XPS/PU plates is very high (the highest in Europe).

  As in the response to the 2000 S&A report, Austria provided the following explanation: HFC-125, HFC-143a and HFC-32 are not in use as individual gases but are parts of the blends HFC-404a, HFC-402a and HFC-407c. These blends are in use for stationary

refrigeration where actual emissions normally are very low but the potential emissions comply with the respective equipment installation stock.
SF_6 is used in noise insulation windows and for electrical transmission/distribution. In the electrical transmission and distribution sector, the potential emissions comply with the respective equipment installation stock. In Austria all switchgear/controlgear companies use SF_6 in their systems. Therefore potential emissions are very high.
The actual emissions from the noise insulation window sector are based on annual production data plus leakage (1 %) from the total stock of insulating glass filled with SF_6. The potential emissions are the theoretical levels of SF_6 in all SF_6 filled insulating glass, minus the amount of SF_6 which escapes by diffusion.

2.B.1 Ammonia production

For the previous submission the value of the CO_2 IEF (0.86 t/t) was low compared to most Parties and lower than the IPCC default values (1.5-1.6 t/t). The Party responded that in the 2001 submission for the inventory year 1999 the value of the IEF would be 0.96 t/t (based upon plant-specific data from the only ammonia producer in Austria). The IEF reported for all years during this reporting period is greater than 1; for 1999 the IEF is 1.772 t/t.
Austria explained that CO_2 emission factors represent an annual emission rate which is calculated from the annual ammonia activity and the annual emission from ammonia production. These are plant-specific data from the only ammonia producer in Austria. For 1999 the correct emission rate is 0.96 t/t. Probably because of a transcription error of the activity rate an invalid emission rate was declared. This will be corrected in the next submission.

- CO_2 emissions increased by 22.8% from 1994 to 1995, a substantial difference from other years.
Austria explained that CO_2 emissions from the ammonia production process are measured by the plant operator (half-yearly, quarterly or monthly measurements) and are extrapolated to an annual emission rate. Ammonia production data were obtained directly from the only ammonia producer in Austria and thus represent plant-specific data.

Non-key sources

2.B.2 Nitric acid production

- The value of the N_2O IEF (0.001 t/t) is low compared to most Parties and lower than the IPCC default values (0.002-0.009 t/t). The Party noted that the emission factor results from a study done in Austria based on direct inquiries of the only nitric acid producer in Austria which has regular measuring of N_2O emissions.

2.A.2 Lime production

- The value of the CO_2 IEF (0.37 t/t) is low compared to most Parties and lower than the IPCC default values (0.79-0.91 t/t). The Party has, however, previously noted that the emission factor of 0.37 t/t lime was taken from an Austrian study [BUWAL, 1995].
- The IEF is constant from 1990 to 1999 even though emissions change over the period.
- No change in activity data from 1995 to 1999; CO_2 emissions, however, varied.
Austria explained that activity data for 1994 and 1995 are reported from the Association of the Stone and Ceramic Industry. From 1996 to 1999 the activity data from 1995 were updated.

2.C.3 Aluminium production

- A confidentiality notation with regard to aluminium production was reported; no estimation (NE notation) of CO_2 and CF_4 - C_2F_6 emissions (notation NO) was reported. The United Nations data do report secondary production and primary production (1990-1992).
Austria explained that PFC emissions from primary aluminium production are only relevant for the years 1990 to 1992 (since primary aluminium production stopped in Austria in 1992). There was only one primary aluminium producer in Austria so the activity data were confidential. There are no process-specific GHG emissions from secondary aluminium

production. Pyrogen CO_2 emissions from secondary aluminium production have been accounted in the IPPC category 1 (energy).

SOLVENT AND OTHER PRODUCT USE

Non-key sources
Emissions from this sector are high compared to other reporting Parties.

3.A Paint application
- No information on methods and emission factors used was given in either the CRF or NIR.

3. B Degreasing and dry cleaning
- NMVOC emission estimates were not provided (reported as IE). No information was given as to where these emissions were included (table 9 was not reported).
- No activity data were reported

3.C Chemical products manufacture and processing
- No reported activity data

AGRICULTURE

Emissions estimates were not provided for: N_2O from 4.B Manure management (reported as NE); CH_4 from rice cultivation and savanna burning were reported as NO.
This was also noted in the S&A 2000. In its response, Austria had stated its intention to estimate N_2O from manure management as part of its implementation of the IPCC good practice guidance.
In the response to the present S&A, Austria indicated that estimates for manure management as part of the implementation of the IPCC good practice guidance would be available at the end of the year 2002 and provided in the 2003 inventory submission.

Austria further provided the following information: As part of the inventory improvement programme, work is in progress to use a more accurate methodology for the estimation of GHGs in the source categories: enteric fermentation, manure management and agricultural soils. A new study covering the requirements of the IPCC good practice guidance in emission estimation as well as taking into account the change in national agricultural structure (extensive-intensive farming) is expected to be finalized by the end of the year 2002. Recalculated data will be provided in the 2003 submission, which should also address N_2O emissions from manure management. Missing additional information in the background tables of the CRF will be provided accordingly.

Key sources
4.A Enteric fermentation – CH_4
- Activity data. There was a difference of 48% in swine population data compared to FAO data (2,570 thousand head in the CRF versus 3,810 in the FAO data); for the S&A 2000 report for the year 1998, this difference was 29%.
  This was also noted in the S&A 2000. In its response to the S&A 2000 Austria explained that national statistics give concise information, but that piglets below 20 kg are currently not counted; Austria stated its intention to also cover piglets below 20 kg as part of its implementation of the IPCC good practice guidance.
  Austria confirmed its previous response and noted that this difference is a result of piglets under 20 kg not being counted in the calculation of emission estimates.

- CH$_4$-IEF. For dairy and non-dairy cattle, the IEFs (92 and 38 kg CH$_4$/hd/yr,) were in the lower half of the range of IEF values and rather low compared to the IPCC default for Western Europe (92 versus 100 and 38 versus 48 kg CH$_4$/hd/yr, respectively).
  In its response to the S&A 2000 Austria stated its intention to use IPCC default emission factors as part of its implementation of the IPCC good practice guidance.
  Austria noted that part of the inventory improvement programme within the study mentioned above would be to develop country-specific emission factors and include references.
- CH$_4$-IEF. IEFs for sheep and swine equal IPCC defaults (the Party reported the use of country-specific emission factors for enteric fermentation).
  Austria clarified that table Summary 3 of the CRF should include notation key "D" next to notation key "CS" for emission factor used in the category enteric fermentation.

- Trends in activity data
  - Dairy cattle population decreased by 13% between 1994 and 1995; non-dairy cattle population increased by 7% between 1994 and 1995 and decreased by 6 % between 1996 and 1997. Some annual changes of up to 10% in swine population (10 % increase for 1992/93 and 10% decrease for 1998/99)
    Austria explained that a reason for the decreasing dairy cattle population and increasing non-dairy population could be the change in agricultural policy by supporting mother-cow holdings instead of milk production. Population data are published by Statistik Austria in the Statistical Yearbook and are based on a general counting of domestic livestock, carried out according to national regulations.
  - Horse population increased by 66% between 1990 and 1999, with annual changes of up to 18 % (1990/91). Goat population increased by 56% between 1990 and 1999, with annual changes of up to 20.1% (1992/93).

4.D Agricultural soils – N_2O and CH_4

- N$_2$O. No disaggregated reporting according to subcategories; consequently no estimates for 4.D.1 soil emissions and 4.D.2 indirect emissions from soils are available; an aggregated estimate is reported in sectoral table 4s2 of the CRF. No activity data were reported in Table 4.D (reported as NE), so no IEFs were calculated.
  In its response to the S&A 2000 Austria explained that this is due to the national method used, and stated its intention to improve reporting of this source category as part of its implementation of the IPCC good practice guidance.
- CH$_4$. No disaggregated reporting according to subcategories.
  Austria explained that the national method uses categories different from those of the Revised 1996 IPCC Guidelines. Activity data are collected on an area basis (according to CORINAIR 97 Snap Level 3) and are multiplied with a corresponding emission factor. Aggregate emissions are reported. Austria further noted that disaggregated reporting is foreseen in the 2003 submission.

4.B Manure management – CH_4

- CH$_4$-IEF. IEFs for cattle (dairy and non-dairy) were among the lowest compared to those of other reporting Parties, and low compared to IPCC defaults for cool-Western Europe (8.7 versus 14 kg CH$_4$/hd/yr, and 4.3 versus 6 kg CH$_4$/hd/yr).
  In its response to the S&A 2000 Austria stated its intention to use IPCC default emission factors as part of its implementation of the IPCC good practice guidance.
  Austria noted that part of the inventory improvement programme within the above-mentioned new study would be to develop country-specific emission factors, including their references.

Non-key sources

4.F Field burning of agricultural residues – CH_4 and N_2O

- N_2O-IEF. The IEF for 4.F.1 Cereals-wheat (0,119 kg N_2O/t dm) was the highest value among seven reporting Parties.
- Activity data. Except for "biomass burned", no numerical information on activity data was reported (all data for cereals were included under wheat).
- Trends in emissions. A constant value was reported for 1990 to 1999 for both CH_4 and N_2O emissions.

Austria explained that, in Austria, straw burning on open fields is legally restricted and only occasionally permitted on a small scale. The contribution of emissions from the category field burning of agricultural residues to the total emissions is very low.

Austria further explained that the calculation of GHG emissions is based on a simple methodology: the amount of straw is multiplied by a corresponding emission factor (the amount of straw and emission factors being expert judgments).

LAND-USE CHANGE AND FORESTRY

Overview

- Austria reported in Table 5 CO_2 emissions/removals under 5.A (Changes in Forest and Other Woody Biomass Stocks), following the IPCC default method (no tier stated) and country-specific emission factors.
- Non-CO_2 gas emissions were not reported.
- Only sectoral background Table 5.A was reported; sectoral background Tables 5.B, 5.C and 5.D were filled in with indicators.

5.A. Changes in forest and other woody biomass stocks

- Gross emissions are not reported in Table 5; gross removals are taken as net removals in Table 5, although both emissions and removals are specified in Table 5A.
- It was not reported whether the estimates in this category are gross or net values.
  The Party has stated that the 2002 submission will be improved and will be much closer to the IPCC methodology.
- CO_2 emissions from tropical and boreal forests, as well as from grassland/tundra, were stated as "IE" in CRF-Table 5, but reported differently in Table 5.A. (NO for tropical and boreal forests). No information was provided in the documentation boxes.
  Austria explained that the reporting of the net CO_2 removal figures in the row "CO_2 removals" of Table 5 and the missing figures for the row "CO_2 emissions" in Table 5 (categories "total land-use change and forestry", "changes in forest and other woody biomass stocks" and "temperate forests") are shortcomings which arose during transfer of the data from Table 5A. In addition, "IE" in Table 5 for the categories "tropical forests", "boreal forests", "grassland/tundra" should be "0" or "NO", while "IE" in the category "harvested wood" should be "NE". The related comments of the reviewers are right - Austria will try to avoid such shortcomings in the submissions of the next years.
- CO_2 removals decreased by 17.2% from 1990 to 1999, with high annual changes: +46.5% for 1990/91, -35.9% for 1991/92, -12.5% for 1993/94, -25.8% for 1995/96, and +41.7% for 1996/97.
- Average annual growth rates for aboveground biomass in temperate evergreen commercial forests were provided for all years from 1990 to 1999 and ranged from 4.9 to 6.0 t dm/ha, with a mean value of 5.07 t dm/ha. All values, including the one reported for 1999 (4.91 dm/ha), are well above the mean of the values reported by other Parties for the same forest category (3.86 t dm/ha).
  Austria explained that the Austrian method of calculating figures from 5A allows exact estimates for individual years. The figures for annual growth and for annual harvest differ

year by year for several reasons (e.g. weather conditions, timber market and windthrows). These reasons explain the high annual changes in the CO_2 net removals by the forests.

- Average annual growth rates for aboveground biomass in temperate deciduous commercial forests were provided for all years from 1990 to 1999 and ranged from 5.2 to 6.2 t dm/ha, with a mean value of 5.31 t dm/ha. All values, including the one reported for 1999 (5.15 t dm/ha), are well above the mean of the values reported by other Parties for the same forest category (3.59 t dm/ha).
- Average annual growth rates of aboveground biomass reported for 1990 and 1999 differ for commercial evergreen and commercial deciduous (temperate forests), by 17.5 and 17.2% respectively.
  Austria explained that the annual growth rates for temperate deciduous and temperate evergreen forests include above- and below-ground biomass and not only above-ground biomass as stated in the assessment report. This difference might be one reason for higher growth rates in Austria compared to some other countries. Nevertheless, the Austrian figures for the growth rates fit well those of countries with similar ecological conditions.

WASTE

Key sources

6.A Solid waste disposal on land - CH_4

- No estimation is provided for degradable organic carbon (DOC) and CH_4 recovery.
- CH_4 emissions per capita were reported as gradually decreasing from 1990 to 1999, so that in 1999 they were about 22% less than in the base year.

On the first bullet, Austria confirmed the comments, and provided the following values and reference for the data: DOC= 200 kg C/t waste (Hackl, Mauschitz 1999); CH_4 collecting factor year 1990 15% (landfills with gas collecting system), year 1996 20% (landfills with gas collecting system).

On the second bullet, the Party noted that this decline happened because the total amount of deposited waste has been reduced due to increased use of other waste management practices, e.g. incineration, mechanical-biological waste treatment.

Non-key sources

6.B Wastewater handling.

- N_2O emission estimate from human sewage was not reported. Austria indicated ethat it would provide this information in its 2002 submission
- Austria used the number of inhabitants as activity data for wastewater handling but does not provide per capita wastewater generation rate

In its comments, Austria noted that the per capita wastewater generation rate was not provided because the methodology used split wastewater generation into three technologies (mechanical wastewater treatment, biological wastewater treatment and installations for further treatment). Detailed information on the factors used is included in the NIR (table 77, see page 122, 123)

6.C. Waste incineration

- Emissions from incinerated wastewater sludge from domestic and industrial sources were reported elsewhere (IE used in report). Table 9s1 was not completed to assist cross checking.
  Austria commented that emissions from wastewater incineration are included under the energy sector. Table 9s1 will be completed in the future.
- CH_4 and N_2O emissions from "open burning of agricultural wastes" were reported under waste incineration instead of the agriculture sector as requested in IPCC Guidelines. This was the situation in the 2000 submission. Austria indicated that it would report this in the future under the appropriate sector.

6.D Other waste

- No activity data were provided for sludge spreading and compost production in CRF and NIR, though emissions are recorded in summary tables. It is appropriate to report these emissions under wastewater handling.
  Austria explained that activity data for sludge spreading and compost production are reported in the NIR on page 127. The Party indicated its intention to report those activity data in the future under wastewater handling (sludge spreading) and waste disposal on land (compost production).
- Emission factors used were not provided.
  Austria indicated that emission factors for compost production are included on page 127 of the NIR and the methodology to calculate emissions for sludge spreading is described on pages 126 and 127 of the NIR. Since emission factors were not explicitly used, and therefore were not reported. The Party promised that more on emission factors would be provided in the NIR in the next submission.

BELGIUM

General

Common reporting format (CRF) and national inventory report (NIR)
Belgium provided partial inventory data for 1998 and 1999 using the CRF. The CRFs only included sectoral reports, as well as Summary 1.A, Summary 1.B and Summary 2 of the CRF. HFC, PFC and SF_6 emission estimates were not included in the CRFs, but were reported in separate data files. A NIR was not submitted.

Consistency of information between the CRF and the NIR
Not applicable, since neither a NIR nor any other additional information was provided.

Time series consistency
Analysis of time series is not possible since data other than for 1998 and 1999 were not reported. Trend tables of the CRF (table 10) were not provided.
Belgium explained that official time series of GHG emissions in Belgium for 1990-97 are still those reported in the 1999 submission; recalculation of these data is currently in progress.

Comparison with previous submissions
The submission does not provide any information on recalculations. However, in comparing the estimates for the inventory year 1998 contained in the 2000 CRF and the 2001 CRF submissions, there are differences. For example, when comparing Summary Table 1.A between the two submissions, there is an increase in CO_2 emissions from 121,974 Gg in the 2000 submission to 130,762 Gg in the 2001 submission. Noticeable differences are also detected for the other gases as well.
Belgium explained that data for the inventory year 1998 contained in the 2000 CRF submission were provisional estimates; 1998 emission data were updated for the 2001 CRF submission. The substantial increase of the CO_2 emissions in the 2001 submission results mainly from the figures in the category "other" of the industrial sector; an industrial process was included in this category which was not considered before (which justifies a recalculation of the complete time series, back to 1990, which will be published in the next CRF submissions by Belgium).

When comparing the Summary 2 Table for inventory year 1998 from the CRF submission in 2000 to the CRF submission in 2001, a 94.5% increase in the 2001 submission is detected in the total national emissions. Closer analysis of the Summary 2 Tables shows that the 1998 emissions for SF_6 from "consumption of halocarbons" are reported to have increased from 206.29 Gg of CO_2 eq in the 2000 submission to 2,485,600 Gg CO_2 eq in the 2001 submission (probably due to a reporting/calculation error).
Belgium explained that data for SF_6 and other F-gases reported in the CRF submission in 2001 are not valid; these data were reported in separate data files. Hence, the increase appearing in the Summary 2 Table is due to a reporting error and should be disregarded.

Key sources
Belgium did not perform any key source analysis.

QA/QC and verification procedures
No information was available on whether the inventory data was subject to any self-verification or independent review procedures.

Uncertainty estimates
Belgium did not provide any information on uncertainty estimates.

Sector-by-sector findings
Analysis of implied emission factors (IEF), activity data and other parameters was not possible due to the lack of reporting sectoral background data tables. Analysis of emission trends was not possible either, nor could information on methods and emission factors used be analysed (table Summary 3 was not provided) Consistency checks of activity data and other parameters could not be performed either. In addition, key sources could not be identified at the same level of disaggregation as was done for other countries, and have only been identified at the level of category disaggregation as provided in table Summary 1.A of the CRF.
For these reasons, the scope for analysis on a sector-by-sector basis and comparisons with data from other Parties is very limited.

ENERGY

Reference approach
The reference approach was not provided.

Comparison with international data
No activity data were reported in the CRF.

INDUSTRIAL PROCESSES

2.A.1. Cement production – CO_2
No activity data were reported.

2.F Consumption of halocarbons and SF_6 - HFCs, PFCs, (table 2(II)s2
There is a huge difference in emissions between the 2000 and 2001 submissions. Total aggregated GHG from halocarbon emissions in Summary 2 increase 3,400 times, the main underlying factor being an increase in the estimated actual emissions of SF_6 of 10,000 times (perhaps due to reporting errors). A specific additional table showing all the calculations performed for F-gases is attached to the CRF submission but no explanation for this major revision is available and 1998 and 1999 data appear to be internally consistent. Potential and actual emission estimates have been reported since 1995 and the ratio of potential to actual emissions appears reasonable, with the exception of HFC-152a (0.18).
Belgium explained that data for SF_6 and other F-gases reported in the CRF submission in 2001 are not valid; these data were reported in separate data files. Hence, the increase appearing in the Summary 2 Table is due to a reporting error and should be disregarded.

2.G. Other
CO_2 emissions from this source represent about 4.3% of total CO_2 emissions in 1999 and no details or explanations are provided.

AGRICULTURE

No information was provided for the following source categories: 4.C Rice cultivation, 4.E Prescribed burning of savannas and 4.F Field burning of agricultural residues. For CH_4 and N_2O under 4.B Manure management and 4.D Agricultural soils, no disaggregated estimates according to subcategories were provided.

LAND-USE CHANGE AND FORESTRY

Overview

- Belgium reported in Table 5 emissions and removals under 5.A (Changes in Forest and Other Woody Biomass Stocks) and 5.E (Others).
- Sectoral Tables 5A – 5D were not reported.
- Total emissions of non-CO_2 gases reported for CH_4 and N_2O; the values reported for category 5.A were 5 Gg and 0.8 Gg respectively and for category 5.E 0.1 Gg and 0.05 Gg respectively.

5.A. Changes in forest and other woody biomass stocks

- Gross emissions are provided only for years 1998 and 1999. Gross removals only for 1998 and 1999.
- Only temperate forests were reported in the removals column.
- Net emissions are reported from harvested wood products.
- Values reported for CO_2 emissions and removals are the same for the years 1998 and 1999.

5.E. Other

- A large removal was reported for 1999 (-3,359.50 Gg CO_2), but placed in the column of emissions as a negative number. This value was not taken into account for final accounting.
- There is no information on the source/sink category considered.

WASTE

Due to a lack of data submitted, only very limited analysis of the data is possible. See comments above in “sector-by-sector findings”.

BULGARIA

General

Common reporting format (CRF) and national inventory report (NIR)

Bulgaria provided inventory data for the year 1999 using the CRF and included all requested tables. However, for SF_6 no data on emission trends were provided, while for HFCs and PFCs emissions trends were given for 1998-1999 only. Information on recalculations was given for 1998. An NIR was provided, containing information on methodologies and activity data, values of emission factors, and information on the application of the IPCC good practice guidance (e.g. on methods applied according to decision tree, uncertainty assessment and key source identification).

Consistency of information between CRF and NIR

Some inconsistencies were found between the CRF and NIR data as shown in the table below:

Differences in data contained in NIR-Table 2.1. and the CRF for 1999-Table 10s and Summary 1As1

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Difference for CO_2, Gg	-6,977.7	1,142.3	977.2	1,854.5	1,397.7	1,211.8	777.2	-6,534.0	474.7	-0.6	-0.4
%	**-6.7**	**1.4**	**1.5**	**3.1**	**2.3**	**2.0**	**1.2**	**-9.8**	**0.8**	**0.0**	**0.0**
Difference for CH_4, Gg	79.2	10.4	4.7	3.0	-4.4	8.0	13.3	24.2	188.9	0.0	0.0
%	**5.9**	**0.7**	**0.3**	**0.2**	**-0.4**	**1.0**	**1.5**	**2.9**	**26.8**	**0.0**	**0.0**
Difference for N_2O, Gg	-50.6	-47.7	-45.2	-40.1	-36.3	-34.7	-34.6	-36.6	-31.4	0.0	0.0
%	**-62.1**	**-61.7**	**-66.1**	**-67.7**	**-67.5**	**-66.2**	**-62.7**	**-64.1**	**-59.7**	**0.0**	**0.1**

Time series consistency

The CRF contained detailed inventory data for 1999 only, which limited a comprehensive analysis of the time series. Based on the information provided in the trend table of the CRF (table 10), some large changes (more than 10 per cent) and variations in emission estimates from year to year could be noted, for the following sources:

- CO_2 emissions from 1. Energy,
- CO_2 emissions from 2. Industrial processes,
- emissions from international bunkers,
- CH_4 emissions from 1. Energy,
- CH_4 emissions from 1.A.2.c. Chemicals and 1.A.2.f. Other,
- CH_4 emissions from 4. Agriculture,
- CH_4 emission from 6. Waste, and
- N_2O emissions from 1.A.2.c. Chemicals and 4.B(b)manure management.

Comparison with previous submissions

Bulgaria provided recalculated estimates (tables 8(a)) and explanatory information (table 8 (b)) for 1998. The effect of recalculations for 1998 (as reported in the CRF tables) was a reduction of approximately 3.5 per cent in the total CO_2 equivalent emissions excluding land-use change and forestry (LUCF), and a reduction of 3.8 per cent if LUCF is taken into account. These changes were due to recalculations of CO_2, CH_4 and N_2O estimates in the energy sector with the major changes having occurred in the manufacturing industries and construction category.

QA/QC and verification procedures

Bulgaria included information on some self-verification procedures, such as double checking of activity data, in its NIR. Some attempts to use QA/QC methods recommended in IPCC Good Practice Guidance were made. Quality indicators are provided in Table 7 Overview of the CRF.

Key sources
Bulgaria includes in its NIR an identification of key sources for 1999 using the level and the trend assessment. It differs from the identification of key sources performed by the UNFCCC secretariat in two ways: (1) Bulgaria is using a more aggregate definition of sources and (2) the contribution of individual sources to total emissions.

Uncertainty estimates
Bulgaria provided data on uncertainty estimates for a few fuel types in the energy sector (lignite and brown coal) using the IPCC Tier 1 method as examples of applying IPCC good practice guidance for estimating uncertainties.

Sector-by-sector findings
The analysis of trends in IEFs, activity data and emissions at category levels that are more detailed than those in the trend table was hampered due to lack of data for the years 1990 to 1998. Sectoral background data tables were only reported for 1999.

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 0.14 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach.

Comparison with international data
The Bulgarian reference approach energy data correspond very closely to the data reported to the IEA (total differs by 0.6%). Specific differences include:
- The CRF reference approach does not show any exports of naphtha. In total, this represents about 2430 TJ. There are differences in coal production (CRF is 2926 TJ higher) and imports (CRF is 7636 TJ lower).

Key sources
Fuel combustion
1.A.1 Energy industries - solid fuels
- The value of the CO_2 IEF in 1999 (78.4t/TJ) is the lowest across the reporting Parties.
- The value of the CO_2 IEF for public electricity and heat production in 1999 (108.6 t/TJ) is the second highest across the reporting Parties.
- The value of the CO_2 IEF for manufacture of solid fuels and other energy industries in 1999 (4.9 t/TJ) is the lowest across the reporting Parties.

1.A.1 Energy industries - liquid fuels
- The value of the CO_2 IEF in 1999 (5.5 t/TJ) is the lowest across the reporting Parties.
- The value of the CO_2 IEF for petroleum refining in 1999 (2.1 t/TJ) is the lowest across the reporting Parties.

1.*A.3.b Road transportation (CO_2 and N_2O):* Activity data for gasoline were not reported.

1.A.4.c Other sectors - solid fuels - agriculture: The value of the CO_2 IEF in 1999 (100.4 t/TJ) is the highest across the reporting Parties.

Fugitive emissions
1.B.2.a v,vi Oil: Activity data and emissions from distribution of oil products and other were not reported.
1.B.2.b ii,iii Natural gas: Activity data and emissions from other leakage were not reported.
1.B.2.c,i,iii Venting: Activity data from combined were reported as "NE".
Flaring: Activity data from flaring were reported as "NE".
1.B.1.a Coal mining and handling: The activity data for coal reported in the CRF are lower compared to the data published by the IEA (367 per cent).

Non-key sources
1.A.3.e Other transportation - liquid fuels: The value of the CO_2 IEF in 1999 (76.1 t/TJ) is the highest across reporting Parties.
1*.A.1Energy industries - liquid fuels*: The value of the N_2O IEF in 1999 (0.387kg/TJ) is one of the lowest across the reporting Parties.
1.A.3.c Railways – liquid fuels: The value of the CO_2 IEF in 1999 (76.14 t/TJ) is the highest across the reporting Parties.
1.A.1 Energy industries - solid fuels - public electricity and heat production: The value of the N_2O IEF in 1999 (34.0 kg/TJ) is the highest across the reporting Parties.

Bunker fuels
1.A.3.a International aviation
- The activity data for jet kerosene reported in the CRF are higher than the data published by the IEA (33 per cent).

INDUSTRIAL PROCESSES

Key sources
2.C.1 Iron and steel production – CO_2
- CO_2 estimates were only reported for steel and not pig iron. The resulting IEF for steel (0.821 t/t) is low in comparison to the IPCC default value of 1.6 t/t for the iron and steel category.

2.A.1. Cement production – CO_2
- The overall emissions from mineral products in 1999 are 44% of the 1990 value. Most of the reduction had occurred by 1992, with emissions varying between 44 and 52% of the 1990 value from 1992 to 1999.

Non-key sources
2.B.1 Ammonia production - CO_2
- CO_2 IEF (0.88t/t) is low compared to most Parties and lower than the IPCC default range (1.5-1.6t/t)

2.A.2 Lime production
- More than 1000% increase in CO_2 emissions from 1998 to 1999 (there was a change in activity data from hydrated lime (1998) to quicklime production (1999)).

2.A.4 Soda ash production and use – CO_2
- Bulgaria reported activity data (84.708kt) for soda ash use, noting that they were confidential
- CO_2 IEF for soda ash production is the lowest amongst Parties.

2.C.3. Aluminium production – PFCs
- The IEF for C2F6 (100 kg/t) is 1000 times the IPCC default and may be due to an input error.

- CF_4 IEF of 1.4 kg/t is the highest amongst the Parties, but within the IPCC range (Good Practice, 1.7 kg/t for SWPB process).
- The total production level in 1999 seems to be a rather low figure, 4.2 kt/year.

SOLVENT AND OTHER PRODUCT USE

Although activity data were reported for some sources, no emission estimates were made for CO_2 or N_2O under any of the sources.

AGRICULTURE

Source category 4.E Burning of Savannas was reported as NO.

Key sources
IPCC Tier 1 default method and default emission factors were used to estimate CH_4 emissions from enteric fermentation. Method and source of emission factors for N_2O emissions under 4.D agricultural soils were reported as “NE”, a fact that differs from the 2000 submission.

4.A. Enteric fermentation - CH_4 emissions
- Activity data. For swine, the population size was lower by 6.4% than the FAO value (1,617 thousand head in CRF versus 1,721 thousand according to FAO)
- Trends in CH_4 emissions**.** Large annual changes for enteric fermentation (up to 23 % decrease between 1992 and 1993).

4.D. Agricultural soils – direct and indirect N_2O emissions (4.D.1. and 4.D.3.)
- Method and EF used. Reported as NE although N_2O emission estimates were reported for this source category.
- N_2O-IEF. IEF for 4.D.1.1 synthetic fertilizers was among the lowest values compared to other Parties. The IEF for 4.D.1.2 animal wastes applied to soils (0.0046) was the lowest value among reporting Parties, while for 4.D.1.3 N-fixing crops it was among the highest values compared to the other reporting Parties.
- Trend in N_2O emissions. Large annual variation between 1998 and 1999 (45 per cent increase).

4.D. Agricultural soils – N_2O emissions due to animal production (4.D.2.)

Non-key sources
4.B. Manure management – CH_4 and N_2O emissions (4B(a) and 4.B(b))
- Activity data. For non-dairy cattle different population size data have been reported in tables 4.B(a) and 4.B(b) (250.3 and 260.1 (in thousand head), respectively).

4.C. Rice cultivation – CH_4 emissions
- CH_4-IEF. The IEF of 40g CH_4/m2/yr is the largest value among the seven Parties reporting estimates under “4.C.1.1. Irrigated - Continuously flooded”.
- Trends in emissions. Large annual variations; annual declines of up to 74 per cent (between 1993/1994) and increases up to 89 per cent (1995/1996).
- No information was provided for the other types of water regimes (table 4.C was left blank except for information related to “4.C.1.1. Irrigated - Continuously flooded”.

4.F. Field burning of agricultural residues – CH_4 and N_2O emissions
- Value for dry matter in wheat (0.55) is the lowest among the seven reporting Parties.

LAND-USE CHANGE AND FORESTRY

Overview

- Bulgaria used country-specific methods and emission factors to estimate CO_2 emissions and removals under 5.A. (Changes in Forest and Other Woody Biomass Stock) for temperate forests (evergreen and deciduous), harvested wood, and other fuel use.
- Only Table 5 and sectoral Table 5.A. were provided with numeric data.
- Emissions of non-CO_2 gases were not reported
- Net emissions/removals are provided for all years in the period 1990–1999 but gross emissions and gross removals only for 1998 and 1999
- There is a percentage change in net removals comparing the base year with 1999 of 42.
- Net CO_2 removals presented some high annual changes: +35.8% for 1990/91, +35.8% for 1991/92, and -18.6% for 1997/98.

5.A. Changes in forest and other woody biomass stocks

- Average annual growth rates for aboveground biomass of temperate evergreen and deciduous commercial forests were reported as "different" but implied carbon uptakes ranging from 1.1 to 0.95 t C/ha; these values are rather low when compared to the mean value calculated from the data reported by other Parties (1.52 and 1.33 tC/ha) for the corresponding forest types.
- Average annual growth rates are low if compared with IPCC defaults for temperate forest plantations; values are similar to IPCC defaults for native forest regeneration, under temperate conditions.
- No forest species were identified in Table 5.A.

WASTE

Key sources

6.A Solid waste disposal on land – CH_4

- A sharp decrease in CH_4 emissions from solid waste disposal from 1990 to 1999 was reported in the trend tables (Table 10s2). CRF Table 6A,C indicated a zero CH_4 recovery.

6.B Wastewater handling – CH_4

- CH_4 emissions per capita in 1999 were reported high compared to most other Parties.
- Large fluctuations in CH_4 estimates from wastewater handling over the entire time series (1990 – 1999), and unexplained differences in the trends of CH_4 and N_2O emissions from the same source are encountered.

CANADA

General

Common reporting format (CRF) and national inventory report (NIR)
The CRF was provided for 1990 to 1999 and included all requested tables. The CRF was accompanied by an NIR that provided information on methodologies, activity data, emission factors, verification, quality control and assurance and key source analysis for all sources categories. Notation keys were used appropriately in almost all tables.

Consistency of information between CRF and NIR
No inconsistencies have been found between the information provided in the CRF and the NIR.

Time series consistency
No major deviations in emissions were found on the basis of the trend tables (table 10 of the CRF) with the exception of LUCF (see below under land-use change and forestry).

Comparison with previous submissions
Canada provided recalculated estimates (table 8(a)) and explanatory information for 1990 to 1998. Canada revised its 1990 total emission estimates in CO_2 equivalent downward by 0.8 per cent excluding land-use change and forestry (LUCF), and by 4.7 per cent if LUCF is taken into account. Major revisions have taken place in the energy sector for CH_4 and N_2O, particularly in the other sectors category and the energy industries category where CH_4 emissions have been revised upwards by 4,500 per cent (according to table 8(a) of the CRF for 1990), agriculture, particularly N_2O emissions from agricultural soils, and LUCF, particularly CO_2 estimates from changes in forest and other woody biomass stocks.

Canada's calculated percentage changes for inventory years 1990 and 1998 contained in their recalculation tables in the CRF were compared to the secretariat's independent recalculations using Canada's submitted data for 2000 and 2001 submissions. The percentage changes for total GHG emissions agreed well.

QA/QC and verification procedures
The NIR describes the process of reviewing and considering inventory data aimed at improving data collection and data quality. The NIR states that the reference approach for fuel combustion and expert review were the primary means to ensure the quality of the inventory. The Canadian inventory is distributed formally to industry, academia and government ministries for the purposes of review. Most of the data used are from published sources.

Key source analysis
Canada used the IPCC tier 1 approach for identification of its key sources using the level and the trend assessment, and also applied a qualitative approach in determining its key sources. The results covered all the categories identified in the independent key source basic analysis of the secretariat, plus about 10 additional key sources with the use of trend and qualitative analysis.

Uncertainty estimations
Uncertainties associated with emission and removal estimates were mentioned in the NIR in regard to a 1994 uncertainty analysis conducted on 1990 inventory data that utilized Monte Carlo simulations to determine source category uncertainties. However, a more recent uncertainty analysis of the inventory was not available. The NIR does describe the use of a rounding protocol to approximate the level of uncertainty associated with each source category. The rounding protocol, however, was not utilized in the CRF tables because the CRF does not support such rounding.

<u>Sector-by-sector findings</u>

ENERGY

Reference approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 9 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data

The Canadian reference approach energy data for 1999 are 6 per cent higher than those reported to the IEA. The CRF is 9.7 per cent higher for liquid fuels, 3.5 per cent higher for solid fuels and 2.1 per cent higher for natural gas. Specific differences include:

- Production of crude oil and NGL in the CRF is 446,729 TJ higher than the IEA numbers.
- Crude oil and residual fuel oil imports are higher in the CRF.
- It is not clear if exports of naphtha have been counted as refinery feedstocks.
- It is not clear under what category international bunkers for diesel and residual fuel have been included.
- Liquid fuel stock changes are 147,571 TJ different and, in fact, the CRF shows a stock build and the IEA shows a stock draw.
- Coal imports of coking coal and other bituminous coal are 18,719 TJ higher in the Canadian data.
- Coal stock changes are much higher in the IEA numbers. The Canadian data do not appear to show stock changes for sub-bituminous coal, lignite and coke-oven coke.

Most of the above observations are also applicable to the 1990 data where the CRF data are 5.5 per cent higher than the IEA data. The growth rate of overall apparent consumption between 1990 and 1999 is very similar between the two data sets. The CRF grows by 18.9 per cent and the IEA by 18.3 per cent.

Key sources

<u>Fuel combustion</u>

Energy data have been given on a gross calorific value basis. This means that the IEFs are about 5 per cent lower for liquids and solids and about 9 per cent lower for gaseous fuels than they would have been if the data were given on a net calorific value basis. The comparison of IEFs is to be done among the countries that use GCV as the basis for their energy data.

The CO_2 IEF from gaseous fuels in the subcategories of stationary combustion are among the lowest across the four Parties that report data for these categories.

1.A.1 *Energy industries - liquid fuels*

- The value of the CO_2 IEF in 1999 (66.5 t/TJ) is the lowest across the reporting Parties that use GCV as the basis for their energy data.

1.A.1 Energy industries - solid fuels

- The value of the CO_2 IEF for manufacture of solid fuels and other energy industries in 1999 (79.5 t/TJ) increased by 40 per cent compared to its 1990 level (56.1 t/TJ).

1.A.2 Manufacturing industries and construction - solid fuels

- The value of the CO_2 IEF in 1999 (31.1 t/TJ) is the lowest across the Parties that use GCV as the basis for their energy data. The value of this IEF decreased by 14 per cent from 32.3 t/TJ in 1990 to 27.7 t/TJ in 1993 and then gradually increased to its 1999 level (31.1 t/TJ).

1.A.4 Other sectors- liquid fuels

- The value of the CO_2 IEF for commercial/institutional in 1999 (99.8 t/TJ) is the highest among the reporting Parties that use GCV as the basis for their energy data, having increased by 23 per cent over its 1990 level (81.4 t/TJ).
- The value of the CO_2 IEF for agriculture/forestry/fisheries in 1999 (92.7 t/TJ) is the highest across the reporting Parties that use GCV as the basis for their energy data.

1.A.4 Other sectors - solid fuels

- The value of the CO_2 IEF in 1999 (90.2 t/TJ) increased by 4 per cent compared to its 1990 level (86.9 t/TJ). The value of this IEF exhibited minor fluctuations from 1991 to 1998.

1.A.3.b Road transportation (CO_2 and N_2O)

- *The value of the N_2O IEF for gasoline in 1999 (13.9 kg/TJ) increased by 40 per cent compared to its 1990 level (9.9 kg/TJ).*

<u>*Fugitive emissions*</u>

1.B.2.a iii, iv,v Oil

- Although emissions of CO_2 and CH_4 were provided for transport, activity data were reported as "NA".
- Activity data and emissions for refining/storage and distribution of oil products were reported as "NE".

(see document FCCC/WEB/SAI/2000 for Canada's response to similar comments on the 2000 submission)

1.B.2.b iii Natural gas

- Although emissions of CO_2 and CH_4 were provided for exploration, activity data were reported as "NA".
- Activity data and emissions for other leakage were reported as "NA".

Non-key sources

1.A.1 Energy industries - gaseous fuels

- The value of the CH_4 IEF in 1999 (122.1 kg/TJ) decreased by 8 per cent compared to its 1990 level (133.4 kg/TJ).

1.A.2 Manufacturing industries and construction - biomass

- The value of the CO_2 IEF (17.86 t/TJ) is the lowest across the Parties that use GCV as the basis for their energy data.

1.A.3.e Other transportation - liquid fuels

- The value of the CH_4 IEF in 1999 (24.5 kg/TJ) decreased by 14 per cent from its 1990 level (28.4 kg/TJ).

1.A.4 Other sectors - biomass

- The value of the CO2 IEF (377.5 t/TJ) is the highest across all reporting Parties (next highest value is 110.2 t/TJ). The value of this IEF increased from a value of 303.4 t/TJ in 1990.

INDUSTRIAL PROCESSES

Key sources
2.C.1. Iron and steel production – CO_2
- Activity data were provided only for coke. Activity data for steel and pig iron were reported as NA

2.C.3. Aluminium production – CO_2
- CO_2 emissions increased sharply from 1990 to 1991 by 14.3% and about 17% from 1992 to 1993.

2.C.3. Aluminium production – PFCs
- C_2F_6 and CF_4 implied emission factor decreased from 1990 to 1999, decreasing by about 8% from 1992 to 1993 and about 20% from 1994 to 1995.
- CF_4 emissions increased from 1990 to 1999 by 4.3%. The C_2F_6 emissions decreased in the some period by 4%. From 1992 to 1993, the actual CF_4 and C_2F_6 emissions increased and then decreased from 1994 to 1995.

2.B.3. Adipic acid production
- This is reported as a point source with production data given in the CRF for 1992-1999. Canada indicated in the NIR, however, that production data were from 1990-1999.
- A new methodology was used to estimate N_2O emissions from 1997, but Canada did not indicate the type of N_2O abatement system and plant utilization factor used.

2.C.4.2 SF_6 used in magnesium foundries
- No activity data were reported in the CRF. The notation key NA was, however, used.
- Actual emission estimates decreased by 72% from 1990 to 1999.

Non-key sources
2.A.2 Lime production
- The NIR does not indicate whether reported production data refer to the marketable lime product or a combination with non-marketed intermediates, for example in the production of steel, synthetic soda ash, etc.

2.A.3. Limestone and dolomite use
- The explanation for the increase of IEF from 0.49 t/t to 0.57 t/t from 1990 to 1998 in the previous submission was that there was an error in the activity data reporting in the CRF (i.e. 752 and 490 kt for 1990 and 1998 respectively). In the 2001 submission there are variations in activity data; 65% decrease from 1992 to 1993 and 80% in 1994.

2.B.1 Ammonia production - CO_2
- CO_2 IEF (0.838t/t) is the lowest among Parties and lower than the IPCC default range (1.5 – 1.6t/t)

SOLVENT AND OTHER PRODUCT USE

Activity data for paint application (3.A) and degreasing and dry cleaning (3.B) were reported as NA. Emission estimates for CO_2 and NMVOC for 3.A and 3.B were not provided (reported as NE).

AGRICULTURE

Source categories 4.C Rice cultivation, 4.E Savanna burning, and 4.F Field burning of agricultural residues were reported as not occurring (NO).

Key sources
IPCC Tier 1 method and default emission factors were used to estimate CH_4 emissions from enteric fermentation and manure management, and direct and indirect N_2O emissions from agricultural soils.

4.A. Enteric fermentation – CH_4

- Activity data. Compared with 1999 FAO statistics, cattle population reported in the CRF was 5.7% higher (13,675 thousand versus 12,902 thousand head), while sheep population was lower by 49.9% (433 versus 649 thousand head).
  In its responses to review stages of the 2000 inventory submission, Canada referred to the official national statistics as reference source and stated that attempts to find out the source of data being used by FAO are under way.
- CH_4-IEF. IEF for dairy cattle is lower than the IPCC defaults for North America (99.6 versus 118 kg CH_4/hd/yr); while IEF for non-dairy cattle and sheep is higher than the same reference; in the case of sheep, it is one of the highest among reporting Parties (54.1 versus 47 for non-dairy cattle, and 13.3 versus 8 kg CH_4/hd/yr for sheep).
  In its responses to review stages of the 2000 inventory submission, Canada explained how values were calculated, based on IPCC defaults plus national derived emission factors for bulls, beef cows and dairy and beef heifers. The Party also stated that it was on the way to make changes in these emission factors solely based on the IPCC Guidelines for the next inventory year.
- Trends in activity data. The goat population had a very large annual change between 1995 and 1996, from 21.9 thousand to 73.3 thousand head (+234.8%). The NIR states that there is no annual data collection for goats.
- Trends in IEF. The CH_4 IEF for sheep declined by 4 per cent from 1990 to 1999 (from 3.9 to 3.3 kg CH/hd/yr).

4.B. Manure management - CH_4

- CH_4-IEF**.** IEF for sheep is relatively high compared to the IPCC default for cool-North America (0.32 versus 0.19 kg CH_4/hd/yr).

4.D. Agricultural soils – direct and indirect N_2O emissions (4.D.1 and 4.D.3.)

- N_2O-IEF. IEF for synthetic fertilizers is higher by a factor of 1000 compared to those of other Parties, IPCC defaults (11.3 versus 0.01 kg N_2O-N/kg N) and those calculated for 1990 and 1998 in the 2000 inventory submission (0.006 kg N_2O-N/kg).
- N_2O-IEF. IEF for nitrogen leaching and run-off is higher by a factor of 10 compared to those of other Parties (0.178 versus 0.025 N_2O -N/kg N).
- Trends in IEF. N_2O IEF for N-fixing crops decreased by 63% between 1990 and 1999; N_2O IEF for crop residues increased 21%. For cultivation of histosols the N_2O IEF increased from 0.00062 as calculated in 1990 to 5.0 kg N_2O-N/ha in 1991 through 1999.
- Trends in emissions. N_2O emissions from agricultural soils increased by 22% from 1990 to 1999, with direct emissions increasing by 21.7% and indirect emissions by 25.7%.

4.D. Agricultural soils - CO_2 emissions
This source has been identified as key only according to the trend assessment.

- Canada reported CO_2 emissions from agricultural soils under the 4.D Agricultural soils category (the IPCC allows for reporting them in either the Agriculture or LUCF sector). These emissions are reported in the Summary tables of the CRF. CO_2 emissions decreased from 7,255 Gg in 1990 to 712.5 Gg in 1998 (recalculated value) and to 177 Gg in 1999, corresponding to a 98% decrease between 1990 and 1999, and an annual decrease of 75 per cent from 1998 to 1999. This fact was

said to be mainly due to changes in farming practices, in particular an increase in conservation tillage.
In its responses to review stages of the 2000 inventory submission, Canada provided the corresponding sources of references.

Non-key sources

4.B. Manure management – N_2O emissions (4.B(b))

- N$_2$O IEF for AWMS. IEFs for AWMS were higher by a factor of 10^6 compared to the values of other Parties and to IPCC defaults for North America. Differences of 10^6 (for dairy cattle) to 10^3 (for sheep) when comparing the sum of nitrogen excretion over all animal waste management systems per livestock to the corresponding nitrogen excretion rate per animal multiplied by the population.
- Consistency checks. Total N excretion for the AWMS pasture range and paddock (table 4B(b)) is lower by a factor of 10^6 compared to the reported activity data under 4.D.2. Animal production (N excretion on pasture range and paddock) in table 4.D.
Concerning the above two observations, Canada explained in its responses to review stages of the 2000 inventory submission, that these differences were due to reporting of percentages rather than kg N_2O-N/kg N for each AWMS.
- N excretion rates. N excretion rates for livestock values are consistently lower compared to the IPCC default values for North America, particularly in the case of sheep.
In its responses to review stages of the 2000 inventory submission, Canada explained that average amount of annual nitrogen excretion was based on research conducted in the USA; reference was provided.

4.D. Agricultural soils - animal production, N_2O (4.D.2.)

- Trends in IEF. The N_2O IEF for 1990 was 15% lower than the value for the other years (0.01735 in 1990 versus 0.02 kg N_2O-N/kg N for 1991 to 1999).
- Trends in emissions. N_2O emissions from pasture range and paddock increased by 15% in 1999 compared to 1990 emissions; for activity data the same value was reported in both 1990 and 1999.

LAND-USE CHANGE AND FORESTRY

Overview

- Canada applied country-specific and IPCC default methods along with country-specific emission factors to estimate CO_2 emissions and removals from 5.A. (Changes in Forest and Other Woody Biomass Stocks) for Canadian Wood Production Forest, from 5.B. (Forest and Grassland Conversion) for temperate mixed coniferous/broadleaf forests, from 5.C. (Abandonment of Managed Lands) for temperate and boreal forests, from 5.D. (CO_2 emissions/removals from Soils) for land conversion, and from 5.E. (Others) for anthropogenic fires outside wood production forests.
- Non CO_2-gas emissions estimated from 5.B.and 5.E.
- Table 5 and sectoral tables 5.A. to 5.D. have been submitted, but most of the cells did not contain numerical information due to the fact that the classification of source-categories differs substantially from the IPCC. The NIR states than net emissions or removals are mainly produced as estimates from each sector.
- The Party explained that the methodology followed better reflects Canada’s national circumstances; however, the Party also pointed out that special care has been taken to develop an accounting model that closely follows the IPCC methodology.
- Aggregate net removals presented a large decrease from 1990 to 1999 (-67%), with some large annual changes: -25.7% for 1991/92, -18.6% for 1992/93, -11.3% for 1993/64, -49% for 1994/95, +33.8% for 1995/96, -19.3% for 1996/97 and +12.6% for 1997/98 *(The Party*

explained that annual oscillations are due to variability of aggregate results, accounting model very sensitive to the impact of anthropogenic activities.)

5A. Changes in forest and other woody biomass stocks

- No specification of species in table 5.A. An aggregate value for net annual growth of aboveground biomass of the Canadian wood production forests was reported (1.26 t dm/ha/yr). *The Party explained that the data of the Canadian Forest Inventory do not match IPCC forest categories.*
- The subcategory specified as "Other temperate forests", was reported with a rather low value of annual growth rate within the range of values produced by the Parties. It is also low if compared to IPCC defaults for native regeneration in temperate conditions (2.0 t dm/ha/yr). *(In the NIR, the Party states that as no data were available to relate age with annual increment of biomass, a long-term average value, referred to a mean annual increment to maturity was used; the NIR recognizes that this net value is the greatest source of uncertainty in estimating carbon uptake by forest.)*
- Large annual changes for net removals were reported: -21.8% for 1991/92, -14.6% for 1992/93, -19.8% for 1993/94, -19.6% for 1994/95, -10.1% for 1996/97 and +23.2% for 1997/98, with a total decrease of –54.5% for the period 1990 to 1999.

5.B. Forest and grassland conversion

- The value reported for CO_2 emissions in table 5.B for 1999 differs from the value reported in Table 5 (4,172 versus 4,154Gg CO_2).
- CO_2 emissions showed a large increase from 1990 to 1999 (+192.4%), reaching 4.154 Gg in 1999.
- Some significant annual changes in CO_2 emissions were reported: +19.6% for 1992/93, +21% for 1993/94, +15.8% for 1994/95, 19.3% for 1995/96 and +30.1% for 1996/97.
- No IEFs for non-CO_2 trace gases were reported in Table 5.B. The NIR states that emissions of non-CO_2 trace gases could not be allocated, as insufficient data were available to disaggregate cleared biomass into off- and on-site routes.

5.C. Abandonment of managed lands

- Average annual growth rates for aboveground biomass were reported as 0.95 and 0.21 t dm/ha/yr (0.48 and 0.10 t C/ha/yr, respectively, as implied carbon uptake), for temperate and boreal mixed coniferous/broadleaf forests. Values are the lowest values among the reporting Parties and lower than the IPCC defaults. (*NIR recognizes this fact but states that the reported values better reflects the national conditions; NIR also gives the support bibliography*.)
- CO_2 removals increased 26.4% from 1990 to 1999, reaching 4,103 Gg CO_2 in 1999, with a large annual change between 1997 and 1998 (23.9%).

5.D. CO_2 emissions/removals from soils

- No detailed explanation of methodology was provided in the NIR.
- Net values (CO_2 emissions) increased 49.3% from 1990 to 1999, with some large annual changes: 99.9% for 1996/97, -76.2% for 1997/98 and 319.4% for 1998/99.
- Large annual fluctuations for both emissions and removals were reported for the years 1996 to 1997 (*The Party expressed that post-1996 estimates of emissions and removals in this subcategory rely on forecast data; hence they may change when actual data become available.*
- Additionally, CO_2 emissions from soils rose steeply between 1996 and 1997 (almost double) and then decreased to almost a quarter in 1998. *(The Party explained that CO_2 emissions from soil are based on the projected increase in the conversion of grasslands to agricultural lands in 1997; the accuracy has to be confirmed later.)*
- Table 5D has not been used to report activity data, only indicators; hence, no IEFs were calculated. A separate data sheet has been provided. It seems that the split of emissions from

soils in two sectors (“Agriculture” and “Land-Use Change and Forestry”) makes this table useless to hold information.

- No support references were given for emission factors and activity data, such as annual rate of carbon removal for soils, carbon content of soil prior to conversion and fraction of carbon released over 25 years.

5.E. Others

- Emissions from wildfires were not included in the inventory. (*Canada stated in its NIR that emission estimates from wildfires, although high (733 Kha in 1990, and 1,926 Kha, in 1999), are not finally included in the national totals*).
- CO and NO_X emissions were not reported.
- CH_4 and NO_2 emissions changed significantly over consecutive years (maximum values of +216 and 304% for 1997/98). Annual changes were all >10%.

WASTE

Key sources

6.A.1. Managed waste disposal on land

- Annual MSW disposed at SWDs, MCF and DOC and fraction of waste disposed at SWDs were not provided (reported as NA)
- CH_4 IEFs for managed and unmanaged solid waste disposal sites were not calculated.

Non-key sources

6.B Wastewater handling

- Emission estimate for wastewater handling does not include industrial waste. The Party explains in the NIR that no data were available.

6.C Waste incineration

- Emissions of CH_4 from sewage sludge incineration have been assumed constant since 1996. The activity data were collected in a survey developed in the period 1993-1996.

CZECH REPUBLIC

General

Common reporting format (CRF) and national inventory report (NIR*)*

The Czech Republic provided inventory data for the year 1999 using the CRF. The submission encompassed most requested tables. However, tables on trends and recalculations, as well as some sectoral background data tables were not provided. The use of indicators was limited. An NIR was not submitted.

The Party explained that the National Inventory Report for 1999 Inventory has not been submitted to the UNFCCC, because only the Czech version of the NIR was available. For the 2002 submission (containing data from the year 2000) it is planned to prepare an English version in addition.

It was also noted that the N_2O emissions for the period 1990 – 95 for all sectors and CH_4 from waste for the period 1990 – 1999 are being recalculated.

Consistency of information between CRF and NIR

Not applicable since neither an NIR nor any other additional information were provided.

Time series consistency

Analysis of the time series was not possible since data other than for 1999 were not reported. The corresponding trend tables of the CRF (table 10) were not submitted.

The Party explained that the tables with emission trends were not elaborated for the 2001 submission of the CRF, because all necessary recalculations had not been completed; intend to provide trend tables as part of the 2002 submission. Moreover, the intent is to provide also all emission and activity data for 1990 in the CRF as part of the 2002 submission.

Comparison with previous submissions

Information on recalculations was not provided in the CRF. Comparison of data with previous submissions was not possible because the 2001 submission did not include any emission data for the years prior to 1999.

In its response to the 2000 synthesis and assessment report the Czech Republic explained the reasons for not having submitted an NIR, nor having provided data on trends and recalculations, and indicated its intention to do so for the 2002 submission.

Verification procedures

No information was available on whether the inventory data was subject to any self-verification or independent review procedures.

Key sources

The Czech Republic did not provide any classification of key sources.

It was explained that the classification of the key sources is presented in the Czech version of the NIR, but that only tier 1 (level assessment) has been elaborated so far.

Uncertainty estimates

Uncertainty estimates were not provided.

<u>Sector-by-sector findings</u>

ENERGY

Reference approach

Comparison of reference approach with national approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 2 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach.

Comparison with international data

The Czech Republic reference approach energy data for 1999 are 1.1% lower than those reported to the IEA. The CRF is 7.2% lower for liquid fuels. Solid fuels and natural gas correspond very closely. Specific differences include:

- There are 7,536 TJ of ‘other hydrocarbon’ production in the IEA statistics which are not shown in the CRF. So far, IEA contacts in the Czech administration have not indicated what is being included here.

The Czech Republic explained that the term “other hydrocarbons” means “liquids from coal liquefaction”, which in the Czech Republic represents oils and tars from coking of coal. Therefore this item is not involved in the reference approach, because it is included in the “coking coal” fuel type. However this item (oils and tars) is treated in the sectoral approach.

- Imports of naphtha, bitumen, lubricants, petroleum coke, white spirit and paraffin waxes do not seem to be reported in the CRF. The difference in liquid fuel imports is 24,169 TJ.

Stock changes for liquid fuels and solid fuels seem to be different between the two data sets**.**

The Czech Republic reiterated the explanation contained in its response to comments on its 2000 submission, namely, that at the time of compilation only a draft version of the Czech energy balance is usually available. In the case of liquid fuel imports, the values are nearly the same in both versions: 359,849 TJ and 359,068 TJ for the final and the draft version, respectively. However, in the final version of the Czech energy balance (reported by the Czech Statistical Bureau), imports of non-energy fuels are not included either. These values are given only in the questionnaire completed for IEA by the Czech Ministry of Industry and Trade. Unfortunately, this questionnaire has not been officially available to the Czech GHG inventory team so far – it will be necessary to improve in future this imperfection in the Czech GHG inventory management. From unofficial information obtained recently, the import of non-energy fuels in question is 19,091 TJ. When considering the final version of the energy balance, including the latest questionnaire for IEA, the resulting value of apparent consumption of all liquid fuels would be 14,709 TJ lower than the value presented in the Czech 2001 submission for the 1999 inventory.

Key sources

<u>*Fugitive emissions*</u>

- *1.B.1.a Coal mining and handling:* It is not explained in the documentation box whether the data correspond to ROM or saleable production.

  In a similar comment included in the 2000 S & A report, the Party explained that activity data in the “Czech Mining Year Book” is based on saleable production.
- The activity data for coal reported in the CRF are lower compared to the data published by the IEA (6 per cent).

Non-key sources

<u>*Fugitive emissions*</u>

1.B.2.a v, vi Oil

- Activity data for distribution of oil products were reported but CH_4 emission estimates were not provided.

- Activity data and emissions for "other" were not reported.

1.B.2.b.iii Natural gas: Activity data and emissions for other leakage were not reported.

1.B.2.c Venting and flaring: Activity data and emissions for venting and flaring were reported as “NE”**.**

1.B.1.b Solid fuel transformation: It is not clear where CO_2 emissions from this source are included (in the CRF they were reported as “IE”).
The Czech Republic explained that the CO_2 emissions are included as part of CO_2 emissions from 1A1c.

<u>*Fuel combustion*</u>
1.A.1 Energy industries - solid fuels: The value of the CH_4 IEFs in 1999 (3.0kg/TJ) is among the high values across reporting Parties.

1.A.3.d Navigation (domestic): Activity data and emissions for residual oil were not reported.

1.A.3.a Civil aviation (domestic): Activity data and emissions for aviation gasoline were not reported.

1.A.4.b Other sectors (residential): The value of the CH_4 IEF in 1990 (20 kg/TJ) is the highest across the reporting Parties.

1.A.4.b Other sectors (commercial): The value of the CH_4 IEF fell from 155 kg/TJ in 1998 to 100 kg/TJ in 1999.

1.A.4.a Other sectors (residential): The value of the CH_4 IEF rose from 163 kg/TJ in 1998 to 225 kg/TJ in 1999.
The Czech Republic expressed its belief that CH_4 emissions will be more reliable when the new international database of GHG emission factors is implemented. Up to now, it has used for the CH_4 emission estimates values from the National Emission Register (REZZO), where only the sum (CH_4 + NMVOC) is registered. The problem is in evaluation of the right CH_4 fraction. The traditional estimate of this ratio (1/3 of CH_4 for combustion of coal in the residential sector) may perhaps be too high.
Observed changes in CH_4 IEFs for the years 1998 and 1999 are due to the corresponding changes in the sum (CH_4 + NMVOC) taken over from the REZZO system while the CH_4 fraction is kept constant.

Bunker fuels
1.A.3.a International aviation: The activity data for jet kerosene reported in the CRF are higher compared to the data published by the IEA (35 per cent).
The Czech Republic explained that a similar problem, discussed in the previous paragraphs (see comment under comparison with international data), exists also in the case of bunkers. Its estimate of jet kerosene consumption at the time of inventory compilation was 7,610 TJ while the latest value obtained from the above-mentioned questionnaire for IEA is 4,829 TJ.

INDUSTRIAL PROCESSES

Non-key sources

2.B.1 Ammonia production - CO_2

- Although production data was provided under this sector, emissions were included in the energy sector.
  The Party explained that the activity data were included only for information purposes, as emissions have been included in energy sector

2.C.1 Iron and steel production - CO_2

- Emissions were included in the energy sector (in table 2(I)A-G, CO_2 emissions were reported in the column under "emissions reduction"). Activity data was reported in a disaggregated manner, while for CO_2 emissions only an aggregate estimate was provided. Consequently, no IEFs were calculated for any of the iron and steel sub-categories. The same observation was made during the review of the 2000 submission to which the Party indicated that this had been done to avoid double counting.

2.F. Consumption of halocarbons and SF_6

- Actual emissions for HFCs, PFCs and SF_6 were not provided, hence potential to actual emission ratios for these gases were not calculated. No activity data were provided for these sources.

SOLVENT AND OTHER PRODUCT USE

Non-key sources

3.B. Degreasing and Dry Cleaning

CO_2 IEF (2.53t/t) was high in comparison to other Parties.

The Czech Republic explained that from the original calculation sheets it was noted that the value of 52 kt of solvent is related only to degreasing, while the consumption of solvents in the whole sub-sector 3.B is 64 kt.

AGRICULTURE

No information was provided in the tables for agriculture (table 4 and sectoral background data tables) for the following source categories: 4.C Rice cultivation, 4.E Prescribed burning of savannas and 4.F Field burning of agricultural residues. However, in Summary 3 and Table 7 these were indicated as "NO".

Key sources

4.A. Enteric fermentation - CH_4 emissions

- CH_4-IEF. IEFs for dairy cattle and non-dairy cattle were the lowest values among the reporting Parties and relatively low (68.2 and 23.6 kg CH_4/hd/yr, respectively) compared to IPCC defaults for Eastern Europe (81 and 56 kg CH_4/hd/yr, respectively);
- CH_4-IEF. IEF for sheep (5 kg CH_4/hd/yr) was among the lowest across the reporting Parties and relatively low compared to the IPCC default (8 kg CH_4/hd/yr, respectively).
- CH_4-IEF. IEF for swine is more than double the IPCC default (3.4 versus 1.5 kg CH_4/hd/yr); it is the highest value among the reporting Parties.

The national emission factors are under review, according to the response to the 2000 S&A report provided by the Czech Republic.

In its response to this S&A, the Czech Republic explained that the original set of emission factors was from the Institute of Livestock, Prague-Uhrineves, using IPCC tier 2 approach calculations as part of the US country study programme compiled in 1994. In the late 1990s, all parameters were

revised by the Institute of Agriculture Technology, Prague-Repy. However, inventory experts from CHMI are aware of the fact that emission factors used for cattle and other livestock are significantly lower than IPCC default values, while for swine they are significantly higher.

The Czech Republic further explained that upon availability of resources, a study based on the IPCC good practice guidance should be carried out. Alternatively, suitable values from the international GHG emission factors database currently under development might be used. In both cases all series should be recalculated.

4.D. Agricultural soils - direct and indirect N_2O emissions (4.D.1. and 4.D.3.)

- Default methods and emission factors were applied to estimate N_2O emissions from agricultural soils
- Fractions used. No information was provided on fractions used to estimate direct and indirect N_2O emissions.
- N_2O-IEF. A same value was calculated for synthetic fertilizers, animal wastes applied to soils, N-fixing crops and crop residues; for crop residues the value is among the higher values across the reporting Parties.

The Czech Republic explained that for calculating agricultural N_2O emissions, the complete IPCC default approach from the Revised 1996 IPCC Guidelines (Workbook) was used.

Non-key sources

4.B. Manure management - CH_4 and N_2O emissions (4.B(a) and 4.B(b))

- CH_4-IEF. CH_4-IEFs for dairy and non-dairy cattle were relatively low compared to the IPCC defaults for cool-Eastern Europe (3.3 versus 6.0 kg CH_4/hd/yr, for dairy cattle; 1.0 versus 4.0 kg CH_4/hd/yr, for non-dairy cattle) and those from other reporting Parties.
  The Czech Republic explained that the same reasons as for the IEFs for CH_4 from enteric fermentation cause the relatively low CH_4 IEFs from manure management.
- N_2O-IEF for AWMS. Units of nitrogen were expressed in tons instead of kg; for this reason the values of N_2O IEF have a constant difference by a factor of 10^3 compared to IPCC default values for Eastern Europe and those of most other reporting Parties.
  As in its response to the S&A 2000, the Czech Republic explained that the use of a different unit was due to technical reasons.
- N excretion rates. For cattle and sheep, values were closer to IPCC defaults for Western Europe rather than to Eastern Europe values

The IPCC default methodology was used to estimate N_2O emissions from this sector (see comment under agricultural soils). The Czech Republic further explained that due to the relatively advanced character of agriculture in the country, the parameters for Western Europe were preferred (although the reference calculation with Eastern Europe's set of parameters was also carried out for comparison purposes). The transformation of the results from the IPCC workbook into the CRF caused the technical difficulties described in this report (use of different unit in table 4B(b) and misplacement of N-excretion rate for daily spread).

- Consistency checks. Multiplication of N excretion rates per animal with the corresponding animal population differs from the sum of nitrogen excretion over all AWMS for the particular livestock type, for cattle and non-dairy cattle. One reason is the unit used for N (t instead of kg); another likely source seems to be a mistake in the conversion between N_2O and N_2O-N.
  For pasture range and paddock, values for total nitrogen differ slightly between tables 4.B(b) and 4.D.
  The Czech Republic explained that the value for "Daily spread" (15,408 kt N/yr) in table 4.B (b) corresponding to "Dairy cattle" has accidentally been placed under "Non-Diary cattle".

LAND-USE CHANGE AND FORESTRY

Overview

- The Czech Republic followed a country-specific method and emission factors to estimate CO_2 emissions and removals from 5.A. (Changes in Forest and Other Woody Biomass Stock) for temperate commercial evergreen and deciduous forests**.**
- Emissions of non-CO_2 gases were not reported.
- Only Table 5 and sectoral Table 5.A. was submitted with numerical data.

5.A. Changes in forest and other woody biomass stocks

- Gross emissions, gross removals and net emissions/removals are provided only for 1998 and 1999. A trend cannot be assessed from the reporting of only these two years.
- The same average annual growth rate and implied carbon uptake factor (4.51 t dm/ha and 2.03 tC/ha, respectively) are reported for temperate forests, commercial evergreen and commercial deciduous.
- Average annual growth for aboveground biomass, reported for the identified forest type, was 4.51 t dm/ha/yr (2.0 t C/ha/yr, as implied carbon uptake). No support information was provided in the documentation box.

WASTE

Non-key sources

6. B. Wastewater handling

- IEF for N_2O emissions from human sewage equalled 25.01, which is far above the range of the IPCC default EF for this category.

The Party responded that it had made a mistake in filling in the table. The value of 25 kg protein / person / yr was used as annual protein consumption and 0.16 was a fraction kg N/kg protein, thus <u>IEF = 0.01</u> (IPCC default). It noted that the resulting emission (0.65 Gg) was not influenced by this error. The Czech Republic noted that the value of annual protein consumption of 25 is lower than the expected 30 – 40 kg protein / person / yr.

DENMARK

General

Common reporting format (CRF) and national inventory report (NIR)

Denmark provided inventory data for the years 1990 to 1999 using the CRF. The submission encompassed most requested tables. However, some sectoral background data tables, particularly the reference approach (table 1.A(b) and related information (tables 1.A(c) and (d)) were not provided, nor were some of the summary tables, such as Summary 3, Table 7 and Table 9. Indicators were used in a very limited manner, thus leaving parts of many tables unfilled.

An NIR was provided, containing methodological issues and information on uncertainties and verification procedures. However, the discussions in the NIR are general in nature and do not provide transparency on the specific approaches and assumptions used for most of the individual source categories.

Consistency of information between CRF and NIR

As the NIR did not include numeric information and the CRF did not include information on methods and emission factors used, the possibilities of assessing consistency between the CRF and NIR was very limited.

Time series consistency

Based on the information provided in the trend tables, some large changes and variations (greater then 10 per cent) in emission estimates from year to year could be noted for the following sources:

- CO_2 emissions from 1. Energy (including 1.A. Fuel Combustion and 1.B. Fugitive Emissions from Fuel),
- CO_2 and CH_4 emissions from International bunkers, and
- CH_4 emissions from 1. Energy (mainly, 1.A.1. Energy Industries, with 12 times of increase from 1997 to 1998);
- N_2O emissions from 1.A.3 Transport (which increased by almost 3 times between 1990 and 1999) and from 1.B Fugitive fuel emissions.

Comparison with previous submissions

Denmark provided recalculated estimates (tables 8(a)) for 1990 to 1998. The corresponding table 8(b) of the CRF calling for explanations for the recalculations was not provided, however, explanations for the recalculations made were provided in the NIR. The effect of recalculations for 1990 (as reported in the CRF tables) was a reduction of approximately 0.6 per cent in the total CO_2 equivalent emissions both in- and excluding land-use change and forestry (LUCF), large upward revisions having taken place, *inter alia*, for N_2O in some fuel combustion source categories (1.A.2 and 1.A.4 Other sectors).

QA/QC and Verification procedures

Some quality control (QC) has been performed but not Quality Assurance (QA) with independent review of the inventories. Future work to improve the Danish emission inventories will include further elaboration of how formal QA/QC procedures could be implemented.

Key sources

Denmark did not perform any identification of key sources.

Uncertainties
Uncertainty estimates were given only at an aggregate level for total emissions of CO_2, CH_4, N_2O, CO, NO_X and NMVOC, and for the total inventory in terms of CO_2 equivalent, without disaggregation into sectors and source categories. The NIR states that uncertainty values were combined using a methodology stated in Annex I of the Reporting Instructions of the Revised 1996 IPCC Guidelines. Updated guidance on uncertainty determinations has since been developed as part of the IPCC Good Practice Guidance development. Notation keys were used.

Sector-by-sector findings
No information on methods and emission factors used is provided in Summary 3 of the CRF for any sector. In the NIR, it is stated that “the CORINAIR methodology is the general methodology used; some parts of the underlying methodologies are taken directly from the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories”.

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from the reference approach were not reported.

Comparison with international data
A comparison with IEA data was not possible since Denmark did not provide any data for the reference approach.

Key sources
Fuel combustion
1.A.1 Energy industries - solid fuels (manufacture of solid fuels and other energy industries) :
Activity data and emissions for this subcategory were not reported.

1.*A.4 Other sectors - solid fuels* (Commercial/institutional)*:* Activity data and emissions for this subcategory were not reported.

1.A.1 Energy industries - liquid fuels (manufacture of solid fuels and other energy industries) :
Activity data and emissions for this sub ategory were not reported.
1.A.4 Other sectors - gaseous fuels
- The value of the CO_2 IEF for the subcategory agriculture/forestry/fisheries in 1999 (30.4t/TJ) is the lowest across the reporting Parties.
- The value of the CO_2 IEF for the subcategory commercial decreased from 54.32 t/TJ in 1998 to 49.56 kg/TJ in 1999, which is the lowest value across the reporting Parties.

Fugitive emissions
1.B.2.ai,ii,iii,iv,v Oil
- Activity data and emissions from exploration, production, transport and refining/storage were not reported.
- Activity data were reported for distribution of oil products but CO_2 emissions were not provided.

1.B.2.bii,iii Natural gas: Activity data and emissions from distribution and other leakage were not reported.

1.B.2.c Venting: Activity data and emissions were not reported.

1.B.2.c iii Flaring: Activity data and emissions from “combined” were not reported.

Non-key sources
<u>*Fuel combustion*</u>
1.A.1.a Energy industries - gaseous fuels

- There is a large increase in the value of CH_4 IEFs (from 8.4kg/TJ in 1990 to 164.0 kg/TJ in 1999).
- The value of the CH_4 IEF for the subcategory public electricity and heat production in 1999 (214.8 kg/TJ) is the highest across the reporting Parties.

1.A.4.b Other sectors - gaseous fuels

- The value of the CH_4 IEF for the residential subcategory increased from 8.925 kg/TJ in 1998 to 33.42 kg/TJ in 1999 (almost four times). This value is among the highest across the reporting Parties.
- The value of the CH_4 IEF for the commercial subcategory increased from 30.57 kg/TJ in 1998 to 80.49 kg/TJ in 1999 (2.6 times). The value is the highest across the reporting Parties.

1.A.4.b.2 Other sectors (residential) - solid fuels: The value of the CH_4 IEF in 1999 (15 kg/TJ) is the lowest across the reporting Parties.

<u>*Fugitive emissions*</u>
1.B.2.a v, Oil:

- Activity data for distribution of oil products were reported but CH_4 emissions were not provided.

Bunker fuels
1.A.3.d International marine transport
The activity data for residual oil reported in the CRF are lower compared to the data published by the IEA (8.2 per cent).
The activity data for gas/diesel oil reported in the CRF are higher compared to the data published by the IEA (7.2 per cent).

INDUSTRIAL PROCESSES

Key sources
2.A.1 Cement production – CO_2

- CO_2 IEF was the second highest amongst Parties (from 0.54t/t from 1990 to 0.5333t/t in 1999). It was not reported whether data was for cement or clinker, although the value is still higher than the IPCC default for clinker (0.507t/t) and that of the IPCC Good Practice Guidance (0.526 t/t).
- There is a high relative change in CO_2 emissions from 1990 to 1991 (23.2%) as compared to other years and in 1999 emissions are 46.7% higher than in 1990.

Non-key sources

2.A.2 Lime production

- There is a high variation in CO_2 emissions from 1990 to 1992.
- IEF for CO_2 reported for most years (6 years) is the second lowest compared to other Parties (0.20 - 0.29 t/t), IPCC default ranges from 0.79 to 0.91t/t. The value reported in years 1994, 1995 and 1996 is around 0.56 t/t.

2.B.1 Ammonia production

- The Party did not report any CO_2 emissions associated with ammonia production although according to U.N. data there is ammonia production.

2.B.2 Nitric acid production

- The Party did not report any N_2O emissions associated with nitric acid production although according to U.N. data there is nitric acid production.

2.C.1.1 Steel production

- The Party did not report any CO_2 emissions associated with steel production although according to U.N. data there is steel production.

2.C.4.2 SF_6 used in magnesium foundries – SF_6

- No activity data were provided for SF_6 use in magnesium foundries in the CRF, nor in the NIR.
- There is a large variation in actual SF_6 emission trends from 1990 to 1999(an increase of 54% in emissions from 1992 to 1993, a decrease of 73% from 1995 to 1996 and an increase of 50% from 1996 to 1997).

2.F.7 SF_6 used in electrical equipment

- Actual SF_6 emission in 1990 and 1991 were not estimated
- The ratio of potential SF_6 emissions to actual SF_6 emissions decreased from 12 in 1992 to 9.4 in 1999.
- The P/A ratio is the highest amongst reporting Parties

SOLVENT AND OTHER PRODUCT USE

3.A Paint application

- Although CO_2 and NMVOC emissions were reported the associated activity data was not reported.

3.B Degreasing and dry cleaning

- Although NMVOC emissions were reported the associated activity data was not reported.

3.C Chemical products, manufacture and processing

- Although CO_2 emissions from chemical products, manufacture and processing were not included in the CRF, the Party indicated in the NIR that these CO_2 emissions were included in the total emissions in the IPCC table provided.

AGRICULTURE

No information was provided for the following source categories: 4.C Rice cultivation, 4.E Prescribed burning of savannas and 4.F Field burning of agricultural residues.

Key sources
4.A Enteric fermentation – CH_4 emissions
- Activity data. Sheep and swine population data are very different to FAO statistics, differences being 108 and 25%, respectively (69 thousand head in the CRF versus 143 from FAO for sheep, and 9,305 thousand head in the CRF versus 11,626 from FAO, respectively).
- CH_4-IEF. IEF for non-dairy cattle was relatively low (lower by 23%) compared to the IPCC default value for Western Europe (37 versus 48 kg CH_4/hd/yr).
- Trends in activity data and emissions. Sheep population data and CH_4 emissions show high annual percentage changes (over 10 %) reaching a drop of 56% between 1998 and 1999. Poultry population was reported as 0 from 1990 to 1999.

4.B Manure management – CH_4
- CH_4-IEF. IEF for dairy cattle is among the highest values compared to other Parties and higher than the IPCC default cool-Western Europe (21.8 versus 14 kg CH_4/hd/yr), while the IEF for non-dairy cattle is among the lowest values among Parties and lower than the IPCC values for cool-Western Europe (1.6 versus 6.0 kg CH_4/hd/yr).
- CH_4-IEF. IEF for swine is among the lower values compared to other Parties and lower than the IPCC default for cool-Western Europe (2.5 versus 3.0 kg CH_4/hd/yr). Value for sheep is more than double the corresponding IPCC default for developed countries (0.46 versus 0.19 kg CH_4/hd/yr);
- Trends in CH_4-IEF. Values for dairy cattle, sheep and swine changed significantly between 1998 and 1999, but were rather constant for the period from 1990 to 1998.

4.D Agricultural soils – direct and indirect N_2O emissions (4.D.1. and 4.D.3.)
- No activity data were reported for N-fixing crops and crop residues (although emission estimates were provided), so no IEF could be calculated.
- N_2O -IEF. IEF for animal wastes applied to soils is among the lowest compared to other reporting Parties

Non-key sources
4.B Manure management – N_2O
- N_2O emissions from manure management were reported in Table 4, however no activity data relating to animal waste management systems were provided, hence no IEFs were calculated for this source category - Table 4B(b) contained only population size data.

4.D Agricultural soils –animal production, N_2O (4.D.2)
- Trend in emissions. Emissions decreased by 36% from 1990 to 1999.

LAND-USE CHANGE AND FORESTRY

Overview
- Denmark reported in Table 5 net CO_2 emissions/removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forests, with no further specification.
- Emissions of non-CO_2 gases were not reported.

- Sectoral tables 5.A. to 5.D. were not provided.
- Activity data and other related information for category 5.A were not available in the CRF, nor could IEF be calculated. No data in categories 5B-5E have been provided (entries, if they exist, are equal to 0).
- Denmark stated in its NIR that air emission inventories are based on the CORINAIR methodology and that “the most consistent emission factors have been used, either as measured values or default factors proposed by the CORINAIR methodology”.

5A Changes in forest and other woody biomass stocks

- Gross emissions were not provided. Gross removals are taken as net removals in Table 5A.
- Small year-to-year changes in net removals are observed in the time series from 1990 to 1999, the largest one being 1.2% from 1998 to 1999. There is a percentage change in net removals of 6.6 from 1999 to the base year.

WASTE

Key source

6.A Solid waste disposal on land – CH_4

- No additional information or activity data were provided in CRF tables. No notation keys were used
- No indication of methods and sources of emission factors used was given in the CRF, though Denmark stated in its NIR that Denmark’s air emission inventories are based on the CORINAIR methodology (CooRdination of Information on AIR emissions)

Non-key sources

6.B Wastewater handling,

6.C Waste incineration

- Denmark did not report on emissions from wastewater handling and incineration and no notation keys were used.

EUROPEAN COMMUNITY

General

Common reporting format (CRF) and national inventory report (NIR)

CRF Summary Table 1.A was provided for the years 1990-1999 for the 15 member States of the European Community as part of the Annex to a technical report that describes how the European Community emissions were compiled. The technical report references the CRF tables prepared by each individual country as the source of the emissions data used to compile the European Community summary data. The technical report primarily describes the European Community monitoring mechanism and how member states emission inventories are compiled annually for the European Community report.

Consistency of information between CRF and NIR

The emission data as reported in the CRF summary tables for the European Community and the summary table provided in the technical report are consistent. A comparison was also made between the summary 1999 inventory year CRF tables provided for the European Community and the 1999 inventory year CRF summary tables provided for each of the individual member States in their 2001 submissions. The results were compared for Summary table 1.A, for the total national emissions for CO_2, CO_2 removals, CH_4, and N_2O. The comparison was made utilizing the exact same cells in the CRF tables, by summing the totals from each of the individual member State's CRFs and then comparing that total with the European Community CRF report total. The results of this comparison are as follows:

	Sum of member States' CRF	EC CRF	Differential
CO_2	3,284,922	3,270,520	14,402
CO_2 removals	-139,918	-200,984	61,066
CH_4	17,387	17,445	58
N_2O	1,098	1,092	6

Note: all values are in Gg and are for inventory year 1999

Time series consistency

There is no consistent trend identified in the European Community emissions, as the totals fluctuate up and down through the 1990-1999 time series. The European Community report does not evaluate the trends in emissions or elaborate on sector changes. Because the European Community report is a compilation of member States' inventories, it is difficult to discern if the values reflect a particular trend, since each country has different national trends. A comparison of member States' reported trends to the trends reflected in the reported European Community values might be beneficial (weighted for the impact of each country's emissions on the whole community).

Comparison with previous submissions

There are no recalculation tables provided in the European Community report, however there is a section on changes as compared to the previous (2000) inventory.

QA/QC and verification procedures
There is annual process of submission and review to compile the European Community summary report. These involve checks by the European Environment Agency and circulation of draft European Community inventory to member states for review and finalization.   Otherwise, the European Community report relies on the national systems in place in each country for their QA/QC procedures. The European Community report also states that the IPCC reference approach is reported for fossil fuel combustion, using fossil fuel data from Eurostat.

Key sources
The European Community report is a compilation of member States reports, so there is no separate key source analysis applicable here.

Uncertainty estimates
The European Community report states that uncertainties remain high in industrial greenhouse gas emission estimates because of remaining data gaps reported by member States.

ESTONIA

General

Common reporting format (CRF) and national inventory report (NIR)
Estonia provided inventory data for the year 1999 using the CRF. The submission encompassed most of the requested tables. However, tables on trends and recalculations, overview, summary table for emission factors and methods, as well as some sectoral background data tables, were not provided. The use of indicators in sectoral reports and sectoral background data tables was limited. An NIR was not submitted, nor was any textual explanation of the numerical information.

Consistency of information between CRF and NIR
Not applicable since neither an NIR nor any other additional information was provided.

Time series consistency
Analysis of the time series was not possible since data other than for 1999 were not reported. The corresponding trend tables of the CRF (table 10) were not submitted.

Comparison with previous submissions
Information on recalculation was not provided in the CRF. Comparison with previous submissions was not possible because the 2001 submission did not include any emission data for the years prior to 1999.

QA/QC and verification procedures
No information was available on whether the inventory data was subject to self-verification or quality assurance (QA)/quality control (QC) review procedures.

Key sources
Estonia did not provide any key source analysis.

Uncertainty estimates
Uncertainty estimates have not been provided.

Sector-by sector findings

Since neither emissions estimates nor activity data or related information was reported for 1990 to 1998, analysis of trends was not possible for any sector.
Information on methods and emission factors used was not reported for any sector (Summary 3 of the CRF was not provided).

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is no difference in the CO_2 emission estimates between the reference approach and the sectoral approach.
Estonia explained that small differences occurred upon calculation, as in the energy balance of 1999, the entry "statistical difference" was introduced for the first time. Differences in the energy industries sector were eliminated in order to avoid contradiction in the sum table.

International data comparison
In the CRF only the apparent consumption is shown so it is not possible to do a complete comparison.
The Estonian reference approach energy data for 1999 are 8.5% higher than those reported to the IEA. The CRF value is 22% higher for liquid fuels and 4.7% higher for solid fuels while natural gas corresponds very closely. One specific difference is:

- The CRF shows data for shale oil, natural gas liquids, jet kerosene and other kerosene while the IEA does not show any apparent consumption for these fuels.

Estonia explained that the main source of energy data in the national inventory is the energy balance published by the Statistical Office of Estonia. Unfortunately, Estonia has no IEA data to complete the comparison and cannot comment on why there are some differences.
According to the energy balance 1999, the consumption of fuels was as follows:
Liquid fuels total: 47,513 TJ.
Solid fuels total: 11,518 TJ.
Gas total: 24,146 TJ.

Key sources
Fuel combustion
1.A.1 Energy industries - liquid fuels (petroleum refining and manufacture of solid fuels and other energy industries): Activity data and emissions from these subcategories were not reported.
Estonia explained that there is no petroleum refining or solid fuel manufacture in Estonia.

1.A.3.b Road transportation (CO_2 and N_20): The value of the CO_2 IEF for gasoline in 1999 (68.6 t/TJ) is lower than the IPCC default value (73.0 t/TJ) for Europe.
Estonia explained that the value of the CEF it had used for gasoline was 18.9 tC/TJ (equivalent to 69.3 tonnes CO_2/TJ). The CEF is taken from the IPCC Guidelines, Volume 2, Table 1.2. Estonia has no adjusted CEF (for gasoline) values for Europe.

Fugitive emissions
1.B.2.ai,iv,v vi Oil:

- Activity data and emissions from exploration were not reported.
- Activity data from refining/storage were reported but estimates of CH_4 emissions were not provided or were less than 0.005 Gg.
- Activity data and emissions from distribution of oil products and other were not reported.
- The units were not reported.

Estonia explained that there is no petroleum refining industry in Estonia. There is only shale oil (produced from oil shale) production in Estonia. The table has now been updated. Distribution is included in the transport section (see Worksheet 1-7); there is no distribution in the oil section.

1.B.2.b i,iii Natural gas:

- The value of the CH_4 IEF from production/processing and transmission in 1999 (458,000 kg/PJ) is the highest across the reporting Parties.
- Activity data and emissions from distribution and other leakage were not reported.

1.B.2.c Venting: Activity data and emissions from flaring were not reported.
Estonia explained that there is no natural gas production in Estonia. The production of landfill gas amounted to 0.11 PJ. The CH_4 emission factor is taken from Table 1-61, Eastern Europe and the former USSR. It is higher than the selected average due to the technical

condition of Estonia's gas distribution equipment. A lower emission factor will be taken in the coming years, as the condition of the equipment is improving every year. Table 1.B.2 updated.

Non-key sources

1.B.1.a Coal mining and handling: The value of the CH_4 IEF from **u**nderground mines (mining activities) in 1999 (1.34 kg/t) is among the lowest across the reporting Parties and is lower than the IPCC default values (4.5 – 16.75 kg/t).
Estonia explained that this concerns oil shale mines, not coal. As oil shale layers are located very close to the surface of the earth and the overburden (limestone) is full of tectonic disturbances, methane is emitted; for emission calculations the recommendations of local mining specialists have been taken into account (methane emission factor 1.34 kg/t).

1.A.3.b Road transportation (CO_2 and N_20): The values of the N_2O IEF for both gasoline and diesel oil in 1999 (0.6 kg/TJ) are the lowest across the reporting Parties and are lower than the IPCC default values for Europe.
Estonia explained that N_2O emission factors for diesel and gasoline of 0.6 kg/ TJ were used, taken from Table 1-8, IPCC Guidelines, Vol. 2, p. 1.36.

Bunker fuels

1.A.3.d International marine transport

- The activity data for residual oil reported in the CRF are lower compared to the data published by the IEA (73 per cent).
- The activity data for gas/diesel oil reported in the CRF are lower compared to the data published by the IEA (31 per cent).

Estonia explained that the activity data (for residual oil 3,050 TJ and diesel oil 1,590 TJ) were taken from the energy balance 1999, Statistical Office of Tallinn, 2000.

INDUSTRIAL PROCESSES

Key sources

2.A.1 Cement production – CO_2

- Reported activity data in CRF (644.8kt) is substantially different than the UN 1999 data for cement production (360kt).
  Estonia confirmed that production totalled 644.8 thousand tonnes (kt) in 1999 and noted that it includes clinker.

SOLVENT AND OTHER PRODUCT USE

No information reported for this category.
Estonia explained that GHG emissions from solvent and other product use were not calculated because of a lack of methodology and emission factors.

AGRICULTURE

No information was provided for the following source categories: 4.E Prescribed burning of savannas and 4.F Field burning of agricultural residues. 4.C Rice cultivation was reported as “zero”.

Key sources

4.A Enteric fermentation – CH_4

- Activity data. Reported cattle and swine population data were 15 and 14% lower than FAO statistics (267 versus 308 for cattle and 286 versus 326 thousand head for swine).
  Estonia explained these differences in number of cattle and swine as being due to different timing: FAO statistics give numbers for 1998, while the Estonian Statistical Yearbook (used for the inventory) provides numbers as at 01.01.1999.

4.D Agricultural soils – direct N_2O emissions (4.D.1.)

- Fractions used. Large value reported for $Frac_{BURN}$ (0.9);
  Estonia explained that this large value (0.9) is the default IPCC value.[1] As emissions from prescribed burning of savannas and field burning of agricultural residue were not reported in the inventory, this parameter is not in use. The table is currently being updated.

- N_2O-IEF. IEFs for N-fixing crops and crop residues were among the lowest values among the reporting Parties.
  Estonia explained that coefficients from the Revised 1996 IPCC Guidelines were used.

Non-key sources

4.B Manure management – CH_4 and N_2O

- CH_4-IEF. IEF for non-dairy cattle was the highest value among the reporting Parties (IEF corresponds to IPCC default for temperate Eastern Europe). The IEF for sheep was among the lower values compared to other reporting Parties and low compared to the IPCC default for cool-developed countries (0.16 versus 0.19 kg CH_4 /hd/yr). It is not clear which climate region has been applied for emission factors (cool or temperate).
- N excretion rates for all livestock types are largely the lowest values of the reporting Parties and lower by a factor of 1000 compared to IPCC default values for cool-Eastern Europe.
- Consistency checks. Multiplication of N excretion rates per animal by the corresponding animal population differs by a factor of 100 from the sum of nitrogen excretion over all AWMS for the particular livestock type.

Estonia explained that emission factors and coefficients for temperate regions from the Workbook of the Revised 1996 IPCC Guidelines (table 4-4, 4-5, 4-6, 4-7) were used for calculating emissions. Estonia assumes that the reason for some of the identified issues could be technical problems in the data transfer from the IPCC software into the CRF.

LAND-USE CHANGE AND FORESTRY

Overview

- Estonia reported in table 5 CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for boreal forests, 5.B (Forest and Grassland Conversion), 5.C (Abandonment of Managed Lands) and 5.D (Emissions and Removals from Soils).
- Emissions of non-CO_2 gases were not reported
- Values were only reported for the year 1999. Calculation of trends was therefore not possible.

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[1] According to the Revised 1996 IPCC Guidelines, Volume 2 (Workbook), page 4.35, table 4-17 the value for $Frac_{BURN}$ is as follows: 0.25 in developing and 0.10 or less in developed countries (kg N/kg crop-N) (see also Volume 3 of these guidelines (Reference Manual), page 4.94, table 4-19).

- In table 5, CO_2 emissions, removals and net removals for category 5.A were reported, but only total removal was included in Table 5.A.

5.A. Changes in forest and other woody biomass stocks

- Average annual growth rates of aboveground biomass were reported for boreal forests (4.28 t dm/ha/yr or 1.93 t C/ha/yr). These values seem to be high compared to the IPCC default of 1 t dm/ha/yr. The reported values also fall above the mean value calculated from the corresponding values reported from other Parties, equal to 3.59 t dm/ha.
  Estonia mentioned that the source of annual growth rates is the Forest Yearbook 1999. It stated that this is not high if compared to the IPCC Special Report on LULUCF, page 175, which states that average annual growth rate in boreal forests could be up to 4.5 tC /ha/yr[2].

5.B. Forest and grassland conversion

- Area converted annually for on- and off-site burning differs significantly from average area converted for decay (0.06 versus 0.42 kha).
  Estonia explained that since 1995 establishment of new ditches and roads has declined greatly. The area converted annually fell to 0.006, according to expert opinion of specialists from the Estonian National Board.
- Value of 60.82 t dm/ha (reported as "Average annual net loss of biomass", in t dm/ha/yr) seems to be "Annual net loss of biomass" (t dm/yr) (if assumed, the average annual net loss of biomass would be exactly that estimated for "on- and off-site burning".
- Value reported for average annual net loss of biomass for boreal, mixed coniferous/broadleaf under on- and off-site burning (144.8 t dm/ha) is double that reported for the same vegetation formation under decay (60.82 t dm/ha).
- Value reported for average annual net loss of biomass for boreal, mixed coniferous/broadleaf (144.8 t dm/ha) is outside the default range provided by IPCC (40 – 87 t dm/ha).

5.C. Abandonment of managed lands

- Average annual growth rate for aboveground biomass, in boreal mixed coniferous/broadleaf forests (4.28 t dm/ha/yr) is several times higher than the value reported by Canada (0.28), for the first 20 years. It is also higher than the IPCC default for the first 20 years (0.7 to 2.0).

5.D. CO_2 emissions and removals from soils

- Average annual rates of soil C uptake/removal from mineral soils ranged from –0.32 (low activity soils) to 0.14 Mg C/ha/yr (sandy soils), exceeding values reported by Finland (-0.05 to 0,01 Mg C/ha/yr).

WASTE

Key sources

6.A Solid waste disposal on land –CH_4

- Estonia did not complete Table 3s1 on methods and sources of emission factors used.
- Additional information and activity data (e.g. annual MWS disposed at SWDs, population) were not provided in CRF tables. No notation keys were used.
- Fraction of DOC (1.0) is too high [fraction DOC times annual MSW at SWDs = DOC degradable, which is given in CRF as 0.77]

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2 According to table 3-17 of the IPCC Special Report on LULUCF, page 175, the average rate of uptake for AR activities in boreal forests its not higher than 1.2 tC/ha/yr

6.B Wastewater Handling

- Methods used and other activity and background data were not provided.

FINLAND

General

Common reporting format (CRF) and national inventory report (NIR*)*

Finland provided its GHG inventory using the CRF for 1990 to 1999 and included all requested tables. Finland submitted an NIR, in which it describes sources, methods, activity data and emission factors used to compile the inventory. Indicators have widely been used.

Consistency in information between CRF and the NIR

No inconsistencies have been found in the information provided in the CRF and the NIR.

Time series consistency

The GHG trends provided in the trend table of the CRF (table 10) reveal increasing emissions (5 per cent) for the energy sector between 1990 and 1999. Emissions from industrial processes decrease by 33 per cent to a low in 1993 and then gradually increase. Emissions from the agriculture sector decline by 37 per cent for the same period. Removals from LUCF decline by 55 per cent for the same period. Substantial documentation has been provided in the NIR to explain these trends.

Comparison with previous submissions

Finland recalculated its inventory for 1990 and 1998 and provided the corresponding recalculation tables (tables 8 (a)) and explanatory information for these recalculations (table 8 (b)). The effect of the recalculation on the total base years' inventory in terms of CO_2 equivalent was an increase of 1.7 and 2.5 per cent, without and with land-use change and forestry, respectively. Major changes occurred, for both years, in the estimates of CH_4 in the industrial processes sector (metal production) and CO_2 from the agricultural soils, where estimates reported for the base year were twice as high compared to estimates from the 2000 submission. The Party reported the cause for this being mainly improved activity data and elaboration of the IPCC methodology. Independent secretariat calculations of the per cent changes in total CO_2 equivalent (with and without LUCF) for inventory years 1990 and 1998 based on the CRF 2000 and CRF 2001 submissions resulted in no significant differences.

QA/QC and verification procedures

The 1999 inventory data has not yet been verified by a third Party. The quality management system is still under development and will be implemented in the submission of 2002. Quality indicators were provided in Table 7 of the CRF.
Finland explained that it is currently considering different QA/QC procedures and the implementation of a quality management system both at the sector-by-sector level and at the level of the entire calculating and reporting system. One solution so far has been the use of some parallel calculation methods and data collection systems, and procedures for cross-checking of results among the experts of some source categories.

Key source analysis

Finland has made a preliminary identification of its key sources utilizing IPCC Good Practice Tier 2 methodologies for key sources determination. In the preliminary analysis, which uses trend or level criteria, 26 key sources were identified. The analysis relied on level, trend, qualitative, and uncertainty criteria applied at the source category level.

Uncertainty estimates
Finland provided preliminary uncertainty estimates, which are based on the Tier 1 method as described in the IPCC Good Practice Guidance, and rely primarily on expert judgement. The NIR recognizes this as an area for future improvement. The quality of estimates is considered to be high if the uncertainty is less than 10 per cent, low if the uncertainty is more than 40 per cent and medium for values in between.
Finland indicated that it plans to continue to improve and work on their key source analysis and uncertainty estimates of inventories.

Sector-by-sector findings

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 0.11 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(c) of the CRF.
Finland provided the following comments.
In recent years the differences between RA and NA have been relatively small. There are however some years in the early 1990s where the differences are nearly +/- 10 per cent. Probably one reason for these differences is the changes in national emergency reserve stocks of oil products. These reserve stocks are confidential and they are not transparent in the official energy statistics. Due to new legislation concerning maximum sulphur content of fuels, these reserve stocks were gradually changed in the first half of the 1990s. Thus some parts of import/export and consumption actually took place in different years. These changes are not fully reflected in stock changes or statistical differences of oil products. It seems however that the cumulative difference is close to zero. There may also have been other issues concerning the customers' stock changes as well as in the allocation of certain oil products from the customs statistics data.

Comparison with international data
The Finnish reference approach energy data for 1999 are 3.4 per cent lower than those reported to the IEA. For liquid fuels, this difference is 6.4 per cent. Specific differences include:
- Liquid fuel imports in the CRF are 26,790 TJ less that those reported to the IEA. Since the CRF combines many products with 'other oil', it is difficult to see where the problems are. There is a difference of 7,097 TJ for crude oil.
- Total liquid fuel exports are 6,434 TJ lower in the CRF.
- Stock changes for liquid fuels do not correspond well. The CRF crude oil stock change is –17,063 TJ while the IEA shows –19,963 TJ.

Most of the above questions are also applicable to the 1990 data where the CRF data are 3.7 per cent higher than the IEA data. The growth rate of overall apparent consumption between 1990 and 1999 is quite different in the two data sets: CRF rate –0.1 per cent and IEA rate 7.2 per cent.
Finland provided the following comments.
The data for the Eurostat/IEA Joint Questionnaire are taken from the same sources as the national energy balance, which is used for the reference approach. It is not clear at the moment why there are such differences in the IEA energy balance and national energy

balance. Some possible reasons might be different allocations, reporting levels and NCVs and on the other hand, lack of updating.
Statistics Finland will perform a study proposed by Eurostat to identify, explain and finally eliminate the differences between CRF data and Joint Questionnaire data as part of a project. The deadline for the project is May 2002 and it concerns the years 1990, 1995 and 1998. The results of this study will finally be used for other years too.
There are some additional issues in checking the energy balances of the first half of the 1990s. At that time the energy statistics were compiled by another organization. Part of the data used then is only available in hard copy (and perhaps some of the background data are not available at all).

Key sources
<u>*Fuel combustion*</u>
1.A.1 Energy industries
- The value of the CO_2 IEFs for liquid fuels decreased by 8 per cent from 72.2 t/TJ in 1990 to 66.6 t/TJ in 1992 and then gradually increased to 73.2 t/TJ in 1999.

Finland explained that the problem is in the category '1.A.1.b Petroleum refining'. There are some not-yet-updated plant level emission factors of refinery fuels in time series in 1992-1994 (CRF data for these years are partly based on previous inventories). These updates will be reported in the next submission.
- The value of the CO_2 IEF for solid fuels for the category manufacture of solid fuels and other energy industries in 1999 (39.7 t/TJ) is among the lowest across the reporting Parties.

Finland explained that this category includes only one fuel, coke oven gas, which has a relatively low CO_2 EF. Coke oven gas and blast furnace gases are included in solid fuels in Finnish inventories (as they originate from solid fuels).
- The value of the CO_2 IEF for other fuels for the category public electricity and heat production in 1999 (102.9 t/TJ) is the second highest across the reporting Parties.

Finland explained that it had reported peat in the category 'Other fuels'. (That was not mentioned clearly enough in the NIR.) 'Other fuels' include hardly any fuels other than peat, which has a relatively high CO_2 EF. This same comment applies to some of the following remarks too.

1.A.2 Manufacturing industries and construction
- The value of the CO_2 IEFs for solid fuels decreased by 20 per cent from 97.3 t/TJ in 1990 to 78.2t/TJ in 1994 and then increased to 97.7 t/TJ in 1999.

Finland explained that probably there is a misallocation of fuels (BF gas) between solid/gaseous in some years; plant level data will be checked before the next submission.
- The value of the CO_2 IEF for other fuels in 1999 (99.9 t/TJ) is one of the highest across the reporting Parties.

Finland indicated that the explanation on 1.A.1. Other fuels is also applicable for this finding.

1.*A.3.b Road transportation (CO_2 and N_2O)*
- The value of the CO_2 IEF for gasoline in 1999 (72.8 t/TJ) is one of the highest across the reporting Parties.

Finland explained that the CO_2 EF is based on national references and will be re-checked.
- The value of the N_2O IEF for gasoline in 1999 (12.6 kg/TJ) increased by 230 per cent compared to its 1990 level (3.8 kg/TJ).

Finland explained that the use of catalytic converters had increased (increasing N_2O emissions).

1.A.3.d Navigation (domestic): The activity data for gas/diesel oil reported in the CRF are lower compared to the data published by the IEA (25 per cent).
Finland explained that the activity data used in the inventory were more recent than the data provided for IEA. The consistency will be checked in the future.

1.A.4 Other sectors - other fuels: The values of the CO_2 IEF in 1999 for the commercial/institutional category (105.2t/TJ) and the residential and agriculture/forestry/fisheries categories (104.9t/TJ) are the highest across the reporting Parties.
Finland indicated that the explanation on 1.A.1. Other fuels is also applicable for this finding.

Non-key sources

Fuel combustion

1.A.1 Energy industries

- The value of the CH_4 IEF from biomass in 1999 (14.4 kg/TJ) decreased significantly compared to its 1990 level (25.8 kg/TJ).

Finland stated that no obvious reason had been found; data will be checked.

- The value of the CH_4 IEF from other fuels in 1999 (3.4 kg/TJ) decreased significantly compared to its 1990 level (6.6 kg/TJ).

Finland stated that no obvious reason had been found; data will be checked.

- The value of the N_2O IEF for biomass in 1999 (22.0 kg/TJ) is the highest across the reporting Parties, having increased significantly compared to its 1990 level (7.8 kg/TJ).
- The value of the N_2O IEF for other fuels in 1999 (15.8 kg/TJ) is the second highest across the reporting Parties.

Finland explained that there was a significant change in combustion technology (wood and peat fired boilers) between 1990 and 1999. It seems that the database of emission factors overestimates N_2O EFs of the new boiler types. New research data are now available and will be used in the following inventories. The time series will be updated as soon as possible. (Comment applicable to both findings above)

1.A.2 Manufacturing industries and construction

- The value of the N_2O IEF from biomass in 1999 (6.5 kg/TJ) increased by 130 per cent over the 1990 level (2.83 kg/TJ)
- The value of the N_2O IEF from other fuels in 1999 (21.0kg/TJ) is the highest across the reporting Parties, having almost doubled compared to its 1990 level (11.8 kg/TJ).

Finland indicated that the explanation on 1.A.1. Biomass and other fuels is also applicable for this finding.

- The value of the N_2O IEFs from liquid fuels in 1999 (7.9kg/TJ) increased by 70 per cent compared to its 1998 level (4.7 kg/TJ).

Finland explained that a new calculation model for off-road machinery (TYKO) had been implemented in 2000. TYKO includes construction machinery in this category. Results of the TYKO model have been used in the 1999 inventory only; previous years will be updated in the next submission. (See NIR 09.04.2001 page 12).

- The value of the N_2O IEFs from solid fuels in 1999 (6.2 kg/TJ) increased by 63 per cent compared to its 1998 level (3.8 kg/TJ).

Finland stated that no obvious reason had been found; data will be checked.

1.A.3.a Civil aviation (domestic): The activity data for aviation gasoline reported in the CRF are lower compared to the data published by the IEA (17 per cent).

Finland explained that the differences probably reflect different conversion factors and rounding.

<u>*Fugitive emissions*</u>
1.B.2.b iii Natural gas - other leakage
The value of CH_4 IEFs (1000 kg/t, about 1 900 000 kg/PJ) is outside the IPCC default emission factor range (175 000-384 000 kg/PJ).

INDUSTRIAL PROCESSES

Key sources
2.A.2 Lime production – CO_2

- Emissions rose 46% from 1998 to 1999.
  Finland indicated that the activity data will be reviewed, noting that there is a new source for 1999 data.

2.B.2. Nitric acid production – N_2O

- The IEF for N_2O (0.0094t/t) is the highest amongst the Parties and is slightly higher than the IPCC default range of 0.002 – 0.009t/t
  Finland explained that the emission factor is slightly higher than in the IPCC guidelines, however, is based on the measurements made in the factories of the fertilizer company, Kemira Agro Ltd.
- A decrease of 12.15% in emissions was observed for 1990 to 1991 and 10.49% for 1991 to 1992, while from 1992 to 1999 emissions fluctuated less year to year. (0 to 6%).
  It was explained that one plant was gradually closed down between 1990 and 1992.

2.A.1 Cement production – CO_2

- The reported activity data in the CRF (1310kt) is higher than the UN cement data (1164kt).
  Finland indicated that the activity data will be reviewed.
- The IEF for CO_2 (0.47t/t) is low compared to other countries and it is slightly lower than the IPCC default value for cement (0.499t/t), although the value has been consistent from 1990 to 1999.
  Finland explained that the emission factor used is a national emission factor.
- CO_2 emissions decreased from 1990 to 1993 (49%), but started increasing from 1994. In 1999 emissions were still 21% lower than in 1990.
  Finland explained that some plants were closed in the beginning of the 1990's.

2.A.2 Lime production – CO_2

- Key source analysis performed by the secretariat identified this source as a key source with a contribution to national total of 0.65% in absolute emission levels. However, Tier 2 key source analysis performed by Finland in its NIR did not identify this source as key.
- Overall CO_2 emission increased by 24.8% from 1990 to 1999.
- A rise in CO_2 emissions (45.84%) was observed between 1998 and 1999.

2.F Consumption of halocarbons and SF_6

- Actual emissions of SF_6 from 1990 to 1999 decreased by 54%. The highest reduction occurred in 1995 (46.9%). Even though a general reduction occurred during this period, SF_6 emission rose by 173% from 1998 to 1999.

Finland responded that the decrease in emissions is explained in part by the peaking of annually installed new capacity of electrical equipment in 1990, and in part by the methodology used, which assumes higher emissions factors for equipment installed prior to 1994.
The considerable increase from 1998 to 1999 in emissions is explained by the aggregation of confidential emissions data from magnesium production in 1999 with other actual SF_6 emissions data. Such aggregation was not carried out in previous years.

- Potential SF_6 emission rose sharply from 1994 to 1995 by 1,892% (6.45 to 128.6Gg CO_2 equivalent)
  Finland explained that the activity data on which the estimates are based indicate that very little new electrical equipment capacity was installed in 1994. Year 1995 was characterised by a much higher activity level, more imports of equipment, and hence considerably higher potential emissions.
- The ratio of potential to actual SF_6 emission (P/A ratio) is the second lowest across Parties (0.9 in 1999).
  Finland explained that these exceptionally low ratios of 0.25 and 0.9, respectively, are due to mistakes made in transferring emissions figures from the calculation system used to the Common Reporting Format. These mistakes will be corrected and recalculation tables filled.
- The P/A ratio, however, increased from 0.25 in 1990 to 9.23 in 1995. In 1997 the ratio was at 10.32.
- There was a significant increase of PFC emissions from 1998 to 1999 (0.9 to 28.55Gg CO_2 equivalent) due to emissions from consumption related to refrigeration and air conditioning equipment and by the semiconductor manufactures. Both these sources had been indicated as not occurring in years prior to 1999.
  Finland explained that prior to 1999, PFC emissions occurred solely due to consumption of PFCs in semiconductor manufacturing. In 1999 a refrigerant new to the Finnish market (R-413A) was introduced. The introduction of this refrigerant, which contains a PFC-component (perfluoropropane), caused the observed sharp increase in emissions of PFCs.

Non-key sources
2.C.1 Iron and steel production – CH_4

- It was observed from the CRF tables that Finland provided activity data for sinter and pig iron from 1992 to 1998, but no activity data were provided in 1999 (notation key NA was reported).
  Finland explained that the CH_4 emissions have not been included, as the IPCC Revised 1996 Guidelines does not have a (default) emission factor for such emissions and because the measurements by Rautaruukki Ltd indicate that the emissions are insignificant. Thus the activity data have not been included either.

2.C.1 and 2 Metal Production – CO_2

- Emissions from iron and steel and ferroalloys production were reported as included elsewhere (energy sector). In the CRF it was noted that since the calculation method gives more accurate total CO_2 emissions (no double counting, completeness) compared to a more or less arbitrary allocation of coke and BF gases between energy use and process use, emissions have been included in the energy sector.

SOLVENT AND OTHER PRODUCT USE

No activity data and emissions of N_2O were provided for the use of N_2O in fire extinguishers, aerosol cans and other N_2O uses. Notation key IE was used but not referenced in Table 9s1.

AGRICULTURE

Emission estimates were not provided for field burning of agricultural residues, which were reported as NE/NO; an additional notation "NZ" was used in this source category, its meaning (nearly zero) being explained in Annex D Agriculture of the NIR but not in the CRF. CH_4 from rice cultivation and savanna burning was reported as NO.
Finland clarified that field burning of agricultural residues is negligible and therefore "NZ" (nearly zero) is used, but that in future, 0 (zero) will be used. There are no activities in rice cultivation and burning of savannas.

Key sources
IPCC default method (no tier specified) for estimating N_2O emissions from 4.B Manure management and 4.D Agricultural soils emissions (direct and indirect) as well as CO_2 emissions from agricultural soils. For all mentioned categories, a combination of country-specific and default emission factors was used.

4.A. Enteric fermentation – CH_4 emissions

- CH_4-IEF. CH_4-IEFs for dairy cattle are relatively high compared to the IPCC defaults for Western Europe (107.6 versus 100 kg CH_4/hd/yr) and to the other reporting Parties, while for non-dairy cattle IEFs are lower than the IPCC range (42.1 versus 48 kg CH_4/hd/yr) and among the lower values across Parties;
- Trends in IEF. CH_4-IEF for dairy cattle increased by 11% between 1990 and 1999 (97.1 to 107.6 kg CH_4/hd/yr) whilst corresponding CH_4 emissions declined by 16% in that period. Similarly, CH_4-IEF for non-dairy cattle increased 3% from 1990 to 1999 (40.9 versus 42.1 kg CH_4/hd/yr) whilst corresponding CH_4 emissions declined by 15% in that period.
- Trends in activity data**.** Annual changes of well over 5% for sheep, goats and swine.

Finland explained that the high emission factor is a result of the high level of milk production and intensive production methods. Meat production is extensive, thus the animals are slaughtered rather small.
The observed trends are due to dairy cattle production per cow having increased, while the number of animals has decreased. Also, meat production has been intensified to some extent (a change in feeding practices has increased the weight of animals), and the total number of cows has fallen slightly.
Generally, the structure of agricultural production changed significantly during the whole of the 1990s as a result of Finland joining the EU.

4.D. Agricultural soils – CO_2 emissions

- Agricultural soils CO_2 emissions were accounted for in the agriculture sector (estimates reported in tables Summary 1.A, 1.B and 2, and in table 10 of the CRF). However, detailed information on this source category was reported in table 5.D, CO_2 emissions/removals from soils.
- Trend in emissions. CO_2 emissions decreased by 37% from 1990 to 1999.

- Recalculations. For 1990, CO_2 estimates from this source were revised upwards by more than 100 per cent.

Finland explained that CO_2 emissions have been estimated using the IPCC methodology, comparing with the situation 20 years back. This causes some random fluctuations and thus this method has to be developed.

Regarding the 100% increase in the 1990 values, Finland attributed this to a new source category (mineral soils) being included in the inventory.

4.D. Agricultural soils – direct and indirect N_2O emissions (4.D.1. and 4.D.3.)

- N_2O-IEF. IEFs for direct and indirect sources of N_2O emissions equal the IPCC defaults (the Party reported the use of default and country-specific emission factors).
- N_2O-IEF. A same value was calculated for synthetic fertilizers, animal wastes applied to soils, N-fixing crops and crop residues; for crop residues the value is among the higher values across the reporting Parties.
- Fractions used. For the $Frac_{GASF}$, the reported value (0.006) is the lowest among the reporting Parties and is lower by a factor of 100 than the IPCC default. For the $Frac_{NCRO}$ Finland reported the highest values across Parties (0.0415).

Regarding the N_2O –IEF for indirect sources, Finland explained that it had used a well-documented national emission factor of 15% for leaching instead of 30%.

The low value for the $FRAC_{GASF}$ is due to the common practice in Finland of placing the fertilizers into the soil (at a depth of 7-8 cm) simultaneously with the sowing operations, which results in very low ammonia emissions. Furthermore, the fertilizers used in Finland cause smaller emissions than, for example, urea, which is the common fertilizer in other countries; in Finland the use of urea is negligible. (References are provided in the NIR). Also the Finnish soils are rather acidic resulting to low ammonia emissions.

For the $FRAC_{CRO}$ Finland referred to the IPCC default values[1] being used in the calculation.

4.B Manure management – N_2O emissions (4.B(b))

This source has been identified as key only according to the trend assessment.

- N excretion rates. Values for non-dairy cattle, swine and poultry were among the lowest across the reporting Parties and are low compared to the IPCC defaults (35 versus 70 kg N/hd/yr for non-dairy cattle; 9.6 versus 20 kg N/hd/yr for swine, 0.4 versus 0.6 kg N/hd/yr for poultry).
- Trend in N excretion rates. For swine, N excretion rates decreased by 20% from 1990 to 1999; for poultry, it decreased by 31% during that period.
- Trend in emissions. N_2O emissions decreased by 26% from 1990 to 1999.

Finland explained that the N content of the manure was acquired from the Rural Advisory Services (from Juho Kyntäjä). Feeding practices in Finland are different from those of many other countries, and are based on coarse feed (with low nitrogen content).

In recent years, much attention has been paid in Finland to the excessive use of N, which has resulted in changes in practices, especially in the N balance in the livestock diet.

[1] According to the Revised 1996 IPCC Guidelines, Volume 3 (Reference Manual), page 4.94, table 4-19 the following value for $Frac_{NCR0}$ can be found: $Frac_{NCR0}$ =0.015 kg N/kg of dry biomass.

Non-key sources

4.B. Manure management – CH_4 emissions (4.B(a))

- <u>CH_4-IEF.</u> IEFs for cattle are low compared to IPCC default values for cool-Western Europe (7.5 versus 14 kg CH_4/hd/yr for dairy cattle; 2.3 versus 6 CH_4/hd/yr for non-dairy cattle);
- <u>Trends in CH_4-IEF.</u> CH_4-IEF for non-dairy cattle increased by 18% from 1990 to 1999, with one annual variation of 12% for 1994/95. CH_4-IEF for swine increased 21.4% in that period due to a single annual change, which took place between 1994 and 1995.

Finland explained the low CH_4 –IEF by the prevalence of manure systems over liquid slurry systems. The emission factor for manure systems is one tenth of the emission factor of the slurry system. The increase in the emission factor is caused by an increase in the proportion of the slurry systems, the increase in the weight of animals and by changes in feeding practices.

Finland also explained that information on manure treatment has been gathered only twice: in 1992 and for the years 1995-97. This explains the step (change) in 1995.

LAND-USE CHANGE AND FORESTRY

Overview

- Finland used a country-specific method for reporting CO_2 emissions and removals from 5.A. (Changes in Forest and Other Woody Biomass Stocks) for boreal forests and from 5.D. (CO_2 emissions/removals from soils) for cultivation of mineral and organic soils, and liming of agricultural soils.
- Estimates from Table 5.D. have been reported under “Agriculture”.
- Emissions of non-CO_2 gases were not reported.

5.A. Changes in forest and other woody biomass stocks

- No activity data were reported in table 5.A as a country-specific method was used. The information together with the species identification is included in the NIR.
- Net removals decreased 54.5% from 1990 to 1999, with some very large annual changes: +60.5% for 1990/91, -16.5% for 1991/92, -40.7% for 1993/94, -14.9% for 1994/95, +43.2% for 1995/96, -39.9% for 1996/97, -23.1% for 1997/98 and +11.4% for 1998/99.
  Finland explained that fluctuations are caused by changes in commercial harvest, which are affected by the situation on the timber product market.

5.D. CO_2 emissions/removals from soils

- Rates of annual carbon loss from organic soils (1.1 to 1.3 Mg C/ha/yr) for cool temperate conditions (upland crops and pasture/forests, respectively) are among the lowest values of the four reporting Parties.
  The Party explained that CO_2 from organic soils is small as it uses a different classification system from the IPCC. It considered the IPCC definition of “organic soils” difficult to apply. The most recent estimations are about 60 000 ha of “histosoils” (organic matter content > 40 %) and 240 000 ha of “other organic soils” (organic matter content 20 – 40 %). Therefore, the Party decided to use different emission factors for these soils; O.M > 40 % = 2 and 4 Mg/ha/a for pasture and upland crops, respectively, and. 20 – 40 % 0,5 and 1 Mg/ha/a for pasture and upland crops, respectively.

WASTE

Key sources

6.A Solid waste disposal on land – CH_4:

- The CH_4 emissions from this source show large and steady decreases over time in agreement with the CH_4 recovery programme explained in the NIR.

Non-key sources

6.B Wastewater handling - CH_4:

- The implied emission factors for both industrial and domestic/commercial wastewater appear to be some 10 or more times lower than for other Parties.

Finland explained that the implied emission factors for both industrial and domestic wastewater treatment were low because the treatment systems included in the inventory were either aerobic or anaerobic with complete methane recovery. The emission factors mainly illustrated exceptional operational conditions. The wastewater treatment systems in rural areas, which may have much higher emission factors, were not yet included in the inventory (as stated in the NIR).

6.C. Waste incineration

- Emissions of CO_2 and N_2O from waste incineration were included in the energy sector and referenced in Table 9s1 on completeness. Finland explained that "waste incineration without energy recovery is nearly zero and it is included in the calculations of the energy sector".

FRANCE

General

Common reporting format (CRF) and national inventory report (NIR)

France provided inventories for 1990 to 1999 using the CRF, and included almost all requested tables. However, some sectoral background data tables (e.g. tables 1A(b), 1A(d) and 5.A-D) were provided only for a limited number of years (e.g. for 1990 and 1998-1999), but not for the entire time series. Notation keys were widely used throughout the tables. The NIR was submitted in French and a summary in English was provided.

France indicated that as the methodology used for the land/use change and forestry sector is completely different than that of the IPCC, the CRF tables 5A-D were not applicable. It also noted that provision of all CRF tables for the base year and the latest two years were sufficient and although not all the background data for other years were provided, sectoral and summary level emissions were provided for all years.

Consistency of information between CRF and NIR

No inconsistencies were identified in data from the NIR and CRF tables.

Time series consistency

There were no inconsistencies in the emission series for the period of reporting.

Comparison with previous submissions

France provided recalculated estimates (tables 8(a) for 1990 to 1998, and explanatory information for these recalculations (tables 8(b)). Although France indicated in the summary of the NIR that extensive data revisions have been undertaken since the last submission, the effects of the recalculations on the total base years' inventory in terms of CO_2 equivalent were 0.1 per cent (both in- and excluding land-use change and forestry). For some source categories, the recalculation tables included an estimate under "previous submission", but for "latest submission" reported zero. Although an explanation is provided in table 8(b), it is not clear, where these emissions have not been included in the CRF or where they have been allocated to in this current submission.

The Party indicated that the recalculations referred to in this report concern category 1B2 and to some extent 2C1. The respective emissions of CH_4 and N_2O are not zero, however, they are considered very negligible. They were reported in the previous submission, however, the format of the CRF does not allow for presentation of these emissions in tables 1B2 and 2(I)A-G. therefore there is a difference between the present and previous submissions.

However, a comparison at the level of the CRF between the 2000 and 2001 submission is not possible because France did not make any submission for the year 2000 using the CRF.

The Party indicated that the previous submission provided the IPCC sectoral tables which are highly similar to those of the CRF and comparisons are possible to a large extent.

Key source analysis

France did not carry out any key source analysis.

QA/QC and verification procedures

The NIR contained a discussion on uncertainty and validation issues. The discussion referred to the use of cross-comparisons on the energy sector (utilizing reference and sectoral approach) and a comparison with potential emissions for the fluorinated compounds. Also, there is reference to inventory review by pertinent agencies for source categories. There is no documentation of

quality control (QC) procedures that were implemented. Quality indicators for estimated source categories are provided in Table 7 Overview of the CRF.
The Party noted that this aspect of work is to be further developed and is underway. More information should be presented in the 2003 submission.

Uncertainty estimates
The NIR contains a general discussion on uncertainty issues related to the inventory, however, there is no uncertainty analysis or quantified uncertainty estimates provided in the inventory.
The Party noted that work is underway to calculate estimates of uncertainty.

Sector-by-sector findings

ENERGY

(France provided comments to the findings included in this section in French. These comments were unofficially translated into English for the purpose of this report.)

Reference approach
CO_2 emissions from the reference approach were provided for the years 1990 and 1998. For 1998, there is a difference of 1.86 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(c) of the CRF.

Comparison with international data
The French reference approach energy data for 1998 are 5.7% higher than those reported to the IEA. The CRF is 7.1% higher for liquid fuels, 6.4% higher for solid fuels and 1.5% higher for natural gas. Specific differences include:

- Stock changes have the opposite sign for all products except for lubricants.
- International bunkers for jet kerosene are 195,667 TJ lower in the CRF.
- Coal imports are 96,717 TJ higher in the CRF.
- Natural gas imports are 143,808 TJ higher in the CRF.

Most of the above questions are also applicable to the 1990 data where the CRF data are 5.3% higher than the IEA data. The growth rate of overall apparent consumption between 1990 and 1998 is very similar between the two data sets: CRF 5.3% and the IEA 4.8%.

France provided the following comments.
The sectoral approach is based on the energy balance compiled by the Energy Observatory, which is also in charge of producing energy data for submission to international organizations. The data concerning this comment were not available for the previous year given that the report was sent during the time in which the inventory was being produced (they will be sent before 15 April).
The Energy Observatory explains that the principal reasons behind the differences between the national and the international energy balances were the difficulties encountered in compiling statistics on petroleum products, where a "degradation" of the import data occurred (less precise distribution and customs statistics). This happened in the years up to 2000. Another reason for the divergence is that the data are transmitted to the IEA via the DIMAH (Ministry of Industry) and not the Energy Observatory. Different views occur between these

two. The data provided by the observatory are more reliable than those from the IEA. It is intended that in the future this problem will be solved by asking the DIMAH to submit its data via the observatory, and the methods will be analysed to find the reasons for the divergence. In future, these divergences will disappear.

Key sources

Fuel combustion

1.A.1 Energy industries - solid fuels

- The value of the CO_2 IEF (105.9 t/TJ) is the fourth highest across the reporting Parties
- The value of the CO_2 IEF (106.2 t/TJ) for manufactory of solid fuels and other energy industries is the second highest across the reporting Parties

1.A.1 Energy industries - other fuels

The value of the CO_2 IEF (103.95 t/TJ) is the second highest across the reporting Parties

1.A.2 Manufacturing industries and construction - solid fuels:

- The value of the CO_2 IEF in 1999 (114.9 t/TJ) is among the highest across the reporting Parties, having increased by 13 per cent compared to its 1990 level (101.6 kg/TJ).

France explained that the aggregated emission factors have a relative importance because they are sensitive to the difficulties inherent in the identification of fuels, the determination of their characteristics, the feedback on the energy balance and the variability of parameters from one year to another. The French emission factors are higher than the default values of the IPCC.

1.A.3.a Civil aviation (domestic):

- Activity data and emissions from aviation gasoline were not reported.

France explained that aviation fuel is included in kerosene (added in the CRF table 1A(a)s4)

- The activity data for jet kerosene reported in the CRF are higher compared to the data published by the IEA (33 per cent).

France explained that the reported activity included the overseas territories (DOM-TOM). Comparisons with the IEA are not pertinent.

1.A.3.b Road transportation:

- The value of the N_2O IEFs for gasoline in 1999 (9.6 kg/TJ) was about five times higher than the 1990 level (1.8 kg/TJ).

France confirmed this finding and explained that since 1993, more cars have been equipped with catalytic converters. The difference between a car with and without a catalytic converter is a little more than 7 on average.

Fugitive emissions

- The value of the CO_2 IEFs for oil refining/storage in 1999 (876340.0 kg/PJ) was 13 per cent below its 1990 level (1,009,786 kg/PJ).

France explained that these values reflect the available data and they are based on improvements in the refining process.

1.B.2.c i,ii,iii Venting:

- Activity data and emissions for oil, gas and combined were not reported.
- Flaring (gas): Activity data and emissions were not reported.

France explained that it is impossible to distinguish clearly between flaring and venting. Flaring encompasses both. The help provided by the guidance in this matter is insufficient. Flaring after gas production is included in line iii (combined).

Non-key sources

1.A.2 Manufacturing industries and construction **-** *biomass*:

- The value of the CH_4 IEFs in 1999 (11.8 kg/TJ) decreased by 30 per cent compared to its 1990 level (17.1 kg/TJ).

France replied that it had not been possible in the time available to make all the necessary verifications, but this difference reflects the structural variability of the biomass, which includes very different products with different emission factors.

1.A.3.d Navigation (domestic):

- The activity data for residual oil reported in the CRF are higher compared to the data published by the IEA (77 per cent).
- The activity data for gas/diesel oil reported in the CRF are lower compared to the data published by the IEA (11 per cent).

France indicated that the explanation is similar to that for civil aviation (domestic)

Fugitive emissions

1.B.1.a Coal mining and handling:

- The value of the CH_4 IEF (26.2 kg/t) from underground mines (mining activities) is the highest across the reporting Parties, having increased by 67 per cent compared to its 1990 level (15.6 kg/t).

France explained that the methane emissions are established on the basis of gross production data from mines and coal shipment. The values of the emission factors can fluctuate independently of the quantity of coal produced. It should be taken into account that several mines were closed in France after 1990.

1.B.2.a iv Oil:

- The value of the CH_4 IEF for refining/storage in 1999 (66 kg/PJ) is one of the lowest across the reporting Parties.

France indicated that it would need more precise information relating to this finding.

Bunker fuels

1.A.3.a International aviation:

- The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (16 per cent).

1.A.3.d International marine transport:

- The activity data for gas/diesel oil reported in the CRF are higher compared to the data published by the IEA (7 per cent).

See comments on domestic aviation and navigation.

INDUSTRIAL PROCESSES

Key sources

2. A.1 Cement production

- Activity data from CRF is less than UN data (1998) by 15%. In the CRF it is not clearly specified if activity refers to clinker or cement production.

The Party clarified that production refers to clinker.

2.B.3 Adipic acid production

- N_2O emissions decreased by 47% from 1997 to 1998 and again by 53% from 1998 to 1999.
- The IEF (0.07 t/t) was lower than the IPCC default values (0.264-0.3 t/t).

The Party explained that there is only one production facility. Since 1997 an abatement system has been developed and installed (reductions of emissions could reach 90%).

2.B.2. Nitric acid production

There has been a significant reduction in emissions from this source between 1990 and 1999 (-49.5%). Reduction of the IEF accounts for 2/3 of the reduction, however, no explanation was provided in the Party's submission.

The Party noted that between 1990 and 1999 the production of nitric acid decreased 14%. The emission factors used were from the following sources: for the year 1990 the factor was taken from "Default emission factors hanbook, CORINAIR of January 1992", given as 8,000 g/ t of acid, and from 1994 onward the factor was taken from a study providing a value of 4,700 g/ t of acid. Since February 1998 regulation has required rates to be limited to 7 kg of N_2O per tonne of acid.

2.F Consumption of halocarbons and SF_6

- Aggregate consumption was second lowest among reporting Parties.

Party noted that estimates are calculated in consultation with industries concerned.

- Potential HFCs, PFCs and SF_6 emissions were not estimated

Party noted that it is very difficult to obtain information pertaining to fluids in imported and exported products. In the absence of data this approach is not feasible to implement in a country of this size.

- Actual SF_6 emissions increased by 20% from 1998 to 1999

The Party indicated that emissions were reported as indentical for 1998 and 1999, (0.1 Gg).

2.B.1 Ammonia production

- A reduction of 15% in emissions from 1990 to 1991 and an increase of 46% from 1991 to 1992

The Party noted that the rates mentioned above were correct as the emissions of NO_X provided in the CRF were 3.18 Gg (1990), 3.50 Gg (1991), and 2.73 Gg (1992). Subsequent to the submission, the Party detected an error in the relevant data; actual emissions should have been 3.85 Gg (1990), 3.89 Gg (1991) and 3.42 Gg (1992), and will be corrected in the next submission.

2.C.1 Iron and steel

- There are observed erratic changes in emission trends from 1990 to 1999.

The Party noted that changes reflect the deviations in production levels from year to year.

2.B.5 Other (chemical industry)

- Activity data for dichloroethylene was not reported
- Activity data for methanol was not reported

The Party explained that the production of methanol (not produced in France) and dichloroethylene are not treated in the inventory. The SNAP97 nomenclature is used to develop the inventory and the SNAP does not list these two sources (associated emissions are negligible or presently not able to be estimated).

- France did not specify what chemicals are group under "2.B.5 Other". A relevant quantity of N_20 emissions is connected to the production of those chemicals and France is the only reporting Party having reported such emissions.

The emissions of N_2O are activities associated with the production of glyoxal and glyoxylic acid.

Non-key sources

2.A.2 Lime production

- IEF (0.44t/t) is lower compared to other Parties and lower than the IPCC default (0.79t/t). However, it is indicated in the CRF that the reported data is for "limestone consumed".

2.C.3 Aluminium production

- The methods and emission factors used were not stated in the CRF.

The Party indicated that the factors are provided by the industry, based on the models recommended by good practice.

- Emissions of CF_4, C_2F_6 have been erratic (28.8% decrease from 1990 to 1991, 39% decrease from 1992 to 1993, 30% increase from 1997 to 1998, and 29.8% increase from 1998 to 1999).

The Party indicated that the production data and emission factors are provided by the industry. Production has varied during the period.

- CO_2 trends were not consistent with the previous emissions: 15.38% decrease from 1990 to 1991, 46% increase from 1991 to 1992, 9.5% decrease from 1992 to 1993, 5% increase from 1997 to 1998 and 7.4% increase from 1998 to 1999.

Party noted that emissions of CO_2 are not correlated with emissions of CF_4 but fluctuate with production. The emission factors used throughout the period were constant.

- The IEF for CO_2 is stable throughout the period, the IEF for CF_4 and C_2F_6 is decreasing from 1990 to 1995-1996 by about 75% and then increasing again by about 50% from 1996 to 1999.

SOLVENT AND OTHER PRODUCT USE

Non-key sources

3.A Paint application

- IEF for CO_2 emissions are high compared to other Parties

3.C Chemical products, manufacture and processing

- No reporting of CO_2 emissions

The Party noted that the CRF does not allow for the presentation of these emissions (e.g. table 3 column C).

3.D Other

- CO_2 and N_2O emissions are high compared to other Parties

It was noted that the N_2O is attributed as its use in anaesthesia and that the issue of CO_2 is a question of method for accounting for NMVOCs

AGRICULTURE

France did not provide information on 4.E Savanna burning and 4.F Field burning of agricultural residues.

France explained that savannas do not exist in the country. The burning of agricultural residues in fields is in principle prohibited, and data on this anyhow limited activity are not available.

Key sources

4.A. Enteric fermentation – CH_4 emissions

- Activity data. Swine population differs from FAO statistics by 107% (7,107 thousand head in CRF versus 14,682 thousand head reported by FAO).
  France explained that the inventory takes into account only swine of 50 kg and more (which number 7,107 thousand head).
- No poultry population and emissions estimates were reported for 1990, 1997, 1998 and 1999 (for N_2O, estimates and corresponding activity data were provided (tables 4.B(a) and 4.B(b).
  France explained that the enteric fermentation of poultry is negligible and has been neglected.
- CH_4-IEF. IEF for dairy cattle is among the lower values across reporting Parties and relatively low compared to the IPCC default for Western Europe (82 vs. 100 kg CH_4/hd/yr).
  France explained the low IEF by the inclusion of dairy cows and dairy heifers within the category of dairy cattle. Given that heifers have a lower emission rate, the IEF is lower than it would be if dairy cattle only were considered. France expressed its intention to report heifer dairy under other (livestock) in future inventories.
- CH_4-IEF. IEF for sheep is among the lowest values across reporting Parties and relatively low compared to the IPCC default (6 vs. 8 kg CH_4/hd/yr).
- CH_4-IEF. IEF for swine was the lowest value across reporting Parties and 33% lower than the IPCC default value (1.0 vs. 1.5 kg CH_4/hd/yr).
  With respect to the IEFs for swine and sheep, France explained that emission factors were taken from MIES[1] that are close to those from the IPCC. However, revisiting of the emission factors currently undertaken could lead to application of IPCC default emission factors.

4.B. Manure management – CH_4 and N_2O emissions (4.B(a) and 4.B(b))

- CH_4-IEF. IEF for sheep equals IPCC default (the Party reported the use of country-specific emission factors).
- CH_4-IEF. IEF for dairy cattle was among the lowest values across the reporting Parties. IEFs for dairy and non-dairy cattle are very low compared to the IPCC default values for

[1] Mission interministerielle de l'effet de serre.

temperate-Western Europe (5.9 versus 44 kg CH_4/hd/yr for dairy cattle; 3.5 versus 20 kg CH_4/hd/yr for non-dairy cattle).

- N_2O-IEF for AWMS. N excretion from anaerobic lagoons was reported to be “zero”. IEF for liquid system is almost the lowest value across reporting Parties and approximately half the IPCC default (0.0007 versus 0.001 kg N_2O-N/kg N). The IEF for “other AWMS” was among the lower values across reporting Parties; the meaning of “other” was not specified in the CRF.
- Consistency checks. The sum of nitrogen excretion from sheep over all AWMS is three times higher than the corresponding N excretion rate per animal multiplied by the corresponding animal population; for non-dairy cattle the corresponding data comparison results in a 1 per cent difference.

France explained that the emission factors used for dairy cattle come from MIES and are based on IPCC equations; parameters used are country-specific and take particularly into account the management of less-emitting, more “liquid” waste than manure. Later, France will verify this data and its pertinence.

France explained that this inconsistency was due to a transcription error in table 4.B(b). The N_2O emission factors are those of the IPCC, and the reported emissions are correct. The category “other” refers to the category as in the IPCC.

4.D. Agricultural soils – direct and indirect N_2O emissions (4.D.1. and 4.D.3.) and animal production (4.D.2)

- Fractions used. Not reported.
  France indicated that explanation of these fractions would entail additional calculations that have not been performed.
- No information or data were provided for cultivation of histosols; for atmospheric deposition no estimates were provided due to a possible risk of double-counting (see documentation box of table 4.D)
  Regarding the cultivation of histosols, France explained that this activity is not considered in the inventory. Regarding the missing estimates for atmospheric deposition, France explained that possible double counting could occur if the N available for producing N_2O originates from NH3, which is already accounted for elsewhere.[2]
- N_2O-IEF. IEFs for animal wastes applied to soils, N-fixing crops and crop residues are among the lowest values across the reporting Parties.
- Activity data. Value for N excretion on pasture range and paddock (kg N/yr) reported in table 4.D is more than 60 per cent lower than the corresponding value in table 4.B(b) (total N excretion for AWMS pasture range and paddock)
  France explained that IPCC N_2O emission factors were used for crop residues and N-fixing crops. Regarding animal wastes applied to soils, only the organic supply /contribution used as fertilizer are considered. The pastures are excluded and accounted for under « storage » (solid storage and drylot) in table 4.B(b). Consequently, no pastures were reported in table 4.D. Therefore “Total” in table 4.B(b) without pastures can only be compared to the animal wastes applied to soils in table 4.D. The error in table 4.B(b) (see response above) hinders this comparison. France stated its intention to correct this error in the next inventory.

[2] ***France suggested that further clarification within the IPCC Guidelines would be needed as to whether or not secondary pollutants have to be reported.***

Non-key sources

4.C. Rice cultivation – CH_4 emissions

- No information was provided for the other types of water regimes (table 4.C was left blank except for information related to "4.C.1.1. Irrigated - Continuously flooded".
  France explained that no water regimes other than the reported one are utilized.

LAND-USE CHANGE AND FORESTRY

Overview

- France used a country-specific approach (methods and emission factors) to estimate CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for wet tropical forest, temperate forest plantations, temperate commercial evergreen and deciduous forests; from 5.B. (Forest and Grassland Conversion) for temperate mixed broadleaf/coniferous forests; from 5.C. (Abandonment of Managed Lands) for tropical wet very moist forest; and from 5.D. (CO_2 emissions/removals from soils)
- Estimated emissions of non-CO_2 gases were reported for 5.E. Others
- Sectoral table 5.D contained indicators only. Sectoral table 5.C was not filled in.

5.A. Changes in forest and other woody biomass stocks

- The average annual growth rates for temperate forests, commercial evergreen and deciduous, seem to be incorrect (10884000 and 7864000 t dm/ha/yr). These values are presented only for 1990, 1998 and 1999, the same value being reported for the last two years. These values were larger by a factor of 10^6 than the values reported by other countries.
- France is the only country that reports an average annual growth rate for tropical forests (others), at 8.34 t dm/ha.
- Implied carbon uptakes of 0.28 and 0.30 t C/ha/yr, for temperate commercial forests (evergreen and deciduous respectively) were among the lowest values in the range of values reported by other Parties and lower than the IPCC defaults for natural regeneration of temperate forests and forest plantation growth.
  France remarked that the comments are justified given the difficulty of adapting the CRF to national methodologies. France has a corrected version of these tables.

5.C. Abandonment of managed lands

- France reports the same value of –48.0 Gg CO_2 for CO_2 removals for each year in the period 1990-1999.
  The Party mentioned that the category 5.C includes the overseas territories.

5.D. Emission/removals from soils

- No activity data and emission factors were reported for this category, although emissions and removals are reported in Table 5.
- Some annual changes were larger than 10% for net emissions/removals: -11.3% for 1993/94 and +18.4% for 1994/95.
  The Party commented that the variations for category 5.D were the result of the correct application of the methodology: these results were based on the evolution of different soil aggregates during the past 20 years.

WASTE

Key sources

6.A. Solid waste disposal on land - CH_4

- CH_4 recovery and CH_4 conversion factor were not reported for 1991 to 1997

France commented that CRF tables for 1991 – 1997 provided on CD ROM and not in the report. The background table were not filled in except for some data that are generated automatically.

- DOC not reported for managed waste disposal sites.

The Party responded that DOC was not reported in Table 6 A for the year 1999, because no waste were disposed at so-called "non-compacted" sites. We consider that as of 1999, waste is not anymore disposed at these type of sites. Consequently, the DOC of this waste equals to 0. The calculations of emissions were based on the principle of the first order kinetics. CH_4 emissions are the result of the kinetics of degradation. Since we were submitting data for 1999, no supplementary data on DOC were assigned to this type of activity.

- Annual MSW disposed at SWDS was the second highest among reporting Parties

France responded that the amount of tonnes of waste placed in waste disposal sites was taken from survey by ADEME.

- CH_4 IEF for unmanaged shallow WDS was the highest among reporting Parties. The value for 1999 was, however, not reported

The Party explained that regarding the CH_4 IEF on non- compacted sites, the problem is the same as with the DOC. The emissions are due to the waste disposed at the years preceding 1999. Activity for 1999 equals to 0. The proposed emission factor has no real significance, because it refers to the current year in Table 6A, whereas CH_4 emissions are due to the waste disposed in the previous 30 years. Even if the tonnage reduces significantly from one year to another as it is the case for non- compacted waste, the potential of emissions it is still high.

Non-key sources

6.B. Wastewater handling

- CH_4 emissions from industrial wastewater were not calculated

The Party commented that it considered that CH_4 emissions from waste water handling negligible. This hypothesis will be revised, taking into account the importance of the agro-industry and resulting fermentable waste.

- N_2O emissions from human sewage were not estimated.

GERMANY

General

Common reporting format (CRF) and national inventory report (NIR)

Germany did not provide a complete CRF submission (summary and trend tables, reference approach) but did provide separate IPCC sectoral summary report tables. Inventory years 1990 to 1999 were covered in the submission. Sectoral background data was only provided for the energy sector. Indicators were used throughout the tables. An NIR was not submitted with the inventory.

Consistency of information between CRF and NIR

Since there was no NIR submitted, this comparison was not applicable.

Time series consistency

A review of the Table 10 Emissions Trends Summary shows a generally consistent trend downwards for CO_2 and CH_4 (this is mimicked for the most part in the energy, agriculture, and industrial sector breakout summary trend as well). For N20, there was a sharp 20% decrease in 1998 reported emissions as compared to 1997. The waste sector shows significant declines in emissions from 1990 to 1999 (decrease of over 50%). LUCF has remained relatively level throughout the period.

Comparison with previous submissions

Germany did not provide recalculation tables. Germany did not submit a CRF in 2000, so a direct comparison to previous tables was not possible. However, a cross-comparison of the Table 10 Emissions Trend Summary provided in the 2001 submission to the summary trends provided in the NIR submitted in 2000 revealed no significant changes in total GHG emissions (not including LUCF) for the years 1990 to 1998.

QA/QC and verification procedures

There was no documentation provided for quality assurance (QA)/quality control (QC) or verification procedures that were implemented. Quality level indicators were provided in Table 7, Overview of the sectoral tables submission.

Key sources

No key source analysis was provided.

Uncertainty estimates

No uncertainty analysis was provided.

Sector-by sector findings

Since neither activity data nor related information was reported for sectors other than for energy, to some extent, the sector-by-sector analysis only includes information on energy.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

CO_2 emissions from fuel combustion were calculated using the reference approach for the years 1990 to 1996. For 1996, there is a difference of 6.9 per cent in the CO_2 emissions estimates between the reference approach and the sectoral approach. No explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data
The comparison with the IEA data was performed for the year 1996 since no energy data were submitted for the years 1997 to 1999.

The German Reference approach energy data for 1996 correspond very closely to the IEA data (only 0.1 per cent lower). Specific differences include:

- Crude oil imports are 34,937 TJ lower in the CRF and the stock changes are in a different direction.
- Gasoline imports are 23,192 TJ lower in the CRF and stock changes are much larger.
- Diesel oil imports are 16,481 TJ lower in the CRF and stock changes are much larger.
- Residual fuel oil imports are 20,914 TJ higher in the CRF and stock changes are much larger.
- Coking coal seems to be included with other bituminous coal in the CRF.
- Lignite production is 23,758 TJ higher in the CRF.

Most of the above questions are also applicable to the 1990 data where the CRF data are 0.5 per cent higher than the IEA data. The growth rate of overall apparent consumption between 1990 and 1996 is very similar between the two data sets. The CRF decreases by 3.0 per cent and the IEA by 2.3 per cent.

GREECE

General

Common reporting format (CRF) and national inventory report (NIR)
Greece provided CRF tables for 1990 to 1999 and included all requested tables. However, some tables of the CRF were not provided throughout the entire time-series 1990 to 1999, and some tables have not been fully completed (Tables 7, Overview Table for quality indicators). An NIR was also submitted, which covers the national inventory for greenhouse and other gases for the years 1990-1999. Notation keys were used in most cases.

Consistency of information between CRF and NIR
There was no inconsistency identified in the data provided in the CRF tables and the NIR.

Time series consistency
A noticeable decrease in the positive trend of emissions is seen for the first time since 1990, however, the NIR correlates this trend to a switching of solid and liquid fuels to natural gas in the electricity and industry sectors.

Comparison with previous submissions
Greece provided recalculated estimates for 1990 to 1998 (Tables 8(a) of the CRF) and explanatory information for these recalculations (tables 8(b)). The effect of the recalculations (as reported in the CRF tables) was an increase of approximately 1.3 per cent in the total CO_2 equivalent emissions in the base year excluding land-use change and forestry, and a decrease of 0.01 per cent if LUCF is taken into account. However, large recalculations in the base year took place in the energy sector, particularly CH_4 and N_2O from energy industries, N_2O from transport and CH_4 from oil and natural gas, where estimates more than doubled as compared to estimates submitted in 2000.
For 1998, N_2O recalculated emissions were revised upwards by 34% compared to the estimates for the same year of 2000 submission.

QA/QC and verification procedures
The NIR states that, where possible, statistical data used in the inventory were cross-referenced among different sources before they were used (e.g., fuel consumption was obtained from both the Ministry of Development and from the energy statistics of IEA).

Key source analysis
There was no indication whether any quantitative key source classification has been performed.

Uncertainty estimates
Uncertainty estimates have not been provided. However, the NIR recognizes considerable amount of uncertainty for the non- CO_2 emission factors and is investigating improved emission factors to better reflect the Greek industry.

Sector-by-sector findings

ENERGY

Reference approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 0.03 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach.

International data comparison
The Greek reference approach energy data for 1999 correspond very closely to the IEA data (only 1.7% higher). Apparent consumption of liquid fuels is 4.4% higher in the CRF, solid fuels is 2.8% lower and natural gas is the same. Specific differences include:
- CRF value for production of lignite is 10,448 TJ lower than that reported to the IEA.
- Crude oil imports in the CRF are 19,269 TJ higher than those reported to the IEA.
- Use of jet kerosene in international bunkers is 8,293 TJ lower in the CRF numbers.

It is interesting to note that most of the above questions are also applicable to the 1990 data where the CRF data are 1.5% higher than the IEA data. The growth rate of overall apparent consumption between 1990 and 1999 is very similar between the two data sets: CRF 21.1% and IEA 20.8%

Key sources
Fuel combustion
1.A.1 Energy industries - solid fuels
- The value of the CO_2 IEF in 1999 for the subcategory public electricity and heat production (122.1 t/TJ) is the highest across the reporting Parties.

1.A.2 Manufacturing industries and construction - gaseous fuels
- The value of the CO_2 IEF in 1999 (41.5t./TJ) is one of the lowest across the reporting Parties. During the period 1990-1999, the value of this IEF fluctuated considerably (it increased by 29 per cent from 38.7t/TJ in 1990 to 50.9t/TJ in 1996 followed by a gradual decline).

1.A.3.a Civil aviation (domestic)
- The activity data for jet kerosene reported in the CRF are higher compared to the data published by the IEA (35 per cent).

Non-key sources
1.A.1 Energy industries - solid fuels
- The value of the N_2O IEF in 1999 (15.9 kg/TJ) is second highest across the reporting Parties. This IEF increased sharply by 420 per cent from 3.1 kg/TJ in 1990 to 16.1 kg/TJ in 1991 and then levelled off.

1.A.1 Energy industries - liquid fuels:
- The value of the N_2O IEF in 1999 (11.7 kg/TJ) is one of the highest across the reporting Parties. The value of this IEF dropped sharply by 76 per cent from 45.8 kg/TJ in 1990 to 10.8 kg/TJ in 1991 and then stabilized.

1.*3.b Road transportation (CO_2 and N_2O):*
- The value of the N_2O IEFs for gasoline increased by 160 per cent from 1.8 kg/TJ in 1990 to 4.7 kg/TJ in 1999.

1.A.2 Manufacturing industries and construction:
- The value of the N_2O IEF in 1999 (10.85kg/TJ) from biomass burning is the second highest across the reporting Parties.
- The value of the N_2O IEF in 1999 (16.84 kg/TJ) from solid fuels is the highest across the reporting Parties.

Fugitive emissions
1.B.2.a. ii, iii, iv, v Oil
- Activity data and emissions were not provided other than for the production subcategory.
- The value of the CH_4 IEF for production (2.92 kg/GJ=2 920 000 kg/PJ) is very high across the reporting Parties (average 3,400 kg/PJ). This is possibly due to an error in the activity unit (TJ instead of GJ).

1.B.2.b. I Natural gas
- Activity data and emissions for production were not provided, although in Table 1.A(b) 105 TJ of gas produced were reported.
- The value of the CH_4 IEF (20.9 kg/TJ) is the lowest across the reporting Parties.

Bunker fuels
1.A.3.a International aviation
- The activity data for jet kerosene reported in the CRF are lower than the data published by the IEA (26 per cent).

INDUSTRIAL PROCESSES

Key sources
2.E Production of halocarbons and SF_6
- Greece reported activity data as confidential (C) and therefore no disaggregated information on emissions (actual or potential) was available for HFCs, PFCs or SF_6.

2.C.3 Aluminium production(PFCs)
- Greece reported activity data as confidential and comparison with U.N. data was not possible.
- There were substantial year to year changes in emissions from 1990 to 1994 and 1998 to 1999.

Non-key sources
2.B.2 Nitric acid production
- There is a large difference between reported activity data for 1992 compared to other years in the 2001 submission. (95,668% difference between 1991 and 1992)
- IEF for N_2O for 1992 was high compared to other Parties
- A difference of 17.6% and 14% of emissions between 1990 to 1991 and 1995 to 1996 respectively.

SOLVENT AND OTHER PRODUCT USE

3.A Paint application

- IEF for CO_2 is the lowest among reporting Parties.

3.B Degreasing and dry cleaning

- IEF for CO_2 is the lowest among reporting Parties.

3.D Others

Emissions from the following sources were not estimated (reported as NE)

- Use of N_2O in anaesthesia
- Use of N_2O in fire extinguishers
- N_2O from aerosol cans

AGRICULTURE

Greece did not provide information on N_2O from 4.D.3 Indirect emissions from agricultural soils, and reported CH_4 from this source as NE. Source category 4.E Savanna burning was reported as NO.

Key sources

IPCC Tier 1 default method and default emission factors were used to estimate CH_4 emissions from 4.A Enteric fermentation, and CH_4 and N_2O emissions from 4.D Agricultural soils.

4.A Enteric fermentation

- Activity data. Swine population data were 35% higher than the corresponding FAO value (1,424 thousand versus 933 thousand head).
- CH_4 -IEF. IEFs for dairy and non-dairy cattle are similar to IPCC defaults for Eastern Europe (81 and 56, for dairy and non-dairy cattle, respectively).
- Trends in activity data and CH_4 emissions. For all livestock types the same data were reported for 1998 and 1999.
  CH_4 emissions from swine increased by 43% from 1990 to 1999, with some annual changes over 10%.

4.D Agricultural soils – direct N_2O emissions (4.D.1.)

- N_2O-IEF. IEF for animal wastes was higher by a factor of 100 compared to the other Parties and IPCC default. IEF for N-fixing crops was the highest value among 16 reporting Parties.
- Trends in IEF. N_2O-IEF for N-fixing crops increased by 14% from 1990 to 1999.
- For 4.D.1.4 Crop residue, no emission estimate was provided, although activity data were reported, so no IEF was calculated.
- No information on 4.D.1.5 Cultivation of histosols.

4.D Agricultural soils – animal production (4.D.2.) - N_2O

- Trends in N_2O-IEF. Values of N_2O IEF for pasture range and paddock oscillated between 0.2 and 1.0 kg N_2O -N/ha between 1990 and 1999.

Non-key sources

4.B Manure management – CH_4 and N_2O

- CH4-IEF. IEFs are similar to IPCC defaults for temperate-Eastern Europe. IEF for non-dairy cattle was the highest value among the reporting Parties.
- N excretion rates. Values for dairy and non-dairy cattle are similar to IPCC defaults for Eastern Europe; values for sheep and swine are similar to those of IPCC defaults for Asia.
- Consistency checks. Differences of 18 per cent when comparing the sum of nitrogen excretion over all AWMS per livestock with the corresponding N excretion rates per animal multiplied by the corresponding animal population (for dairy and non-dairy cattle).
- Trend in emissions. N_2O emissions increased by 40 per cent from 1990 to 1999. While for 1990/91 and 1998/99 no annual changes in estimates were noted, for the years 1996 to 1998 annual percentage changes were greater than 10%.

4.C Rice cultivation – CH_4 emissions

- CH_4-IEF. Value for irrigated fields – continuously flooded (0.29 g CH_4/m2/yr), was the lowest value among the seven reporting Parties and lower by a factor of 100 than other reporting Parties (values ranged from 22 to 40 g CH_4/m2/yr).
- Trend in emissions. CH_4 emissions increased by 58% from 1990 to 1999, with some large annual changes: -10% for 1990/91, +38% for 1992/93, +15% for 1993/94, +12% for 1994/95, +11% for 1995/96 and –13% for 1997/98; for 1999 the same value as for 1999 was reported.

4.F Field burning of agricultural residues – CH_4 and N_2O

- Trends in emissions. High annual changes for CH_4 and N_2O emissions for 1990/91 (+45%) and 1991/92 (-20%).

LAND-USE CHANGE AND FORESTRY

Overview

- Greece reported in Table 5 CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forest, different species, and harvested wood, 5.B (Forest and Grassland Conversion) for temperate forest, coniferous, broadleaf, evergreen broadleaf, and grasslands and 5.D (CO_2 Emissions and Removals from Soils).
- Emissions of non-CO_2 gases were reported in Table 5. E missions of CH_4, N_2O, NO_X and CO were reported for Changes in Forest and Other Woody Biomass Stocks and for Forest and Grassland Conversion.
- Support information was reported in Tables 5.A, 5.B and 5.D
- Greece reported the use of a country-specific method for N_2O emissions from 5.A. No information on methods and emission factors for the rest of the estimates and categories.
- Annual changes of net values (either emissions or removals) showed high annual changes, ranging from –370,3 Gg, in 1995, to +2,416,9 Gg, in 1998. These fluctuations are due to changes in emissions.
- Some high annual changes in gross emissions: -15.5% for 1990/91, +33.7% for 1991/92, -27% for 1994/95, +53.4% for 1997/98 and +30.2% for 1998/99.
- Large annual changes for CH_4, including 1997-1998 with 510% change and 1991 – 1992 with 313% change.
- Large annual changes of N_2O emissions, including 1997-1998 with 228 % change and 1994/1995 with 119% change.

5.A Changes in forest and other woody biomass stocks

- Average annual growth rates reported ranged from 0.71 to 5,90 t dm/ha (0.36-2.95 t C/ha/yr, as implied carbon uptake), for a set of evergreen species, and from 0.27 to 1.58 t dm/ha (0.14-0.79 t C ha/yr), for a set of deciduous species; these values are well below the mean value of 3.9 and 3.5 t dm/ha calculated from the corresponding values reported by other Parties. Values reported ranged from 0.71 to 5.95 t dm/ha/yr for evergreen species and from 0.27 to 7.33 t dm/ha/yr, for deciduous species.
- Lowest values for growth rates are below the IPCC defaults for the respective forest types (between 2 and 3 t dm/ha/yr, as natural regeneration).
- Net emissions fluctuate as a consequence of fluctuations in gross emissions, 1998-1999 being the highest with a 41% change. Removals remain at a constant level of 4004.9 Gg C/yr.

5.B Forest and grassland conversion

- IEF for CO_2 emissions from burning off-site biomass was lower by a factor of 100 compared with IEFs from Canada and France, for similar forest types (specifically, temperate forests)
- CO_2 emissions reduced by 61.2%, from 1990 to 1999, with some very large annual changes: -57.2% for 1990/91, +274.2% for 1991/92, -24.4% for 1992/93, -18.5% for 1993/94, -53% for 1994/95, +461.4% for 1997/98 and –85% for 1998/99.
- CH_4 and N_2O emissions decreased by 65.3% and 70.8% respectively from 1990 to 1999, with some very large annual changes (even >100%).
- Annual net losses were not reported for boreal and tropical forests. For temperate forest ecosystems, the country reports average annual net losses of 9.7 t dm/ha for mixed coniferous/broadleaf; 33.9 t dm/ha for coniferous; and 19.7 t dm/ha for broadleaf.
- Average quantities of biomass left to decay are given but not supported by activity data.

5.D CO_2 emissions/removals from soils

- Large annual changes for CO_2 removals: +50% for 1994/95, +100.7% for 1996/97, -83.4% for 1997/98 and +302.2% for 1998/99. No annual change for 1995/96. No data for 1990 to 1994.

WASTE

Key sources

6.A Solid waste disposal on land - CH_4

- Although the IPCC default method was used, the methane correction factor (MCF) for unmanaged (deep) solid waste disposal sites was reported as 0.6, which is lower than the IPCC default (0.8). This same problem was raised during the review of the 2000 submission.

Non-key sources

6.B Wastewater handling

- Activity data for industrial wastewater sludge were not estimated (reported as NE)

HUNGARY

General

Common reporting format (CRF) and national inventory report (NIR)

Hungary provided inventory data for the year 1999 using the CRF. The submission encompassed most requested tables. The use of indicators in sectoral reports and sectoral background data tables was limited. Some accompanying materials (IPCC tables, emission trends, etc) were provided. A NIR was not provided with the initial submission in May, however a NIR was provided in hardcopy in July and in September an electronic version of the NIR and some electronic files (background data input sheets) were provided containing additional source/sector information such as data gaps, methods used, changes from previous data and uncertainty.

Consistency of information between CRF and NIR

There was no inconsistency identified in the data provided in the CRF tables and the NIR.

Time series consistency

Emissions do not indicate any notable fluctuations in the national totals (Table 10). However, some changes with respect to the base year (1985-87) and 1999 are noted below:

- CO_2 emissions from 1.A.1Energy Industries decrease by 21 per cent.
- CO_2 emissions from 1.A.4 Other Sectors decrease by 42 per cent.
- CO_2 emissions from 2A Mineral Products decrease by 42 per cent.
- CO_2 removals from 5.A Change in Forest and other woody Biomass increase by 100 per cent.
- CH_4 emissions from 1.B Fugitive Emissions from Fuels decrease by 16 per cent.
- CH_4 emissions from 4.A Enteric Fermentation decrease by 50 per cent.
- N_20 emissions from 4.D Agriculture Soils increase by 725 per cent.

Comparison with previous submissions

Information on recalculation was not provided in the CRF. A comparison between the summary emissions trend data contained in Table 10 of the CRF submissions for 2000 and 2001 revealed no significant differences in the reported total national GHG emissions for the base year (1985-1987) through to inventory year 1998. However, some of the background data sheets provided indicated if changes had occurred from previous submissions.

QA/QC and verification procedures

There was only very limited mention in the NIR, indicating that although no certified procedures/quality assurance system was in place, they made an effort to follow the Good Practice Guidance to the extent possible at this time. Quality indictors were provided in Table 7, Overview Table of the CRF, however there was no discussion provided on how such determinations were made.

Key source analysis

Hungary provided a key source analysis (level assessment) for the years 1998 and 1999.

Uncertainty estimates

No uncertainty estimates were provided in the NIR, however, the data input sheets (electronic background files) provided a general assessment, an estimate not a calculation, for each source/sector (excellent, good, middle, poor).

Sector-by sector findings

ENERGY

Hungary confirmed the findings included in this section. Two specific comments were submitted and are included below.

Reference approach

Comparison of reference approach with national approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 0.73 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach.

Comparison with international data

The Hungarian reference approach energy data for 1999 correspond very closely to the IEA data (only 0.9 per cent lower). Apparent consumption of liquid fuels is 2.2 per cent higher in the CRF, solid fuels is 8.6 per cent lower and natural gas is the same. Specific differences include:

- Production of NGL is 5,968 TJ higher in the CRF.
- CRF data for imports of naphtha, lubricants, petroleum coke and white spirit appear to have been reported, in part, in “other oil”.
- Oil exports are 2,043 TJ lower in the CRF.
- Stock changes of gasoline are different and the CRF does not show any stock changes for naphtha.
- It is possible that the primary coal rows have been misreported in one of the data sets. The CRF numbers in “other bituminous coal” corresponds to sub-bituminous coal in the IEA. The sum of the CRF numbers in sub-bituminous coal and in lignite has been reported in lignite in the IEA.

Hungary provided the following comment.
This is a common problem in databases concerning energy consumption. The Hungarian Statistical System defines the several coals differently from the IEA:

Classification of coal (MJ/kg):

	Lignite	***Brown coal***	***Hard coal***
Hungarian statistics	***3.5-10.0***	***10.0-17.0***	***17.0 <***
IEA/EUROSTAT statistics	***<17.4***	***17.4-23.9***	***23.9 <***

Hungary uses the Hungarian classification for the CRF and the EUROSTAT classification for the IEA.

- The IEA shows 37,322 TJ of coking coal imports that have not been reported in the CRF.
- The CRF shows 23,053 TJ of coke oven coke/gas coke imports whereas the IEA shows 642 TJ.
- No exports of coke oven gas/gas coke have been reported in the CRF.

Key sources

Fuel combustion

1.A.1 Energy industries

- The value of the CO_2 IEF for gaseous fuels in 1999 (57.5 t/TJ) is one of the highest across the reporting Parties.

1.A.2 Manufacturing industries and construction

- The value of the CO_2 IEF for solid fuels in 1999 (102.1 t/TJ) is one of the highest across the reporting Parties.

- The value of the CO_2 IEF for liquid fuels in 1999 (41.8 t/TJ) is one of the lowest across the reporting Parties.

Fugitive emissions
1.B.2.a iii, v, vi Oil
- Activity data and emissions from transport and distribution of oil products and other were not reported.

1.B.2.b i,ii iii, Natural gas
- Activity data and emissions from production/processing, distribution and other leakage were not reported.

Hungary provided the following comment.
This assertion is not correct, because the activity data from production/processing were reported (109.87 PJ). For this subsector and for distribution, emission are reported under transmission, because the emission factor from the Revised Guidelines (Workbook I. 30. Table 1-6: Emissions from Processing, Transmission and Distribution) seems to contain all the three values. The indicator IE should be used in the table.

Non-key sources
1.A.3.C Railways - liquid fuels
The value of the CO_2 IEF in 1999 (68.6 t/TJ) is one of lowest across the reporting Parties.

Bunker fuels
1.A.3.a International aviation
- The activity data for jet kerosene reported in the CRF are lower than the data published by the IEA (6 per cent).

INDUSTRIAL PROCESSES

Key sources
2.C.3 Aluminium production – PFCs
- CF_4 IEF (0.85kg/t) is high compared to other reporting Parties
- C_2F_6 IEF (0.085kg/t) is the highest among reporting Parties.

Non-key Sources
2.C.1. Iron and steel production – CO_2
- No information as to the amount of production in this category was provided.

2.C.4.2. SF_6 used in magnesium production
- Emissions estimates from this source were not provided (reported as NE).
  Hungary explained that there is no such activity in Hungary and that the indicator “not occurring” (NO) ought to have been used.

SOLVENT AND OTHER PRODUCT USE

Non-key source
3.A Paint Application
- CO_2 IEF (0.311 t/t) was low compared to most Parties.
  Hungary explained that the emission factor used is counted from the rate of the solvents and its chemical construction.

3.B Degreasing and dry cleaning

- CO_2 IEF (0.0625 t/t) was low compared to most Parties.
  Hungary explained that the emission factor used is counted from the rate of the solvents and its chemical construction.

AGRICULTURE

Hungary did not provide information on 4.E Savanna burning.
Hungary explained that there is no such activity in Hungary and that the indicator "not occurring" (NO) ought to have been used.

Key sources
IPCC default methods (no tier specified) and emission factors were applied to estimate CH_4 emissions from enteric fermentation and manure management, and direct and indirect N_2O emissions from agricultural soils.

4.A. Enteric fermentation – CH_4

- CH_4-IEF. Values are similar to the IPCC defaults for Western Europe.
- Emission trend. Total CH_4 emissions from enteric fermentation decreased by 49% from 1990 to 1999, with annual changes of 14% between 1991/92 and 1992/93.

4.B. Manure management – CH_4

- CH_4-IEF. IEFs for cattle are similar to IPCC defaults for cool-Western Europe.

4.D. Agricultural soils – direct and indirect N_2O emissions (4.D.1. and 4.D.3.)

- N_2O -IEF. IEF for crop residues is the lowest among reporting Parties; IEF for cultivation of histosols is on the very low side of the IPCC range and is almost the lowest among reporting Parties (2 kg N_2O -N/ha).
- Trend in emissions. Total N_2O emissions from agricultural soils showed some very large annual fluctuations: -59% between 1990/91, 23% between 19993/94 and 1,866% between 1997/98. From 1990 to 1999 emissions increased by 627%. In it response to the 2000 synthesis and assessment report and in its NIR, Hungary noted that the significant changes from 1998 onward are due to the use of the Revised IPCC Guidelines (considering domestic soil composition) and therefore the data are not consistent over time.

Non-key sources
4.B. Manure management – N_2O

- N excretion rates. Values are lower by a factor of 1000 compared to the other reporting Parties and to IPCC default values for cool-Eastern Europe.
- Consistency checks. Differences of 10^3 when comparing the sum of nitrogen excretion over all animal waste management systems per livestock to the corresponding nitrogen excretion rate per animal multiplied by the population. The cause seems to be a mistake in the nitrogen units (kg instead of tons).

4.C. Rice cultivation – CH_4 emissions

- Trend in emissions. CH_4 emissions decreased by 88% in 1999 compared to the base year. Emissions were constant from 1993 to 1995 and showed annual changes of more than 20% between the other years.

4.F. Agricultural burning of residues – CH_4 and N_2O emissions

- For cereals other than wheat and barley no data were provided.
  The Party explained that no data for cereals are available in Hungary.

- Trends in CH_4 emissions. Very large annual changes in emissions: - 40% for 1991/92, -33.3% for 1992/93, -100% for 1993/94, -25% for 1996/97, -40.8% for 1998/99. The largest change was reported for 1997 to 1998 (increase in CH_4 emissions from 0.003 to 1.75 Gg).

LAND-USE CHANGE AND FORESTRY

Overview

- Hungary used IPCC default method to estimate CO_2 emissions and removals from 5.A. (Changes in forest and other woody biomass stocks) for temperate forest (commercial, evergreen and deciduous), from 5.B. (Forest and grassland conversion) for temperate forest (coniferous and broadleaf) and grasslands, and from 5.D. (CO_2 emissions/removals from Soils) for cultivation of mineral and organic soils and liming of agricultural soils.
- Estimates of non-CO_2 gas emissions, reported for subsector 5.B
- Default emission factors only reported for subsector 5.D
- Net removals increased by 45.3% from 1990 to 1999, supported mainly by high annual fluctuations during the early years of the time series: +44.2% for 1990/91, -27.5% for 1991/92, +18.0% for 1992/93, +22.9% for 1993/94, and –18.1% for 1996/97.

5.A. Changes in forest and other woody biomass stocks

- Country reports gross emissions and gross removals only for 1998 and 1999. Net removals are presented for all years from 1990 to 1999.
- Net removals increased 99.9% from base year to 1999; some high annual changes reported: +12.4% for 1991/92, +16.1% for 1992/93, and –12.6% for 1995/96.

5.B. Forest and grassland conversion

- Average annual net loss of aboveground biomass, for temperate coniferous, was 114.2 t dm/ha; this value is about 50% of the IPCC default. The value is about 30 to 40% higher than values from France (76-81) and Estonia (60.8).
  Hungary explained that these figures in Table 5.B might have been misplaced by mistake. Hungary provided data to correct table 5.B.
- Average area converted for temperate, coniferous was 114.2 kha/yr, the same value estimated for the average annual net loss of biomass. Country should check for possible mistake.
  Following the comment above, the Party explained that the values for average converted area for both coniferous and broadleaf forests should be 0.
- Values provided for the average annual net loss of biomass for grasslands (on- & off-site burnings (-1.0 t dm/ha) and decay (-6.25 t dm/ha) are negative. Country should check for sign and for the difference in the average values provided for the same vegetation type.
  Hungary explained that the negative sign was used because it was assumed that due to site preparation more carbon is emitted than fixed. The Party requested that the value of 6.25 be changed to 1.
- Country reports 1.0 t dm/ha under average annual net loss of biomass from on- & off-site burnings for temperate, coniferous and 114.20 t dm/ha from decay, for the same vegetation type.
- IEF for CO_2 emissions from burning on-site biomass (0.07 t CO_2/ha/yr) was lower by a factor of 10^{-3} compared with values from Greece (50 and 29 t CO_2/ha/yr) for the same forest type (temperate coniferous and broadleaf forests).
  The Party stated that the mistakes made when filling the CRF tables will be corrected in future submissions.

WASTE

Key sources

6.A. Waste disposal on land-CH_4

- Emissions for the base year were reported as NAD (i.e. not reported).
- Emissions per capita in 1999 were reported as being some 40% higher than in 1991-1998.
- DOC not reported and notation keys were not used.

6.B. Wastewater handling – CH_4

- Emissions per capita appeared to be the third highest among all Parties.

6.C. Waste incineration- CO_2

- Activity data were not reported, notation keys were not used
- Hungary reported total (aggregated) CO_2 IEF for all waste incineration

Non-key sources

Wastewater handling – N_2O

- N_2O emissions from human sewage were not estimated. Notation keys were not used.

ICELAND

General

Common reporting format (CRF) and national inventory report (NIR)

Iceland provided CRF inventory data for 1999 only. Notation key were used appropriately throughout the tables. No NIR was submitted as part of the 2001 submission.

Consistency of information between CRF and NIR

Not applicable, since neither a NIR nor any other additional information were provided in the 2001 submission.

Time series consistency

Analysis of the time series was not possible since Iceland had emission data for only 1999.

Comparison with previous submissions

Not applicable since Iceland did not make any CRF submission for the year 2000.

QA/QC and verification procedures

No information was available on whether the inventory data was subject to any self-verification or independent review procedures. However, quality indicators were provide in Table 7 of CRF submission.

Key source analysis

There was no information or any results provided for a key source analysis.

Uncertainty estimates

No information on uncertainty estimates was provided.

Sector-by-sector findings

ENERGY

Reference approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 1.97 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach.

Comparison with international data

The reference approach energy data for 1999 are 25.2 per cent lower than those reported to the IEA. The CRF data are 17.5 per cent lower for liquid fuels and much lower for solid fuels. Specific differences include:

- No information in the CRF on some fuel types (e.g. bitumen, lubricants, petroleum coke, white spirit. These fuels should be included and if they are used for non-energy purposes, then the fraction of non-energy should be used to calculate the stored carbon.
- The IEA shows 2,045 TJ of solid fuel imports that have not been reported in the CRF.
- The CRF has not included any stock changes for liquid fuels.

Key sources
<u>*Fuel combustion*</u>
1.A.1 Manufacturing industries and construction **-** *liquid fuels*

- The value of the CO_2 IEF in 1999 (81.2t/TJ) is the highest across the reporting Parties.

Non-key sources
1.A.3.a Civil aviation (domestic)

- The value of the CO_2 IEF for aviation gasoline in 1999 (68.6t/TJ) is one of the lowest across the reporting Parties
- The activity data for aviation gasoline reported in the CRF are higher compared to the data published by the IEA (18 per cent).

1.*A.3.d Navigation (domestic)*

- The value of the CO_2 IEF for gas/diesel oil in 1999 (68.6t/TJ) is the lowest across the reporting Parties.
- The activity data for gas/diesel oil reported in the CRF are lower compared to the data published by the IEA (6 per cent).

Bunker fuels
1.A.3.d International marine transport

- The activity data for residual oil reported in the CRF are higher compared to the data published by the IEA (14 per cent).

INDUSTRIAL PROCESSES

Key sources
2.C.2 Ferroalloy production – CO_2

- CO_2 IEF (3.455t/t) was high compared to most Parties

2.A.1 Cement production – CO_2

- CO_2 IEF (0.44t/t) for cement production is low compared to other Parties and is lower than the IPCC default of 0.499t/t for cement.

SOLVENT AND OTHER PRODUCT USE

Non-key sources
3.D. Others
Emissions from the following sources were not estimated (reported as NE)

- Use of N_2O in anaesthesia
- Use of N_2O in fire extinguishers
- N_2O from aerosol cans
- Other use of N_2O

AGRICULTURE

Emission estimates were not provided for N_2O emissions from 4.B manure management, which were reported as not estimated (NE), N_2O from 4.D.3 indirect emissions from agricultural soils and N_2O from 4.D.2 animal production (NE reported) and 4.F field burning of agricultural residues, which were reported as NE/NO;
Source categories 4.C Rice cultivation and 4.E Savanna burning were reported as not occurring (NO).

Key sources
Iceland applied IPCC default methods (no tier identified) and emission factors to estimate CH_4 emissions from enteric fermentation and direct N_2O emissions from agricultural soils.

4.A. Enteric fermentation – CH_4 emissions
- Activity data. Swine population showed large difference with FAO statistics (4 thousand head in the CRF versus 43 thousand head by FAO).

4.D. Agricultural soils – direct N_2O emissions (4.D.1.)
- Fractions used. Not reported.
- N_2O-IEF. IEF for synthetic fertilizers was among the higher values across reporting Parties; IEF for animal wastes applied to soils was the highest value across reporting Parties and was higher by a factor of 10^2 than IPCC defaults and values from other Parties.

Non-key sources
4.B. Manure management – CH_4 and N_2O emissions (4.B(a) and 4.B(b))
- N excretion rates. Although N_2O emissions from manure management per AWMS were not estimated (reported as NE), values for N excretion rates were provided. Reported N-excretion rates are lower by a factor of 10^{-3} compared to IPCC default values for cool-Western Europe and those reported by other Parties. Corrected values are still lower than IPCC defaults for Western Europe (70 versus 100 kg N/hd/yr for dairy cattle; 24 versus 70 for non-diary cattle; 1.5 versus 20 for sheep).

4.D. Agricultural soils – animal production (4.D.2.) and indirect N_2O emissions (4.D.3.)
- Not estimated (NE reported).

4.D Agricultural soils – CO_2
- CO_2 emissions from agricultural soils were reported in the trend table of the CRF (table 10s1); but not in tables Summary 1.A, 1.B and Summary 2, where these emissions were reported neither under agriculture nor under LUCF. It is not clear where these emissions are accounted for in the national inventory.

WASTE

Key sources
6.A. Waste disposal on land-CH_4
- MCF and DOC were not provided. No additional background information was reported

IRELAND

General

Common reporting format (CRF) and national inventory report (NIR)

Ireland submitted inventory data for the year 1999 using the CRF and included all requested tables. Summary inventory data for the years 1990 to 1997 were provided using the IPCC summary tables. A NIR was not submitted.

Consistency of information between CRF and NIR

Not applicable since a NIR was not provided.

Time series consistency

In depth analysis was not possible, since only data for 1999 were provided in detail in the 2001 submission. Aggregated emission data as reported in the trend table of the CRF (table 10) did not indicate any noticeable annual fluctuations in national totals.

Comparison with previous submissions

Table 8s1 and 8s2 did not indicate the performance of any recalculations. A comparison of CRF Table 10, Emissions Trends Summary, from the 2000 and 2001 submissions did not reveal any differences in reported total GHG emissions for the time series 1990-1998 between the two submissions.

QA/QC and verification procedures

No information was available as to whether the inventory data was subject to any self-verification or independent review procedures. There are quality indicators provided in the CRF Table 7, Overview, however there is no documentation provided on what quality control (QC)/quality assurance (QA) procedures were implemented.

Key source analysis

No information on key source analysis was available as no NIR was submitted.

Uncertainty estimates

No information on uncertainty estimates were provided.

Sector-by-sector findings

ENERGY

Reference approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 3.17 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data

The Irish reference approach energy data for 1999 correspond very closely to the IEA data (only 0.2% lower). The CRF figure is 2.9% lower for liquid fuels, 6.9% higher for solid fuels and the same for natural gas. Specific differences include:

- No information on some fuels types (e.g. bitumen, lubricants, petroleum coke, refinery feedstocks, white spirit, paraffin waxes, lignite). These fuels should be included and if they are used for non-energy purposes, then the fraction of non-energy should be used to calculate the stored carbon.
- No production of NGL has been reported to the IEA.
- Stock changes do not correspond for most of the liquid and solid fuels.

Key sources

Fuel combustion

1.A.1 Energy industries

- The value of the CO_2 IEF for liquid fuels for the public electricity and heat production category in 1999 (78.6 t/TJ) is the second highest across the reporting Parties.

Ireland explained that emissions of CO_2 from public electricity are reported on a plant-by-plant basis by the electricity company and they are considered reliable. The corresponding activity data come from official national statistics. The calorific value for residual oil used by the electricity company may not exactly match the standard value used for compiling the national energy balance. This can often result in implied emission factors slightly different to the expected value.

- The value of the CO_2 IEF for gaseous fuels from the petroleum refining category in 1999 (65.0t/TJ) is the highest across the reporting Parties.

Ireland explained that the CO_2 IEF for gaseous fuels refers to refinery gas and should in fact be entered under liquid fuels.

1.A.3.b Road transportation (CO_2 and NO_2)

- The value of the CO_2 IEF for gasoline in 1999 (70.0 t/TJ) is lower than the IPCC default value (73.0 t/TJ) for Europe.

Ireland explained that the CO_2 IEF for gasoline is a country-specific value (similar to the average of reported values in 1999). The default value does not seem typical of gasoline generally.

Non-key sources

1.A.1 Energy industries

- The value of the N_2O IEF for liquid fuels in 1999 (14.3 kg/TJ) is one of the highest across the reporting Parties.
- The value of the N_2O IEF for solid fuels in 1999 (13.5 kg/TJ) is one of the highest across the reporting Parties.

Ireland explained that emission factors for N_2O for all fuels are taken from CORINAIR default values.

1.A.3.b Road transportation (CO_2 and NO_2)

- The value of the N_2O IEF for diesel oil in 1999 (4.1 kg/TJ) is one of the highest across the reporting Parties for 1999.

Ireland explained that the N_2O emission factor is determined by the COPERT emissions model developed for CORINAIR.

1.A.3.d Navigation (domestic)

- The activity data for residual oil reported in the CRF are higher compared to the data published by the IEA (4 per cent).

INDUSTRIAL PROCESSES

Key sources

2.B.1 Ammonia production

- The IEF for CO_2 (2.3t/t) was the highest among reporting Parties and higher than the IPCC default range (1.5 - 1.6 t/t).
  Ireland explained that emissions of CO_2 from ammonia production are based on information obtained from the plant concerned. All carbon in the natural gas feedstock is emitted.

2.B.2 Nitric acid production

- IEF for N_2O (0.0101t/t) is high compared to other reporting Parties and slightly higher than the IPCC default range (0.002 - 0.009 t/t).
  Ireland explained that the amounts of N_2O emissions and nitric acid production are reported by one plant.

SOLVENT AND OTHER PRODUCT USE

3.A Paint spplication

- CO_2 emissions were reported, however no activity data were provided.

3.B Degreasing and dry cleaning

- CO_2 emissions were reported, however no activity data were provided.

3.D Other

- CO_2 emissions were reported, however no activity data were provided and the sources of emissions were not specified.

Ireland explained that the amount of carbon in VOC emissions is assumed to be 85 percent. The carbon in VOC emissions from painting, dry cleaning and domestic solvent use is converted to CO_2 on this basis.

AGRICULTURE

Source categories 4.C Rice cultivation, 4.E Savanna burning and 4.F field burning of agricultural residues were reported as not occurring (NO).

Key sources

Ireland reported the use of IPCC default methods (no tier specified) and a combination of country-specific and IPCC default emission factors, to estimate CH_4 emissions from 4.A enteric fermentation and 4.B manure management, and N_2O emissions from 4.D agricultural soils.

4.A. Enteric fermentation – CH_4 emissions

- Activity data. Reported activity data for sheep were 16.8 % higher than the corresponding value from the FAO (6,756 thousand head in the CRF versus 5,624 thousand head by FAO).

Ireland explained that FAO data for cattle and sheep are not comparable to national data. The annual data in the CRF account for two national census surveys per annum (June and December populations differ markedly) and they also reflect three-year averaging, as recommended by IPCC. According to the Party's response, national statistics on livestock populations are good in Ireland.

- CH_4-IEF. As the IEFs for cattle, sheep and swine are equal or very close to IPCC defaults for Western Europe, it is not clear in which cases the Party has used country-specific emission factors, as indicated in Summary 3 of the CRF.
  Ireland explained that an in-depth evaluation of the feeding regime and production of cattle in Ireland by the Agricultural Ministry, TEAGASC (the Irish agricultural research institute) and other experts led to the adoption of 100 kg/head as the annual methane production for dairy cattle, coincidentally equal to the default value. A country-specific weighted mean value of 50 kg/head covers all other cattle (derived largely on a Tier 3 basis). The default CH_4 emission factors are used for other animals.

  In addition, Ireland provided the following information in its response. Enteric fermentation in large cattle populations is a key source of GHGs in Ireland. A major research project is currently under way to substantially improve on inventory data being used for this source. The study will measure CH_4 production by representative animals in all important cattle groups and will relate CH_4 produced to detailed information on their feed intake. A robust Tier 3 approach will then be applied to recalculate CH_4 emissions. The research includes comprehensive farm surveys to better quantify waste production and waste management practices so that the methodology relating to CH_4 from waste management can also be made more country-specific.

- Trends in emissions. For swine, an overall increase in emissions of 60% was reported, with high annual changes of over 10% for the period from 1990 to 1992.

4.B. Manure management – CH_4 emissions (4.B(a))

- CH_4-IEF. CH_4 emissions for sheep were reported as "zero".
  Ireland stated that there is no manure management related to sheep in Ireland.

4.D. Agricultural soils – direct and indirect N_2O emissions (4.D.1. and 4.D.3.), animal production (4.D.2)

- Under direct soil emissions, N-fixing crops, crop residue, and cultivation of histosols, were not estimated (reported as NE).
  Ireland explained that there is insufficient data available for the inclusion of a robust accounting of emissions related to N-fixing crops, crop residue and cultivation of histosols. There appear to be inconsistencies in the available FAO data relevant to these issues.

- N_2O-IEF. IEFs for direct and indirect N_2O emissions, and for animal production are similar to the IPCC defaults (the Party reported the use of default and country-specific emission factors).
  Ireland stated that default emission factors are generally used for N_2O emissions. National circumstances have been taken into account as much as possible in the other parameters affecting emissions, e.g. N excretion rate, N leaching, N deposition.

- Fractions used. Value for $Frac_{GRAZ}$ (reported as 0.65) was the highest among the reporting Parties. Values for $Frac_{GASF}$ (0.04) and for $Frac_{LEACH}$ (0.04) were lower by a factor of 10, compared to the IPCC defaults and those reported by most other countries.
  Ireland explained that the value of 0.65 for $Frac_{GRAZ}$ is higher than average because cattle are outdoors for longer periods in Ireland. The value is based on survey data related to the EU REPS scheme.
  Ireland further explained that values of 0.04 for $Frac_{GASF}$ (and 0.17 for $Frac_{GASM}$) are derived from its ammonia inventory (volatilization of synthetic N and animal waste N) with the added assumption that the contribution from NO is negligible.
  The amount of N leaching, $Frac_{LEACH}$, is based on published studies comparing leaching rates on grassland (2 kg/ha/year) and tillage areas (76 kg/ha/year) in the southeast of Ireland.

In addition, Ireland provided the information that detailed studies on the N_2O emissions from soil (another key source of GHG in Ireland) are being conducted in parallel with the research on CH_4 emissions from cattle. The results are intended to provide for a thorough appraisal of the several default emission factors related to this source and for adequately accounting for national circumstances of soil types and fertilizer application rates. Revised N_2O estimates are inevitable.

Non -key sources

4.B. Manure management – N_2O emissions (4.B(b))

- N excretion rates. N excretion rates for sheep and swine are among the lower across reporting Parties. Values are also low compared to IPCC defaults for cool-Western Europe (50 kg N/hd/yr versus 70 for non-dairy cattle, 8 versus 20 for sheep, and 12 versus 20 for swine).

LAND-USE CHANGE AND FORESTRY

Overview

- Ireland used the IPCC default method (no tier specified) to report CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forest, commercial evergreen and deciduous; and 5.D (CO_2 Emissions and Removals from Soils).
- Non-CO_2 gas emissions were not reported.
- Sectoral tables 5.B. and 5.D. were provided only with notations.
- Net removals of CO_2 increased 34.1% from 1990 to 1999.

5.A. Changes in forest and other woody biomass stocks

- Gross emissions were not provided. Gross removals are taken as net removals in table 5A. No removed biomass was reported in Table 5A.
- Average annual growth rate for aboveground biomass in temperate commercial evergreen forests (5.92 dm/ha/yr and 3.3 C/ha/yr, as implied carbon uptake) was among the highest for that forest type from reporting Parties (values ranged from 0.71 to 5.95 t dm/ha, with a mean value equals to 3.87 t dm/ha).
  Ireland explained that the value of 3.3 t/C/ha/year for coniferous forests is based on Sitka spruce (yield class 16; density 0.37; carbon content 0.43 and biomass expansion factor 1.3). The Party acknowledges that the method overall has come to be regarded as

oversimplified. They also explained that a series of recalculations on carbon uptake, covering all years 1990-2000, is currently being undertaken by COFORD, the Irish forest research institute. Ireland hopes to be able to include the revised estimates in the next CRF submission

5.D. Removal from soils

- There is a net emission from soil from 1990 to 1999, with a variation of 0.3%. However, there are internal year-to-year variations in the time series, with a peak of 27.1% from 1993 to 1994.
  Ireland explained that liming of agricultural lands is the source of CO_2 emissions in this case as the amount of applied lime may vary substantially from year to year.

ITALY

General

Common reporting format (CRF) and national inventory report (NIR)

Italy provided inventory data for the years 1998 and 1999 using the CRF. However, recalculation tables (tables 8(a) and (b)), completeness table (table 9), Table 7 (Overview), Summary 3, and some sectoral tables were not provided. An NIR was not submitted.

Consistency of information between CRF and NIR

Not applicable, since neither an NIR or any other additional information was provided.

Time series consistency

In-depth analysis was not possible as detailed inventory data were provided for 1999 only. Based on the information reported in the trend tables, the trend for total national emissions and sectors were rather regular with no substantial changes between two consecutive years. The exceptions were Industrial Processes and Land Use Change and Forestry, each showing one annual change each >10% of difference. The main irregularities in the trend (large changes from 1990 to 1999 (>50% difference)) are noted below:

- CO_2 emissions from 1.A.2.f. Other (energy) and International Bunkers (Aviation),
- CO_2 fluxes from 5.A. Changes in Forest and Other Woody Biomass Stock, 5.B. Grassland and Forest Conversion and 5.C. Abandonment of Lands, and CH_4 and N_2O emissions from 5.B. Grassland and Forest Conversion,
- CH_4 emissions from some sources for 1.A. Fuel Combustion, 1.B. Fugitive emissions, 6. Wastes, and International aviation and marine Bunkers,
- N_2O emissions from some sources of 1.A. Fuel Combustion, and 6.C. Waste incineration,

Sources showing some large annual changes (>10% difference) included:

- CO_2 emissions from 1.A.2.f. Other, 1.B. Fugitive emissions, 1.A.2.c. Chemicals and International Bunkers (marine),
- CO_2 fluxes and CH_4 and N_2O emissions from 5. Land use change and forestry,
- CH_4 emissions from 1.A.2.f. Other and 6.C. Waste incineration and 6.D. Other,
- N_2O emissions from 1.A.2.f. Other and 6.C. Waste incineration.

Comparison with previous submissions

Information on recalculations was not provided in the CRF. However, a comparison of 1998 data submitted in 2000 with data of this submission for that year reveals there have been changes in the emission totals. The total net GHG emissions (including LUCF) for 1998 as reported in the 2000 CRF submission are 516,114 Gg CO_2 -Eq; in the 2001 CRF submission, total net GHG emissions are reported as 521,023 Gg CO_2 -Eq. The most significant change appears to be in the LUCF sector, with an emission change of 8,349 Gg CO_2 -Eq. A comparison of 1990 base year emission totals as reported in the Table 10 summaries of the CRF, also show a change in the 1990 base year totals as reported in the 2001 CRF submission as compared to the 2000 CRF submission. The 2000 submission reports a total net emissions of 492,887 Gg CO_2 -Eq, while the 2001 submission reports a total net emissions of 498,240 Gg CO_2 -Eq. Again the change appears to be most significant in the LUCF sector.

QA/QC and verification procedures

No information was available on whether the inventory data was subject to any self-verification or quality assurance (QA)/quality control (QC) review procedures.

Key sources
Italy did not carry out an analysis of key sources.

Uncertainties
Italy did not provide any uncertainty estimates.

Sector-by-sector findings
The analysis of trends in IEF, activity data and emissions at category levels that are more detailed than those in the trend table was hampered due to lack of data for the years 1990 to 1997. Sectoral background data tables were only reported for 1998 and 1999.
No information was provided on methods and emission factors used for any sector (Summary 3 of the CRF was not provided).

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 2.99 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. No explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data
The Italian reference approach energy data for 1999 are 2.3 per cent higher than the data reported to the IEA. Most of this difference is due to liquid fuels (3.6 per cent). Specific differences include:
- The CRF shows orimulsion imports that are 46,271 TJ higher than the IEA data.
- CRF residual fuel oil imports are 36,717 TJ lower than the IEA.
- CRF international bunkers are 99,537 TJ lower than the IEA bunkers.

Key sources
Fuel combustion
1.A.1 Energy industries - solid fuels
- The value of the CO_2 IEF in 1999 (117.1 t/TJ) is the second highest across all reporting Parties.
- The value of the CO_2 IEF in 1999 for the subcategory manufacture of solid fuels and other energy industries (235.6t/TJ) is the highest across all reporting Parties.

1.A.2 Manufacturing industries and construction - solid fuels: The value of the CO_2 IEF in 1999 (67.3t/TJ) is among the lowest across all reporting Parties.

1.A.4 Other sectors - solid fuels (agriculture/fisheries/forestry): The Party did not report activity data and emissions from this subcategory.

1.A.4 Other sectors - other fuels(agriculture/fisheries/forestry): The Party did not report activity data and emissions from this subcategory.

Fugitive emissions
1.B.2.a iii v,vi , Oil: Activity data and emissions from transport, distribution of oil products and other were not reported.

1.B.2.b iii Natural gas: Activity data and emissions from other leakage were not reported.

1.B.2.c Venting: The Party did not report CH_4 emissions from venting and flaring (gas and combined).

Non-key sources
1.A.4 Other sectors - biomass (agriculture/fisheries/forestry): The Party did not report activity data and emissions from this subcategory.

1.A.4.b.2 Other sectors (residential, solid fuels): The value of the CH_4 IEFs in 1999 (20.28 kg/TJ) is the second lowest among the reporting Parties.

1.A.3.a Civil aviation (domestic): The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (64 per cent).

1.A.4 Other sectors - liquid fuels: The value of the N_2O IEF in 1999 (10.1 kg/TJ) is one of the highest across the reporting Parties.

1.A.3.b Road transportation (CO_2 and N_2O) - gasoline: The value of the CH_4 IEF in 1999 (48.8 kg/TJ) is the second highest across the reporting Parties.

Bunker fuels
1.A.3.a International aviation: The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (35 per cent).

1.A.3.a International marine transport: The activity data for residual oil reported in the CRF are lower compared to the data published by the IEA (78 per cent).

INDUSTRIAL PROCESSES

Key sources
2.B.3 Adipic acid production
- N_2O IEF (0.3t/t) is high as compared to other countries in 1999.

2.F Consumption of halocarbons and SF_6 – HFCs, PFCs & SF_6
- SF_6 potential to actual (P/A) emission ratio of 8.98 was the second highest among reporting Parties
- Actual HFC emission increased by 143.8% from 1998 to 1999. Data for other years was not provided.
- HFCs P/A ratio of 1.38 is one of the lowest amongst the Parties
- PFCs potential emissions were not reported hence P/A ratio could not be determined
- Actual PFCs emission increased by 43.3 % from 1998 to 1999. Data for other years was not provided.

Non-key sources

2.C.1 Iron and steel production - CO_2

- CO_2 IEF for steel production (0.0388t/t) is the second lowest among the countries that reported.
- IEF for pig iron production was not reported even though activity data were provided in the CRF tables.

2.B.2 Nitric acid production

- N_2O emissions decreased by 10% from 1998 to 1999.

2.A.2 Lime production

- The value of the CO_2 IEF (0.15 t/t) is the lowest reported value from Parties and lower than the IPCC default values (0.79-0.91 t/t).

2.A.4 Soda ash production and use

- No data are reported for this item, although activity data are reported for many processes that normally uses soda ash as paper production, glass production, soap and detergents, water treatment.

2.B.1 Ammonia production - CO_2

- CO_2 IEF (1.0 t/t) is low compared to most Parties and lower than the IPCC default range (1.5-1.6t/t).

SOLVENT AND OTHER PRODUCT USE

Non-key source

- Emissions were reported under 3.D (Others) but no activity data was provided.

AGRICULTURE

No information was provided for the following source categories: 4.E Prescribed burning of savannas.

Key sources

4.A Enteric fermentation – CH_4

- $\underline{CH_4\text{-IEF.}}$ CH_4-IEFs for dairy and non-dairy cattle (117.6 and 53.6 kg CH_4/hd/yr, respectively) were relatively high compared to the IPCC defaults for Western Europe (100 and 48 kg CH_4/hd/yr, respectively): value for dairy cattle was among the highest across reporting Parties.

4.B Manure management – CH_4 and N_2O

- $\underline{CH_4\text{-IEF.}}$ IEF for sheep is similar to IPCC default for cool conditions.
- $\underline{N_2O\text{-IEF for AWMS.}}$ IEFs for liquid systems, solid storage and drylot and others, were 1.0 kg N_2O -N/kg N, which are higher by a factor of 1000 compared to IPCC default values and those of other Parties.
- N excretion rates. N-excretion rate for dairy cattle was among the highest values across Parties and higher than the IPCC default for Western Europe (111 compared to 100 kg

N/hd/yr). For non-dairy cattle, swine and sheep, N-excretion rates were lower than the IPCC defaults for Western Europe (lower by 20 to 36 per cent).
- Consistency checks. Multiplication of N excretion rates per animal by the corresponding animal population differs by a factor of 100 from the sum of nitrogen excretion over all AWMS for the particular livestock type (for dairy and non-dairy cattle and sheep).

4.D Agricultural soils – direct and indirect N_2O emissions (4.D.1. and 4.D.3.)
- N_2O -IEF. A same value was calculated as IEF for synthetic fertilizers, animal wastes applied to soils, N-fixing crops and crop residues.
- N_2O -IEF. For atmospheric deposition and nitrogen leaching and run-off, the IEFs were higher by a factor of 100 compared to IPCC default values and those of other Parties.

Non-key sources
4.D Agricultural soils – animal production (4.D.2.), N_2O
- N_2O-IEF. IEF for pasture range and paddock was higher by a factor of 100 compared to IPCC default values and those of other Parties.

4.F Field burning of agricultural residues – CH_4 and N_2O
- Activity data. Residue/crop ratios for wheat and maize (0.325 and 0.10, respectively) were by far the lowest values across the seven reporting Parties.

LAND-USE CHANGE AND FORESTRY

Overview
- Italy reported in Table 5 CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forests and other, 5.B (Forest and Grassland Conversion) for temperate forest (coniferous, broadleaf, mixed broadleaf/coniferous), from 5.C (Abandonment of Managed Lands) for temperate forests (coniferous, broadleaf, mixed broadleaf/coniferous) and from 5.D (CO_2 Emissions and Removals from Soils)
- Non-CO_2 gas emissions were reported in table 5, including CH_4, N_2O, NO_X and CO from sectors 5.A and 5.B
- Some annual changes for net CO_2 emissions exceeded 10%: -18.4% for 1990/91 and –10.9% for 1996/97.
- Annual changes in CH_4 and N_2O emissions were larger than 25%, reaching a maximum value of +196.3% for 1996/97.

5.A. Changes in forest and other woody biomass stocks
- At CRF-98, a wrong allocation of data was made: as net emissions in Table 5.A. appears a number (33,593.11 Gg CO_2), which is different from the one allocated as net emissions in Table 5. (24,969,2 Gg CO_2).
- Country does not provide gross emissions in Table 5 Gross removals are net removals calculated on the basis of removals and emissions reported in Table 5A.
- For temperate forests, the value of 5.08 t dm/ha/yr reported for average annual growth rate is the largest of the reported values and well above the mean value of 2.62 t dm/ha/yr obtained from 24 values provided by Parties in the category. This high value is, however, adjusted by a low carbon in biomass estimate (0.28 t C/t dm) leading to an ICUF of 1.40, which is the upper limit of the third quartile of the distribution of all ICUF values reported.
- Implied carbon uptakes for other temperate forests (ranging from 1.39 to 1.40 t C/ha/yr) are related to average annual growth rates of 5.08 t dm/ha/yr. If so, it would mean a carbon content of 0.27 to 0.28 in dry matter.

5.B. Forest and grassland conversion

- No implied emission factors were calculated. Table 5.B is filled with aggregate values.
- Although non-CO_2 levels are reported in table 5 from this sector, the values for non-CO_2 gases in table 5.B are reported to be 0.
- CO_2 emissions decreased by 53.76% from 1990 to 1999, with large annual fluctuations; consecutive annual change percentages for the time series were: -41.7, -34.7, +113.5, -38.6, -26.5, -46.6, +90.4, 48.4, and –16.5.
- CH_4 and N_2O emissions increased by 66.8% from 1990 to 1999, with large oscillations of annual values (from –80.0 to +196.3%).
- Total biomass lost was assumed to be burned on-site but no emission estimates were provided.
- Values provided for average annual net loss of biomass for temperate ecosystems (mixed coniferous/broadleaf; 11.0 t dm/ha and coniferous; 9.4 t dm/ha) seem to be too low for these vegetation types.

5.C. Abandonment of managed lands

- Annual rate for aboveground biomass growth (2 t dm/ha/yr) for temperate mixed coniferous/broadleaf forest, is more than 100% larger than the value reported by Canada (0,95).
- Annual rate for aboveground biomass growth for the first 20 years (2 t dm/ha/yr), for temperate and boreal coniferous forests, is twice the value reported by Slovakia (1.0)
- Annual rate for aboveground biomass growth for the first 20 years in temperate broadleaf forest (2 t dm/ha/yr), is 33.3% higher than Slovakia's value (1.0).
- Value reported in table 5.C for CO_2 net removals in the year 1998 is 152,719.3 Gg CO. This value seems to be incorrect, 152.72 Gg CO_2 being the right value.
- CO_2 removals increased by 108.3% from 1990 to 1999, with some large annual changes: +54.8% for 1990/91 and +16.2 for 1992/93.
- Table 5.C: CO_2 removal estimated but as no activity data were provided (1999), IEFs could not be calculated.

5.D. CO_2 emissions/removals from soils

- The IEF value reported for annual carbon loss in 1999 (1.55 Mg C/ha/yr) is significantly lower than the IPCC default for warm temperate conditions (10 Mg C/ha/yr). Additionally, there is a great difference between this same value reported for the years 1998 (1.55 Mg C/ha/yr) and 1999 (0.07 Mg C/ha/yr).
- IEF for annual carbon loss from organic soils (pastures, warm temperate conditions) was 0.12 Mg C/ha/yr; IPCC default value is 2.5 Mg C/ha/yr. If compared to the values reported by Finland and Sweden for cool conditions (1.1 and 2.8 Mg Cha/yr, respectively), the value reported by Italy is notably lower.
- CO_2 emissions grew by 198.2% from 1990 to 1999, with some large annual changes: +159.3% for 1990/91, +11.1% for 1992/93, +23.4% for 1996/97 and –10.5% for 1997/98.
- The value reported for land area under warm/temperate cultivation of organic soils seems not to be correct. Italy reports a total of 23,672 kha, when its total land area is 30,132 kha. Country should check this value.

WASTE

Key sources

6.A Solid waste disposal on land-CH_4

- The CH_4 IEF for managed solid waste disposal of 0.02t/t is low compared to other Parties
- Degradable organic carbon (DOC) was not provided in the CRF
- A value of 0.90 was used for the CH_4 fraction in landfill gas, which appeared high. This value is normally 0.5 but can vary between 0.4 and 0.6 depending on several factors.

6.B. Wastewater handling

- Domestic and commercial wastewater: N_2O emissions from human sewage were not estimated and no explanation was provided in the completeness table (table 9s1)

JAPAN

General

Common reporting format (CRF) and national inventory report (NIR)
Japan submitted the CRF and separate sectoral report tables for years 1990 to 1999.
The CRF submission encompassed most requested tables, and notation keys were used throughout the tables. A NIR was not submitted with the inventory.

Consistency of information between CRF and NIR
Since no NIR was submitted, this comparison is not applicable.

Time series consistency
A review of emission trends summary (Table 10) in the 1999 CRF revealed some inconsistencies in the trend. Emissions are reported for HFCs, PFCs, and SF_6 only from 1995 forward (In Table 11 it was indicated that 1995 is the selected base year for HFCs, PFCs and SF_6). This lack of reporting for earlier years results in inconsistent trends in emissions over the time period 1990-1999. After 1995 LUCF emissions are not estimated, which has a significant effect on the net emissions totals for years 1996 to 1999. This is explained in the CRF completeness table (Table 9) as being due to the fact that for some categories in the LUCF sector the latest available data is that for 1995 and/or there is no reliable measurement and survey data.
The Party acknowledged that the emissions data for HFCs, PFCs and SF_6 from 1990 to 1994 are not included, but explained that the information provided still provides adequate information on trends in emissions as required.

Comparison with previous submissions
Japan did not provide recalculation tables, however, it's emission totals have changed for years 1990 to 1998 as compared to the 2000 CRF submission. For each of the inventories for years 1991 to 1994 this change resulted in a total net GHG emissions (with LUCF) decrease of around 6% since the 2000 submission.
The Party explained that the decrease to total GHG emissions was mainly caused by the change of method from potential emissions to actual emissions for HFCs, PFCs and SF_6.

QA/QC and verification procedures
There was no information provided on quality assurance (QA)/quality control (QC) or on any verification procedures that were implemented. Quality level indicators were provided in Table 7 (Overview) of the CRF submission.

Key sources
No key source analysis was provided.

Uncertainty estimates
No uncertainty analysis was provided.

Sector-by-sector findings

ENERGY

Reference approach

Comparison of reference approach with national approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 0.2 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data

The Japanese reference approach energy data for 1999 correspond very closely to the IEA data (only 0.15 per cent higher). Specific differences include:

- International bunkers appear to be included in exports in the CRF.
- Stock changes (especially for refinery feedstocks) and imports are very different between the two data sets.

Key sources

Fuel combustion

Stationary combustion – liquid fuels

- The value of the CO_2 IEF for liquid fuels in 1.A.1 Energy industries, 1.A.2 Manufacturing industries and construction and 1.A.4 Other sectors, decreased gradually during the period 1990-1999 (see table below).

Subcategory	**CO_2 IEF (t/TJ) for liquid fuels**		
	1990	**1999**	**Difference**
1.A.1 Energy industries	71.3	69.3	2.8%
1.A.2 Manufacturing industries and construction	73.0	72.4	0.8%
1.A.4 Other sectors	70.3	69.8	0.7%

Stationary combustion – solid fuels

- The value of the CO_2 IEF for solid fuels used in 1.A.2 Manufacturing industries and construction in 1999 (101.3 t/TJ) increased by 2 per cent compared with its 1990 level (99.2 t/TJ).
- The value of the CO_2 IEF for solid fuels used in 1.A.4 Other sectors in 1999 (105.8 t/TJ) was the highest among all reporting Parties, having increased by about 5.5 per cent compared with its 1990 level (100.3 t/TJ).

Stationary combustion – gaseous fuels

- The values of the CO_2 IEF in 1999 for gaseous fuels used in 1.A.1 Energy industries (54.8 t/TJ) and in 1.A.4 Other sectors (51.6 t/TJ) are the lowest among all Parties using NCV as the basis for their energy data.
- The value of the CO_2 IEF in 1999 for gaseous fuels used in 1.A.2 Manufacturing industries and construction (51.7 t/TJ) is the second lowest among all Parties using NCV as the basis for their energy data.
- The value of the CO_2 IEF for gaseous fuels in 1.A.2 Manufacturing industries and construction and 1.A.4 Other sectors, decreased gradually during the period 1990-1999 (see table below).

Subcategory	CO_2 IEF (t/TJ) for gaseous fuels		
	1990	1999	Difference
1.A.2 Manufacturing industries and construction	53.1	51.7	2.7%
1.A.4 Other sectors	52.8	51.6	2.4%

Mobile combustion – road transportation

- The value of the CO_2 IEF for gasoline in 1999 (72.3 t/TJ) is the second lowest among the Parties that use NCV as the basis for their energy data.
- The value of the CO_2 IEF for diesel oil in 1992 and 1994 (1,726.3 t/TJ) is significantly higher compared with the level of this IEF in other years (72.3 t/TJ). This may be attributed to the insertion of the wrong activity data in the corresponding CRF table.

Japan confirmed this finding and it further explained that the correct IEF in 1992 and 1994 is the same value as other years (72.28 t/TJ). The wrong activity data were inserted when they converted the units from cal to J.

- The value of the CO_2 IEF for LPG in 1999 (52.0 t/TJ) is the lowest among all reporting Parties.

Mobile combustion – civil aviation

- The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (8 per cent).

Japan confirmed this finding and explained that the activity data in the CRF are based on fuel consumption published in "The Survey on Transport Energy" (Ministry of Land, Manufacture and Transport). But sources of IEA activity data are being investigated.

Mobile combustion – navigation

- The activity data for heavy oil (types A, B and C) reported in the CRF are higher compared to the data for residual oil published by the IEA (50 per cent).
- The activity data for diesel oil reported in the CRF are about 11 times lower compared to the data published by the IEA.

Japan confirmed both findings and explained that the activity data in the CRF are based on fuel consumption published in "The Survey on Transport Energy" (Ministry of Land, Manufacture and Transport). But sources of IEA activity data are being investigated.

Non-key sources

Stationary combustion

- Emissions of CH_4 and N_2O from a number of subcategories in the energy sector were reported as negative numbers. *(In a similar comment included in the synthesis and assessment report for the 2000 GHG inventory submissions, Japan referred to the calculation sheets that were provided together with the CRF. However, since a NIR has not been provided, it is not clear why the emission factors used for some subcategories are negative.)*

Japan explained that the reason for the negative values of emissions from certain sources is that the concentrations of CH_4 and N_2O in exhaust become lower than those in the intake, due to combustion.

Bunker fuels

International aviation

- The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (7 per cent).

Japan indicated that sources of IEA activity data are being investigated. It also indicated that the activity data value for jet kerosene in the CRF is 262,033 TJ. However, in table 1(c) of the 1999 CRF this value is 248,931 TJ.

International marine transport

- The activity data for residual oil reported in the CRF are higher compared to the data published by the IEA (7 per cent).

Japan indicated that sources of IEA activity data are being investigated. It also indicated that the activity data value for residual oil in the CRF is 232,389 TJ. However, in table 1(c) of the 1999 CRF this value is 221,250 TJ.

- The activity data for gas/diesel oil reported in the CRF are about eight times lower compared to the data published by the IEA.

Japan indicated that sources of IEA activity data are being investigated. It also indicated that the activity data value for gas/diesel oil in the CRF is 1,267 TJ. However, in table 1(c) of the 1999 CRF this value is 1,203 TJ.

INDUSTRIAL PROCESSES

Key sources

2.A.1-2-3 Cement, lime and limestone use – CO_2

- Emissions from Cement and Lime production and for Limestone and dolomite use are all reported under “Limestone and Dolomite use”. In the documentation provided full details are reported on the methodology and data used, and all data refer to the basic minerals used as input to industrial process and not to the final marketed products.

2.B.3 Adipic acid production

- N_2O emissions decreased by 89% from 1998 to 1999 (the IEF decreased from 0.25 to 0.025). No explanation is provided for the change in IEF.
  Japan explained that a destruction device of N_2O emitted from adipic acid production has begun to work in the only plant producing adipic acid in Japan, since March 1999. Consequently, the EF became lower and N_2O emissions from this source decreased by 85%.

2.F Consumption of halocarbons and SF_6 – HFCs, PFCs, SF_6

- The ratio of total potential emission to actual emissions for HFCs, PFCs and SF_6 are the lowest among reporting Parties (0.14, 0.56 and 0.2).
  Japan explained that by mistake the ratio of actual emissions to potential emissions were calculated. The correct values should be 7.31, 1.78 and 4.99.

Non-key sources

2.A.5-6 Asphalt roofing and road paving – CO_2, NO_X, CO, NMVOC, SO_2

- CO_2 and CO emissions were reported as “NE” (no reliable data available) and NMVOC emissions were reported as “NO”. In the case of NO_X and SO_2 emissions from road paving IE was reported (aggregated into Mineral Products total).
  Japan explained that for NMVOC emitted from asphalt roofing and road paving, reported as “NO”, should be replaced with “NE”.

2.C.1.4 Coke production

- Estimated coke production has been reported under chemical production, “other” (2.B.5.).
  Japan explained that the reason for reporting CH_4 emissions from coke production is that coke is not only produced in iron and steel plants but also in chemical plants and according to the Revised 1996 IPCC Guidelines, the default EF is indicated in “other chemical production”.

2.C.3 Aluminium production

- The methods and EF used were not indicated in the CRF. Emissions of CF_4 and C_2F_6 are reported as "NE" and no activity data were reported for aluminium production.
  Japan explained that it is investigating the data concerned.

SOLVENT AND OTHER PRODUCT USE

3. A & 3.B. Paint application and degreasing and dry cleaning

- Emissions of CO_2 and N_2O from paint applications and degreasing and dry cleaning were reported as "NO".
  Japan explained that emissions from paint applications and degreasing by mistake were reported as "NO" instead of "NE".

3.D. Other

- Emissions of N_2O from fire extinguishers, aerosol cans and other solvent use for production were reported as "NE" (no reliable data available).

AGRICULTURE

Source category 4.E Prescribed burning of savannas was reported as not occurring (NO).

Key sources
No key source was identified in the agriculture sector.
Japan stated that according to its national key source analysis, the following source categories have been identified as key sources: 4.A Enteric fermentation (level assessment) and 4.C Rice cultivation (level and trend assessment). A list of its key sources according to the tier 1 level and trend assessment for the year 1999 was provided as part of Japan's response to the present S&A.

Non-key sources[1]
4.A. Enteric fermentation – CH_4

- Activity data**.** Population size data for sheep differ from FAO data by 26 per cent.
- CH_4 IEF. IEF for dairy cattle seems relatively high compared to the IPCC default for Asia (90.3 versus 56 kg CH_4/hd/yr). For sheep, the IEF was low compared to the same reference (4.1 versus 8 kg CH_4/hd/yr) and was the lowest among reporting Parties.
  In its responses to review stages of the 2000 inventory submission, Japan explained that the nationally derived emission factors for cattle are higher than for other Asian countries due to higher productivity in Japan.
  Japan explained that emission factors for dairy cattle are based on measurements of each age group of dairy cattle in Japan. These values are relatively high, chiefly because the productivity (22.7 kg PCM/day in 1998) of cattle is higher than in other Asian countries. For sheep, emission factors are also based on measurements in Japan.
- Trends in CH_4 IEF. IEF for CH_4 increased by 2.4 per cent from 1990 to 1999.

[1] In this synthesis and assessment report, the classification according to key and non-key sources follows the key source identification provided by the UNFCCC secretariat, which differs from the national key source identification undertaken by the Party (see comment by Japan under "key sources").

4.B. Manure management – CH_4 and N_2O

- CH_4 IEF for non-dairy cattle seems high compared to the IPCC default for Asia (3.2 versus 1 kg CH_4/hd/yr), while for swine the IEF was very low compared to the same reference (0.3 versus 1 to 4 kg CH_4/hd/yr) and was the lowest among reporting Parties.
  Regarding the IEF for non-dairy cattle, Japan explained in its responses to review stages of the 2000 inventory submission the differences in manure management systems for dairy and non-dairy cattle, which result in higher CH_4 emissions for non-dairy cattle.
  Japan explained that most manure of non-dairy cattle is treated by a deposition system which generates more CH_4 than other manure management systems, thus resulting in a relatively high IEF. Regarding swine, most manure is treated by composting systems which generate less CH_4 than other manure management systems.
- All AWMS were reported as "NO" with the exception of "other", which includes all systems. The resulting IEF is higher by a factor of 10^6 compared to those of other Parties and the IPCC default.
  In its responses to review stages of the 2000 inventory submission, Japan explained that the national classification of AWMS does not correspond to the IPCC Guidelines classification, and stated its intention to reconsider the national classification.
  Japan explained that NO was reported accidentally and that it should be replaced with IE. Japan further noted that the IEF is wrong because N_2O emission factors were entered instead of N-excretion rates and the number of head of livestock was not multiplied by 1,000. The correct IEF would be 0.012 kg N_2O-N/kg N.
- N excretion rates are lower by a factor of 100 compared to those reported by other Parties and IPCC defaults.
  In its responses to review stages of the 2000 inventory submission, Japan stated that this was due to misreporting in the CRF, but corresponding N_2O emissions were correct.
  Japan explained that emission factors (kg N_2O/year/head) had accidentally been entered as N-excretion rates but N_2O emissions are correct. The correct N-excretion rates are as follows: 80 for dairy cattle, 47 for non-dairy cattle, 8.3 for swine and 0.9 for poultry (all in kg N/head/yr).
- Table 4.B(b): The activity data for dairy and non-dairy cattle have been interchanged in this table, compared to data provided in tables 4.A and 4.B(a).
  In its responses to review stages of the 2000 inventory submission, Japan stated that the correct activity data are those reported in tables 4.A and 4.B(a).
  Japan confirmed that this was a mistake in table 4.B(b) and that correct activity data are those reported in tables 4.A and 4.B(a).

4.D. Agricultural soils

- With the exception of synthetic fertilizers, all other sources within this source category have not been estimated (NE reported).
- The N_2O IEF for synthetic fertilizers was the lowest among reporting Parties (lower by a factor of 10).
  In its responses to review stages of the 2000 inventory submission, Japan stated that emission factors used are based on field measurements and referred to the relevant calculation sheets in its NIR.
  Japan confirmed its previous statement that the emission factor used is based on field measurements in Japan.

4.F. Field burning of agricultural residues – CH_4 and N_2O

- IEFs for rice (CH_4 and N_2O) are high compared to values from other Parties, in the case of N_2O by a factor of 100.
  In its responses to review stages of the 2000 inventory submission, Japan stated that emission factors used are based on measurements and referred to the relevant calculation sheets in its NIR.

Japan confirmed its previous statement that the emission factor used is based on field measurements in Japan.

WASTE

Key sources

6.A. Solid waste disposal on land – CH_4:

- IEF for managed waste disposal appeared to be the third highest among the countries.
- No additional background information was provided, including the specification of whether total or urban population was used, the waste generation rate, the composition of landfilled waste etc.

Non-key sources

6.B. Wastewater handling, CH_4, N_2O

6.C. Waste Incineration

- Activity data, IEF and emissions were reported as NE.

The Party responded that this should be replaced with "IE".

- CH_4 IEF was reported as 0.00 although in the documentation box the Party explained that the median value of the range 263.6 – 900.7 mg-CH_4/m^3 was used.

Japan replied that it was a mistake; the notation key "NE" should have been used instead of 0.0. The Party further explained that it had applied country-specific methodology, and therefore could not provide corresponding activity data and emission factors in the CRF.

LATVIA

General

Common reporting format (CRF) and national inventory report (NIR)

Latvia provided inventory data for 1999 using the CRF. The submission encompassed most requested tables, except those on recalculations. A NIR was submitted which includes summary information on methodologies used for 1998 and 1999 inventories. Indicators were used in some CRF tables.

Consistency of information between CRF and NIR

Summary emissions provided in the NIR are consistent with those provided in the CRF summary tables.

Time series consistency

In-depth analysis of the trend was not possible since only data for 1999 were provided in detail. Based on the trend tables of the CRF (table 10) inconsistencies in the aggregated CO_2 emissions trends from mineral production from 1992 through to 1994 could be observed. Also, sharp increase in methane from landfills from 1997 to 1998, as opposed to gradual increase seen from 1990 to 1997.

Comparison with previous submissions

Information on recalculations was not provided in the CRF for years 1990-1998. It was not possible to compare data with previous (2000) submission because, for example under industrial processes Latvia did not report much numerical data, but used the notation key “C” for several of the activity data and reported 1998 emissions data for 1999 in the case of mineral products due to the confidentiality of 1999 data.

Key source analysis

Latvia did not carry out any key source analysis.

QA/QC and verification procedures

No information was available on whether the inventory data was subject to any self-verification or independent review procedures. Qualitative indicators for data quality are provided in Table 7, Overview of the CRF, and the NIR states that these indicators were made according to available data.

Uncertainty estimates

No information on uncertainty estimates was provided.

Sector-by-sector findings

The analysis of trends in IEF, activity data and emissions at category levels that are more detailed than those in the trend table was hampered due to lack of data for the years 1990 to 1998. Sectoral background data tables were only reported for 1999.

ENERGY

Reference approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 0.1 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach.

Comparison with international data
The Latvian reference approach energy data for 1999 correspond closely to the IEA data (1.95 per cent higher). Specific differences include:
- Residual fuel oil appears to be included in gas/diesel oil in the CRF.
- Bitumen and lubricant appear to be included in other oil in the CRF.
- Peat production and bituminous imports are higher in the CRF.

Non-key source
1.A.3.d Navigation (domestic):
- The activity data for gas/diesel oil reported in the CRF are higher compared to the data published by the IEA (55.6 per cent).

Latvia explained that data from the energy balance are used.

1.A.1 Energy industries - solid fuels:
- The value of the CH_4 IEF in 1999 (22.4 kg/TJ) is the highest across the reporting Parties.

Latvia expressed its understanding that "solid fuels" covers all kinds of solid fuel, including coal, peat etc. In the national database, emissions are calculated individually from every fuel using IPCC default factors. Latvia added together the emission factor for coal (1Mg/PJ) and that for peat (30 Mg/PJ). If this was not correct, advice would be welcome.
There are not influences of these factors to summary emissions.

1.A.3.b Road transportation
- The value of the N_2O IEF for gasoline in 1999 (1.6 kg/TJ) is very low compared to the average (10.6 kg/TJ) of all reporting Parties.

Latvia stated that it had obtained the value of the N_2O IEF for gasoline by adding together all factors:
Passenger cars – 0.002 Gg/PJ;
Light duty vehicles – 0.001 Gg/PJ;
Heavy duty vehicles – 0.001 Gg/PJ;
Motorcycles – 0.001 Gg/PJ

- The value of the CH_4 IEF (26.4 t/TJ) for gasoline in 1999 is the second highest across the reporting Parties.

Latvia explained that it had obtained the value of the CH_4 IEF for gasoline by adding together all factors as follows:
Passenger cars – 0.03 Gg/PJ;
Light duty vehicles – 0.02 Gg/PJ;
Heavy duty vehicles – 0.02 Gg/PJ;
Motorcycles – 0.12 Gg/PJ

- The value of the CH_4 IEF (5.85 t/TJ) for diesel oil in 1999 is the fourth highest across the reporting Parties.

Latvia stated that it had obtained the value of the CH_4 IEF for diesel oil by adding together all factors as follows:
Passenger cars – 0.001 Gg/PJ;
Light duty vehicles – 0.06 Gg/PJ;
Heavy duty vehicles – 0.002 Gg/PJ;

Fugitive emissions
1.B.2.b,ii Oil
- Activity data were provided in the CRF but emission estimates for CO_2 and CH_4 were not reported.

Bunker fuels
1.A.3.a International aviation:
- Activity data and emissions for 1999 were not reported.

1.A.3.d International marine transport:
- Activity data and emissions for 1999 were not reported.

INDUSTRIAL PROCESSES

Non-key sources
2.A.1, 2 & 3 Cement and lime production and limestone and dolomite use
- Party provided 1998 emissions data and IEFs for 1999 as 1999 data was indicated as confidential business information.
  Latvia explained that if there are less than three enterprises in the country data cannot be provided. In Latvia there is only one enterprise and therefore part of the data are indicated as confidential.

2.A.4.1 Soda ash use
- Soda ash use was reported as NE, however, no explanation was provided in table 9 of CRF.
  Latvia explained that there are no estimates because no data are available.

2.A.5, 6 & 7 Asphalt roofing, road paving and other (glass production)
- No estimates were provided as an activity data was reported as confidential.

2.B Chemical industry
- All source categories were reported as NO.

2.C.1 Steel production
- Activity data was reported as confidential and estimates were reported as IE, with an indication in Summary table 3 as to their inclusion in the energy sector under manufacturing and construction industries.
- All other source categories for 2.C were reported as NO.

2.E Production of halocarbons and SF_6
- Party reported that production of these gases does not occur (NO).

2.F Consumption of halocarbons and SF_6 (actual & potential emissions)

- Reported actual emissions as not occurring for all gases. However, for potential emissions not estimated was reported for HFC-23, 32, 41, 43-10mee, 125, 134, 134a, 152a, 143, and 143a.
- Potential emissions from electrical equipment were reported in the sectoral table 2(I) but were reported as NO in sectoral report table 2(II).
  Latvia pointed out that in sectoral table 2(II)s2 potential activity data are reported in the sub-category "Total Potential Emissions of Halocarbons (by chemical) and SF_6" as 0.0039 t which corresponds to the emission of 0.09 Gg CO_2 equivalent.

SOLVENT AND OTHER PRODUCT USE

3.A & B Paint application & degreasing and dry cleaning

- CO_2 & N_2O emissions from these categories were reported as not occurring. NMVOC emissions were reported from paint application.

AGRICULTURE

Source categories 4.C Rice cultivation, 4.E Savanna burning, 4.F Field burning of agricultural residues and 4.G Other were reported as not occurring (NO).

Key sources
Latvia reported the use of IPCC Tier 1 methods and default emission factors for the agriculture sector as a whole (for CO_2, CH_4 and N_2O). Information on methods and emission factors used according to source categories was not provided in the CRF.

4.A. Enteric fermentation – CH_4 emissions

- <u>Activity data.</u> Activity data were reported in number of head instead of thousand head, for all the livestock types. After correction of the units, there is still a difference of 15% for cattle numbers reported in the CRF compared to FAO statistics (378 thousand head reported in the CRF versus 434 thousand by FAO).
  Latvia explained that activity data are taken from the Statistical Yearbook. There was a mistake in the number of head in the CRF initially submitted, which has been corrected in the revised CRF.
- <u>IEF.</u> Values reported for CH_4 IEF (formulas for calculating the IEF have been overwritten) do not correspond to those that would have been calculated by the embedded formulae of the CRF.
  Latvia explained that it had used emission factors from the IPCC Guidelines. For technical reasons the IEFs were entered manually.
- <u>Trend in emissions.</u> CH_4 emissions decreased by 72% from 1990 to 1999, with some large annual decreases: -38% for 1992/93, -16% for 1991/92, -17% for 1993/94, and –13% for 1998/99.
  Latvia explained the decreases in CH_4 emissions by decreasing animal numbers.

4.B. Manure management – N_2O emissions (4.B(b))

- IEF. Values reported for N_2O IEF have been entered manually (formulas for calculating the IEF have been overwritten) and do not correspond to those that would have been calculated by the embedded formulae of the CRF.
- Activity data. Value for total N excretion for AWMS pasture range and paddock reported in table 4.B(b) is lower by a factor of 10^8 compared to the value for N excretion on pasture range and paddock (kg N/yr) reported in table 4.D. This was due to the fact that in table 4.B(b) the sum for the total N excretion for pasture range and paddock was overwritten; if the formula had been used, the value would match that reported in table 4.D exactly.
- Consistency checks. For all livestock types, the sum of nitrogen excretion over all AWMS is lower by a factor of 1000 than the corresponding N excretion rate per animal multiplied by the corresponding animal population; after correction of the unit used for population size (Latvia reported in number of head rather than in 1000 head), the corresponding data comparison still results in a 1 per cent difference for dairy cattle.

Latvia explained that the values for the N_2O IEF had to be entered manually for technical reasons. Formulas used are taken from the IPCC Guidelines and entered in the CRF to ease the work. In Table 4.B(b) total per AWMS is already calculated in Gg, which links to 4.B. Manure management in sectoral table 4.

4.D. Agricultural soils – direct and indirect N_2O emissions (4.D.1. and 4.D.3.)

- N_2O-IEF. A same value was reported for synthetic fertilizers, animal wastes applied to soils, N-fixing crops and crop residues; for crop residues, the value is among the higher values across the reporting Parties.
- N_2O-IEF. All values for N_2O IEF under agricultural soils have been entered manually (formulas for calculating the IEF have been overwritten) and do not correspond to those that would have been calculated by the embedded formulae of the CRF.
- Trend in emissions. N_2O emissions from agricultural soils decreased by 59% from 1990 to 1999, with some large annual changes: -31% from 1991/92, -16% for 1992/93 and for 1993/94. No change between 1998 and 1999.

Non-key sources

4.B. Manure management – CH_4 emissions (4.B(a))

- Trend in emissions. CH_4 emissions decreased by 71% from 1990 to 1999, with large annual decreases between 1991 and 1992 (-24%), and between 1992 and 1993 (-40%).
- IEF. Values reported for CH_4 IEF have been entered manually (formulas for calculating the IEF have been overwritten) and do not correspond to those that would have been calculated by the embedded formulae of the CRF.

LAND-USE CHANGE AND FORESTRY

Overview

- Latvia reported in Table 5 CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forest (commercial evergreen, deciduous ant other); and emissions from 5.D (CO_2 Emissions and Removals from Soils).
- Latvia has reported the use of the IPCC Tier 1 method (no information on emission factor sources) to estimate CO_2 emissions and removals only from Changes in Forest and Other Woody Biomass Stocks.

The Party mentioned the use of the IPCC Tier 1 method to estimate CO_2 emissions, where many factors specific for Latvia, following expert opinion, were used.

- Non-CO_2 gas emissions were not reported, but former estimates are included in last year's submission.
- Numeric information on sectoral tables is found only in tables 5.A and 5.D.

5.A. Changes in forest and other woody biomass stocks

- Gross emissions are not provided. Gross removals are taken as net removals.
- Although in table 5.A emissions, removals and net removal estimates were reported, only net removals (as total removals) are reported in Table 5.
- The formula for calculating the implied emission factor was changed and values were input manually. The value of 0.5 reported by Latvia is lower than the data calculated by the review team result: 2.88 and 2.91 t C/ha/yr for temperate forests (evergreen and deciduous respectively).
  Latvia explained that the value of 0.5 for calculating IEF was selected following experts' judgement. Expansion factor for conversion of stemwood volume to whole tree biomass volume in managed forests was assumed to be 1.9 according to the IPCC guidelines. Likewise, the average dry wood density was given the value of 0.5 t dry matter/m^3 .

- Average annual growth rates for commercial temperate forest evergreen and deciduous (5.76 and 5.83 t dm/ha/yr) are well above the mean of the corresponding values reported by other Parties (3.87and 3.59 t dm/ha/yr, respectively).
- Average annual growth rate for other temperate forests (0.95 t dm/ha/yr) was well below the mean of the corresponding values provided by other Parties (2.62 t dm/ha/yr).
- The values reported for the trend of CO_2 removals are the same for the years 1990 to 1994 and for 1995 to 1998. That for 1999 is different.

5D. Removal from soils

- The country reports a net CO_2 emission of 93.2 Gg/yr from soils in 1999, which represents a change of –30.5% in relation to the base year.
- Some high year-to-year changes exist in the time trend analysis, such as –36.6% from 1991 to 1992 and +23.9% from 1993 to 1994.

WASTE

Key sources

6.A. Solid waste disposal on land – CH_4

- Latvia provided activity data for managed and unmanaged waste disposal sites but did not calculate the IEF for CH_4 (reported in CRF as 0.00)
- CH_4 emissions were reported as having almost doubled since 1998.

The Party responded that the IEF for CH_4 should be 0.5 t/tMSW.
On the second comment, it noted that in the period 1990-1997 CH_4 emissions were lower than in 1998 and 1999 because the Party had used factors that were identified using expert judgement, which were lower than the IPCC default (0.6 and 0.16 for managed and unmanaged waste disposal respectively). Since 1998, following the expert re-examination, the Party has used the IPCC default factors of 1.0 for managed and 0.6 for unmanaged disposals.

6.B *Wastewater handling – CH_4*

- Activity data for industrial and domestic/commercial wastewater were lumped together.
- Latvia reported the second highest protein consumption (40.15 kg protein/person/yr) among Parties

LUXEMBOURG

General

Common reporting format (CRF) and national inventory report (NIR)

Luxembourg provided inventory data for 1999 using table Summary 1.A and energy sectoral background data table 1A(a) of the CRF. No other tables of the CRF were provided. An NIR was not submitted either.

A separate document with tables of CO_2 emissions was also provided with the CRF. This table shows national CO_2 emissions for 1999 for Luxembourg, including estimates related to fuel consumed by foreign travel in Luxembourg.

Consistency of information between CRF and NIR

The separate tables containing 1999 CO_2 emissions for Luxembourg does not agree with the CRF summary table emissions. The total national CO_2 emissions reported in the Summary Table 1.A of the CRF is 5,431 Gg CO_2; the national total reported in the separate document table is 8,145 Gg CO_2. It appears that the difference may be due to the separate tables accounting for foreign traveler consumption in the country, but without documentation this could not be determined.

Time series consistency

Time series consistency check was not possible, as Luxembourg did not provide emission estimates for the entire period of reporting. The few tables provided did not include trend tables (Table 10).

Comparison with previous submissions

Comparison with previous submissions was not possible because data for the years prior to 1999 were not provided in the 2001 submission. Apart form the data received in 2001, inventory data have not been received by Luxembourg since the second national communication.

QA/QC and verification procedures

No information was available on whether the inventory data was subject to any self-verification or quality assurance (QA)/quality control (QC) review procedures.

Key sources analysis

Luxembourg did not provide any key source analysis.

Uncertainty estimations

No information on estimates of uncertainties was provided.

Sector-by-sector findings

Only very limited sectoral analysis was possible as only limited data were provided. Other analysis such as comparisons of IEF with other reported values and trend analysis were not possible as activity data and other related information were not reported.
As for sectors other than energy information was only provided in Summary 1.A of the CRF, any sectoral findings are limited to the energy sector.

As data were not reported at a detailed level it was not possible to perform the key source analysis according to the Good Practice Guidance; an assessment was only possible at the summary level.

ENERGY

Reference approach
CO_2 emissions from fuel combustion using the reference approach were not provided.

Key sources
1.A.4 Other sectors **-** *solid fuels*

- The value of the CO_2 IEF (100.7 t/TJ) is the second highest across the reporting Parties, but is very close to the average value for the reporting Parties.

NEW ZEALAND

General

Common reporting format (CRF) and national inventory report (NIR)

New Zealand submitted inventory data for the year 1999, using the CRF, but excluding tables 5.A. to 5.D.; some of the tables for Agriculture (4(b) a, b) were partially filled in with activity data and some other tables (4.C. and 4.F.) were filled in only with notation keys. The CRF was accompanied by a NIR that includes information on methodologies, activity data, emission factors, uncertainties in the calculation of all source categories and worksheets for the calculation of emission estimates for the year 1999. Notation keys were widely used.
The Party noted that the tables 5.A. to 5.D. were not submitted as New Zealand uses a country specific methodology to calculate LUCF and these results are included in Appendix 5 of the NIR. The tables in Agriculture sector (4(b) a was not complete as New Zealand is currently developing its T2 methodology and this information was not available at the time of submission. Table 4(b) b also lacked "liquid system" and "daily spread" data which was due to the lack of information.

Consistency of information between CRF and NIR

The data provided in the CRF tables for the inventory year 1999 showed some differences with the data contained in the worksheets that accompanied the NIR. There were some differences in relation to emissions from energy. Total fuel combustion CO_2 emissions as reported in Table 1, Sector Report for Energy were listed as 26,984.14 Gg. However, in the worksheets in Appendix 1 of the NIR (worksheet # 1.2 specifically), the total CO_2 emissions for fuel combustion activities is given as 25,000Gg. This equates to a difference of 1,984 Gg CO_2, with the CRF total being almost 8% greater than the worksheet total. Following is a further breakdown of the fuel combustion sector CO_2 comparisons that show the differences for individual sectors noted between the CRF Table 1 and the worksheets contained in Appendix 1 of the NIR:

Sectors	**Gg CO_2 from CRF Table 1**	**Gg CO_2 from NIR Worksheet**	**% difference**
Energy Industries	**6,629**	**6,580**	**- 0.7%**
Manuf. Industries and Construct.	5,825	4,480	- 23 %
Transport	11,729	11,731	<0.1%
Other Sources	2,799	2,210	- 21%

Outside of the energy sector, no other significant discrepancies were found in comparing the CRF to the NIR worksheets.
The Party noted that the inconsistencies were due to a processing error. Corrections will be made for the next submission.

Time series consistency

Emissions data are rather steady, not indicating notable annual fluctuations in national totals. LUCF was the only sector having one annual change over 10% of difference. In terms of categories, some significant changes[1] were noted:

- CO_2 emissions from 5.B. Forest and Grassland Conversion,

Party explained that this reflects areas of scrubland burnt for afforestation. This varies annually and can be reflected in the "new planting rates" also.

[1] 50% for tine series changes and >10% for annual changes.

- CH_4 emissions from 1.B. Fugitive emissions, with high annual changes,

Party explained that this is primarily due to higher production of both below ground and surface coal-mining over the period.

- N_2O emissions from 1. Energy sector ,some high annual changes, and

Party explained that this reflects increasing emissions generally in the energy sector.

- N_2O emissions from International Bunker (aviation) , large increase in the period, due only to one annual changes (1994 to 1995).

Party explained that this reflects the use of a two decimal point system in the CRF – the rounding nature makes for a rapid jump up rather than the actual gradual increase which can be seen in the data before being rounded.

Comparison with previous submissions

New Zealand provided recalculated estimates (tables 8(a)) and explanatory information (tables 8(b)) for these recalculations for the years 1990 to 1998. For the year 1998, the changes in CO_2 emissions were -0.35% for energy, 0.34% for industrial processes, 0.3% for land use change and forestry and –8.25% for biomass consumption. Also minor changes in CH_4 and N_2O emissions were due to recalculations.

QA/QC and verification procedures

The NIR states that the inventory has been subject to extensive internal peer review, but no external peer review has been undertaken. Quality indicators are provided in Table 7 (Overview) of the CRF, but there is no documentation in the NIR of the quality assurance (QA)/quality control (QC) procedures that were implemented.

Key sources

No key source analysis was documented in the NIR.

Uncertainty estimations

Quantified uncertainty estimates were provided for each of the major sectors. It could not be determined from the documentation provided in the NIR whether the uncertainty analyses followed IPCC Good Practice guidance.

Party noted that this will be explained more clearly in future submissions of the NIR.

Sector-by-sector findings

ENERGY

Reference approach

Comparison of reference approach with national approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 4.1 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data

The New Zealand reference approach energy data for 1999 are 7.8 per cent higher than the data reported to the IEA. Apparent consumption of liquid fuels is 3.9 per cent higher in the CRF, solid fuels is 16.9 per cent higher and natural gas is 9.9 per cent higher. Specific differences include:

- Natural gas production is 22,433 TJ (10 per cent) higher in the CRF than the IEA data.

- LPG production in the CRF should probably be shown in NGL since theoretically LPG should only be a secondary product.
- CRF stock changes are 5,050 TJ while IEA stock changes are 13,262 TJ. The biggest differences occur for gasoline and gas/diesel oil.
- No stock changes for solid fuels have been provided in the CRF.
- CRF shows bitumen imports while IEA data show bitumen, lubricants, petroleum coke, white spirit, paraffin waxes and “other oil”.

New Zealand stated that the differences mentioned came from some procedural difficulties and varying reporting time frames. This has been amended for future submissions.

Key sources
New Zealand explained that IEFs are a result of country-specific emission factors, and in many cases the IEF is the weighted average of multiple emission factors.
Previous CRFs have reported figures based on NCVs but this is not correct. All New Zealand data are based on GCVs, unless specified otherwise.
Recommendations where appropriate have been implemented into the next submission, for example, LPG reporting under NGL, and the reporting of pig iron.

<u>*Fuel combustion*</u>
Energy data have been given on a gross calorific value basis. This means that the IEFs are about 5 per cent lower for liquid and solid fuels and about 9 per cent lower for gaseous fuels than they would have been if the data were given on a net calorific value. The comparison of IEFs was based on the four Parties whose data are based on GCV.

CO_2 IEFs for gaseous fuels in all subcategories of stationary combustion(1.A.1, 1A.2, 1.A.3, 1.A.4) are among the lowest across the reporting Parties.

1.A.1 Energy industries
- The value of the CO_2 IEF for solid fuels in 1999 (93.0 t/TJ) is the highest of all Parties whose fuel consumption data is expressed in GCV.
- The value of the CO_2 IEF for liquid fuels in 1999 (73.6 t/TJ) is the second highest across Parties whose fuel consumption data is expressed in GCV.

1.A.2 Manufacturing industries and construction
- The value of the CO_2 IEF for gaseous fuels in 1999 (32.0 t/TJ) is the lowest of all Parties whose fuel consumption data is expressed in GCV.

1.A.3.b Road transportation (CO_2 and N_2O)
- CO_2 emissions from gasoline and diesel oil were reported as “NE”.

1.A.3.a Civil aviation (Domestic)
- CO_2 emissions from jet kerosene and aviation gasoline were reported as “NE”.

<u>*Fugitive emissions*</u>
1.B.2.a i,ii, iv,v,vi Oil:
- CH_4 emissions from exploration, production, distribution of oil products and other were reported as “NE”.
- Although CH_4 emissions from refining/storage were reported, activity data were given as “NE”.

1.B.2.b i,iii Natural gas:
- CH_4 and CO_2 emissions from exploration, production/processing, distribution and other leakage were reported as "NE".

1.B.2.c Venting:
- Fugitive emissions from this subcategory were reported as "NE".

Non-key sources
1.B.1.a Coal mining and handling - underground mines (mining activities):
- The value of the CH_4 IEF in 1999 (23.19 kg/t) is the second highest among all reporting Parties and is also higher than the IPCC default values (4.5-16.75 kg/t).

1.A.3.d Navigation (domestic):
- Emissions from residual oil and gas/diesel oil were reported as "NE".

1.A.3.b Road transportation(CO_2 and N_20):
- N_2O emissions from gasoline and diesel oil were reported as "NE".

1.A.1 Energy industries - biomass:
The value of the CH_4 IEF in 1999 (1.1 kg/TJ) was the lowest of all the Parties whose fuel consumption data are expressed as GCV.

INDUSTRIAL PROCESSES

Key sources
2.C.1 Iron and Steel Production – CO_2
- No emissions or activity data for pig iron, sinter and coke were provided. They were reported as "NE" but no information was provided in the completeness table as to the reason for not estimating these emissions.
- CO_2 IEF for steel (1.99t/t) is the highest among reporting Parties and higher than the IPCC default value of 1.6 t/t.

Party explained that IEF's are a result of country specific emission factors, and in many cases, the IEF is the weighted average of multiple emission factors.

Non-key sources
2.F Consumption of Halocarbons and SF_6 - PFCs, HFCs & SF_6
- No numerical values for potential emissions of HFC-32, HFC-125, HFC-134a, HFC-152a, HFC-143a, and HFC-227ea were provided (reported as NE). The potential to actual emissions ratios of these gases were not calculated.

2.C.3 Aluminium Production
- Aluminium activity data (327.8 kt) was lower than the UN data (996 kt)
- CF_4 and C_2F_6 IEFs are among the lowest of reporting Parties.

SOLVENT AND OTHER PRODUCT USE

3.A, B., C. & D.
Estimated emissions for only NMVOC under this category, N_2O and CO_2 emissions are reported as NE. No information was provided in the completeness table as to the reason for not estimating CO_2 and N_2O emissions.

New Zealand explained that the reason for not estimating CO_2 and N_2O emissions is that no methodology has been developed in New Zealand to calculate CO_2 and N_2O emissions from solvents.

AGRICULTURE

Source categories 4.C Rice cultivation and 4.E Prescribed burning of savannas were reported as not applicable (NA).
New Zealand explained that there is no rice cultivation or prescribed burning of savannas in New Zealand and that therefore the notation key "NA" would have to be changed to not occurring (NO) in the next inventory submission.

Key sources
4.A. Enteric fermentation - CH_4

- IPCC Tier 1 methodology together with country-specific emission factors was used to estimate CH_4 emissions from enteric fermentation.
- CH_4-IEF. IEFs for dairy cattle and non-dairy cattle (76.8 and 67.5 kg CH_4/hd/yr, respectively) were relatively high compared to the IPCC defaults for Oceania (68 and 53 kg CH_4/hd/yr, respectively). For sheep, the IEF (15.1 kg CH_4/hd/yr) was the highest value among reporting Parties and very high compared to the IPCC default for developed countries (8 kg CH_4/hd/yr). In its responses to review stages of the 2000 inventory submission, New Zealand explained that these differences arose from offspring animals being taken into account in the country-specific emission factors for ruminant animals, but not in the annual statistics.
- Emissions. CH_4 emissions were reported for cattle (dairy and non-dairy), sheep, goats and deer (under "other"). For all other livestock types, emissions were not estimated (NE).
  In its responses to review stages of the 2000 inventory submission, New Zealand referred to the lack of national emission factors for the "not reported" livestock types and stated its intention to fill this gap in the future, noting that reported livestock types represent most of the emissions.

4.D. Agricultural soils - N_2O
For N_2O emissions from agricultural soils, the IPCC default methodology (no tier specified) and a combination of country-specific and IPCC default emission factors was used.

4.D.1 and 4.D.3 Direct and indirect emissions from agricultural soils - N_2O

- N_2O-IEF. IEFs for N-fixing crops and crop residues are among the lower values compared to those of other Parties.

4.D.2. Agricultural soils, animal production - N_2O

- N_2O-IEF. N_2O-IEF for pasture range and paddock was almost the lowest value among reporting Parties.

Non-key sources
4.B. Manure management – CH_4 and N_2O

- CH_4-IEF. IEFs for dairy and non-dairy cattle were the lowest or almost the lowest among reporting Parties and also very low compared to the corresponding IPCC defaults for cool-Oceania (0.89 versus 31 for dairy and 0.91 versus 5 kg CH_4/hd/yr for non-dairy cattle).
- CH_4 emissions. Estimates were reported for cattle (dairy and non-dairy), sheep, goats and deer (under "other"). For all other livestock types emissions were not estimated (NE).
- N excretion rates. The N excretion rate for sheep was among the lower values among reporting Parties and relatively low compared to the IPCC default for Oceania (11.8 versus 20 kg N/hd/yr).

4.F. Field burning of agricultural residues

- With the exception of cereals (CH_4 and N_2O emissions) and sugar cane (NA reported), emissions were not estimated for the other sources within this source category (NE reported).

LAND-USE CHANGE AND FORESTRY

Overview

- New Zealand applied a country-specific approach (based on modelling and country-specific emission factors) to estimate CO_2 emissions and removals from 5.A. (Changes in Forest and Other Woody Biomass Stocks) for temperate forest, and from 5.B. (Forest and Grassland Conversion) for temperate shrublands.
- IPCC default emission factors were applied to estimate CH_4 emissions from 5.B. (Forest and Grassland Conversion) for temperate forest and temperate shrublands.
- Only Table 5 was provided with numeric information; sectoral tables only filled at the documentation boxes. Additional worksheets, including activity data and emission factors needed to estimate emissions and removals, were provided.
- Some annual changes were larger than 10%: -10.1% for 1991/92, -10.5% for 1992/93, and +15.1% for 1997/98.

5.A. Changes in forest and other woody biomass stocks

- Gross emissions are not provided. Net removals are taken as the gross removals in Table 5A.
- Implied emission factors were not calculated as Table 5.A. was not filled in with numeric data.

5.B. Forest and grassland conversion

- Implied emission factors were not calculated as Table 5.B. was not filled in with numeric data.
- CO_2 emissions increased by 68.3% from 1990 to 1999, with high annual changes, all of them over $\pm$10% and four of them over $\pm$30% (1990-1991: 1992-1993; 1994-1994 and 1997 – 1998).

WASTE

Non-key sources

6.B Wastewater Handling

6.C. Waste Incineration

- Activity data for industrial, domestic and commercial wastewater were not provided and no other additional information was reported

The Party noted that Table 6B of the CRF used the additional information box to record a large number of different wastewater handling systems. In addition, the documentation box for Table 6B stated that detailed calculations were provided in the NIR. The other parts of the additional information tables were not used, as the data used in the New Zealand calculations did not fit within the parameters of the additional information tables in the CRF.

NORWAY

General

Common reporting format (CRF) and national inventory report (NIR)

Norway submitted inventory data for the years 1990 and 1999 using the CRF and included most of the requested tables, except some sectoral background data tables. The CRF was accompanied by an NIR that included summary information on the Norwegian inventory model and other methodologies used. References to methodologies, activity data, emission factors and measurements were also included as part of an associated report published in year 2000. Since the 2000 report only provides information up to inventory year 1997, it is not transparent as to the specific activity data and assumptions utilized for inventory years 1998 to 1999. Indicators were widely used throughout the CRF.

The Party noted that methodologies, activity data, emission factors and measurements are, as noted, included as part of an associated report. Although that report only provides information up to inventory year 1997, this information is generally also valid for consecutive years. Deviations due to changes in methodology after 1997 are reflected in table 8(b) in the latest emission reports (reports 1742/2000 and 1801/2001).

Consistency of information between CRF and NIR

The data that were provided using the CRF in electronic format were reproduced in the NIR. Some minor adaptations were made to the CRF particularly in Agriculture (Table 4.B (a)) and LUCF. No major differences between the information provided in the CRF and NIR were identified.

Time series consistency

Summary analysis only of the trend across the complete time series was possible since inventories for only 1990 and 1999 were provided in the CRF. Emission trends as shown in table 10 of the CRF do not indicate any notable annual fluctuations in national totals that are not explained by associated changes in the sectors. The Party had previously noted in its response to the 2000 synthesis and assessment that due to uncertainties with respect to the requirements in the reporting guidelines and because of the large effort required for complete reporting of all years, that the 2001 submission would not contain data for all years.

Comparison with previous submissions

Norway provided recalculated estimates (Tables 8 (a)) for 1990 and 1998 and explanatory information for these recalculations (tables 8 (b)). For the year 1990, the effect of this recalculations is a slight downward revision of 0.02-0.03 per cent (without and with LUCF, respectively) for the entire inventory in terms of CO_2 equivalent. As for the 1998 inventory, revisions to the entire inventory are down 1.2 per cent. Norway also recalculated CH_4 fugitive emissions from coal mining and handling (changed from Tier 1 to Tier 2).

The Party explained that the downward revision for the year 1990 should, according to the report, be 0.2-0.3%. Respectively for 1998, if land-use is also considered for that year, the downward revision should be in the interval 0.8-1.2%.

QA/QC and verification procedures

The NIR does not include sections on quality control (QC), quality assurance (QA), or verification procedures. The CRF Table 7 Overview, does, however, included qualitative indicators for quality for estimated sources.

The Party explained that Statistics Norway is in 2001 running a quality project aiming at improving QA/QC procedures. Several actions are planned to be implemented in 2002 to facilitate checks of data, documentation and archiving.

Key sources
Norway did not perform an identification of key source.
Party explained that it has performed a Tier 2 key source identification. However, this concept was not directly described or so far directly used in the emission inventory report. However, the sources described in detail in the report are the key sources, but based on national source categories.

Uncertainty estimates
Qualitative uncertainty estimates were provided in table Summary 7 of the CRF, but no additional information was provided in the NIR. The associated report on methodologies references a review of uncertainties in Section 4.4 and of planned further analysis on uncertainties to be completed in year 2000. However, there is no documentation of these activities in the NIR.
Party explained that the information on uncertainty (Chapter 6) in our previous report (SFT-report 1742/2000) also applies for this report. A detailed description on uncertainty can be found in the Statistics Norway report "Uncertainties in the Norwegian greenhouse Gas Emission Inventory". (http://www.ssb.no/emner/01/04/10/rapp_200013/rapp_200013.pdf). This work is according to Good practice, Tier 2.

Sector-by-sector findings

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 7.2 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data
The Norwegian reference approach energy data for 1999 are 7.6% higher than the data reported to the IEA. Apparent consumption of liquid fuels is 22.6% higher in the CRF, consumption of gaseous fuels is 37.4% lower, and consumption of solid fuels is comparable. Specific differences include:

- Production of crude oil is 239,278 TJ lower in the CRF and production of NGLs are 152,089 TJ higher in the CRF.
- Exports of liquid fuels are 175,740 TJ lower in the CRF (2.9%). Differences in exports of crude oil, NGL, gasoline and LPG are especially high.
- Production of natural gas is 180,783 TJ higher in the CRF (8.9%)
- Exports of natural gas are 234,993 TJ higher in the CRF (12.5%)
- Jet kerosene used in international bunkers is 13,346 TJ in the CRF and 24,613 TJ in the IEA data.

Most of the above questions are also applicable to the 1990 data where the CRF data are 0.6% lower than the IEA data. The growth rate of overall apparent consumption between 1990 and 1999 is quite similar between the two data sets. The CRF rate is 41.7% and the IEA rate 30.2%.

Norway explained that in the next submission it would use the same data as reported to the IEA, with the exception of aviation fuel, as explained below. The reference approach and the assumptions and factors used have been reviewed in a report to Eurostat to be submitted in the autumn 2001. However, due to the large upstream oil and gas sector there will still be large differences in CO_2 estimates from the sectoral approach, which Norway considers more accurate.

Key sources

Fuel combustion

1.A.1 Energy industries- liquid fuels:

- The value of the CO_2 IEF in 1999 (59.58 t/TJ) increased by 3.2 per cent compared to its 1990 level (57.71 t/TJ).

Norway explained that there has been an increase in IEF due to the larger fraction of light oil compared to heavy fuel oil with a lower heating value. The reason is a large increase in the use of light fuel oil in district heating plants from 1990 to 1999.

- The value of the CO_2 IEF in 1999 for the petroleum refining subcategory (56.3 t/TJ) is the second lowest across the reporting Parties.

Norway explained that most of the combustion in oil refineries is refinery gas (according to the IPCC Guidelines reported as liquid fuels). Refinery gas as used in Norway has a higher heating value than most other types of energy commodities.

1.A.1 Energy industries - solid fuels:

- The value of the CO_2 IEF in 1999 for the public electricity and heat production subcategory (86.1t/TJ) is among the lowest across the reporting Parties.

Norway explained that this value corresponds to combustion of coal at Spitsbergen for electricity and heat production. The calculation is based on an emission factor of 2.42 kg CO_2/tonne coal. This emission factor has been confirmed by direct contact with the plant in 2001. The coal used in Norway and at Spitsbergen is all high quality coal.

- The Party did not report activity data and emissions from the subcategory manufacture of solid fuels and other energy industries.

Norway explained that no emissions are reported because there are no activities in this subcategory in Norway (NO).

1.A.4 Other sectors - gaseous fuels: The Party did not report activity data and emissions from the subcategories residential and agriculture/forestry/fisheries.

Norway explained that no emissions are to be reported as gas is not used in these sectors in Norway (NO).

1.A.4 Other sectors - solid fuels:

- The Party did not report activity data and emissions from the commercial/institutional subcategory.

Norway explained that no emissions are to be reported as coal is not used in these sectors in Norway (NO).

- The value of the CO_2 IEF in 1999 for the agriculture/forestry/fisheries subcategory (86.1t/TJ) is among the lowest across the reporting Parties.

Norway explained that for agriculture/forestry/fisheries, the IEF of 86.1 for solid fuels corresponds to combustion of a small amount of coal (150 tonnes) in agriculture. The basis is an emission factor of 2.42 kg CO_2/tonne coal. The value is uncertain; as the consumption is very low the EF has been assumed equal to other sectors.

1.A.3.b Transportation (CO_2 and N_2O):

- The value of the N_2O IEF for diesel oil in 1999 (1.95 kg/TJ) is one of the lowest across the reporting Parties and is lower compared to the IPCC default values.

Norway explained that N_2O emissions from heavy-duty diesel vehicles were calculated erroneously with emission factors for gasoline vehicles: 6 mg/km instead of 30 mg/km. The data will be corrected in the 2002 submission.

1.A.3.a Civil aviation (domestic): The activity data for jet kerosene reported in the CRF are higher compared to the data published by the IEA (46 per cent).
Norway explained that data published by the IEA are not correct. Data used for domestic transport in the CRF are based on annual surveys where all airline companies report their domestic consumption. These data are considered to be reliable.

<u>*Fugitive emissions*</u>
1.B.2.a, I, ii, iv,v vi Oil:

- Activity data for exploration were not reported, but emissions (CO_2, CH_4) were provided.
- Activity data and emissions from production were not reported.
- CH_4 emissions from production, refining, and storage and distribution of oil products were not reported.
- The value of the CH_4 IEF for transport (2,112 kg/PJ) is the highest among all reporting Parties and is also higher than the IPCC default value (745 kg/PJ).

1.B.2.b Natural gas

- Activity data were not provided.
- Emissions (CO_2 and CH_4) were not provided (except for other leakage).

1.B.2.c i,ii Venting:

- Oil and natural gas: Activity data and emissions were not reported.
- Flaring (oil and combined): Activity data were not reported but CO_2 emissions for oil were provided.

For all findings under fugitive emissions, Norway stated that activity data were not given as they are not directly used or relevant, but they can of course be reported for reference. It is also in general difficult to distribute activities between oil, gas and combined fields. However, reporting is in principle complete and covers all relevant activities. Norway will make efforts to improve completeness and transparency in reporting for the 2002 submission. Some of the missing data are displayed below for reference.

Data related to oil and gas production

	1990	***1998***	***1999***
Gas production, PJ	***1046,1***	***1879***	***2059,4***
Flaring of crude oil*, PJ	***-***	***0,909***	***0,651***
Venting CO_2 (tonnes)	***26651***	***38538***	***41429***
Venting CH_4 (tonnes)	***6707***	***8173***	***7471***

**** This is incineration of oil at pre-production facilities before a system of oil transport has been established.***

Non-key sources
1.A.4 Other sectors (residential and agriculture/forestry/fisheries) – gaseous and other fuels: The Party did not report activity data and emissions from these source categories.

Norway explained that no emissions are to be reported as gas is not used in these sectors in Norway (NO).

1.A.1 Energy industries - biomass: The value of the CH_4 IEF in 1999 (14.3 kg/TJ) is one of the lowest across the reporting Parties.

Norway explained that the value of the CH_4 IEF in 1999 is based on an IPCC tier 2 factor of 15 kg/TJ (rounding errors give 14.3). This is for stoker boilers given in table 1-16 in the Reference Manual. The tier 1 factor given in table 1-7 is 30 kg/TJ. Norway has reported based on the tier 2 method.

Bunker fuels

1.A.3.a International aviation: The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (84 per cent).

Norway explained that the total sale of aviation fuel is reported to the IEA. The fuel used in the inventory as aviation bunker fuel is the total sale minus the domestic share as required by the IPCC Guidelines.

INDUSTRIAL PROCESSES

Key sources

2.C.2 Ferroalloy production – CO_2

- No activity data were provided for years 1990 to 1998 in the 2001 submission even though activity data was reported for 1998 in the 2000 submission.
  Norway explained that the time series has been recalculated due to a correction in methodology (correction of emission factor due to humidity of coal). This means that the 1999 estimate submitted in 2001 not can be compared to the 1998 estimate submitted in 2000. Updated CRF was not provided for 1998 in 2001. Activity data (production volumes) are available and will be given in the 2002 submission (displayed below for reference).
  Production of ferroalloys. Tonnes.

	1990	**1998**	**1999**
FeSi	460,431	412,426	442,270
SiMetal	79,348	136,358	152,321
Other	441,329	620,182	571,970

- CO_2 IEF decreased by 13 % from 1998(3.20582t/t) to 1999 (2.83436t/t)

2.B.2 Nitric acid production – N_2O

- No activity data was provided in CRF or in the NIR.
  Norway explained that there is only one plant in Norway and the data are confidential.

2.C.3 Aluminium production

- Sources of methodology and EF used were not given.
  Norway explained that the methodology used for calculating CF_4 and C_2F_6 from aluminium production is described in (SN/SFT 2000) that was enclosed to this and lasts years report. For calculation CF_4 and C_2F_6 emissions we have used a Tier 2 methodology.
- No activity data were provided for CF_4 and C_2F_6.

- ***Norway provided the following activity data:***
  Production of aluminium. Tonnes:

	1990	**1998**	**1999**
Prebaked	373,896	362,439	364,162
Søderberg	495,999	628,843	643,898

- Norway has a high ratio of CF_4 to C_2F_6 emission (CF4/C2F6 = 26.22) as compared to other countries**.**
  Norway explained that the ratio of 26,22 between CF4 and C2F6 was based on current knowledge at that time. The uncertainty is, however, large and a revision of this figure is being considered.
- CO_2 IEF in 1999 (3.59t/t) was among the highest amongst the Parties and higher than IPCC default is (1.5 – 1.8t/t).
  Norway explained that the IEF for aluminium production is 3,59 tonne CO_2/tonne electrode. In a comment in the CRF file Norway has given a description of the activity data: use of petrolcoke, coal electrodes etc. The IPCC factor referred to in the UNFCCC comment is not for petrol coke, coal electrodes etc. but for tonnes of product.

2.A.1 Cement production – CO_2
- For confidential reasons activity data was not provided (reported as C).
- Emission data were provided for only 1990 and 1999. Emissions increased by 32% from 1990 to 1999.
  Norway explained that there are only two plants producing cement. The cement production has increased by about 30 % from 1990 to 1999.

2.C.4.2 SF_6 use in magnesium foundries
- No activity was data provided in CRF or in the NIR.
  Norway provided the following activity data:
  Production of magnesium:

	1990	**1998**	**1999**
Magnesium	48,222	43,345	51,836

2.B.1 Ammonia production
- For reasons of confidentiality activity data for ammonia production was not provided (reported as C).
- Emissions from 1990 to 1999 reduced by 44%.
  Norway explained that emissions from 1990 to 1999 were reduced by 44 % because the ammonia factory has been partly closed since 1998. The reduction in emissions is caused by the subsequent decrease in consumption of LPG in the process (The factory has now been reopened).

2.B.4 Carbide production
- CO_2 emissions decreased by 20 % from 1990 (250.88Gg) to 1999 (201.01Gg).
  Norway explained that the 20% decrease in the emissions of CO_2 is caused by smaller production volumes, with a subsequent reduction in the amount of petrol coke used in the process.

2.F Consumption of halocarbons and SF_6 – HFCs, PFCs and SF_6
- SF_6 actual emissions was reported for only 1999.
- SF_6 potential emissions were not estimated and no notation keys were used in the CRF.

- Norway has a high value for both HFCs P/A ratio (4.79) and PFCs P/A ratio (18.1) compared to other Parties for 1999. Norway indicated in the response to queries raised during the 2000 synthesis and assessment report that, it has well kept equipment and very good recovery and recycling systems and the Tier 2 approach is relatively detailed, thus these probably accounting for its high P/A ratios.

  Norway explained that a model, aimed at improving this reporting, has been developed, and will be used in next years reporting.
  With respects to HFCs our comment during the 2000 synthesis and assessment report is, as assumed, still valid for the 2001 report.

Non-key sources
2.C.1 Iron and steel production – CO_2
- For confidential reasons activity data were not provided (reported as C).

SOLVENT AND OTHER PRODUCT USE

Non-key sources
3.A. Paint application
- IEF for CO_2 emissions (3.0 t/t) is the highest as compared to other reporting Parties.

3.B. Degreasing and dry cleaning
- IEF for CO_2 emissions is the highest as compared other reporting Parties.

3.D Other:
- Provided aggregate activity data for other use of solvents; No CO_2 IEF was calculated.

Norway explained that the IEF is according to the chemical conversion of NMVOC to CO_2.

AGRICULTURE

No information was provided for the following source categories: 4.C Rice cultivation, 4.E Prescribed burning of savannas and 4.F Field burning of agricultural residues. N_2O from 4.B Manure management was reported as NE/NO;
Norway explained that the activities under categories 4.C and 4.E do not take place in Norway (NO). Activity 4.F (field burning of agricultural residues) takes place on a small scale, but emissions have not been estimated due to lack of data. Norway stated its intention to report emissions from 4.F in its 2002 submissions, though activity data are considered to be highly uncertain.

Key sources
4.A Enteric fermentation
- IPCC Tier 1 method and default emission factors were used to estimate CH_4 emissions from enteric fermentation.
- Activity data. The reported sheep population data were higher by 12 per cent compared to FAO statistics, while swine population data were lower by 9 per cent compared to the FAO (2,715 versus 2,400, and 631 versus 690 thousand head, respectively).

Norway stated in its response to the S&A 2000 that data used were considered to be the best available and that differences in population sizes may arise from different counting periods and lifetimes.

- Under this category, CH_4 emissions from humans were also reported.
  The Party stated in its response to the S&A 2000 that CH_4 emissions from humans were erroneously reported but this would be corrected for the 2002 submission.

Norway confirmed that its comments made for the S&A 2000 are also valid for this year's S&A.

4.D Agricultural soils - direct and indirect N_2O emissions (4.D.1 and 4.D.3.)

- IPCC default method (no tier specified) and default together with country-specific emission factors were used.
- N_2O -IEF. Value for animal wastes applied to soils was among the lowest across the reporting Parties (0.010 kg N_2O-N/kg N).
  Norway explained that it uses the IPCC default emission factor of 1.25 % N-loss. However, this factor applies to the manure minus the ammonia loss. The activity reported in the CRF (62,685 tonnes) includes volatile ammonia.
- Fractions. For the fraction of synthetic fertilizer N applied to soils that volatilizes as NH_3 and NO_X ($Frac_{GASF}$), the value reported (0.048) is among the lowest compared to those reported by most other Parties and about 50% lower than the IPCC default (0.1).
  The Party explained in its response to the S&A 2000 that it uses a model for estimating N_2O from ammonia and that the type of fertilizer used in Norway has a lower N fraction that volatilizes.

4.D Agricultural soils - CO_2

This source was identified as *key* source according to the trend assessment.

- Estimates reported under this category correspond to CO_2 emissions from liming of agricultural soils;
- Emissions decreased by 40% over the 1990 to 1999 period.

Norway explained that emissions of CO_2 from agricultural soils in Norway derive from liming of soil and that the decrease is being caused by a reduction in liming.

Non-key sources

4.B Manure management – CH_4 and N_2O

- CH_4-IEF. IEF for sheep (0.63 kg CH_4/hd/yr) was approximately three times higher than the IPCC default for cool-developed countries (0.19 kg CH_4/head/year); it was one of the highest values among the reporting Parties.
  Norway explained in its response to the S&A 2000 that this could be due to the fact that sheep are kept indoors part of the year, which leads to different rates of emissions.
- CH_4-IEF. IEF for swine was among the lowest across reporting Parties and lower than the IPCC default value for cool-Western Europe.
  Norway explained that the tier 2 emission factors used have been determined in cooperation with national expertise and that they reflect their best judgement. Also most swine in Norway are for slaughter and are on average small, leading to a low IEF.

- N-excretion rates and N_2O-IEF per AWMS. No activity data or emission estimates were reported, and thus no IEFs were calculated; the Party however indicated the use of default methods and default/country-specific emission factors for N_2O from manure management (Summary 3 of the CRF).

The Party explained in its response to the S&A 2000 that it meant to report N_2O emissions from this source category under agricultural soils. Since the methodology is complex there may be smaller subsources that have not been reported according to the guidelines.

LAND-USE CHANGE AND FORESTRY

Overview

- Norway reported in Table 5 CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for boreal forests.
- Norway used a country-specific method and emission factors to estimate CO_2 emissions and removals from 5.A.
- Estimates of non-CO_2 gas emissions were not reported.

5.A. Changes in forest and other woody biomass stocks

- Country provided gross removals but not gross emissions. Gross removals are taken as net removals in Table 5A.
  Norway explained that the reported figure of 17 742 Gg CO_2 (1999) represents net removals. In 1999, total annual growth increment was 34 073Gg and total consumption from stocks, including natural decay, was 16 331 Gg.

- Large increment of removals (+85%) from 1990 to 1999, with large annual changes: +22% for 1990/91, +13.2% for 1991/92, +16.0% for 1993/94, -13% for 1994/95, and +29.1% for 1995/96.
  Norway explained that the total growth increment has been increasing steadily for several decades, while consumption has declined with large annual variations. In 1990, total growth increment was 30 900 Gg, and consumption was 21 300 Gg.

WASTE

Key sources

6.A Solid waste disposal on land – CH_4

- IEF for CH_4 is high compared to other Parties
- Total population data are not estimated. Waste generation rate (kg/capita/day) was not provided.

The Party commented that it had no response to this information at the moment. It asked if it is necessary to undertake additional investigations to answer this question.

Non-key sources

6.B Wastewater handling

- CH_4 emissions per capita from wastewater handling (0.09 kg/capita) are low compared to most Parties
- Activity data and IEF for wastewater were not provided, though wastewater volumes are reported under additional information

The Party reiterated its response to the S&A 2000 that the IPCC default methodology was used for this source. Since only about 2% of the wastewater was treated anaerobically in the country, this was considered a very small emission source and the calculation methods have not been evaluated and described in detail.

6.C. Waste incineration

- Activity data were provided but no emission estimates given.

The Party explained that almost all waste incineration in Norway was associated with energy utilization and was reported under the energy sector.

PORTUGAL

General

Common reporting format (CRF) and national inventory report (NIR)
Portugal submitted inventory data for the years 1990 to 1999 using the CRF tables, and included almost all requested tables; not included were tables 2(II)C-E, 2(II)F and 5.A. to 5.D. Indicators were widely used in the CRF tables. A NIR was not provided, nor was explanation on the numerical information provided in the documentation boxes.

Consistency of information between CRF and NIR
Not applicable, since a NIR was not provided.

Time series consistency
National and sectoral emissions do not indicate major fluctuations in the time series. At the level of categories, the following have been identified as large changes for the time series (>50%) and/or large annual changes (>10%):

- CO_2 emissions from 1.A.3. Transport, 1.B. Fugitive sources, 2.B. Chemical industries and 2.C. Metal production,
- CO_2, CH_4 and N_2O emissions from 6.C. Waste incineration (due to a significant increase between 1998 and 1999),
- CH_4 emissions from 1.B.2. Oil and natural gas, and 4.C. Rice production, and
- N_2O emissions from 1.A.3. Transport.

Comparison with previous submissions
The CRF submitted provide information on recalculations for all the years of the time series. The recalculated values are included in Tables 8 of the for each inventory year in the 2001 CRF submission. There are minor changes in almost all sectors due to recalculations. Large differences, more than 25%, can be found in CH_4 and N_2O emissions from wastes. Base year 1990 changes due to recalculations are reported as +12.20% for total CO_2 equivalnet (with LUCF), and + 13.6% (without LUCF).

QA/QC and verification procedures
No information was available on whether the inventory data was subject to any self-verification or independent review procedures. The CRF Table 7, Overview lists quality indicators for source categories, however with the absence of an NIR, there is no documentation of quality assurance (QA)/quality control (QC) procedures implemented.

Key sources
No key sources calculations were provided.

Uncertainty estimations
No uncertainty estimates were provided.

<u>Sector-by-sector findings</u>

ENERGY

Reference approach

Comparison of reference approach with national approach
CO_2 emissions by the reference approach were provided for the years 1990 to 1998. For 1998, there is a difference of 9.5 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data
The Portuguese reference approach energy data for 1998 are 2.5 per cent higher than the data reported to the IEA. Apparent consumption of liquid fuels is 2.3 per cent higher in the CRF, consumption of solid fuels is 3.9 per cent higher, and consumption of gaseous fuels is comparable. Specific differences include:

- Imports for refinery feedstocks are 22,422 TJ (46 per cent) higher in the CRF.
- International bunkers for jet kerosene are 11,922 TJ in the CRF and 20957 TJ in the IEA data.

Most of the above questions are also applicable to the 1990 data where the CRF data are 3.8 per cent higher than the IEA data. The growth rate of overall apparent consumption between 1990 and 1998 is very similar between the two data sets: CRF 34.9 per cent and IEA 36.8 per cent.

Key sources

<u>Fuel combustion</u>
1.A.1 Energy industries

- The value of the CO_2 IEF for liquid fuels in 1999 (71.7 t/TJ) is one of the lowest across the Parties.

Portugal indicated that observing the country data tables it appears that this value is within the normal range.

- The value of the CO_2 IEF for solid fuels for the public electricity and heat production category in 1999 (92.0t/TJ) is one of the lowest across the reporting Parties.

Portugal indicated that observing the country data tables it appears that this value is within the normal range.

- The Party did not report activity data and emissions for gaseous fuels for the categories petroleum refining and manufacture of solid fuels and other energy industries

1.A.3.a Civil aviation (domestic): The activity data for jet kerosene reported in the CRF are higher compared to the data published by the IEA (44 per cent), while the activity data for aviation gasoline are lower (88 per cent).

1.A.3.d Navigation (domestic): The activity data for gas/diesel oil reported in the CRF are higher compared to the data published by the IEA (74 per cent).

1.A.4 Other sectors

- The value of the CO_2 IEF for liquid fuels for the residential category in 1999 (65.1 t/TJ) is one of the lowest across the reporting Parties.

Portugal indicated that observing the country data tables it appears that this value is within the normal range.

- The Party did not report activity data and emissions for solid fuels for the categories commercial/institutional, residential and agriculture/forestry/fisheries.

Non-key sources

<u>*Fuel combustion*</u>

1.A.3.b Road transportation (CO_2 and N_2O): The value of the N_2O IEF for gasoline in 1999 (10.2 kg/TJ) increased significantly compared to its 1990 level (1.8 kg/TJ).

Portugal explained that this increase reflects the introduction of catalytic converters, which have a higher EF.

<u>*Fugitive emissions*</u>

1.B.2.b ii Natural gas: Activity data were reported for transmission but no CO_2 emissions were given.

Bunker fuels

1.A.3.a International aviation

The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (92 per cent).

1.A.3.d International marine transport

The activity data for residual oil and gas/diesel oil reported in the CRF are lower compared to the data published by the IEA (52 per cent and 59 per cent, respectively).

INDUSTRIAL PROCESSES

Key sources

2.A.1. Cement production

- CO_2 IEF (0.403t/t) for cement production is one of the lowest among reporting Parties and lower than the IPCC default, for cement (0.499t/t).
  Portugal explained that the original calculation was done upon clinker production and using the default IPCC percentage of CaO in clinker (0.646 t CaO/ ton Clinker). Differences in the IEF result however from the fact that Portuguese cement appears to have a lower clinker content (from national data) than the assumed default value of IPCC (about 98% or 63.5/64.6*100).

2.B.2. Nitric acid production

- N_2O IEF is one of the higher values reported by Parties, but is within the IPCC default range.
- N_2O emissions decreased from 1992 to 1993 by 16.5% and further decreased by 24.9% from 1993 to 1994, and this was followed by a sharp increase in emissions from 1994 to 1995 (59.2%).
  Portugal explained that this variation reflects activity data as available. However, emission estimates for this sector are being improved and will be available in the future. Also, Portugal must stress that the number of Nitric Acid Plants in Portugal is small and hence big annual changes can occur easily. Emission factors were always constant.

2.B.1. Ammonia production

- Ammonia production decreased from 1993 to 1994 (110.5kt to 70.39kt) with concomitant decrease in emissions of CO_2 by 32 %. However, with increase in production levels from 1994 to 1995 (70.39kt to 187.91kt) emissions of CO_2 the remained constant. The same inconsistency occurs from 1995 and 1996. No reason was attributed to these inconsistencies in the CRF.
  Portugal explained that available data for ammonia production refer 1990 to 1995. However, emissions of CO_2 were estimated from fuel consumption (High Vacuum Residual Oil) which was available only until 1994 and was thereafter considered constant. This results in an inconsistency, which could and shall be corrected in the next report.
- The time series for the CO_2 IEF from 1991 to 1996 has been very erratic and the CO_2 IEF for 1999 (1.33 t/t) was lower than the IPCC default range (1.5 – 1.6 t/t).
  Portugal explained that CO_2 emissions estimates resulted from fuel consumption (HV Residual Fuel Oil) and not from default emission factors based normally in Natural Gas. This is specific to Portuguese industry.

Non-key sources

2.A.3 Limestone and dolomite use

- CO_2 IEF (0.32) is lower than the IPCC default range (0.44 – 0.48 t/t).
  Portugal explained that activity data are the sum of very different products (soda carbonate, and calcium carbonate) but available years are very few. Emissions were estimated from mass balance. As with the case of cement, ammonia and other production sectors these estimates will be updated in the near future.

2.C.3. Aluminium production

- No estimates of PFC (CF_4 and C_2F_6) emissions were reported for 1990–1994. However, values for these gases were reported starting from 1995 – 1999.
- No activity data were reported for CF_4 and C_2F_6 in table 2 (II) C, E.

2.F Consumption of halocarbons and SF_6 – HFCs, PFCs & SF_6

- HFCs, PFCs and SF_6 actual and potential emissions were not reported, hence the P/A ratios could not be determined.

SOLVENT AND OTHER PRODUCT USE

- Portugal used mass balance to determine the activity data (reported as MA)
- Very stable time series emissions were observed under all the sub-categories except under Chemical Products, Manufacture and Processing where emissions of CO_2 and NMVOC increased by 8.77% and 8.1% respectively from 1990 to 1991.
  Portugal explained that as with the case of cement, ammonia and other production sectors these estimates will be updated in the near future.

AGRICULTURE

No estimates were provided for 4.E Savanna burning, which was reported as not applicable (NA).

CO_2 emissions/removals from agricultural soils were not estimated (reported as NE in both the agriculture and LUCF sector).

Key sources

IPCC Tier 1 method and default emission factors were used to estimate CH_4 emissions from enteric fermentation.

IPCC Tier 2 and default and country-specific emission factors were used to estimate CH_4 and N_2O emissions from manure management.

Default method (not specified) and emission factors were used to estimate N_2O emissions from agricultural soils.

Default method (not specified) and a combination of country-specific and default emission factors were applied to estimate CH_4 emissions from rice production.

4.A. Enteric fermentation – CH_4

- Activity data. Compared to FAO statistics, the sheep population reported in the CRF was 68.5% lower (3,472 thousand head in the CRF versus 5,850 thousand according to FAO).
  Portugal explained that the figures used are official data from the Portuguese Agriculture Ministry collected on an annual basis.
- Trends in activity data. Some animal populations (horses, mules/asses and poultry) showed a sudden annual change between 1994 and 1995. For cattle, there was a notable decline in animal numbers between 1991 and 1992.
  Portugal explained that these annual variations are due to data collection being sparse and data not being available for all years for some animal species.

4.B. Manure management - CH_4 and N_2O (4.B(a)) and 4.B(b))

- CH_4-IEF. IEF for swine was the highest value across reporting Parties; this value is five times higher than the IPCC default for temperate-Western Europe (54.9 versus 10 kg CH_4/head/yr).
- CH_4-IEF. IEF for dairy cattle was lower than IPCC default for temperate-Western Europe (25.7 versus 44 kg CH_4/head/yr); in the case of non-dairy cattle the IEF was lower by a factor of 10 compared to the default values (1.9 versus 20 kg CH_4/head/yr).
- CH_4-IEF. IEF for sheep was the highest value among the reporting Parties and higher by a factor of 10 compared to IPCC default for temperate-Western Europe (1.6 versus 0.28 kg CH_4/head/yr).

Regarding the CH_4 IEFs, Portugal explained that specific figures for Portugal as reported by the National Agriculture Ministry were used. The IPCC default emission factors assume a specific distribution for the share of different manure management systems.

- N_2O-IEF for AWMS. IEFs for anaerobic lagoons and liquid systems were among the highest values across reporting Parties, the value for anaerobic lagoons being well over the IPCC default range of values.
  Portugal explained that under 4.B.10 (Anaerobic lagoons) direct N_2O emissions estimated using the IPCC default emission factor were included, but also indirect emissions from ammonia volatilization and nitrate leaching. Consequently, the IEF incorporates also these emission factors.

- N excretion rates. For daily spread and other, N excretion was reported to be “0”. Rates are among the highest values across Parties; in the case of sheep, the value reported by Portugal was the highest across Parties and double the IPCC default for Western Europe (40.9 versus

20 kg N/hd/yr). Other rates also differed from IPCC defaults for Western Europe (108 versus 100 for dairy cattle; 54 versus 70 for non-dairy cattle; and 0.74 versus 0.6 kg N/hd/yr for poultry).
Portugal explained that it had used information (quantities of manure produced and nitrogen content) made available by the National Agriculture Ministry.

- Trends in N_2O IEF. The IEFs for AWMS changed from 1990 to 1991, but remained constant for the rest of the period until 1999;
- Trend in emissions. While CH_4 emissions showed a decrease between 1990 and 1999, N_2O emissions showed an overall increase of 27% from 1990 to 1999, with an annual increase of 18% from 1990 to 1991; from 1995 to 1996 there was no annual change in emissions.

Portugal explained that these trends reflect the varying importance of different animals for each emission type. The increase in N_2O reflects mainly an increase in solid storage emissions, which strongly reflects the increase in poultry-related emissions. However, CH_4 emissions from poultry are just a small fraction of total emissions and the increase in the poultry population does not have the same impact as it does for N_2O.

4.D. Agricultural soils – direct and indirect N_2O emissions (4.D.1. and 4.D.3.) and animal production (4.D.2)

- Cultivation of histosols was not estimated (reported as NE).
- Emissions from crop residues were reported as "0" (consequently no IEF for crop residues was calculated), although 44% of crop residues were reported as being burned on field.
  Portugal explained that 44% is the percentage of residues actually burned, out of the potential residues that could be burned (only some crops were chosen) and therefore does not correspond to the value for fraction of crop residue burned ($Frac_{BURN}$***). Portugal stated that this value should be removed to avoid misinterpretation.***
- IEF calculated for pasture range and paddock was "0"; however, emissions of 5.25 Gg N_2O in 1990, and 5.45 Gg in 1999, as well as corresponding activity data are reported.
  Portugal explained that it had changed the formulas of the IEF and introduced a mistake. The actual figure is not zero.
- Fractions used. Values for $Frac_{BURN}$ (0.4409) and $Frac_{GRAZ}$ (0.512) were among the highest across the reporting Parties and, in the case of $Frac_{BURN}$, higher than the IPCC default. Values for $Frac_{NCRBF}$ and $Frac_{GASM}$ were the lowest among the reporting Parties and below the IPCC defaults.
  Regarding the $Frac_{BURN}$ Portugal explained that this value corresponds to the percentage of residues actually burned, out of the potential residues that could be burned (only some crops were chosen). The $Frac_{GRAZ}$ is a national figure. $Frac_{NCRBF}$ and $Frac_{GASM}$ were estimated from crop carbon and nitrogen content, percentage of dry matter and ratio of residues to crop.
- Trend in IEFs and emissions. N_2O-IEF for animal waste applied to soils increased 37% over the 1990 to 1999 period, with an annual increase of 35 % between 1990 and 1991. Corresponding emissions increased by 50 % over that period, with the largest increase (38%) also taking place between 1990 and 1991. It is not clear whether estimates for 1990 are methodologically consistent with those of the rest of the time series (1991-1999).
  Portugal explained that these results were due to an error for the year 1990.

4.C. Rice cultivation – CH_4 emissions

This source has been identified as key only according to the trend assessment.

Trend in CH_4 emissions. Large annual fluctuations between the years 1991 and 1994 (-36.9, -37.5 and +75.2%, respectively); since 1996 the CH_4 emission estimates have been constant. Over the entire time period, CH_4 emissions decreased by 33% between 1990 and 1999. ***Portugal explained that the rice cultivated area is only available until 1995.***

Non-key sources

4.F. Field burning of agricultural residues – CH_4 and N_2O emissions

- Activity data. All crop production data were reported as “0” although, e.g. for rice, emission estimates and related activity data related to burning were provided. Corresponding related activity data, such as dry matter fraction and residue/crop ratio were also reported as “0” for all crop types.
  Portugal explained that the information was not given for each crop type but was all grouped together and reported under “Other”; it noted that, for rice, specific information could have been presented.
- The CH_4-IEF for cereals-rice was the lowest among the reporting Parties, while the N_2O-IEF was among the highest.

LAND-USE CHANGE AND FORESTRY

Overview

- Portugal followed IPCC default methods (no tier specified) and applied IPCC default emission factors to estimate CO_2 emissions and removals from 5.A. (Changes in Forest and Other Woody Biomass Stocks) for temperate forest; and from 5.B. (Forest and Grassland Conversion) for temperate forests.
- Estimates of non-CO_2 gas emissions were not provided.
- Portugal did not report data on sectoral tables (5.A. to 5.D.)

5A. Changes in forest and other woody biomass stocks

- Removals increased by 32.4% from 1990 to 1999,.
- Gross removals are reported as net removals in Table 5A.

5.B. Forest and grassland conversion

- Country reports a negative value for the average annual net loss of biomass from grasslands (for both on- & off-site burnings and decay).
- No activity data or emission factors were reported.

5.C. Abandonment of managed lands

- This sector was reported as IE in Table 5 and Summary 1.As2, but no additional information was provided.

5.D. CO_2 emissions/removals from soils

- Sector reported as NE, in Summary 1.As2, but no additional information was provided.

WASTE

Non-key sources

6.C. Waste incineration

- The recalculated values (Table 8 of the CRF 99) indicated a reduction of 50% in CO_2 emissions for all years. Explanations were not provided.

Portugal replied that the explanation was presented in table 8 (b).

- CO_2 emissions in 1999 were reported about ten times higher that those in 1998; most likely because of an error in a decimal digit. This mistake might also affect the value of IEF.

The Party indicated that the increase reflected real data and a shift in composition of incinerated wastes. Portugal explained that incineration of MSW only started in 1999, which explained the sudden increase; until 1998 only minor quantities of hospital wastes were incinerated

SLOVAKIA

General

Common reporting format (CRF) and national inventory report (NIR)

Slovakia submitted inventory data for the year 1999 using the CRF, and included all requested tables, with the exception of tables 8(a,b) and 9. No information on recalculations and completeness was provided. Indicators were used in some sectoral and sectoral background tables in a limited way. A NIR was not provided, information in documentation boxes was not provided.

Consistency of information between CRF and NIR

No applicable since neither a NIR nor any other additional information was provided.

Time series consistency

Emissions in the trend tables indicated that the trend for total national CO_2 emissions showed only one annual change (1990/91) larger than 10%, which was due primarily to the increases in the energy sector. Land-Use Change and Forestry had 4 annual changes larger than 10% of difference. As far as other categories are concerned, almost all the sources showed at least one annual change over 10% of difference and/or more than a 50% change for the time series. General trend of decreasing or flat emissions for the time series holds in most sectors, except for high GWP gases.

Comparison with previous submissions

No recalculation tables were completed in the 2001 CRF submission, although it appears emissions have been recalculated since the 2000 CRF submission. A comparison to 2000 CRF submission reveals that changes in total GHG emissions have occurred. A check of 1990 inventory year emissions from the 2000 CRF showed total GHG emissions (without LUCF) of 76,304 Gg CO_2 Eq, while the 2001 CRF submission shows a total of 72,530 Gg CO_2 Eq. This is an approximately 5% decrease in overall emissions.

QA/QC and verification procedures

No information was available on whether the inventory data was subject to any self-verification or independent review procedures. The Table 7, Overview in the CRF contains quality indicators for each estimated category, however there is no documentation of implemented quality assurance (QA)/quality control (QC) procedures.

Key sources

No key sources calculations were provided.

Uncertainty estimates

No uncertainty estimates were provided.

Sector-by-sector findings

The analysis of trends in IEF, activity data and emissions at category levels that are more detailed than those in the trend table was hampered due to the lack of data for the years 1990 to 1998. Sectoral background data tables were only reported for 1999.

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 1.33 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data
On an aggregate level, the 1999 reference approach energy data correspond well to the IEA data (0.04 per cent higher). Specific differences include:
- Lignite production is 2,585 TJ higher in the CRF and imports are 2,939 TJ lower.

Key sources
Fuel combustion
1.A.2 Manufacturing industries and construction - *solid fuels*: The Party did not report activity data and emissions from this subsector.

1.A.2 Manufacturing industries and construction - *gaseous fuels*: The Party did not report activity data and emissions from this subsector (indicated as "IE").

1.A.1 Energy industries - *liquid fuels* (public electricity and heat production): The value of the CO_2 IEF in 1999 (50.0 t/TJ) is among the lowest across the reporting Parties.

1.A.2 Manufacturing industries and construction - *liquid fuels*: The Party did not report activity data and emissions from this subsector.

1.A.1 Other sectors - *liquid fuels*: The value of the CO_2 IEF for commercial/institutional in 1999 (32.4t/TJ) is the lowest across the reporting Parties.

Fugitive emissions
1.B.2.a i, iii,v Oil:
- Activity data and emissions for exploration and distribution of oil products are reported as "NE".
- The value of the CH_4 IEF for transport in 1999 (0.7) is the smallest across the reporting Parties. However, Slovakia has not specified the unit for the activity data used.
- *1.B.2.b i, ii Natural gas*: Activity data and emissions for exploration and distribution are reported as "NE".

1.B.2.c Venting and flaring (i,ii,iii): Activity data and emissions are reported as "NE".

1.B.1.a Coal mining and handling: The value of the CH_4 IEF for underground mines (post mining activities) in 1999 (0.3 kg/t) is the second lowest across the reporting Parties.

Non-key sources
Fuel combustion
1.A.3.a Civil aviation (domestic): Although activity data for jet kerosene are reported in the CRF as "NA", CO_2 emissions are provided.

1.A.1 Energy industries - gaseous fuels: The value of the CH_4 IEF in 1999 (5.0 kg/TJ) is one of the lowest across the reporting Parties.

Bunker fuels
1*.A.3.a. International aviation*: Activity data and emissions from all fuel categories were not reported in the CRF.

1.A.3.d International marine transport: Activity data and emissions from all fuel categories were not reported in the CRF.

INDUSTRIAL PROCESSES

Key sources
2.A.1 Cement Production – CO_2
- No indication is made as to whether data refers to cement or clinker production and the IEF (0.411t/t) is one of the lowest among reporting countries, lower than the IPCC defaults for cement 0.499t/t or clinker 0.507-0.526t/t.

2.A.1. Limestone and dolomite use – CO_2
- There was a rather sharp increase in emissions from 1997 to 1998 of about 14.2% a decrease of 7.1% from 1994 to 1995.

Non-key sources
2.B.1 Ammonia production
- Data for ammonia production was not reported although according to U.N. data there is such production.

2.B.2 Nitric acid production
- N_2O IEF (0.0005t/t) is the lowest among Parties and lower than the IPCC default value (0.002 – 0.009t/t).

2.C.3. Aluminium production
- CO_2 emissions from aluminium production are not estimated. It is reported as IE however no indication is given in the completeness table (Table9s1) as to where it was included.
- CF_4 and C_2F_6 IEFs (0.014 – 0.0014 kg/t) are the lowests among Parties; CF_4 IEF is lower than the IPCC default value (0.02 kg/t).

Other comments
- 2.C Metal production: emissions from metal production were indicated as reported under Energy. However, no emissions were reported for 1.A.2 Manufacturing industries and construction.

2.F Consumption of halocarbons and SF_6 – HFCs, PFCs & SF_6
- For PFCs and SF_6 only the actual emissions were reported, hence the P/A ratios could not be determined.

SOLVENT AND OTHER PRODUCTS USE

Slovakia did not provide activity data for all sub-categories, but provided emission estimates.

AGRICULTURE

Source categories 4.C Rice cultivation, 4.E Savanna burning and 4.F Field burning of agricultural residues were reported as NO.

Key sources

4.A Enteric fermentation – CH_4

- Activity data. Cattle population data were 24% lower than FAO values (570 thousand versus 705 thousand head). Different values for non-dairy cattle population were reported in different tables of the CRF: 296,000 head in tables 4.A and 4B(b) and 391,000 in table 4B(b).
- CH_4 -IEF. CH_4 -IEF for dairy cattle is higher than IPCC default value for Eastern Europe (96 versus 81 kg CH_4/hd/yr). For the inventory year 1998 (as provided in the 2000 submission), the CH_4 IEF was 92 kg CH_4/hd/yr. This corresponds to a 4 per cent increase of the IEF from 1998 to 1999.
- Trend in emissions. CH_4 emissions decreased by 54% from 1990 to 1999. Annual fluctuations of more than 10 per cent were noted for 1990/91, 1991/92, 1992/93 and 1997/98.
- Non-dairy cattle CH_4 emissions decreased by 30 per cent between 1998 and 1999.

4.D Agricultural soils - direct N_2O emissions (4.D.1.)

- Fractions used. Value for FracLEACH (0.0739) is almost the lowest value across the reporting Parties and below the IPCC default value (0.3; range from 0.1 to 0.8).
- N_2O -IEF. Value for animal wastes applied to soils was among the lowest across the reporting Parties.
- No information on 4.D.1.5 cultivation of histosols.
- Trend in emissions. Total N_2O emissions from agricultural soils decreased by 42% from 1990 to 1999, with some large annual changes: -12% for 1990/91, -18.5% for 1991/92, and – 12% for 1997/98, while the values for 1998 and 1999 were constant.

Non-key sources

4.B Manure management – CH_4 and N_2O

- N excretion rates. Value for dairy cattle is high compared to the IPCC default for Eastern Europe (90 versus 70 kg N/hd/yr).
- Trend in emissions. CH_4 and N_2O emissions decreased by 45 and 52%, respectively, from 1990 to 1999, with some annual changes of around 10% or higher.
- Consistency checks**.** Differences of 32 and 14 per cent when comparing the sum of nitrogen excretion over all AWMS per livestock to the corresponding N excretion rates per animal multiplied by the corresponding animal population (for non-dairy cattle and sheep).

4.D Agricultural soils - indirect N_2O emissions (4.D.3.)

- N_2O-IEF. N_2O-IEF for atmospheric deposition (0.001 kg N_2O -N/kg N) is lower by a factor of 10 compared to values of most other reporting Parties (0.01), and is below the range of the IPCC default emission factors (0.002-0.2 kg N_2O -N/kg N).

LAND-USE CHANGE AND FORESTRY

Overview

- Slovakia applied country-specific and IPCC default methods (no tier specified), along with a combination of country-specific and default emission factors, to estimate CO_2 emissions and removals.
- Slovakia reported in Table 5 CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forests including a list of species in table 5.A, from 5.B (Forest and Grassland Conversion) for temperate forests, coniferous and broadleaf, from 5.C. Abandonment of Managed Lands for temperate forests, coniferous and broadleaf and from 5.D (CO_2 Emissions and Removals from Soils) for liming and agricultural soils.
- Although sectoral table 5.B reports emissions of non-CO_2 gases (CH_4 and N_2O), these were not included in Table 5.
- Support information was reported in Tables 5.A, 5.B, 5C and 5.D

5.A. Changes in forest and other woody biomass stocks

- Largest year-to-year variation of all Parties; percentage difference in removals from 1997 to base year was of the order of 560% (with larger removal in 1997); the net removals reported for 1997 and 1998 were -2244.5 and +63.5 Gg CO_2 /yr, respectively. Other large annual changes: +163.5% for 1993/94, +103.5% for 1995/96 and -108.2% for 1997/98.
- Large increase (101.7%) of net removals between 1990 and 1999, accompanied by large annual changes: +163.5% for 1993/94, +103.5% for 1995/96, -108.2% for 1997/98 and -537.1% for 1998/99.
  Slovakia explained that the large annual fluctuations in removals are mainly connected with the fluctuations in annual biomass harvest. On the other hand, up to 1997 the different methodology for removal calculations was used and therefore the data for the period 1990-1997 are not well consistent with the data for 1998-1999. In the near future all data for category 5.A will be harmonized for the whole period 1990-2000.
- Gross emissions and gross removals reported only for 1998 and 1999. Missing in all other years.
  Slovakia explained that this is due to the fact that the IPCC methodology was used only for the years 1998-1999. A complete set of gross emissions and removals for the whole period will be provided in the next submission.
- No annual change from 1990 to 1994 and from 1995 to 1996.
  The Party explained that the calculations were carried out for the years 1990, 1994 and 1996, respectively. Due to this, for the years 1991, 1992 and 1993 the Party used the same values as for 1990, and for 1995 the same ones as for 1996.
- Average annual growth rates for different species (belonging to other temperate forests) ranged from 1.01 to 4.42 t dm/ha/yr (0.5 to 2.16 t C/ha/yr, as implied annual carbon uptake); these values cross the whole range of reported values for the forest type (from 0.95 to 4.51). Half of them were above the mean average calculated on the basis of all the values reported (2.62 t dm/ha/yr).
  Slovakia explained that data on annual growth rates according to the individual tree species are based on the National Forest Inventory.
- For 1999, different values between Table 5.A. and Table 5 (sector 5.A.): –2,098.22 versus -808.65 Gg CO_2 as net removals; 9,265.99 versus 9,171.00 Gg CO_2 as gross emissions and –11,394.71 versus –9,979,65 Gg CO_2 as gross removals

5.B. Forest and grassland conversion

- Emissions increased by 88.7% from 1990 to 1999, with large annual changes in the last years of the time series: -11.9% for 1995/96, +18.4% for 1997/98 and +102.7% for 1998/99.
- Gross removals increased by 18% between 1998 and 1999.
  Slovakia explained that annual fluctuations in this category are connected with the annual changes in land use and land-use change activity data (deforestation, forest fires, biomass harvest residues burning).
- No activity data and emission factors were reported, so no IEFs were calculated.
  Slovakia mentioned that in the near future, the National Inventory Report would be prepared with all needed information.
- The Party reported annual net loss of biomass from on- and off-site burning for temperate, broadleaf (1179.6 kt dm) but does not provide area converted and average annual net loss of biomass. Same applies for temperate, coniferous (853.29 kt dm).
- No area converted for on- and off-site burning but biomass loss given
  The Party explained that Slovakia reported annual net loss of biomass from on-off site burning due to forest fires and biomass harvest residues burning because in Slovakia these processes are not connected with the changes in forest area (these areas are completely reforested).
- No annual change from 1990 to 1994 and from 1995 to 1996
  Slovakia stated that, as for table 5.A, the calculations were carried out for the years 1990, 1994 and 1996, respectively. Due to this, for the years 1991, 1992 and 1993 they used the same values as for 1990, and for 1995 the same ones as for 1996.
- IEF not calculated but emission estimates given.
  The Party explained that the ccalculations were carried out according to IPCC methodology and Slovakian country-specific conditions. A clarification will be provided in the near future in the NIR.

5.C. Abandonment of managed lands

- No annual change in CO_2 removals from 1990 to 1993 and from 1994 to 1995.
  The Party explained that calculations were carried out for the years 1990, 1994 and 1996, respectively. Due to this, for the years 1991, 1992 and 1993, the Party used the same values as for 1990, and for 1995 the same ones as for 1996.

5.D. CO_2 emissions/removals from soils

- Some large annual changes in net removals: -13.9% for 1995/96, -32.0% for 1996/97, and +13.0% for 1998/99.
  Slovakia explained that annual changes in net removals are connected with changes in areas of specified land-use categories with different carbon stocks.
- No annual change in net removals from 1990 to 1993 and from 1994 to 1995.
  Slovakia explained that, as for table 5.A, the calculations were carried out for the years 1990, 1994 and 1996, respectively. Due to this, for the years 1991, 1992 and 1993 they used the same values as for 1990, and for 1995 the same ones as for 1996.
- Emissions are reported in negative numbers in Table 5.D. Values were transferred to removals in Table 5 (Mineral soils). As a consequence, the emission figures in 1998 and 1999 have different signs. The absolute value changed 31% for 1998/1999.

- No activity data and emission factors for cultivation of mineral soils.
  Slovakia stated that activity data related to cultivation of mineral soils will be provided in the near future in the NIR.

5.E. *Others*

- Large increase of CH_4 and N_2O emissions from biomass burning on-site (+80.8% from 1990 to 1999), with some large annual fluctuations: -26.6% for 1993/94, -62.1% for 1995/96, +109.0% for 1996/97, -71.5 for 1997/98 and 15.6% for 1998/99.
  Slovakia explained that annual fluctuations in this category are connected with the annual changes in land use and land-use change activity data (deforestation, forest fires, and biomass harvest residues burning).

WASTE

Key sources

6.A *Solid waste disposal on land – CH_4*

- All emissions from this subcategory are reported under "Other" and specified as Agricultural and industrial waste and Municipal (managed and unmanaged). The default MCF value used is 0.6.

6.B *Wastewater handling - CH_4*

- CH_4 per capita emissions from wastewater handling appear high compared to most other countries.
- IEF for sludge is 5-15 times higher than for other countries.
- CH_4 emissions from wastewater handling declined rapidly in 1991-1993. No explanation on this was provided.

SPAIN

General

Common reporting format (CRF) and national inventory report (NIR)
Spain provided partial inventory data for 1990 to 1999 using the CRF. The CRFs provided were incomplete in that only national summary, sectoral summary, recalculation and trend tables were provided. Indicators have not been used and in many cases only "0" was reported.
The Party noted that not all tables were provided as it was not possible to translate all background information available in the CORINAIR-IPCC core database to the CRF sectoral background Excel tables.

A NIR was submitted, including explanatory information on the status of inventory preparation in Spain, methodological issues, some additional information (temporal homogeneity, coherence, exhaustivity, uncertainty, transparency) and global results.

Consistency of information between the CRF and the NIR
Values included in the NIR are consistent with the values reported in the CRF 1999.

Time series consistency
In-depth analysis was not possible since sectoral background data tables were not provided for any year. Expressed as CO_2-equivalent and with the exception of emissions from Waste, emissions do not indicate notable annual fluctuations. Emissions from Waste grew almost 60% from 1990 to 1999, but annual changes were rather regular. For LUCF, the same number was reported for all years 1990 to 1999.

Comparison with previous submissions
Spain provided recalculated estimates (tables 8 (a)) and explanatory information (tables 8 (b)) for the year 1998 recalculated. This recalculation meant +3.3 difference for CO_2 and CH_4 emissions and +0.4% difference for N_2O emissions.
Main changes were allocated to the sector Solvent and Other Product Use (for CO_2), Energy sector (for CH_4 emissions) and the Industrial processes sector (for N_2O emissions).
Overall national level recalculations for 1998 and 1990 were in close agreement with independently estimated per cent changes in total national GHG emissions calculated by the Secretariat.

QA/QC and verification procedures
No information was submitted on whether the inventory data was subject to any self-verification or independent review procedures. There is a mention as to the intention of incorporating IPCC good practices for QA/QC in the near future.

Key source analysis
No key sources calculations were provided.

Uncertainty estimation
The NIR discusses that there is a plan to implement quantified uncertainty procedures following IPCC Good Practice, but that this plan has not been implemented yet. At this point a combination of formal and ad-hoc review processes are utilized to determine qualitative uncertainty in the data.

<u>Sector-by-sector findings</u>

The analysis of trends in IEF, activity data and emissions at category levels as well as comparisons with other countries was hampered due to lack of data for the years 1990 to 1999. Sectoral background data tables were not provided for most sectors.

As data was not reported at a detailed level it was not possible to perform the key source analysis according to the Good Practice Guidance; key sources have been identified only at the level of category disaggregation as provided in Summary 1.A of the CRF.

ENERGY

Reference approach

Comparison of reference approach with national approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 1 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach.

Comparison with international data

The Spanish reference approach energy data for 1999 are 14.1 per cent lower than the data reported to the IEA. Apparent consumption of liquid fuels is 20.6 per cent lower in the CRF, consumption of solid fuels is 5.8 per cent lower, and consumption of gaseous fuels is comparable. The comparison could only be done on apparent consumption so no detailed differences were identified.

For 1990, the CRF data are 12 per cent lower than the IEA data. The growth rate of overall apparent consumption between 1990 and 1999 is similar in the two data sets: CRF 32 per cent and IEA 34.5 per cent.

Spain provided the information that a specific 1990-1999 time series of energy balances has been produced as a fundamental piece of background information for the inventories. These specific energy balances have been constructed trying to maintain the data as they appeared in the energy balances published by IEA and EUROSTAT. Nevertheless, where alternative data were available on fuel consumption for some sectors (information obtained via inventory questionnaires or any other means considered more accurate for the purposes of the inventory), those data were used instead of the data appearing in the IEA or EUROSTAT energy balances. To make checking easier, Spain submitted as an attached zip file the 1990-1999 time series of energy balances actually used for the inventory compilation.

Spain only provided sectoral reports (Table1) and summary 1.A (IPCC TABLE 7A). For this reason, key sources could only be identified at the level of category disaggregation of Table Summary 1.A of the CRF instead of the recommended level of disaggregation of the IPCC good practice guidance.

INDUSTRIAL PROCESSES

The following categories in industrial processes were identified as key sources

- Mineral Products 5%
- Production of Halocarbons and SF_6 2%
- Consumption of halocarbons and SF_6 1%
- Chemical industry 1%

Ammonia production

- CO_2 Emissions have varied substantially from year from 1990 to 1994.
  Spain explained that the decrease observed in CO_2 emissions in 1993 is due to the shutdown of a production plant. This decrease was compensated for in years 1994 and onwards with the capacity and production enlargement of another existing plant. The following tables show the ammonia production figures and the CO_2 estimated emissions for this activity.

AMMONIA PRODUCTION
(figures in tonnes)

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
601,023	682,503	590,410	437,720	550,621	552,680	565,384	595,963	558,339	531,445

CO_2 EMISSIONS FROM AMMONIA PRODUCTION
(figures in Gigagrammes)

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
549,696	624,217	539,989	400,339	505,046	505,404	519,102	546,218	512,404	486,921

Metal production

- According to U.N. data there is significant production of steel, pig iron and aluminium, however no data was reported for cross-checking.
  The following table shows the production of steel and pig iron. It has been taken into account that the steel production processes (basic oxygen furnace, BOF, or electric furnace) in order to estimate the emissions.

STEEL PRODUCTION
(figures in tonnes)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
BOF	5,749,191	5,320,864	4,820,314	5,368,775	5,546,620	4,034,914	3,677,702	4,177,388	4,437,352	4,319,743
Electric	7,342,000	7,313,000	7,277,000	7,477,000	7,917,494	8,643,836	7,950,487	9,642,202	10,537,577	10,690,771

PIG IRON PRODUCTION
(figures in tonnes)

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
5,583,185	5,606,193	5,066,773	5,389,775	5,460,892	4,158,830	3,791,768	4,273,451	4,484,292	4,267,290

- CO_2 emissions associated with aluminium production were reported as having decreased since 1990 while the U.N. production data indicates increasing production since 1990.
  Spain explained that after checking the CO_2 estimated emissions from this activity, we have

found a mistake in the emission factor applied for one of the production plants in years 1990-1996. The following tables show, on the one hand, that the aluminium production figures, and, on the other hand, the CO_2 emissions submitted and as well as the corrected ones.

ALUMINIUM PRODUCTION
(figures in tonnes)

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
355,301	354,645	357,944	355,516	337,716	361,492	361,460	359,680	360,230	363,855

CO_2 EMISSIONS FROM ALUMINIUM PRODUCTION
(figures in Gigagrammes)

Submitted									
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
676,617	674,866	681,747	679,468	651,078	688,421	688,093	557,504	558,357	563,975
Corrected									
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
550,717	549,700	554,813	551,050	523,460	560,313	560,263	557,504	558,357	563,975

AGRICULTURE

No information was provided for the following source category: 4.E Prescribed burning of savannas.

Analysis of data other than emission estimates was not possible because activity data were not reported for any category in the agriculture sector, and thus no IEFs were calculated (Sectoral background data tables 4.A to 4.F not provided).

Key sources
4.A Enteric fermentation – CH_4

- Trend in emissions. Increase of 8.3% in enteric fermentation CH_4 emissions with annual percentage change of 7.8% between 1995 and 1996.
- CH_4 emissions from swine increased 40% from 1990 to 1999, with an annual increase of 15% from 1998 to 1999.
  Spain explained that these large inter-annual variations are mainly due to significant changes in the numbers of dairy versus non-dairy cattle, and the age-class mix of swine population (each category having been assigned a very different emission factor).

4.B Manure management – CH_4 and N_2O

- Trend in CH_4 emissions. Large annual changes of –36 per cent (from 1997 to 1998) and +60% (from 1998 to 1999); total CH_4 emissions from this source increased by 15 per cent in the period 1990 to 1999.
  Spain attributed these annual variations to the same cause as stated for enteric fermentation, in addition to the sensitivity of the MCF (Methane Conversion Factors) to the climate category assignment (cool versus temperate) according to yearly changes of the annual average temperatures (many provinces passing from year to year from the cool class to the temperate class and vice versa).

- Trend in N_2O emissions. Annual changes of around 9%, from 1995 to 1996 and from 1998 to 1999;
  Spain explained that these annual changes are mainly due to significant changes in the numbers of dairy versus non-dairy cattle, and the age-class mix of the swine population and poultry (each category having been assigned a very different emission factor).

4.D Agricultural soils – N_2O
- No disaggregated reporting according to subcategories; only one aggregate N_2O estimate for agricultural soils was provided.
- Large annual fluctuations in N_2O emissions of up to 20 per cent (from 1995 to 1996)

Non-key sources
4.C Rice cultivation – CH_4
- Trends in emissions. Large annual fluctuations in CH_4 emissions are noted, ranging up to annual increases of 93% between 1995 and 1996; and annual variations of around 40 % from 1992 to 1993 and from 1993 to 1994.
  Spain explained that these inter-annual changes in emission estimates are due to yearly changes in cultivated area.

LAND-USE CHANGE AND FORESTRY

Overview
- Spain reported in Table 5 CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forests.
- Spain used a country-specific method and emission factors for reporting emissions and removals in table 5.
- Estimates of non-CO_2 gas emissions were not reported.
- Sectoral tables 5.A. to 5.D. were not reported. As a result, no IEFs were calculated and vegetation species were not identified.

5.A. Changes in forest and other woody biomass stocks
- Only net removals are reported.
- Net removals were reported as constant from the whole time series (-29,252.2 Gg CO_2/yr).
  Spain explained that estimation of net CO_2 removals in category 5.A has essentially been derived from information contained in the "Second National Forest Inventory" developed in the period 1986-1995. The National Forest Inventory is a continuous process with a rotation period of around 10 years. The "Third National Forest Inventory" is currently operative, as it began in 1996 and is to be finished by 2005.
  Spain commented that, concerning missing information in the tables of category 5, the Party is currently assessing which combination of available data and sound, practicable methodologies could be used to estimate the emissions/removals figures other than the reported CO_2 net removals in subgroup 5.A

WASTE

Analysis of data other than emission estimates was not possible because activity data and IEFs were not reported for any category in the waste sector (Table 6 and sectoral background data tables 6.A to 6.B were not provided).
Spain replied that apparently table 6 was included in the submission. (The background data tables 6.A, 6.B and 6.C are still missing in the CRF.)
In its comments, the Party also described the following main changes in the time series of CH_4 and CO_2 emissions in subcategories 6.A and 6.C:

a) ***CH_4 emissions from Solid Waste Disposal on Land increased from 412 Gg in 1990 to 727 Gg in 1999 as a result of the steady increase of Municipal Solid Waste (MSW) disposal in managed waste disposal sites (instead of unmanaged ones);***
b) ***The reverse trend for CO_2 emissions in this subgroup, passing from 263 Gg in 1990 to 52 Gg in 1999, was due to the fact that in unmanaged sites there was significant combustion of the fossil fuel fraction of wastes but this combustion no longer occurs in managed sites***
c) ***The increase in CO_2 emissions from waste incineration from 608 Gg(1990) to 729 Gg(1999) in subgroup 6C (Waste Incineration) for CO_2, was due to the increase in MSW incinerated.***

SWEDEN

General

Common reporting format (CRF) and national inventory report (NIR)

The CRF was provided for 1999 and included almost all requested tables. Indicators have been used only in a limited way in many sectoral background data tables. A NIR was submitted with the CRF tables.

Consistency of information between the CRF and the NIR

The NIR does not summarize emissions, but provides copies of the CRF tables as Appendices, therefore no comparisons in emissions data were applicable.

Time series consistency

In depth analysis was possible, since all the data from to1990 to 1999 were provided in detail. Emissions data in the trend tables do not indicate any notable annual fluctuation for national totals. However, some notable fluctuations in specific categories are noticed:

- CO_2 emissions from 2.C Metal Production increase by 68 percent from 1990 to 1999 (most of this increase due to a 40% increase that occurred between the base year 1990 and 1991). CO_2 removals from 5.LUCF increase by 20 percent from 1990 to 1999. CO_2 emissions from International Bunker fuels also increase.

Party explained that the increase between 1990 and 1991 has been corrected in the third National Communication. The increase between 1990 and 1991 was due to reporting of incorrect activity data regarding coke.

- CH_4 emissions from 1.A.1 Energy Industries and 1.A.3 Transport show a decreasing trend.

Comparison with previous submissions

Recalculations were documented in the CRF Table 8(a and b) for inventory years 1990 to 1998. According to the NIR, the recalculations have resulted from major changes in the methodologies, activity data, and/or emission factors in the agricultural, LUCF, and waste sectors. Independent calculations by the secretariat for per cent changes in total GHG emissions for inventory years 1990 and 1998 agreed with the reported per cent changes in the recalculations tables in the Sweden CRF submission for 2001.

Key sources

Sweden provided a key source analysis for the energy sector which utilized level and trend criteria. The process for key source determination in the energy sector appears to follow IPCC Good Practice guidance, however there is no documentation confirming what procedures were used. Key source determinations were not provided for any other sectors.

The Party noted that the key source analysis made for the energy sector has been done according to IPCC Good Practice Guidance, chapter 7. In the submission for 2002 a key source analysis for all sectors will be included as well as a description of the procedures used.

QA/QC and verification procedures

The NIR indicates that some quality control (QC) is performed in the preparation of the inventory, but it does not indicate what QC procedures were actually implemented. The NIR states that quality assurance (QA) review has not been implemented. According to the NIR, some of the IPCC Good Practice Guidance on QC has been implemented, but not for QA. General quality indicators were also included in Table 7, Overview of the CRF.

Uncertainty estimates

Overall estimates of quantified uncertainty are provided in the NIR for each GHG. The NIR refers to the use of national statistics as part of its discussion on uncertainty, but there is no information provided on how uncertainties were quantified and there were no results provided for uncertainty determinations at the source category level.

Sector-by-sector findings

The analysis of trends in IEF, activity data and emissions at category levels that are more detailed than those in the trend table will be done in the sector-by-sector treatment since the data for all the years (1990-1999) was supplied.

ENERGY

Reference approach

Comparison of reference approach with national approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 5.5 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. For comparison of emissions from the reference approach and the sectoral approach for 1999, the Party refers to appendix II of the Swedish National Inventory Report (this appendix was provided as a separate Excel file in the 2001 submission).

Comparison with international data

The Swedish reference approach energy data for 1999 are 6.5 per cent higher than the data reported to the IEA. Apparent consumption of liquid fuels is 8.6 per cent higher in the CRF, consumption of solid fuels is 5 per cent lower, and consumption of gaseous fuels is comparable. Specific differences include:

- Crude oil imports are 41,256 TJ (5 per cent) higher in the CRF.

Sweden explained that this difference could be explained by the fact that in Sweden the data on petroleum balances are collected in cubic metres (normal) and then reported in TJ using a conversion factor of 36.2585 TJ/m³. In the IEA questionnaire the import of crude oil is reported in tons and calculated using the conversion factor of 0.86 tons/m³. This figure is then converted to TJ by the IEA using a conversion factor of 1.021 toe/ton. The difference between the two reporting mechanisms depends on different conversion factors.

- The CRF shows a stock draw of crude oil of 20,051 TJ while the IEA shows only 561 TJ. In general, stock draws for oil products do not correspond well between the two data sets.

Sweden explained that in the CRF statistical differences are included in stock changes. The IEA reports these differences separately.

- International bunkers of jet kerosene are 7,842 TJ higher in the CRF.

Sweden explained that the IEA calculates international bunkers from aviation using a different model from the IPCC methodology.

Most of the above questions are also applicable to the 1990 data, where the CRF data are 7.7 per cent higher than the IEA data. The growth rate of overall apparent consumption between 1990 and 1999 differs slightly between the two data sets: CRF –1.3 per cent and IEA 0.0 per cent.

Key sources

<u>*Fuel combustion*</u>

1.A.1 Energy industries - solid fuels (public electricity and heat production):

The value of the CO_2 IEF in 1999 (100.5 t/TJ) increased by about 5 per cent compared to its 1990 level (95.2 t/TJ).

1.A.2 Manufacturing and construction - liquid fuels: The value of the N_2O IEFs in 1999 (11.3 kg/TJ) increased by 20 per cent compared to its 1990 level (9.3 kg/TJ).

1.A.4 Other sectors - solid fuels: Sweden did not report activity data and emissions from all the subcategories.
Sweden explained that the notation key "0" has been used since the activity data are less than one half the unit being used to record the inventory table.

1.A.4 Other sectors - other fuels: Sweden did not report activity data and emissions from all the subcategories under "other sectors".
Sweden explained that the notation key "NO" has been used in the subsectors but is not indicated in the total. This will be corrected in the next submission.

1.A.3.a Civil aviation (domestic): The activity data for jet kerosene and aviation gasoline reported in the CRF are lower compared to the data published by the IEA (85 per cent and 283 per cent, respectively).
Sweden explained that the IEA calculates international aviation bunkers using a different model from the IPCC methodology.

1.A.3.b Road transportation (CO_2 and N_20): The value of the N_2O IEF in 1999 (8.8 kg/TJ) is one of the lowest across the reporting Parties.

1.A.3.d Navigation (domestic): The activity data for residual oil reported in the CRF are higher compared to the data published by the IEA (9 per cent).
Sweden explained that some of the differences that occur are due to conversion factors. Differences can also depend on when the data are collected. Data for domestic navigation are revised continuously and therefore the time of collection can make a difference.

Non-key sources
1.A.1 Energy industries - solid fuels: The value of the N_2O IEF in 1999 (18.5 kg/TJ) is the second highest across reporting Parties.

1.A.1 Energy industries - biomass: There was a 12 per cent decrease in the value of the CH_4 IEF between 1990 (30.0 kg/TJ) and 1999 (26.6 kg/TJ).

1.A.3.b Road transportation: The value of the CH_4 IEF (77.1 kg/TJ) is the highest across the reporting Parties.

Bunker fuels
1.A.3.a International aviation:
- The activity data for jet kerosene reported in the CRF are higher compared to the data published by the IEA (27.4 per cent).

Sweden explained that the IEA calculates international aviation bunkers using a different model from the IPCC methodology.

INDUSTRIAL PROCESSES

Key sources
2.C. 1 Iron and steel production – CO_2
- The pig iron activity data (102.7kt) was lower than the UN data (3816 kt)

2.A.1 Cement production – CO_2
- The CO_2 IEF (0.396t/t) was the lowest (for the entire period of 1990 to 1999) compared to other reporting Parties and was lower than the IPCC default values: cement - 0.499t/t and clinker – 0.507t/t. This observation was made during the synthesis and assessment of the 2000 submission.

Sweden explained that cement production is based on lime use instead of clinker. Accordingly the production of cement reported by UN is 23.7% lower than the value indicated from Sweden for limestone use in 1999.

2.B.2 Nitric acid production – N_2O

- Activity data for nitric acid production was not provided.
Sweden explained that this will be corrected in the next submission and that data are presently available for the years 1997-1999, as follows:

Year	Produced amount of nitric acid, kt
1997	390
1998	399
1999	383

2.F. Consumption of halocarbons and SF_6 – HFCs and SF_6

- No activity data for HFC-32, HFC-125, HFC-134a, HFC-143a, HFC-152a were provided in the CRF tables, but some activity data were reported in the NIR.
Sweden explained that Activity data for HFCs were not filled into the CRF tables since the emission inventory that was performed in Sweden in 2000 for the 1990´s was not divided into the same subgroups as are requested in the CRF´s (e.g. domestic, commercial, industrial refrigeration), although some subgroups are the same. It was felt that trying to divide and make different sums of "our" subgroups to fit into the requested format would lead to more uncertainties. A choice was made at that point to report activity data in a separate table in the NIR instead.
All calculations of actual emissions of fluorinated GHG are made in an Excel model that was developed for this purpose. In this model all activity data for all years (1990-1999) are present as a basis for the calculations of annual emissions. Printouts of all activity data will be added to the NIR in the next submission.
- Potential emissions were reported for 1995 – 1999. Earlier years were not reported.
Sweden explained that potential emissions have been calculated based on two different sources of information. The import and export of chemicals in bulk originate from a register at the Swedish Chemicals Inspectorate, while the imports and exports of chemicals in products have been calculated based on activity data from the emission inventory.
Data from the Swedish Chemicals Inspectorate, to which companies are obliged to report any imports or exports of these chemicals in bulk, are only available for the years 1995-1999. No, or insufficient, data are available from this source for the years 1990-1994. Potential emissions were thus not estimated and reported. Estimates could be made based on data from the emission inventory, but then there would be an introduction of a different methodology.
- 1990 to 1993 emissions from aerosols and metered inhalers were not provided (reported as NE).
Sweden explained that at the time of the inventory and reporting no information was available for metered dose inhalers. Later investigations have indicated that the use of HFCs in metered dose inhaler did not exist in the early 1990´s. Annually, 1996-1999, in the order of 0.1-0.15 ton HFC-134a has been imported and sold in metered dose inhalers in Sweden.
According to the inventory the use in other aerosol products started in 1993 (data for 1993 are reported in the CRF). The NE given in the CRFs for 1990-1992 was because of uncertainties concerning the metered dose inhalers at the time of reporting.
- Very high potential-to-actual emission ratios were reported for 1999 for HFC-23 (51.13), HFC-125 (19), HFC-143a (19.29) and SF_6 (7.14).
Sweden explained that concerning the very high potential-to-actual emission ratios for some substances (HFC-32, HFC-125, HFC-143a and SF_6) for 1999, there might be two major reasons for the discrepancies. Since the calculations of potential emissions is based on information from two independent sources, the discrepancies may be due to incorrect data in either of the two sources (the register at the Swedish Chemicals Inspectorate or data from the emission inventory). Either all actual emissions were not covered in the inventory (or

estimates of imports and exports in products were incorrect), or the numbers in the register at the Swedish Chemicals Inspectorate are not correct.
Data from the Swedish Chemicals Inspectorate for some substances show large fluctuations between the years. This may be due to incorrect reporting from companies handling these substances (some cases of double counting, as well as cases of missing data were found when scrutinizing the data when doing the emission inventory), or large imports registered one year that may actually be used the next year. It is also suspected that imports and exports of chemicals in products may in some instances be reported to the register, even though only chemicals in bulk are said to be reported to the register

2.C.2 Ferroalloys production – CO_2
- CO_2 IEF (2.889 t/t) is high compared to most Parties.
- CO_2 emissions increased by 54.9% from 1991 to 1992.
Sweden explained that incorrect activity data was reported by the company in question. This will be corrected in the next submission.

2.C.3 Aluminium production – PFCs
No activity data for CF_4 and C_2F_6 were specifically given in the CRF tables.
Sweden explained that the production volume of aluminium as well as the emissions of PFCs during 1995-1999, as given by the producing company, is presented in the table below. The emissions of the individual species are calculated as fractions of the total PFC-emissions, 90% CF_4 and 10% C_2F_6. The company uses two production methods, Prebaked and Soderberg and in the table the total production of aluminium, as well as divided between the methods is given.

Table ***Production volume, emissions and implied emission factors for PFC´s from aluminium production 1995-1999.***

	Total produc-tion	Prebaked	Soderberg	Total emissions $CF_4+C_2F_6$	Emissions Prebaked $CF_4+C_2F_6$	Emissions Soderberg $CF_4+C_2F_6$	IEF Prebaked $CF_4+C_2F_6$	IEF Soderberg $CF_4+C_2F_6$	IEF total $CF_4+C_2F_6$
	ton	ton	ton	ton	ton	ton	kg/ton	kg/ton	kg/ton
1990	96300			65.0					0.67
1991*	95000			63.0					0.66
1992*	95000			61.0					0.64
1993*	95000			59.0					0.62
1994*	83900			57.0					0.68
1995	95121	22831	72290	56.2	1.6	54.6	0.07	0.76	0.59
1996	97576	23044	74532	48.8	1.0	47.8	0.04	0.64	0.50
1997	97650	23189	74461	44.6	1.0	43.6	0.04	0.59	0.46
1998	96098	23159	72939	43.2	1.4	41.8	0.06	0.57	0.45
1999	99340	23200	76140	47.5	1.3	46.0	0.06	0.60	0.48

* Activity data for 1991-1993 have been assumed. Total emissions have been interpolated between 1990 and 1995.

- The aluminium activity data (51.4kt) was lower than the U.N. data (96kt).
Sweden explained that in the CRF tables the use of coal elements is given (51.4kt) as activity data for calculating CO_2-emissions. The activity data as production of aluminium was 99.3 kt for 1999. (see above).

Non-key sources
2.A.2 Lime Production – CO_2
- Trend in emissions varied, increasing by 17.98% from 1993 to 1994 and decreasing by 13.38% from 1991 to 1992.

Sweden explained that the variation occurs because of changes in the production caused by state of the market.

2.G Other (Industrial processes) – N_2O, CO_2

- Even though activity data increased from 7,037kt (production of paper pulp) in 1990 to 7,641kt in 1999, CO_2 emissions remained constant at 31Gg.
  Sweden explained that the amount of used lime in the lime sludge reburning kiln is constant regardless of the activity data. Hence the amount 31 Gg.

2.C.3 Aluminium production – CO_2

- CO_2 IEF (3.66t/t) was the highest amongst the Parties, IPCC default is (1.5 – 1.8t/t).
  Sweden explained that this is because Sweden reports activity data as use of coal elements (t) and the IPCC default is in tonnes/tonne product.
  CO_2 emissions decreased by 25% from 1991 to 1992 and increased by 20% from 1992 to 1993.

2.C.5 Other (Metal production) – Copper production- CO_2

- CO_2 emission trend is not monotonic. Emissions from 1991 to 1992 increased by 27.85% and decreased by 16.5% from 1993 to 1994 and further decreased 34.4% from 1994 to 1995. There was a large increase of emission by 60.9% from 1995 to 1996.
  Sweden explained that incorrect activity data for the year 1995 was reported by the company in question. This will be corrected in the next submission. The smaller variations are due to disturbances and interruptions in the production process.

SOLVENT AND OTHER PRODUCT USE

Non-key source

- 1998 data was used to calculate emissions for all years due to under-development of methodologies.
- No activity data was provided in CRF tables.

Sweden explained that a thorough inventory of NMVOC-emissions and related activity data will be performed in the near future, covering the whole time series at least from 1988 to 2001.

AGRICULTURE

Source categories 4.C Rice cultivation, 4.E Savanna burning, 4.F Field burning of agricultural residues and 4.G Other were reported as not occurring (NO).

Key sources

Sweden reported using a combination of IPCC Tier 1 and national derived methods along with a combination of default and country-specific emission factors to estimate CH_4 emissions from enteric fermentation.
A combination of IPCC default and CORINAIR methods along with country-specific emission factors was used to estimate N_2O emissions from agricultural soils.
For N_2O emissions from 4.B Manure management, no information on the use of methods and emission factors was provided.
Sweden stated its intention to correct this omission in its next submission and explained that the same methods as for CH_4 are used (T1, T2; D, CS).

4.A. Enteric fermentation - CH_4 emissions

- <u>CH_4-IEF.</u> CH_4-IEF for dairy cattle (154 kg CH_4/hd/yr) was the highest among all reporting Parties and more than 50% higher than the IPCC default for Western Europe (100 kg CH_4/hd/yr). In its response to the synthesis and assessment of the 2000 submission, Sweden had explained that the use of national emission factors produced this difference, and that these factors are under revision.
  Sweden confirmed that the national emission factors are under revision and that these would be used in the submission due by April 2003.
- <u>Trends in IEF.</u> IEF for non-dairy cattle increased by 15% from 1990 to 1999, with annual changes greater than 4% between 1991 and 1992, and between 1994 and 1995.
  IEF for swine increased by 6% during the 1990-1999 period, with annual fluctuations up to 13%. The highest values were reported in 1996 and 1997 (1.8 kg CH_4/hd/yr).
  Sweden explained that non-dairy cattle consist of more than one subgroup (beef cows, growing animals and calves) with different emission factors. The proportion of beef cows is greater in 1999 than it was in 1990 (see NIR), and therefore the weighted emission factor per animal has increased. Similarly, there were proportionally more sows in 1996 and 1997 than in other years, which means more methane, according to the Swedish model (see NIR).

4.B. Manure management - N_2O emissions (4.B(b))

- Anaerobic lagoons were reported as not occurring (NO); for the AWMSs daily spread, pasture range and paddock, and other AWMS, no data/information was reported, although, for pasture range and paddock, data are reported in table 4.D.
  Sweden had explained in its response to the synthesis and assessment of the 2000 submission that it does not consider animal production of nitrogen from grazing animals as a manure management system.
- <u>N excretion rates.</u> The N excretion rate for dairy cattle is the highest rate across all reporting Parties and higher than the IPCC default rate for Western Europe (118 versus 100 kg N/hd/yr). Rates for non-dairy cattle, sheep, swine and poultry were among the lowest values reported by Parties and, particularly for swine and sheep, far below the ranges of IPCC default values (8.6 versus 20 kg N/hd/yr for swine, and 5.8 versus 20 kg N/hd/yr for sheep, Western Europe values).
  In its response to the synthesis and assessment of the 2000 submission, Sweden explained that figures are weighted averages of subcategories and the mix of animals may lower the average N-production.
- <u>Trends in N excretion rates.</u> Rates for dairy cattle, swine and sheep increased significantly during the period 1990 to 1999: 24.2, 28.8 and 41.3%, respectively.
  Sweden referred to its NIR, where the nitrogen production per animal is stated and which is a better source for a trend analysis of nitrogen production than the CRF, since the values are not weighted averages. The milk production from dairy cattle increased during the nineties, which means increased nitrogen production. In the CRF, the nitrogen production from swine and sheep is a weighted average of adults and young animals. When the lamb percentage decreases, the weighted nitrogen production from all sheep will increase (the same reasoning can be applied to swine).
- <u>Consistency checks.</u> Multiplication of N excretion rates per animal by the corresponding animal population differs from the sum of nitrogen excretion over all AWMS for the particular livestock type, for dairy and non-dairy cattle and sheep (differences are –38, -43 and –50%., respectively).
  Sweden explained that this difference corresponds to the N excreted by grazing animals (not accounted for as a manure management system).

4.D. Agricultural soils - direct N_2O emissions (4.D.1), animal production (4.D.2.) and other (4.D.4)

- Direct soils: N_2O-IEF. IEF for fertilizers (0.0079) is one of the lowest among reporting Parties, while IEF for animal wastes is among the higher values and is also over the range of default IPCC values.
  Sweden explained that the emission factor used by Sweden is taken from a study made by Dr. Åsa Kasimir Klemedtson, and referenced in its NIR, where more information can be found.
- N_2O-IEF. The IEF for histosols is among the lowest of the reporting Parties and far below the IPCC default value.
- Trend in N_2O IEF. For crop residue, there is a sudden 1000-fold increase in the N_2O IEF for the year 1996.
  Sweden explained that in table 4.D, activity data for the category referred to were faulty in that they were given in tons instead of kilograms as requested, but this did not affect the emission estimate. Sweden stated its intention to correct this in the next submission.
- Fractions used. Value for FracGASF (0.0078) is almost the lowest reported value and far below the most commonly reported value and the IPCC default (0.1). Also the FracGASM is relatively low compared to those reported by most Parties and the IPCC default (0.11 versus 0.2).
- Animal production: N_2O-IEF. IEF for pasture range and paddock is among the lowest of the reporting Parties.
  Sweden explained that it uses national emission factors for animal production on grazing land, due to the cold climate in Sweden.
- 4.D Other agricultural soils. N_2O emissions from this category were identified as key source. Sweden reported N_2O emission estimates from the cultivation of mineral soils and from the N-fixation in hayfields under this category.

Non-key sources

4.B. Manure management – CH_4 emissions (4.B(a))

- CH_4-IEF. IEF for non-dairy cattle is approximately three times lower than the IPCC defaults for cool-Western Europe (1.9 versus 6 kg CH_4/hd/yr) and lower than those from most other Parties. IEF for swine is among the lowest values reported by Parties and also lower than the IPCC default (2.32 versus 3 kg CH_4/hd/yr).
- Trends in IEF. CH_4 IEF for dairy cattle increased by 38% from 1990 to 1999; while for non-dairy cattle IEF decreased by 9.8% in the same period; IEF for swine increased by 60% between 1990 and 1999. In all cases, there were some large annual year-to-year changes in the IEFs.
  Sweden explained that the emission factor is a function of, for instance, manure management systems, stable periods and manure production. The liquid systems increased during the nineties for management of manure from dairy cattle, as well as the animal manure production, which increases the methane emissions. For non-dairy cattle, the stable period has decreased, which means more manure production from grazing animals and less liquid manure, which means less methane emissions. Within the swine category, the proportion of swine for meat production increased during the nineties, and hence the methane production. The manure from those animals is managed in liquid systems to a greater extent than the manure from other swine.

4.D. Agricultural soils – indirect N_2O emissions (4.D.3.)

- N_2O-IEF. Values for atmospheric deposition and nitrogen leaching and runoff (0.002 and 0.0025, respectively) are lower by a factor of 10 compared to those of most other reporting Parties and default IPCC values (0.01 and 0.025, respectively).
  Sweden explained this as being due to national emission factors (see above).

LAND-USE CHANGE AND FORESTRY

Overview

- Sweden used a combination of country-specific and IPCC default methods (no tier specified) and emission factors to estimate CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forest and harvested wood; and 5.D (Emissions and Removals from soils)
- No estimates of non-CO_2 gas emissions were provided.
  The Party mentioned that methane emissions are all natural. New drainage activities in forests that would decrease methane emissions but increase CO_2 and perhaps N_2O emissions are not allowed at all any more. The Party also mentioned that N_2O emissions from the forest landscape, including outflow areas, would probably be less if the anthropogenic N deposition were smaller. The Party also stated that, at present, the knowledge base for calculations is too limited. Research is going on, although it will be hard to reach a point where statistically sound conclusions can be drawn.
- Tables 5.A to 5.D of the CRF have not been filled as the IPCC default methods have not been used.
- Values for removals seem to have been rounded.
  Sweden explained that some of the background data only have two sure figures. According to good calculation practice, no output figure can be surer than the input one. Like Finland, Sweden is a country with a more exact knowledge about its forests than most other countries. Sweden mentioned that national inventories include several thousands of sampling sites every year.
- Net removals changed significantly between some consecutive pairs of years: +44.5% for 1990/91, -20.4% for 1991/92, +25.6% for 1992/93, -10.3% for 1993/94, -19.1% for 1994/95, +22.5% for 1996/97 and –10.8% for 1997/98. Changes reflect changes in gross removals.
  The Party explained that growth figures were averaged for five-year periods since Sweden cannot provide good enough estimates on annual variations in growth (e.g. from climate variation). Natural dieback varied for 1990-96 according to figures in a scientific report (based on national inventory data). The 1996 figure was used for 1997.

5.A. Changes in forest and other woody biomass stocks

- No activity data and emission factors were reported.
  The Party explained that since Sweden has more exact data, generalizations on the tables are not suitable
- Some large annual changes in removals were found (+37.3% for 1990/91, -18.1% for 1991/92, +22.1% for 1992/93, -16.6% for 1994/95 and 19.2% for 1996/97) along with no change for 1997/98.
  Sweden explained that this was an effect of varying the forest harvesting level between 1996 and 1997.

WASTE

Key source

6.A. Solid waste disposal on land

- Total population, waste generation rate, fraction of MSW disposed and fraction of wastes incinerated were not provided (reported as NE).

Sweden explained that the data on total population, waste generation rate and incinerated wastes were not used in the calculations, hence this was not included in the CRF.

Non-key sources

- No sectoral background data tables (tables 6.B and 6.C) were provided for all other categories in the waste sector.

Sweden noted that the empty cells in the tables would be filled in with notation keys in the next submission.

SWITZERLAND

General

Common reporting format (CRF) and national inventory report (NIR)

The CRF was provided for 1999 and included all requested tables. Indicators have been widely used in the CRF tables. A NIR was not submitted.

Consistency of information between CRF and NIR

No applicable since neither a NIR nor any other additional information were provided.

Time series consistency

Emissions data in the trend tables do not indicate any notable annual fluctuations in national totals. However, a further analysis of the trends was not possible, since only data for 1999 were provided in detail.

Fluctuations in specific categories were noticed. The following have been identified as large changes for the time series (>50%) and/or large annual changes (>10%):

- Changes from 1990 to 1999, for CH_4 emissions from 1.A.2. Manufacturing Industries and Construction and 6.C. Waste Incineration

Party noted that these emissions amount to a very low contribution to the total of CH_4 emissions in Switzerland, therefore not distorting the time series in any way. These changes are a result of the change in IPCC guidelines for reporting the biomass emissions; before 1996 these biomass emissions had to be reported separately. Unfortunately the model used has suppressed them in the overview tables; this will be corrected for the next submission.

- Changes from 1990 to 1999, for N_2O emissions from 6.C. Waste Incineration and 1.A. Fuel Combustion (mainly, 1.A.3. Transport),

Party explained that the constant decrease 1990 to 1999 of CH_4 emissions comes from reduced emissions of the open incineration of construction waste.

- Annual changes for CO_2, CH_4, and N_2O emissions from 1.A.1. Energy Industries and 1.B.2. Oil and Natural Gas,

Party explained that most of the changes stem from the variations of electricity production of our plant in Vouvry (heavy fuel oil; the only fossil power plant we had; definitive shut down in 1999).

- Annual changes for CH_4 emissions from 6.C. Waste Incineration.

Comparison with previous submissions

Switzerland provided recalculated estimates (Tables 8 (a)) and explanatory information for these recalculations (Tables 8 (b)) for the years 1990 to 1998. For 1998, the effect of the recalculations was an increase of 3.2 % in total GHG emissions, which was only seen in the net emissions including LUCF; no significant change in emissions without LUCF CO_2. All inventory year recalculations resulted in changes of less than 3.5% in total CO_2 equivalent without LUCF. The main change was of CO_2 emissions from Land Use Change and Forest sector, with a decrease in removals of 25.2%.

The Party noted that the reason for the change of CO_2 emissions from land use change and forestry (a decrease) was described in table 8(b) of the 1999 GHG inventory.

Verification procedures

No information was available on whether the inventory data was subject to any self-verification or independent review procedures. Quality indicators are provided in Table 7, Overview of the

CRF, but there is no documentation of quality assurance (QA)/quality control (QC) procedures that were implemented.
The Party noted that self-verification is done at several levels: For the main gas CO_2, the Swiss Energy Agency calculates in their annual Energy statistics (which is the base for all energy related calculations in the Swiss submission) the CO_2 emissions emanating from energy use (by fuel). This is compared to the calculations done with the reference approach in the common reporting format (CRF), to the calculations done by our CORINAIR model and to the sector by sector calculations done in the CRF. Especially the comparison to the calculations in the Energy statistics are very helpful; for other gases on a mathematical level only the comparison between the CORINAIR model and the CRF calculations are made. However, for CO, NO_X and SO_2 an additional control of overall emissions is possible with the comparison of the measured annual mean values of the corresponding ambient air concentrations; this allows a verification of the change and the absolute level of the over all emissions. This is done in Switzerland's clean air concept study, which is updated regularly.

Key sources
Switzerland did not provide a key source analysis.

Uncertainty estimations
No uncertainty estimates were provided.
The Party noted that for CORINAIR uncertainty estimations were done on a more or less aggregated level. The results for the totals of the emissions:
CO_2 plus/minus 10%, N_2O plus/minus 50% and all other gases plus/minus 20%.

<u>Sector-by-sector findings</u>
The analysis of trends in IEF, activity data and emissions at category levels that are more detailed than those in the trend table was hampered due to the lack of data for the years 1990 to 1998. Sectoral background data tables were only provided for 1999.

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 0.37 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data
The Swiss reference approach energy data for 1999 are 23.4 per cent lower than the data reported to the IEA due to missing activity data. Specific differences include:

- No imports of crude oil are shown in the CRF, and seem to be partially distributed in products such as gasoline, jet kerosene, gas/diesel oil and residual fuel oil. Total liquid fuel imports are 27,260 TJ (5.2 per cent) lower in the CRF.

Switzerland explained that there are several reasons for the difference of 27,260 TJ (CRF lower than IEA). First, a major part of the difference is the energy amount of the aviation bunker fuels; in the IEA figures only marine bunkers are included, while aviation bunkers are omitted. Second, in the CRF, oil products of Swiss refineries are distributed in the import

products (see also gas). A third reason is that different conversion factors are used in obtaining the IEA and CRF figures.

- Imports of natural gas (102,416 TJ in the IEA data) are not shown in the CRF.

Switzerland explained that in the CRF apparent consumption and imports are equal because of the lack of exports and bunkers. The IEA figure is the gross calorific value, whereas the value in the CRF is the net calorific value including the amount of refinery gas used for process energy in the refineries of Switzerland (refinery gas and refinery heavy fuel oil for process energy had to be added to the corresponding imports with the chosen allocation of the reference approach of Switzerland, that is to say, calculation of the emissions from fuel combustion was done at the oil product level without taking into account the crude oil level; so the process energy of the refinery process had to be considered).

- Stock changes of gas/diesel oil are 19,730 TJ higher in the CRF data.

Switzerland explained that stock changes given by the IEA apparently consist only of stock changes at the wholesale trade level whilst stock changes of the reference approach in the CRF include in addition the stock changes at the level of the end-user (additional 473,000 tons or about 20,000 TJ).

Key sources

Fuel combustion

1*.A.1 Energy industries:*

- The value of the CO_2 IEF for liquid fuels for the petroleum refining category in 1999 (77.0t/TJ) is the highest across the reporting Parties.

Switzerland explained that the CO_2 IEF for liquid fuel is the same as for heavy fuel oil

- The value of the CO_2 IEF for gaseous fuels for the petroleum refining category in 1999 (59.3 t/TJ) is the second highest across the reporting Parties.

Switzerland explained that the CO_2 IEF for gaseous fuels is the mean value of the factors given by the refinery in Cressier (formerly Shell)

1*.A.3.a Civil aviation (domestic):* The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (17 per cent).

Switzerland explained that the activity data were recalculated in 2001 by Infras; this could be the reason for the differences compared to the IEA. The 17 per cent difference in the activity data of domestic civil aviation is very low (only approx. 600 TJ); this difference will not have any effect on the calculation of national totals of greenhouse gases.

Fugitive emissions

1.B.2.Oil: Although activity data for distribution of oil products were provided, CO_2 or CH_4 emissions have not been reported.

1.B.2.c, i, Venting: The value of the CH_4 IEF (227 kg/PJ) for oil is low compared to the IPCC default (1000-3000 kg/PJ).

Switzerland replied that this line in the CRF should be reported under flaring; this is an allocation fault in the CRF. The losses from the refinery process are listed under 1.B.2.a.iv. refining/storage; here an emission factor of 1,022.73 kg/PJ is given, which lies in the range of the mentioned IPCC default factor.

Non-key sources

1.A.3.b Road transportation: The value of the CH_4 IEF for gasoline in 1999 (12.9 kg/TJ) is one of the lowest of the reporting Parties.

Switzerland explained that it has recalculated the road model in 2001; the quoted low figure of 12.9 kg CH_4/TJ is the result of the updated emission factors due to EURO 2. The model uses emission factors per kilometre travelled; the emission factor in the CRF is only a ratio of total emissions and total fuel consumption.

1.A.3.c. Railways - liquid fuels: The value of the N_2O IEF in 1999 (2.6 kg/TJ) is one of the lowest across the reporting Parties.
Switzerland explained that liquid fuels used in Switzerland are diesel fuel qualities; with this background, the quoted value of 2.6 kg N_2O/TJ is correct.

*1.A.3.d Navigation (domestic)***:** The activity data for gas/diesel oil reported in the CRF are higher compared to the data published by the IEA (60 per cent).
Switzerland explained that allocation in the IEA and CRF figures is not the same; in the CRF, no international marine bunkers are defined, so all consumption is allocated to the domestic sector.

INDUSTRIAL PROCESSES

Key sources
2.A.1 Cement production

- The CO_2 IEF (0.59t/t) for cement production is the second highest among the reporting Parties and higher than the IPCC default value (0.499 for cement) and even higher than the updated values for clinker production in IPCC Good Practice Guidance, Table 3.1 (0.526 t/t).
  Switzerland explained that the quoted CO_2 IEF of 0.59 t/t is calculated as follows: Measurements in 1990 gave an emission factor for all emission of a plant of 0.88 t CO_2/t of cement produced. The mix of the process energy (liquid fuels, gaseous fuels, coal and waste) resulted in an emission factor of 0.29 t CO_2/t cement produced. The difference of these two emission factors gives the emission factor for the emissions from the raw material of 0.59 t CO_2/t cement produced. This value is kept constant over time.

Non-key sources
2.A.2 Lime production

- The CO_2 IEF (0.37t/t) was second lowest amongst the Parties and lower than the IPCC default value (0.79 – 0.91t/t).
  Switzerland explained that the quoted CO_2 IEF of 0.37 t/t is calculated as follows: Measurements in 1990 gave an emission factor for all emission of a plant of 0.79 t CO_2/t of lime produced. The mix of the process energy resulted in an emission factor of 0.42 t CO_2/t lime produced. The difference of these two emission factors gives the emission factor for the emissions from the raw material of 0.37 t CO_2/t cement produced. This value is kept constant over time.

2.C.1 Iron and steel production – CO_2

- A noticeable difference is reported between available production data and UN data (30.7%)

2.C.3 Aluminium production – CO_2, PFCs

- No activity data for CF_4 and C_2F_6 were specifically given in CRF tables.

- From 1998-1999 CO_2 emissions increased 30% and CF_4 emissions decreased 78%. ***Switzerland explained that 1998 data for PFCs were not of high quality, they were preliminary data and are probably not correct.***

SOLVENT AND OTHER PRODUCT USE

- NMVOC, N_2O and other precursor gases emission estimates were reported, however, no corresponding activity data were reported for 3.A, 3.B and 3.D sub-categories. ***Switzerland explained that over 50 separate activities were calculated; the CRF format is not suitable for such a large quantity of data. A list with all NMVOC producing activities including explanations is supplied as an annex (Excel, unfortunately only in German; figures of 1990; a recalculation of actual figures is under way).***

AGRICULTURE

Source categories 4.C Rice cultivation, 4.E Savanna burning, 4.F Field burning of agricultural residues and 4.G Other were reported as not occurring (NO).
However, in Table 4.F, activity data and related information were reported in a disaggregated manner; in addition, some N_2O emission estimates were provided in an extended sheet of table 4.F. It is not clear why in table 4 of the CRF, field burning of agricultural residues has been reported as not occurring.

Key sources
4.A. Enteric fermentation - CH_4 emissions
- CH_4-IEF. IEFs for sheep and swine were among the lowest values across the reporting Parties and also lower than the IPCC default value for developed countries (6.8 versus 8.0 kg CH_4/hd/yr for sheep, and 1.0 versus 1.5 kg CH_4/hd/yr for swine).

4.B. Manure management – CH_4 and N_2O emissions (4.B(a) and 4.B(b))
- No information on methods and emission factors used for N_2O from manure management was reported in Summary 3 of the CRF.
- Activity data. Population data for sheep reported in table 4.B(b) differ from data reported in tables 4.A and 4.B(a).
- CH_4-IEF. IEFs for non-dairy cattle and sheep are among the lower values among the reporting Parties and also lower compared to IPCC defaults for cool-Western Europe (3.4 versus 6 and 0.13 versus 0.19 kg CH_4/hd/yr).
- N excretion rates. Rates for dairy cattle were among the highest values among reporting Parties and higher than the IPCC default for Western Europe, while for sheep the N excretion rate was lower than the corresponding IPCC default for Western Europe (16 versus 20 kg CH_4/hd/yr).

Non-key sources
4.D. Agricultural soils - direct and indirect N_2O emissions (4.D.1. and 4.D.3.)
- N_2O-IEF. IEFs for N-fixing crops and crop residues were among the lowest values compared to most reporting Parties.
- Fractions. No information was provided on FracNCRBF, FracNCRO and FracR.

LAND-USE CHANGE AND FORESTRY

Overview

- Switzerland followed a country-specific methodology to estimate CO_2 emissions and removals from 5.A. (Changes in Forest and Other Woody Biomass Stocks) for temperate forests.
- Non-CO_2 gas emissions were not provided.
- Quantitative data were provided in Table 5 and sectoral Table 5.A.

5.A. Changes in forest and other woody biomass stocks

- Country reported gross removals only, but no gross emissions; gross removals are taken as net removals in Table 5A.
- A change of +32.6% from 1990 to 1999 of removals from changes in forest and other woody biomass stocks was observed; very small (< 4%) year-to-year variation, with the exception of 1992/1993 (+28.9%) and 1998/1999 (-7.5%).
  Switzerland explained that this increase of 32.6 % from 1990 to 1999 was due to the high windthrow damage in the year 1990. An average annual harvest was destroyed in addition to the harvest, which was already undertaken at that time. It also affected the years 1990 to 1992. The decrease in removals from 1998 to 1999 is due to a high wood harvest in 1999, whereas the harvests in the years 1996 to 1998, especially in 1996, were below the annual average.
- Average annual growth rate for temperate commercial deciduous forests (7.33 t dm/ha/yr) was the highest value among the reporting Parties, for the forest type (range from 0.27 to 7.33, with a mean value of 3.59 from 9 reported values). This value is higher than the IPCC default for temperate forest plantations.
  The Party explained that data were obtained from the measured stock change between the 1st and 2nd national forest inventories, undertaken from 1983 to 1985 and 1993 to 1995 respectively. There are no data for evergreen and deciduous forests available to calculate specific growth rates for the two forest types. The Party mentioned that the difference in growth rate of dry matter between evergreen and deciduous forests is due to the higher wood density of deciduous trees. As a matter of fact, the growth rate of deciduous forest (7.33 t dm/ha/y) might be overestimated whereas that of evergreen forests (5.06 t dm/ha/y) might be rather underestimated.
- The average annual growth rate values provided for 1998 for temperate forests (commercial evergreen and deciduous) seem not to be correct (4762 and 2810 t dm C/ha); the Party shall check this value.
  The Party explained that average annual growth rates are not given per ha, but for the whole evergreen and deciduous forest area respectively. This is a shortcoming resulting from transfer of information from the old tables to the new common reporting format. The 1998 values correspond to annual average growth rates of 6.03 and 8.73 t dm/ha/y.

WASTE

6.A Solid waste disposal on land – CH_4

- No activity data, IEF and other related information were provided in Table 6.A.

Switzerland replied that the description of the emissions estimation model was included in the previous National Inventory Report in German only. The Party provided an additional description of the model along with the comments on the C&S to the secretariat.

Non-key sources

6.B Wastewater handling

- No activity data, IEF and other related information were provided in Table 6.B.
- No information on N_2O from human sewage was provided

Switzerland explained that both CH_4 and N_2O emissions were calculated using data on associated population. The emission factor for N_2O emission estimation was 0.01 kg N_2O per corresponding inhabitant; the explanation was given in documentation box 6.B of the inventory.

6.C Waste incineration

See general comments above on the **Time series consistency.**

THE NETHERLANDS

General

Common reporting format (CRF) and national inventory report (NIR)

The Netherlands submitted inventory data for the years 1990 to 1999 using the CRF tables. However, some sectoral background data tables (tables 3.A-D, 4.A, 4B(a), 4B(b) and 5.A) were provided only for a limited number of years (e.g. for 1990 to 1996 and 1991 to 1995, respectively), but not for the entire time series. Notation keys have been used in a limited manner, thus resulting in many reporting gaps in the inventory.
The CRF was accompanied by an NIR that includes information on uncertainty assessment, using IPCC Tier 1, for the calculation of all source categories and differences compared to previous submissions. The NIR also includes appendixes, for temperature adjustments, IPCC tables 7A and recalculation and completeness tables.
The Party noted also that the NIR includes a summary description of methods and data sources used with references to more detailed descriptions.

Consistency of information between CRF and NIR

The data provided in the CRF were reproduced in the NIR. The data were consistent and no differences were detected.

Time series consistency

Emission data do not indicate any notable annual fluctuations in national and sector total, with the exception of Industrial processes, where two annual steps hold a difference larger than $\pm$10% the previous years. A further detailed analysis detected the following singularities in emission trends:
Significant change (>50%) for the times series (from 1990 to 1999), for:

- CO_2 emissions from 1.A.5 Other, 1,B. Fugitive emissions, 2.G. Other industrial processes, International Bunker (Aviation), and biomass consumption,
- CH_4 and N_2O emissions from 1.A.1. Energy industries, 1.A.2. Manufacturing industries and 2.G. Other industrial processes,

Significant annual changes (>10%) for:

- CO_2 emissions from 1.A.4. Other sectors (fuel combustion), 1.B. Fugitive emissions, 2.A. Mineral products, 2.G. Other industrial processes, and Biomass consumption.

The Party noted that the CO_2 emissions from 1.A.5 (Other) refer mainly to CO_2 associated with statistical differences, which is highly variably due to its origin. Moreover, as explained in the NIR, Statistics Netherlands has revised the national energy balance for 1999 in order to eliminate the statistical differences, while recalculation of the balances of previous years was not (yet) done. The differences in the 2.G sector can be partly explained by a different source allocation in different years (e.g. between 2.B, C, D and G), as described in this and previous NIR's. Significant annual changes in CO_2 from 1.A.4 (Other sectors) can be explained by weather variations, as explained in the NIR (temperature correction). Also it has been mentioned in the NIR (par. 2.3) that CO_2 from 2.A and 1.B is missing in the present dataset for some years (1990-1992 and 1998-1999, respectively). For CH_4 and N_2O also the differences in the 2.G sector can be partly explained by a different source allocation in different years (e.g. between 2.A, B and G), as described in this and previous NIR's.

Comparison with previous submissions

Recalculation tables were provided from 1990 to 1998. The effect of the recalculations for the base year was a 0.4 reduction in the total inventory in terms of CO_2 equivalent, both in-and excluding land-use change and forestry. Major changes were made in the energy sector, such as for CH_4 in the energy industries categories, CH_4 and N_2O from manufacturing industries and construction, N_2O from transport, and CO_2 from oil and natural gas, and for actual SF_6 emissions from the industrial processes sector. Comparison of the percent changes in total CO_2-equivalent for all GHG as shown in the Netherlands recalculation tables for inventory years 1990 and 1998 matched with the independent estimates of percentage changes calculated by the secretariat.

QA/QC and verification procedures
The NIR includes a detailed explanation on the QA and QC procedures that the Netherlands is applying. This includes many aspects of QA/QC as outlined in IPCC Good Practice guidance, such as a formal QA system, documentation of methodologies, inventory improvement program, external reviews and QC phases.

Key sources
Netherlands provided a list of about 21 source categories out of 51, which could be identified as "key sources" according to the definition of the IPCC Good Practice Guidance report. There was agreement with the independent key source basic analysis of the secretariat.
Party mentioned that, as mentioned in the NIR, (par. 5.2), the list provided has to be considered as a preliminary identification of key sources.

Uncertainty estimates
The NIR states that an IPCC Tier 1 uncertainty analysis has been performed, and the results of this analysis are presented, both at a summary level and at the individual source category level. The Netherlands plans to eventually use the results of uncertainty analysis as part of their key source determination.

Sector-by-sector findings
Although the CRF was provided for 1990 to 1999, the analysis of trends in IEF, activity data and emissions at category levels that are more detailed than those in the sectoral report tables, was limited in those source-categories in which sectoral background data tables were not provided for the entire time series.

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 1.9 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data
The energy data in the Netherlands reference approach for 1999 correspond very closely to the IEA data (only 0.4 per cent higher). Specific differences include:
- In the CRF, crude oil imports and exports are respectively 1,789,229 TJ and 1,851,891 TJ higher than the IEA data. It is not clear what has been included in the "crude oil" category.
- Stock changes of crude oil are –53,000 TJ in the CRF and 9,010 TJ in the IEA data.
- For gasoline and naphtha, imports and exports are considerably higher in the IEA data set.
- It is not clear what has been included in the "other oil" category.

Most of the above questions are also applicable to the 1990 data, where the CRF data are 0.3 per cent higher than the IEA data. The growth rate of overall apparent consumption between 1990 and 1999 is very similar between the two data sets: CRF 6.3 per cent and the IEA 6.1 per cent.
The Netherlands explained that, as mentioned in the NIR, para. 6.4, the RA calculation has to be considered as provisional, since no official figure for the carbon content of crude oil and NGL has been determined yet. The outcome of the RA for the Netherlands is very sensitive to these figures due to the very high amount of oil refined and imported/exported. Explanations of differences

were provided in the documentation box of table 1.A.(c) of the CRF instead of the indicated table 1.A.(b).

Key sources

<u>Fuel combustion</u>

1.A.1 Energy industries - solid fuels

- The value of the CO_2 IEF for public electricity and heat production in 1999 (108.2 t/TJ) is one of the highest across the reporting Parties, having increased by 12 per cent compared to its 1990 level (98.4t/TJ).
- The Party did not report activity data and emissions for the subcategory manufacture of solid fuels and other energy industries.

1.A.1 Energy industries - other fuels

- The value of the CO_2 IEF in 1999 (1,239.2t/TJ) is the highest across the reporting Parties.

1.A.2 Manufacturing industries and construction - solid fuels

- The value of the CO_2 IEF in 1999 (2,020.5t/TJ) is the highest across the Parties, having increased by 370 per cent compared to its 1990 level (425.9 t/TJ).

The Netherlands provided the following comments, which are relevant for the findings under energy industries and under manufacturing industries and construction.
As explained in the completeness tables 9, coke production is included under 1.A.2; therefore under 1.A.1.c solid fuel consumption is zero. IEFs for CO_2 solid/liquid/gases of the order of 400 or more must be an error and will be looked into. As mentioned in the NIR, if emissions reported by industry could not be associated with fuel consumption of a specific fuel type, both figures were reported under 'other fuels'. In general, the total CO_2 and total fuel reported here do not correspond well (this is explained in the documentation box). Therefore, the IEFs for 'other fuels' often have no meaning. Moreover, coke oven gas and blast furnace gas have a very high carbon content, so the average IEF for the fuel category may be higher than expected.

1.A.3.b Road transportation (CO_2 and N_20):

- The value of the N_2O IEF for diesel oil in 1999 (10.5 kg/TJ) is the highest across the reporting Parties.

The Netherlands commented that, as explained in the NIR, the emission factors for N_2O are based on a methodology summarized and referred to in the NIR, which assumes a direct relation between the NO_X emissions and N_2O.

1.A.4 Other sectors - solid fuels

- The value of the CO_2 IEF for the residential subcategory in 1999 (103.0 t/TJ) is the highest across the reporting Parties.

<u>Fugitive emissions</u>

1.B.2.a ii ,iv Oil:

- It is not clear where CH_4 emissions from oil production are included (reported as IE).

The Netherlands explained that the emissions from exploration, production and processing of oil and gas, including venting and flaring, have all been reported together under the natural gas production/processing category 1.B.2.b. i. (the main source of emissions).

- The value of the CH_4 IEF from refining/storage in 1999 (111.2 kg/PJ) decreased by 12 per cent compared to its 1990 level (127.4 kg/PJ).

1.B.2.a,ii, Natural gas

- The value of the CH_4 IEF from transmission in 1999 (2,748.7 kg/PJ) increased by 217 per cent compared to its 1990 level (1,473.7 kg/PJ).

1.B.2.c Venting

- It is not clear where CH_4 emissions from venting and flaring are included (reported as IE).

The Netherlands explained that the emissions from exploration, production and processing of oil and gas, including venting and flaring, have all been reported together under the natural gas production/processing category 1.B.2.b. i. (the main source of emissions).

Non-key sources

Fuel combustion

1.A.1 Energy industries - gaseous:

- The value of the CH_4 IEF in 1999 (9.3 kg/TJ) increased by 200 per cent compared to its 1990 level (3.1 kg/TJ).

1*.A.3.a Civil aviation (domestic)*

- Activity data and emissions from aviation gasoline were not reported for this source category.
- The activity data for jet kerosene reported in the CRF are higher compared to the data published by the IEA (30 per cent).

1*.A.3.d Navigation (domestic)*

- The activity data for gas/diesel oil reported in the CRF are lower compared to the data published by the IEA (158 per cent).

The Netherlands referred to the general remark on comparison with international statistics.

Fugitive emissions

1.B.2.c Venting:

- It is not clear where CO_2 emissions from venting and flaring are included (reported as IE).

The Netherlands indicated that the allocation of venting emissions is described under 'key sources'.

Bunker fuels

1.A.3.d International marine transport:

The activity data for residual oil reported in the CRF are higher compared to the data published by the IEA (7 per cent).

The Netherlands referred to the general remark on comparison with international statistics.

INDUSTRIAL PROCESSES

Key sources

2.B. 2 Nitric acid

- Activity data were only provided for 1990, 1993 and 1994.
- N_2O IEFs for 1990 (0.0113), 1993 (0.0095), and 1994 (0.0106) are the highest among reporting Parties for each of these years and above the IPCC default values (0.002-0.009 t/t).
- For reasons of confidentiality activity data for 1997 to 1999 were not provided (reported as C). ***The Netherlands explained that also activity data for 1991-1992 and 1995-1996 are confidential (see NIR table 3.1).***

2.E.1 Production of halocarbons and SF_6

- Emissions of HFCs are provided in Tables 2(II)s1 and 2(II)s2 in CRF, but no corresponding activity data were reported in Table 2.(II),C.E.

2.C.3. Aluminium production

- CO_2 emissions from aluminium production were not estimated; they were reported as IE. No indication was provided in the completeness table (Table9s1) as to where they were included.

- Activity data for aluminium production were not provided in the CRF tables.
- PFCs emissions decreased by 14.3 % from1992 to 1993 and increased from 1997 to 1998 by 14.6%.

Non-key sources

F. Consumption of halocarbons and SF_6

- Tier 2 method for actual SF_6 and PFCs emissions estimation was used, but not for all years. ***The Netherlands stated that this comment must be a misunderstanding of the NIR. A Tier 2 method for actual emissions of SF_6 and HFCs was used for all years (1990 to 1999).***
- Reported aggregated activity data values for SF_6 consumption (reported as CBI), potential/actual emissions ratio not calculated.
- Reports aggregated PFCs activity data (report as unspecified and CBI), potential/actual emissions ratio not calculated.

2.B.5 Other (chemical industry) - CO_2, CH_4

- CO_2 emissions for ammonia (2.B.1) and ethylene (2.B.5.2) were reported as IE. No indication was given in the completeness table (Table 9) as to where these emissions were included.
- For reasons of confidentiality activity data for carbon black (2.B.5.1) were not provided (reported as C).
- CH_4 emissions from Carbon Black were estimated only for 1998. Emissions for other years were reported as IE. No indication was given in the completeness table (Table 9) as to where these emissions were included.
- CH_4 emissions from dichloroethylene (2.B.5.3), ethylene, styrene (2.B.5.4) and Methanol (2.B.5.62) were reported as IE. No indication was given in the completeness table (Table 9) as to where these emissions were included.

2.A.1 Cement production

- Reported cement production in CRF is 312% lower than data published by the UN. ***The Netherlands stated that this statement on comparison of cement production data with UN data is incorrect. As stated in the CRF, the Netherlands does not report cement production as activity data in the CRF, but cement clinker production.***

SOLVENT AND OTHER PRODUCT USE

Non-key sources

3.A. Paint application

- NMVOC emissions were provided only for 1997-1999.
- Activity data were provided only for 1997.

3.B. Degreasing and dry cleaning

Activity data were not provided

AGRICULTURE

Source categories 4.C Rice cultivation, 4.E Savanna burning and 4.F Field burning of agricultural residues were reported as not occurring (NO).

Key sources

4.A Enteric fermentation – CH_4

For cattle, a tier 2 methodology was used for the year 1990, while for the other years tier 1 was used. This might affect the consistency in the time series for CH_4 from enteric fermentation. For all livestock types other than cattle, IPCC tier 1 methodology and default emission factors were used.

- Analysis of activity data, IEFs and other related information was limited to the years 1990 and the period 1996-1999, as table 4.A was not provided for 1991 to 1995. In addition, for 1991 to 1995 CH_4 emissions were not reported in a disaggregated manner by livestock types, which limited analysis of trends of individual livestock types over the time series.
- The CH_4 IEF for non-dairy cattle decreased by 18 per cent over the period 1990 to 1999 (56.8 versus 46.5 kg CH_4 /hd/yr). Corresponding CH_4 emissions decreased by 23 per cent over that same period.
  The Netherlands referred to its NIR, para. 7.2.2., where the change in the CH_4 IEF for non-dairy cattle has been explained. This is caused by a shift in the shares of subtypes, each having a different emission factor.
- Horse population increased by 66 per cent over the 1990 to 1999 period. Corresponding CH_4 emissions increased by 55 per cent from 1990 to 1997 and were then reported as "0"in 1998 and 1999. In the trend of the CH_4-IEF there was a drop of 20% in the year 1996 as compared to the values calculated for 1990 and 1997 (15.0 in 1996 versus 18.7 and 18.0 kg CH_4 /hd/yr in 1990 and 1997, respectively).
  The Netherlands explained this as being due to an error in CH_4 emissions from horses for the years 1998 and 1999, which has already been noted in the NIR, para. 2.3. The Netherlands stated its intention to correct this in the next inventory submission.
- Goat population increased 151 % from 1990 to 1999. Corresponding CH_4 emissions increased by 144 per cent over that period, with annual increase of 19 per cent from 1996 to 1997.
- <u>Trends in emissions.</u> Annual decreases of 10 and 11 per cent were reported for sheep and swine emissions in 1997 and 1998, respectively.

4.B. Manure management – CH_4

- <u>CH_4-IEF.</u> IEF for dairy cattle was relatively low compared to IPCC default values for cool-Western Europe (7.0 versus 14 kg CH_4/hd/yr), while for non-dairy cattle and sheep, values were relatively high compared to the same reference and those from other Parties (12.7 versus 6, and 0.49 versus 0.19 kg CH_4/hd/yr, respectively).
- <u>Trends in CH_4-IEF.</u> CH_4-IEF for sheep increased by 10% during the 1990 to 1999 period, with some annual fluctuations of over 10 per cent between some years. CH_4-IEF for swine decreased by 8% from 1990 to 1999, with annual changes of –12% (1996/97) and +14% (1997/98). For goats, a CH_4-IEF of 0.1 was calculated in 1996, while in 1997 to 1999 the IEFs ranged from 2.0 to 2.2 kg CH_4/hd/yr.

4.D. Agricultural soils – direct N_2O emissions (4.D.1.)

- No data/information was provided in the CRF for N_2O emissions from crop residues and cultivation of histosols.
- <u>N_2O-IEF.</u> IEF for animal wastes applied to soils was relatively high compared to those of the other reporting Parties but still within the IPCC default range.
- <u>Trend in emissions.</u> Direct soil emissions increased by 30% from 1990 to 1999.
- No information on the fractions used was provided in table 4.D.

Non-key sources

4.B. Manure management – N_2O

- No disaggregated activity data or other related information were reported; table 4.B(b) contains only one aggregate N excretion value which was reported under "other". Consequently, with the exception of "other", no N_2O IEFs per AWMS have been calculated;

- N$_2$O-IEF for AWMS. The IEF for "other" is the lowest among the reporting Parties and very low compared to the IPCC default (0.0011 versus 0.005 kg N_2O-N/kg N).
- Trends in emission. Annual fluctuations in N_2O emissions of more than 10 per cent were reported from 1992 to 1993 (+14.3%), and from 1995 to 1996 (–12.5%).

4.D. Agricultural soils – indirect N_2O emissions (4.D.3.)

- The Netherlands did not provide emission estimates from this subcategory, but reported emissions as included elsewhere (IE); there is no indication in the CRF (completeness table or documentation box) where these emissions have been included. N_2O emissions from atmospheric deposition have not been estimated (NE reported).
  The Netherlands explained that it does not use the IPCC method to estimate the indirect N_2O emissions; instead the (enhanced) background emissions from agricultural soils have been calculated and reported under 4.D "Other". This was not indicated in the completeness table, since these emissions are still reported under 4.D.

LAND-USE CHANGE AND FORESTRY

Overview

- The Netherlands applied IPCC Tier 1 (no information on emission factor sources) to estimate CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forests.
- Emissions of non-CO_2 gases were not estimated.
- Only Table 5 was provided with numeric data; sectoral tables 5.A. to 5.D. were not provided.
- The Netherlands reported in Table 5 CO_2 emissions and removals from 5.A (Changes in Forest and Other Woody Biomass Stocks) for temperate forests and other, 5.B (Forest and Grassland Conversion) for temperate forest (coniferous, broadleaf, mixed broadleaf/coniferous), from 5.C (Abandonment of Managed Lands) for temperate forests (coniferous, broadleaf, mixed broadleaf/coniferous) and from 5.D (CO_2 Emissions and Removals from Soils)

5.A. Changes in forest and other woody biomass stocks

- No gross emissions were provided. Gross removals are taken as net removals in Table 5A.
- A change of 13.3% in CO_2 emissions from changes in forest and other woody biomass stocks from 1999 to the base year. Most values reported for removals do not vary between years, producing a small fluctuation in the time series.
- No annual growth rate reported.
- For 1990 and 1994, removals reported in Table 5.A. do not match those reported in Table 5: 1,425 in Table 5.A. versus –1,500 in Table 5, for 1990; 1,657 in Table 5.A. versus –1,700 in Table 5. It seems that a broad rounding scheme was applied.
  The Netherlands explained that rounded figures were accidentally used for the years 1990 and 1994 in table 5.
- For the rest of the years, removals in Table 5.A. were reported as 0.
- Annual changes were 0 from 1991 to 1993 and from 1994 to 1999, meaning that the same net removals were reported for each of the periods.

WASTE

Key sources

6.A. Solid waste disposal on land - CH_4

- Methods used for this key source were not reported.
- No activity data were provided for CH_4 conversion factor in CRF for 1990 to 1994
- Activity data for annual MSWD and CH_4 recovery were not provided in CRF.

- CH_4 IEF increased from 1991 to 1998 (0.04673 – 0.08387t/t). CH_4 IEF was not estimated for 1990 and 1999.

The Party replied that these statements seemed incorrect. They pointed out that the method for this source was reported in Ch. 4 of the NIR on methodology (IPCC Tier 2); activity data for annual MSW disposed in landfills and CH_4 recovery was reported in SBT 6.A. The IEF for CH_4 was reported for 1990 and 1999.

Non-key sources

6.B. Wastewater handling (WWTP) *N_2O, CH_4*

- N_2O emissions per capita increased by 11.4% from 1995 to 1996
- CH_4 emissions from wastewater handling are very erratic; -70.7% from 1994 to 1995, -62.2% from 1995 to 1996, an increase of 126.3 % from 1996 to 1997 and 190.4% from 1997 to 1998.
- N_2O emissions from human sewage were not estimated
- The fraction of nitrogen from human sewage was not reported
- Per capita protein consumption not estimated.

The Party responded that although the emissions of CH_4 from WWTP might seem erratic, they were the official figures reported by the individual firms. The Party noted also that the N_2O emissions from human sewage have been reported under 6.B, not under "human sewage" but under "other".

6.C. Waste incineration

- N_2O, CH_4 and CO_2 emissions from waste incineration were not estimated (reported as IE). No information given in completeness table as to where they were reported.
- Activity data for incinerated waste not reported.

UNITED KINGDOM OF GREAT BRITAIN AND NORTHEN IRELAND

General

Common reporting format (CRF) and national inventory report (NIR)
The CRF was provided for 1990 to 1999 and included almost all requested tables. A NIR for 2001 was submitted. It discuses the methodology as well as the estimates and trends of the GHG inventories. The use of notation keys was widely used.

Consistency of information between CRF and NIR
No major differences between the information provided in the CRF and NIR were identified. However, for some sources and sink categories in LUCF (table 5), CO_2 emissions and removal estimates were differently allocated in the Summary Report (IPCC Table 7A) provided in the CRF than in the corresponding table provided in the NIR. However, this had no implications on the total net CO_2 emissions/removals from this sector.
The Party noted that source and sinks for LUCF were previously reported in groupings derived from the IPCC 1996 Guidelines and the NET emission of CO_2 due to land use change (Table 5d) included emissions due to uptake by Set Aside arable land. This grouping continued to be used for the NIR. Also the guidance for the CRF encouraged the reporting of sinks and sources separately for LUCF. As the data were readily available the Set Aside sink has been provided in this way. We do not yet have data to separate the sources and sinks in the soils due to other land use change except for the forestry sink.

Comparison with previous submissions
The United Kingdom provided recalculations for the period 1990 to 1998(tables 8(a) and 8(b)). A comparison was made between the changes in total GHG emissions as shown in Table 8(a) of the CRF for years 1990 and 1998 and independent secretariat calculations of changes based on the UK's 2000 and 2001 CRF submissions. The results were in agreement.

Time series consistency
Emissions data do not indicate any notable annual fluctuation for national totals. Nevertheless, there is a general decline in the total emissions between 1990 and 1999. However, where notable annual fluctuations were identified for specific categories, these are indicated under the sector-by-sector findings below.

QA/QC and verification procedures
The NIR describes the QA/QC system that has been put into place for the current inventory. The NIR states that this system complies with Tier 1 level QA/QC procedures as outlined in the IPCC Good Practice guidance. Tier 1 checks are described in the report, along with a number of source specific QA/QC activities that were performed. Also, a plan for external peer review will begin in 2001.

Key sources
The United Kingdom provided a key source analysis based on the Tier 2 IPCC Good Practice method for key source determination which uses level, trend and uncertainty analysis. An independent key source analysis conducted by the secretariat showed somewhat different results for identified key sources. Fugitive emissions from oil, gas, and coal mining operations did not show up on the UK key source list, but were a key sources based on the level assessment in the secretariat's analysis. Otherwise the results were in agreement.
The Party noted that the difference may arise from the level of disaggregation used and the inclusion of LUCF sources and sinks in the analysis.

Uncertainty estimates
Quantitative estimates of uncertainties were calculated using the Monte Carlo Simulation (IPCC Tier 2) in Good Practice Guidance.

Sector-by-sector findings

ENERGY

Reference approach
Comparison of reference approach with national approach
CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 1999, there is a difference of 6 per cent in the CO_2 emission estimates between the reference approach and the sectoral approach. Explanations were provided in the documentation box of table 1.A(b) of the CRF.

Comparison with international data
The UK reference approach energy data for 1999 are 0.8 per cent lower than the data reported to the IEA. Apparent consumption of liquid fuels is 3.3 per cent lower in the CRF, while consumption of solid and gaseous fuels is comparable. Specific differences include:

- Imports of jet kerosene are 15,886 TJ higher in the IEA data.
- International bunkers of jet kerosene are 355,886 TJ in the CRF and 264,995 TJ in the IEA.
- International bunkers of gas/diesel oil are 36,974 TJ in the CRF and 49,877 TJ in the IEA.
- For natural gas, the CRF shows a stock build of 25,275 TJ and the IEA shows a stock draw of 22,495 TJ.

Most of the above observations are also applicable to the 1990 data where the CRF data are 0.8 per cent lower than the IEA data. The growth rate of overall apparent consumption between 1990 and 1999 is the same between the two data sets: both grow by 2.9 per cent.
The United Kingdom explained that the data used in the reference approach and the main inventories are taken from the Digest of UK Energy Statistics 2000 (DUKES), published in August 2000.
Currently the UK Department of Trade and Industry is undertaking a study to compare the energy data reported in the UK Energy Statistics, the energy data used for the greenhouse gas inventory and the energy data submitted to IEA, in order to clarify the discrepancies referred to.
Some of the discrepancies may arise from different estimates used for marine and aviation bunkers (see below) and these account for 77,988 TJ (=CRF Bunkers- IEA Bunkers) in 1999. Given that the bunkers total is deducted from the CRF production data this would result in the CRF apparent consumption being lower than the IEA figure. The CRF apparent liquid fuel consumption is 3,106,311 TJ and so the bunkers discrepancy accounts for 2.4 per cent (i.e. 77,988/(3,106,311+77,988)), and partly explains the liquid fuel discrepancy.
The imports of aviation fuel are as reported in the Digest of UK Energy Statistics 2000.
The reported natural gas stock change of 25,275 TJ net is a stock reduction and is applied correctly in the estimate of apparent consumption - there may be a difference in sign convention.

Key sources
<u>*Fuel combustion*</u>
1.A.1 Energy industries - gaseous fuels:

- The value of the CO_2 IEF for public electricity and heat production fluctuates quite considerably in the period 1990-1999. The value of the CO_2 IEF increased from a value of 57.9 t/TJ (1990) to a peak of 70.2 t/TJ (1992) and then gradually declined to 58.6 t/TJ (1999).

- The value of the CO_2 IEF for manufacture of solid fuels and other energy industries in 1999 (70.5 t/TJ) is the highest across all reporting Parties, having increased by 8 per cent compared to its 1990 level (64.5 t/TJ).

The United Kingdom explained that the variation in gaseous IEF is due to the rapid increase in mains natural gas used in power generation compared with the relatively constant consumption of unrefined natural gas used on offshore platforms and a power station. Unrefined natural gas has a higher carbon content than mains gas. Hence the relative trends cause a fall in the aggregate emission factor.

The category "other energy industries" comprises consumption by the offshore industry, coke ovens, solid fuel production, collieries and gas distribution. Over the period there has been an increase in natural gas consumption by the offshore industry, much of it unrefined gas with a high carbon content. Hence the IEF has increased over the period.

1.A.2 Manufacturing industries and construction:

- The value of the CO_2 IEF for solid fuels in 1999 (127.0t/TJ) is the second highest across all reporting Parties.

The United Kingdom explained that the high IEF for solid fuels arises from the inclusion of blast furnace gas and coke oven gas in the solid totals (see footnote Table 1.A (a) s4).

- The value of the CO_2 IEF for gaseous fuels in 1999 (58.0t/TJ) is the highest across all reporting Parties.

1.A.4 Other sectors- gaseous fuels (agriculture/forestry/fisheries):

- The value of the CO_2 IEF in 1999 (58.0t/TJ) is the highest across all reporting Parties.

1.A.3.b Road transportation (CO_2 and NO_2):

- The value of the CO_2 IEF for gasoline in 1999 (70.1t/TJ) is among the lowest across all reporting Parties.
- The value of the N_2O IEF for gasoline in 1999 (12.3 kg/TJ) increased considerably compared to its 1990 level (1.7 kg/TJ).

The United Kingdom explained that the change in IEF for road transport reflects the penetration of catalytic converters into the vehicle fleet. In 1990, uptake was lower than other European countries; however, subsequent penetration has been rapid.

Fugitive emissions
1.B.1.b Solid fuel transformation:

- The value of the CO_2 IEF from this subcategory fluctuated during the period 1990-1999 (from a value of 339.2 kg/t in 1990 it decreased to 229.9 kg/t in 1996 and then increased again to 344.6 kg/t in 1999).

The United Kingdom explained that the emission reported is the residual carbon based on a mass balance on the coal and coke consumed by these processes and the coke, patent fuel and coke oven gas produced. Flaring losses are also included. The aim is to make sure that all carbon that is not accounted for under energy is accounted for. The resulting estimate is very uncertain and fluctuates mainly because it is the difference between two uncertain quantities of similar magnitude, namely carbon input and carbon output.

1.B.2 Fugitive oil and gas:

- Emissions from oil and gas are not reported separately. (*In a similar comment in the synthesis and assessment of the 2000 inventory submissions (FCCC/WEB/SAI/2000), the Party explained that these emissions are included in fugitive emissions from production because of the non-availability of disaggregated data.*)

The United Kingdom explained that it is not possible to split offshore emissions into oil and gas fields, nor is it possible to disaggregate them from other fugitives for the whole time series. In the

2001 submission, venting data have been separated out and reported in 2B2c, venting, for 1995-99. Hence the detail of reporting has improved since the 2000 submission.

1.B.2.b iii Natural gas:
- Emissions of CH_4 from other leakage were not estimated (reported as "NE").

Non-key sources
1.A.3.a Civil aviation (domestic):
- The activity data for jet kerosene reported in the CRF are lower compared to the data published by the IEA (373 per cent).

1.A.3.d Navigation (domestic):
- The activity data for gas/ diesel oil reported in the CRF are lower compared to the data published by the IEA (16 per cent)

The United Kingdom provided the following comments, which are relevant to both domestic and international aviation and navigation
Emissions from bunker fuels are estimated using data from the Digest of UK Energy Statistics. This is then corrected for military fuel use and domestic aviation use.
DUKES reports a figure of 1.151 Mt gas oil for marine bunkers and our estimate of naval use is 0.2975 Mt, which at 26 per cent is rather higher than the discrepancy with IEA.
The low IEA figure for jet kerosene is surprising. Assuming the IEA has not corrected for military usage, then it must use a high figure for domestic aviation or a different definition of international aviation. The United Kingdom estimate of domestic aviation is based on domestic aircraft movement data and default fuel consumption data. UK sales of aviation kerosene in 1999 are reported in DUKES as 9.659 Mt (423,933 TJ net). Applying corrections of military and domestic aviation yields a figure for international aviation of 355,885 TJ.

1.A.1 Energy industries - gaseous fuels:
- The value of the N_2O IEF in 1999 (3.8 kg/TJ) decreased by 20 per cent compared to its 1990 level (4.8 kg/TJ)

The United Kingdom explained that the decrease in the N_2O IEF arises from the increase in natural gas consumption for public power generation. The emission factors for combined cycle gas turbines are lower than those used for other sources in the energy industries category (mainly offshore gas turbines) and so the aggregate factor has decreased.

1.A1 Energy industries - other fuels:
- The CO_2 IEF fluctuated in the period 1990-1999. From a value of 30.5 t/TJ in 1990, it increased to a peak value of 40.7 t/TJ in 1996 and then dropped to 34.5t/TJ in 1999.

The United Kingdom explained that the other fuels are municipal solid waste and scrap tyres. The variation in the CO_2 IEF over the period is explained by the relative contributions of MSW and scrap tyres. The consumption of the scrap tyre incineration plant decreased from 1997 onwards and ceased operation in 2000.

Bunker fuels
1.A.3.a International aviation: The activity data for jet kerosene reported in the CRF are higher compared to the data published by the IEA (26 per cent).

1.A.3.d International marine transport: The activity data for gas/diesel oil reported in the CRF are lower compared to the data published by the IEA (35 per cent).
(See comments under domestic aviation and navigation)

INDUSTRIAL PROCESSES

Key sources

2.A.1. Cement production

- A recalculation was done for CO_2 emissions since the 2000 submission; an increase of 2% was noted. The NIR explained that this was due to changes in the methodology to account for CKD.
- The tier 2 key sources analysis in the NIR indicated that this sub-category is not a key source, contrary to the secretariat’s results.

2.F. Consumption of halocarbons and SF_6 –HFC and PFCs

- Consumption of HFCs has generally increased from 1990 to 1999 with a relative percent change of over 6400 from 1990 to 1999 (i.e. from 0.66 Gg CO_2 equivalent in 1990 to 4279 Gg CO_2 equivalent in 1999).
- The potential to actual emission ratio is 2.26, which is relatively low compared to most Parties. However, the potential emissions for 1999 (9653Gg CO_2 equivalent is the second highest among the reporting Parties.
- The potential PFCs emissions increased by 58% from 1992 to 1993 and by 72.8% from 1993 to 1994. The actual PFCs emissions for these years were 56.9% and 70%, respectively.
- The relative change in actual PFCs emissions from 1990 to 1999 was 87%.

2.B.2. Nitric acid production – N_2O

- N_2O emissions from nitric production which was not a key source in the 2000 submission, is now key, contributing 0.47% to the national total in terms of absolute emission levels.
- The N_2O IEF (0.00395t/t) in 1999 is the third lowest among the reporting Parties.
- N_2O emissions decreased by 27.8% from 1990 to 1999.
- There was a decrease of 30.2% in N_2O emissions from 1994 to 1995 and 13.6% from 1998 to 1999; an increase of 15.2% was noted from 1997 to 1998.
- A recalculation was reported due to revised activity data and EF. The result, for example, resulted in N_2O emission in 1990 being 9.5% lower than previously reported.

2.B.3. Adipic acid production –N_2O

- N_2O IEF had an upward trend from 1991 to 1997 and then decreased to 1999.
  As in the response to 2000 S&A report, the United Kingdom explained that ICI and DuPont supply the data reported. The data reported from 1990-1994 include emissions from a small nitric acid plant integrated into the process. Data supplied since DuPont took over the plant from 1994-97 exclude the nitric acid plant and now show more consistent emission factors. The 1998 and 1999 emission factors are low because an abatement plant began operating in 1998.
- Compared to other Parties the N_2O IEF is low, especially in 1999 (0.0149t/t).
- N_2O emissions increased by 21% from 1993 to 1994; N_2O emissions decreased by 95.58% from 1998 to 1999.
- In the NIR there was no indication of the N_2O destruction factor, the type of abatement system and plant availability.

2.C.1. Iron and steel production – CO_2

- The NIR gives a reduction of 495 Gg from iron and steel production as a result of a revision to the amount of coke used in blast furnace and amount of blast furnace gas produced.
- The CO_2 IEF for crude steel (0.1 t/t in 1999) is the lowest among the reporting Parties and much lower than the IPCC reference value (1.6 t/t).
  The Party explained that The IEF factor of 0.1 tCO_2/t refers specifically to the carbon anode consumption in EAFs.

- The CO_2 IEF for coke (3.0067 t/t in 1999) is the highest among reporting Parties.
- Total CO_2 emissions increased by 124% from 1998 to 1999 even though there were some significant decreases in emissions from 1990 to 1991 and 1996 to 1998.
- A large difference is reported between steel production data in the CRF and UN data (+357%). In the notation it is specified that the reported quantity of steel refers to steel from arc furnaces only, pig iron production is reported, but not the final steel production.
  The United Kingdom explained that the steel production data are taken from Iron and Steel Industry Annual Statistics for the United Kingdom. The CRF reports the production of iron from blast furnaces and the production of steel from electric arc furnaces. The iron data are used to estimate sequestration of carbon in steel and are based on the assumption that all iron produced is used to make steel. This is largely true since imports and exports of pig iron are very small (225 kt imports, 1.7 kt exports in 1998). However, it is clear that steel production is significantly higher than iron production (i.e. 17300 kt steel, 12700 kt iron) and presumably the difference is accounted for by the use of scrap and iron ore in EAFs and BOFs as well as pig iron. The methodology has been reviewed in light of the Good Practice Guidance two-stage approach (i.e. iron production and steel production) and has been revised for the 2002 submission
  As in the response to 2000 S&A report, the United Kingdom explained that the emission of CO_2 reported in this category is based on a rather complex calculation to ensure that there is no double counting of carbon emissions in blast furnaces. The methodology is explained in the NIR. The CO_2 reported is in effect the difference between the carbon content of the coke fed to the blast furnace and the output carbon contained in the steel and blast furnace gas produced. As this is the difference between two large numbers it tends to fluctuate from year to year. The accuracy of the data and the energy efficiency of the steel making process heavily influence the reported emission. Its dependency on the coke consumption is probably rather weak, hence the effective emission factor will vary.

Non-key sources

2.B.1. Ammonia production

- IEFs (for CO_2) in the 2001 submission are higher than those in the 2000 submission.
- In comparison with other Parties the reported IEFs are very high (26.29 t/t in 1999) and higher than the IPCC default values (0.79-0.91 t/t).
- In the S&A report for 2000, it was explained that some ammonia plants in the UK are integrated with other plants (i.e. acetic acid and methanol plants). This measure, which in principle is a CO_2 abatement/sequestration technique, should rather lower the IEFs.
- CO_2 emissions decreased by 35.6% from 1996 to 1997, but increased by 25% from 1997 to 1998.

2.A.2 Lime production

- CO_2 IEF (0.44t/t) is low compared to most Parties and lower than the IPCC default (0.79 – 0.91t/t).
  As in its response to the 2000 S&A report, the Party explained that emissions are estimated from the limestone consumed in calcination, these data are available from an Office of National Statistics survey. This explains the apparently low carbon emission factor.
- CO_2 emissions decreased by 10.75% from 1990 to 1991 and increased by 18.5% from 1994 to 1995. There was a further increase in CO_2 emission of 33% from 1996 to 1997.

2.C.3 Aluminium production

- IEF for CO_2 is stable through the period, IEF for the sum of CF_4 and C_2F_6 emissions shows a decrease of about 42% from 1991 to 1992 and of about 35% from 1992 to 1993. No explanation was provided in the available documentation.
  The United Kingdom explained that the PFC emissions are based on manufacturers' estimates. The reduction is due to improved control measures on the plant.

SOLVENT AND OTHER PRODUCT USE

3.A. Paint application
Activity data reported has increased from 1997 to 1999, though NMVOC emissions for this period are decreasing.

AGRICULTURE

Source categories 4.C Rice cultivation, 4.E Prescribed burning of savannas, and 4.F Field burning of agricultural residues were reported as not occurring (NO).

Key sources
4.A. Enteric fermentation – CH_4

- CH_4-IEF. IEF for sheep was almost the lowest among reporting Parties and is significantly lower than the IPCC default (4.7 versus 8.0 kg CH_4/hd/yr).
  In its responses to review stages of the 2000 inventory submission, the United Kingdom explained this lower IEF as being a consequence of assuming a lower emission factor for lambs, whose proportion is taken into account in the total livestock numbers.
  The United Kingdom explained that it did use the IPCC defaults for the categories 'breeding' and 'other' sheep, but smaller emission factors were assumed for lambs. The overall IEFs are therefore smaller than the IPCC defaults.
- Trends in IEF. CH_4-IEF for dairy cattle: 7.2% increase from 1990 to 1999.
  In its responses to review stages of the 2000 inventory submission, the United Kingdom explained such an increase by the constant increase in the live weight of cattle, resulting in increases in intake and yield and thus IEF.
  The United Kingdom confirmed that an annual increase in live weight of dairy cattle is assumed.
- Population size. Goat population decreased by 32% from 1990 and 1999, with annual decreases between 6 and 7% from 1990 to 91, 1992 to 93, 1993 to 94 and 1994 to 95; horse population increased 37%, with annual fluctuations of +15.7% for 1992/93, 8.7% for 1996/97 and –11.7% for 1998/99). Swine population showed an annual decrease of 10 per cent from 1998 to 1999.

4.D. Agricultural soils
IPCC Tier 1a and 1b methods along with default emission factors were used to estimate N_2O emissions from agricultural soils.

4.D.1 and 4.D.3 Direct and indirect emissions from agricultural soils - N_2O
4.D.2 Animal production - N_2O

- N_2O-IEF. IEFs for N-fixing crops and crop residues are among the lower values compared to those of other Parties, the IEF for N-fixing crops being the lowest among reporting Parties (0.0003).
  The United Kingdom explained that changes in staff between 1998 and 1999 resulted in inconsistencies in the interpretation of table 4D.[1]

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[1] The United Kingdom made the following suggestion for modification of table 4.D: ***This table could be made clearer. For example, at the head of column B the units are specified as N input kg N/yr, but for N fixing crops and crop residues the units are then specified as kg dm/year. Use of the latter (as in 1999) gives a much smaller value than use of the former, which was used in previous years and gives the IPCC default emission factor 0.0125. (The number of countries reporting 0.0125 for this IEF suggests that this table is often being completed incorrectly.)***

- N_2O-IEF for cultivation of histosols for 1999 is higher by a factor of 100 compared to other reporting Parties. For the years 1990 to 1998, IEF is of the same order of magnitude as IPCC defaults and those of other Parties (5 kg N_2O -N/ha).
  In its responses to review stages of the 2000 inventory submission, the United Kingdom stated that the high IEF was due to misreporting of units for the area of histosols (kha instead of ha).
  The United Kingdom noted that this was an error in reporting the area of histosols.

- Trends in IEF. IEF for N-fixing crops changed from 0.0125 to 0.0003 kg N_2O -N/kg t dm, meaning a sudden decrease of 98% between 1998 and 1999. IEF for crop residue changed from 0.0125 to 0.00023 kg N_2O -N/kg t dm, which corresponds to a 98% decrease between 1997 and 1998.

Non-key sources

4.B. Manure management - CH_4 and N_2O

- CH_4-IEF. IEF for sheep is the lowest value among reporting Parties and relatively low compared to the IPCC default for developed countries (0.11 versus 0.19 kg CH_4/hd/yr).
  In its responses to review stages of the 2000 inventory submission, the United Kingdom explained this lower IEF as being a consequence of assuming a lower emission factor for lambs, whose proportion is taken into account in the total livestock numbers.
  The United Kingdom confirmed that the same explanation as for enteric fermentation applies (see above).
- Trends in CH_4-IEF. The CH_4-IEF for dairy cattle increased by 7.2% from 1990 to 1999, while corresponding emissions decreased by 5 per cent in that period.
  The United Kingdom explained that the same assumption as for enteric fermentation is responsible for the changes in the CH_4-IEF from manure management (see above).

CH_4-IEF For lambs and dairy cows see enteric fermentation section above.

- N excretion rates. IEFs for non-dairy cattle, swine and sheep were relatively low compared to the IPCC default for Western Europe, in particular for swine and sheep (10.0 versus 20 kg N/hd/yr and 6.9 versus 20, respectively).
  In its responses to review stages of the 2000 inventory submission, the United Kingdom explained that it uses country-specific, experimentally derived emission factors, and indicated its intention to provide information in the next NIR on the criteria for the selection of emission factors that deviate from the IPCC defaults.
  The United Kingdom confirmed its previous response that N excretion rates are based on country-specific data.
- Trends in N-excretion rates. Rates for dairy cattle and poultry increased by 8.3% and 9.8%, respectively, from 1990 to 1999.
  The United Kingdom explained that for dairy cattle this increase was due to an annual increase in body weight and N excretion rate being assumed. Regarding poultry, the United Kingdom explained that there was no change in the N excretion rate of each subcategory of poultry in the period 1990-1999. The differences in the overall N excretion rate are due to a change in the population structure, with increases in subcategories such as ducks and turkeys, which have relatively high N excretion rates.
- N_2O IEF per AWMS for "Other systems" decreased by 20.5% over the 1990 to 1999 period, with a sudden annual drop of 21 per cent between 1991 and 1992, and changes of +12% from 1997 to 1998 and –10% from 1998 to 1999.
- Consistency checks. Multiplication of N excretion rates per animal by the corresponding animal population shows a difference of 20 per cent compared to the sum of nitrogen excretion over all AWMS for the particular livestock type (dairy and non-dairy cattle, and sheep).
  The United Kingdom explained that multiplication of N excretion rates by animal numbers in Table 4Bb does not give the same result as the sum of N excretion over all AWMS, because, as

noted in the comments box for table 4Bb, $Frac_{GASM}$ is subtracted from excreted N when the latter is presented in the AWMS section of the table.

4.F. Field burning of agricultural residues

- Emissions were reported only until 1993. Since then they have been reported as “not occurring”. In its responses to review stages of the 2000 inventory submission, the United Kingdom explained that this practice was banned in 1993.

LAND-USE CHANGE AND FORESTRY

Overview

- The United Kingdom followed a national modelling approach to estimate CO_2 emissions and removals from 5.A. (Changes in Forest and Other Woody Biomass Stocks) for temperate forest and harvested wood, from 5.D. (CO_2 emissions/removals from Soils) for cultivation of mineral soils and liming of agricultural soils, and from 5.E. (Others) for land drainage, peat extraction and changes in crop biomass.
- Non-CO_2 trace gas emissions were not reported.
  The Party commented that non-CO_2 emissions are considered to be negligible.
- Some large annual changes have been reported for net emissions: -20.6% for 1992/93, -18.6% for 1993/94 and –12.9% for 1994/95.
  The Party stated that changes are due to changes in activity data. This also applies to the findings below.

5.A. Changes in forest and other woody biomass stocks

- No activity data or emission factors were reported for this category as the IPCC default method is not used.
- CO_2 removals from harvested wood increased by 21.5% in 1999 compared to the reference year. However, the trend showed a strong decrease from 1990 to 1995 (-42% for the period) and then a rapid increase up to 1999 (+41.8% for that period). *(The Party explained that removals from harvested wood were net results due to the use of the model to account carbon flows)*

5.D. CO_2 emissions and removals from soil

- CO_2 emissions and removals from soil showed some large annual changes: +58.4% for 1993/94, -13.2% for 1996/97 and –24.4% for 1997/98.
- CO_2 emissions from agricultural soil liming decreased by 39.9% in 1999 compared to 1990, with annual changes fluctuating from –38% to +24%, with high year-to-year changes (23.9% from 1990/1991; -37.5% from 1992/1993; +20.4% from 1994/1995; -23.7% from 1997/1998).
- CO_2 removals from set-aside farming showed large annual fluctuations, ranging from -23.1 to +307.8%, with an overall increase of 67.7% from 1990 to 1999.

5.E. Other

- The meaning of “changes in crop biomass” (documentation box, Table 5.D.) needs clarification.
  The United Kingdom commented that “changes in crop biomass” is used due to improvements in productivity causing increases in above-ground biomass values.
- Removals are reported as constant (same value for the years of the time series, -1,100 Gg CO_2)
  The Party explained that a recent review suggests no variation in “changes in crop biomass” in time, hence a constant value was reported.

WASTE

Key sources

6.A Solid waste disposal on land - CH_4:

- CH_4 IEF (9.05t/t) for managed solid waste disposal sites appeared to be the second highest amongst the Parties

The Party explained that the waste activity units were incorrect: Mt has been confused with Gg; hence the reported activity is 1000 times too low. It noted however, that the reported emissions were correct.

- CH_4 emissions per capita decreased constantly by about 3 to 8 % per year from 1990 to 1999. The decrease in 1999 is about 38% as compared to the base year.

The Party stated that the reduction in emissions per capita was due to methane recovery measures being used on new and existing landfill sites.

Non-key sources

6.B Wastewater handling

- CH_4 and N_2O emissions from industrial wastewater were not provided (reported as NE)

The Party replied that reported emissions were based on a study on wastewater discharged to the public system. This would include domestic, commercial and industrial waste. It is likely that there is some treatment by private industrial operators, which would not be included in the estimate.

UNITED STATES OF AMERICA

General

Common reporting format (CRF) and national inventory report (NIR)

The CRF was provided for 1990 to 1999 and included all requested tables. Notation keys were used widely and appropriately. A NIR was submitted providing information on methodologies, activity data, emission factors, differences compared to previous submissions and uncertainty estimates for all source categories.

Consistency of information between CRF and NIR

The data that were provided using the CRF in electronic format were reproduced in the NIR. The data seem largely consistent, with only two particular inconsistencies noticed - the reporting of fuel combustion from US territories and military fuel use in the NIR and CRF and the CO_2 Reference Approach calculations in the NIR and CRF.

The Party had previously explained these seeming inconsistencies which are associated with local circumstances.

The Party explained further that emissions data for U.S. territories and military fuel use were reported under 1.A.5 Other in the CRF. The U.S. national energy statistical system does not treat territories as part of domestic consumption. Therefore, detailed production and supply statistics are not available for territories like they are for the 50 U.S. States and the District of Columbia. In calculating the U.S. reference approach (see Annex O in NIR), consumption data for U.S. territories is added to the apparent consumption data for the rest of the United States. Because U.S. territories only account for approximately 0.8 percent of U.S. energy consumption and 0.7 percent of U.S. CO_2 emissions from fossil fuel consumption, this lack of detail in calculating emissions for the reference approach is believed to be insignificant. It is acknowledged, however, that quality of energy statistics for U.S. territories is not as high as for the 50 U.S. States and the District of Columbia. Also the NIR does not include separate estimates of domestic (versus international bunker) military fuel use emissions. These emissions are included in the transportation sector emissions in the NIR. The United States will endeavor to provide more transparent reporting in its 2002 inventory submission. Overall, the total emissions data in the NIR and CRF submitted in 2001 are fully consistent.

Time series consistency

Emissions data do not indicate any notable annual fluctuations in national totals. In general there is an increasing trend in the emissions for CO_2, CH_4 and N_20. For example, CO_2 emissions from the Energy Sector rose by 12 percent between 1990 and 1999. Some large annual fluctuations or significant changes in trends are noted below:

The party noted that it is incorrect to state that there is an increasing trend in U.S. emissions of CO_2, CH_4, and N_2O. While U.S. CO_2 emissions rose fairly steadily over the 1990 to 1999 period (13 percent), U.S. CH_4 emissions have overall declined by almost 4 percent over the same period. U.S. N_2O emissions have increased by about 9 percent during the period.

- For CO_2, 1.A.4 Other sectors: emissions rose by 6 percent between 1995 and 1996 and dropped the following year.

The Party explained that the 6 percent increase in CO_2 emissions from fossil fuel consumption from "1.A.4 Other sectors" between 1995 and 1996 is entirely consistent with the normal level of variability in U.S. energy consumption trends. This increase was specifically quantified and discussed in the NIR on pages ES-5 and again on page 1-9 and 1-10 (see www.epa.gov/globalwarming/publications/emissions for final layout version of U.S. inventory). The primary reason for this increase was the onset of colder winter conditions, which drove of heating fuel demand relative to 1995. Again, this type of energy consumption pattern is not unusual in the United States.

- For CO_2, 1.A.5 Other: Emissions reached a sudden peak in 1994 and dropped the following year.

The Party noted that the subjective terms such as "sudden," "sharp," or "very erratic," for example, should be avoided in UNFCCC review reports. The increase in emissions from "1.A.5 other" is primarily a result of difficulties in allocating between domestic and military jet fuel consumption. These allocation difficulties, however, do not effect overall emission estimates.

- For CO_2, 5.LUCF, the net removals decrease sharply by 21 percent between 1992 and 1993.

The Party noted that the trend in CO_2 fluxes from LUCF activities seen in U.S. submitted inventory data is a function of the step changes in U.S. forest flux estimates. These step changes are due to the periodicity of U.S. forest stock inventories, which had been performed every five years. Therefore, in the years when new forest inventories were completed, 1992, and 1997, there is a step change in the estimated flux data for forests. (The same type of periodicity is exhibited with U.S. agricultural soil carbon surveys.) The United States has chosen not to "smooth" out these step changes because such data manipulations would mask the nature of the actual data collected. The United States believes that its detailed forest inventory data provides a reliable and reasonably accurate estimate of forest CO_2 fluxes. The methodology and approach for handling the periodic forest stock data is described in the NIR (page 6-5 through 6-7).

- N_20 emissions from 4.DAgricultural soils fluctuate between the years (1990–1999).

The Party explained that the fluctuations in N_2O emissions from agricultural soils are entirely consistent with U.S. national circumstances. The NIR provides an explanation for these fluctuations with the following statement (page 5-16): "The year-to-year fluctuations are largely a reflection of annual variations in synthetic fertilizer consumption and crop production."

- CH_4 emissions from 4.C Rice cultivation increase by 23 percent from 1990 to 1999.

The Party noted that it did feel that a 23 percent increase emissions of CH_4 from rice cultivation over a 10 year period to be a "significant change in trends." Both the overall trend and the annual fluctuations in emissions are consistent in U.S. rice cultivation statistics, as provided in the CRF and in the NIR (see pages 5-10 through 5-15 in the NIR). In addition, the percentage change in emissions from this source category is not unusual in the United States over this time period.

Comparison with previous submissions

Recalculation tables (Tables 8(a) and 8(b)) were provided in the CRF for inventory years 1990 to 1998. The NIR also contains a section that describes in detail the changes and the magnitude of their effect for each source category through the time series. The largest single category percent changes occurred in wastewater treatment methane emissions, where estimates changed up to +250% and the manure management category for methane, where emission changes ranged from –50% to –60% in the time series. The overall total emissions (excluding LUCF), however, did not change more than -0.6% for any given year.

The Party noted that the section in the NIR on "Changes Since Last Year's Report" provides explanations of the revisions. The most important revision to the estimates related to the inclusion of a partial estimate of emissions from industrial wastewater treatment (i.e., pulp and paper). Previous U.S. inventory submissions had not provided emission estimates of industrial wastewater. The 2002 U.S. inventory submission will provide a further expanded estimate of industrial wastewater emissions. Other significant changes were in emission estimates for CH_4 from manure management, where several changes had been incorporated having an affect on estimates for all years.

QA/QC and verification procedures

No information was available on whether the inventory data was subject to any self-verification or independent review procedures. Table 7 (Overview) of the CRF contains quality indicators for each estimated source, however, the NIR does not provide a description of the quality assurance (QA)/quality control (QC) procedures that were implemented.

The Party explained that the NIR does provide a brief description of the public review process undertaken annually (see Preface in NIR, page ii). The United States is currently developing a detailed QA/QC plan that will include rigorous measures for QC checks and data quality investigations. This plan also includes procedures for uncertainty investigations and careful documentation protocols. The U.S. inventory already undergoes multiple stages of careful quality

control checks as well as separate expert and public reviews; however, this plan will rigorously formalize the existing informal system. Selected informal verification exercises are integrated within the U.S. quality control system.

Key sources

A key source analysis was not provided.

The Party noted that since the submission of its inventory in 2001, it has published a detailed key source analysis. This report is available at www.epa.gov/globalwarming/publications/emissions. An updated analysis will be included with the U.S. submission in 2002.

Uncertainty estimates

A discussion on uncertainty was provided under each emission source category in the NIR, however, many categories did not contain quantified uncertainty estimates. For those that did contain estimates, the estimates were stated to be based on expert judgment or there was no description of how the estimates were derived.

The Party noted that it has a rigorous program underway to implement uncertainty analysis procedures as part of its overall QA/QC plan. The NIR provides extensive discussion of uncertainty for every source category, although preliminary quantified uncertainty estimates are provided for only a few source categories. The United States believes that the primary value from the development of a quantified uncertainty analysis is its use as a QA/QC tool. (In other words, the primary value of an uncertainty analysis is in what is learned while doing it, not necessarily in the actual uncertainty values it produces.) Because of the highly subjective nature of the estimation of uncertainty for national greenhouse gas inventories, it is believed that quantitative uncertainty data is not readily comparable in many cases. Therefore, the United States has embarked on a careful and rigorous process for integrating uncertainty analysis into its QA/QC system that will eventually produce quantified estimates of uncertainty through detailed data quality investigations and methodological re-evaluations over the coming years.

Sector-by-sector findings

ENERGY

Reference approach

Comparison of reference approach with national approach

CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. However, the United States of America did not use Table 1.A(b) of the CRF, but it provided activity data and emission estimates in a separate Excel spreadsheet. According to this additional information for 1999, the reference approach provides an energy total that is 2.1 per cent lower than the sectoral approach and an emissions total for CO_2 that is 0.6 per cent higher compared to the sectoral approach.

Comparison with international data

The additional tables provided by the United States do not allow comparison with the IEA data. The main reasons are:

- No detailed supply data are given for the United States territories. Only the apparent consumption is shown.

The USA provided a comment under Consistency of information between CRF and NIR which is relevant to this statement.

- The definition of ‘other liquids’ seems to be different. ‘Other liquids’ shows production (which implies that primary fuels have been included there).
- ‘Unspecified solid fuels’ does not appear in IEA statistics.

The United States indicated that it will provide complete reference approach tables in the CRF for its 2002 submission by developing weighted average fuel statistics and carbon content values.

Key sources

Fuel combustion

Energy data have been given on a gross calorific value basis. This means that the IEFs are about 5 per cent lower for liquid and solid fuels and about 9-10 per cent lower for gaseous fuels than would have been the case if the data had been given on a net calorific value basis.

Comparison of IEFs will be done between Parties with fuel consumption data expressed in GCV. The values of the CO_2 IEFs for gaseous fuels in all subcategories of stationary combustion (1.A.1, 1A.2, 1.A.3, 1.A.4) are among the lowest across the reporting Parties.

The USA provided the following comment.

The carbon content factors used in the United States inventory are the product of extensive research and analysis and are believed to provide highly reliable estimates of CO_2 emissions from fossil fuel combustion. When adjusted to be in terms of net calorific value, the implied CO_2 emission factor for stationary combustion of gaseous fossil fuels in the United States is approximately 55.6 t/TJ. This value is consistent with other values reported by Annex I Parties, which averaged 56.5 t/TJ with a standard deviation of 1.4 t/TJ. Therefore, the United States CO_2 IEF is within one standard deviation of the average. Detailed documentation related to the derivation of USA carbon content values can be found at: http://www.eia.doe.gov/oiaf/1605/87-92rpt/appa.html.

1.A.1 Energy industries - liquid fuels

- The value of the CO_2 IEF in 1999 (73.8 t/TJ) is the highest across Parties whose fuel consumption data are expressed in GCV.

The USA explained that liquid fuels consumed by energy industries (i.e., electric power industry) in the United States consisted primarily of residual fuel oil, which has a higher carbon content coefficient than most other petroleum-based secondary fuels. Once the CO_2 IEF is corrected to be expressed in NCV, it is fairly consistent with several other Parties (e.g., France, Ireland and Switzerland).

1.A.1 Energy industries - gaseous fuels

- The value of the CO_2 IEF in 1999 (50.0 t/TJ) is the lowest of the Parties whose fuel consumption data are expressed in GCV.

See comments above under key sources.

1.A.3.a Civil aviation (domestic)

- The value of the CO_2 IEF for jet kerosene in 1999 (66.5 t/TJ) is the lowest across Parties whose fuel consumption data are expressed in GCV.
- The value of the CO_2 IEF for aviation gasoline in 1999 (64.9 t/TJ) is the lowest across Parties whose fuel consumption data are expressed in GCV.

The USA provided the following comment, which is relevant to the above two findings.

The carbon content factors used in the USA inventory are the product of extensive research and analysis and are believed to provide highly reliable estimates of CO_2 emissions from fossil fuel combustion. When adjusted to be in terms of net calorific value, the implied CO_2 emission factor for civil aviation combustion of jet fuel and aviation gasoline in the United States is approximately 70.0 and 68.3 t/TJ, respectively. These values are slightly lower than the values reported by other Annex I Parties. Detailed documentation related to the derivation of United States carbon content values can be found at: http://www.eia.doe.gov/oiaf/1605/87-92rpt/appa.html and http://www.eia.doe.gov/oiaf/1605/95report/appa.html.

- The activity data for jet kerosene and aviation gasoline reported in the CRF are lower compared to the data published by the IEA (28 per cent and 14 per cent, respectively).

The USA explained that the jet fuel consumption data employed for the United States inventory is adjusted to account for international bunker fuels as defined by the IPCC inventory guidance.

The data reported to the IEA do not follow this definition, and therefore are expected to differ. The United States is investigating the difference in aviation gasoline data; however, the data reported in the CRF submission is believed to be the most accurate.

1.A.3.d Navigation (domestic)

- The activity data reported in the CRF for residual oil are significantly lower compared to the data published by the IEA.

The USA explained that the residual and distillate fuel consumption data employed for the United States inventory is adjusted to account for international bunker fuels as defined by the IPCC inventory guidance. The data reported to the IEA do not follow this definition and therefore are expected to differ.

Fugitive emissions

1*.B.1a Coal mining and handling - underground mines (mining activities)*

- The value of the CH_4 IEF in 1999 (5.4 kg/t) decreased by 40 per cent compared to its 1990 level (7.8 kg/t).

The USA explained that the IEF for United States methane emissions from coal mining decreased primarily due to the growth in methane recovery for energy. Because IEFs in the CRF are calculated from final emissions (after recovery has been removed), changes in recovery percentages have significant effects on IEFs.

1.B.2 iii, iv, Oil

- The value of the CH_4 IEF for transport of oil in 1999 (2,592.8 kg/mm Bb/year) increased by 6 per cent compared to its 1990 levels (2,435.4 kg/mm Bb/year).
- The value of the CH_4 IEF for refining/storage in 1999 (12,605.7 kg/mm Bb/year) increased by 30 per cent compared to its 1990 levels (9,224.2 kg/mm Bb/year).

The USA explained that the method employed by the United States for estimating methane emissions from petroleum systems is based on a detailed analysis of activities and equipment types in the oil industry. Annual production of crude oil in the United States, due to the large quantity of imported oil, provides only a general measure to compare against transport and refinery-related emissions. Additional documentation of the methodology used for this source category is provided in Annex G of the NIR.

1.B.2.b iii Natural gas

- The value of the CH_4 IEF for transmission in 1999 (99,783.7 kg/bill ft^3/year) decreased by 16 per cent compared to its 1990 levels (118,793.1 kg/bill ft^3/year).

The USA explained that the decrease in methane emissions from natural gas transmission is explained by measures taken by the industry to reduce methane leakage from pipeline-related equipment. Additional documentation of the methodology used for this source category is provided in Annex F of the NIR.

Non-key sources

1.A.3.c Railways - liquid fuels

- The value of the N_2O IEF in 1999 (1.4 kg/t).decreased by 30 per cent from its 1990 level (2.0 kg/t).

The USA explained that the cause of this apparent trend is related to the reporting of activity data for railway fuel consumption. Some of the data sources for non-CO_2 and CO_2 emission estimates differ due to the nature of the source categories. Because only one set of activity data for emission of all greenhouse gases can be entered in the CRF, it appears that the IEFs for some minor transportation categories change over time. The differences between these non-CO_2 and CO_2 activity data sets are being resolved for future inventory submissions.

Bunker fuels
1.A.3.a International aviation: The activity data reported in the CRF for jet kerosene are higher compared to the data published by the IEA (8 per cent).
See comment above under 1.A.3.a Civil aviation (domestic).

1.A.3.d International marine transport: The activity data for residual oil and gas/diesel oil reported in the CRF are lower compared to the data published by the IEA (64 per cent and 152 per cent, respectively).
See comment above under 1.A.3.d Navigation (domestic).

INDUSTRIAL PROCESSES

Key sources
2.C.1 Iron and steel production

- A comparison of the CO_2 IEF with other Parties is difficult since these emissions were reported in the energy sector (aggregated with other energy intensive industries).
- Comparison between CRF activity data for crude steel and UN crude steel data was not possible since activity data were not given (reported as IE). However, pig iron activity data were reported for information purposes only.
The United States explained that in the Industrial Processes chapter, estimates are provided for Iron and Steel Production, Ammonia Manufacture, Ferroalloy Production, and CO_2 from Aluminum Production. These estimates are provided for information purposes only, so as to not incur double counting with the Energy chapter. The treatment of feedstock-related process emissions is discussed in the NIR in the introduction of the Industrial Processes chapter as well as in the discussion of the methodology of each of the individual source categories listed above. The United States is currently undertaking an extensive project to develop new methodologies for accounting for non-energy feedstocks that may provide useful input for the next revision to the IPCC guidelines. The 2002 submission of the U.S. inventory estimates these feedstock-related process emissions as separate source categories and removed them from the Energy chapter estimates.

2.F Consumption of halocarbons and SF_6 – HFCs, PFCs

- Relative changes in potential and actual HFCs emissions from 1990 to 1996 have been very erratic.
The Party explained that the variability seen in the U.S. potential/actual ratio data occurs because actual emissions are equal to the sum of emissions from the production and the consumption of halocarbons, while potential emissions are only calculated from the consumption of halocarbons (i.e., HFC-23 emissions from HCFC-22 production are excluded). In earlier years, emissions from HFC-23 from HCFC-22 production were the only significant source of emissions; consequently, actual emissions (which included this HFC-23) were greater than potential emissions (which excluded this HFC-23). In later years, this changes as emissions from ODS substitutes rapidly increase (while HCFC-22 production remains relatively stagnant), therefore changing the ratio of potential to actual emissions on a yearly basis. This is demonstrated in the graph below.
- From 1990 to 1992 the activity data for HFC23 and CF_4 use in fire extinguishers (2.F.3) were not provided (reported as IE).
The United States explained that the activity data for HFC-23 and CF_4 is reported as zero, not as IE in the U.S. CRF submission (see rows D and J of Table 2.(II).F). This field may have been more accurately reported as "Not Occurring".
- Activity data for HFC236fa use in fire extinguishers was not provided (reported as IE).
The Party explained that the activity data for HFC-236fa is reported as zero, not as IE in the

U.S. CRF submission. This field may have been more accurately reported as "Not Occurring".

- For reasons of confidentiality activity data for HFC410mee use in solvent (2.F.5) were not provided (reported as C).
- Activity data for use of SF_6 in electrical equipment was not provided for reasons of confidentiality (reported as C).
  The United States explained that it did not use information on the quantity of SF_6 in electrical equipment (banked gas) to estimate SF_6 emissions from electrical equipment. This information was not available. Instead, the estimates were based on the estimated 1994 U.S. production capacity for SF_6 and a series of assumptions regarding the percentage of capacity that was utilized, the percentage of SF_6 manufactured that was sold to the electrical equipment sector, and the fraction of the SF_6 sold to the electrical equipment sector that replaced emitted gas.
- The HFC-152a, HFC-227ea, and PFC/PFPE emissions have been aggregated and listed in terms of HFC-23 equivalents under "other".
  The Party stated that this is not correct and that emissions were actually aggregated as HFC-41 equivalents under "8 Other," as is noted in the documentation box of Table 2(II).F sheet 2.
- In 1999 only actual emissions of PFCs were reported, hence the potential/actual emissions ratios could not be determined.
  The United States explained that in all years of the U.S. CRF submission only actual emissions of PFCs from semiconductor manufacture were reported. In semiconductor manufacturing process, the gases used may be destroyed or transformed into other gases. Therefore, the United States does not consider the concept of potential emissions to be applicable to this source category because the original consumption of PFCs may not reflect the final compounds emitted. This issue is discussed in the NIR on page 3-31.

2.C.3 Aluminium production – PFCs

- C_2F_6 emissions decreased by 12.7% from 1990 to 1991, by 19.9% from 1992 to 1993 and 19.9% from 1993 to 1994.
- CF_4 emissions decreased by 10.3% from 1990 to 1991, 13.3% from 1992 to 1993 and 17.6 from 1993 to 1994.
  The United States explained that it believes that its estimates of C_2F_6 and CF_4 emissions from aluminium production are reasonably accurate. Emission factors for both C_2F_6 and CF_4 from aluminium smelting have declined by approximately 50 percent over the last 10 years, with some year-to-year changes exceeding 10 percent.
- The ratio of IEF CF_4 to IEF C_2F_6 has increased from 9.399 in 1990 to 11.955 in 1999.
  The Party explained that for most smelters in the United States, smelter-specific emission factors for both CF_4 and C_2F_6 were used. The ratio of emitted CF_4 to emitted C_2F_6 varies depending upon smelting technology. As these technologies have changed over time, so has the ratio between emitted CF_4 and emitted C_2F_6.

2.F.8. Other consumption of halocarbons and SF_6

- Activity data for HFC134a (Other - 2.F.8) were not reported from 1990 to 1992.
  The United States explained that the activity data for HFC-134a is reported as zero, not as IE in the U.S. CRF submission (See rows D and J of Table 2.F.8). This field may have been more accurately reported as "Not Occurring".

2.B.3 Adipic acid production

- IEF for N_2O is the lowest among reporting Parties from 1990 to 1998.
  The United States explained that emissions abatement technologies have been installed at U.S. adipic acid plants, leading to significant emission reductions. The IEF reported by the United States is consistent with this practice. For additional discussion see pages 3-18 through 3-20 in the NIR.

- N_2O emissions increased by 23% from 23.4 Gg in 1998 to 28.9 Gg in 1999.

Non-key sources

2.A.7.1 Glass production

- Emissions were not estimated (NE). It was noted in the completeness table that emissions were not estimated due to difficulties in obtaining data, however, inclusion in the future would be investigated.
  The Party explained that emissions related to limestone and dolomite use for glass making were estimated and are included under 2.A.3. These estimates are documented on page 3-8 of the NIR. A more appropriate notation would have been "NA" rather than "NE".

SOLVENT AND OTHER PRODUCT USE

Non-key source

3.A. Paint application

- CO_2, N_2O and NMVOC emissions were not provided (reported as NE). It was noted in the completeness table that emissions were not estimated due to difficulties in obtaining data, however, inclusion in the future would be investigated.
  The United States explained that NMVOC emissions related to paint application and chemical products, manufacture and processing (3.C) were estimated and are included under 3.D. These estimates are documented on page 4-1 of the NIR. A more appropriate notation would have been "IE" rather than "NE".

3.B. Degreasing and dry cleaning

- No activity data was provided, however, NMVOC emissions were estimated.
  The United States explained that its estimates of ambient air pollutant emissions (CO, NO_X, and NMVOCs) are based on detailed facility, activity, and regional-specific methodologies, and therefore do not use aggregate activity data for the purpose of estimation.
- CO_2, emissions were not provided (reported as NE). It was noted in the completeness table that emissions were not estimated due to difficulties in obtaining data, however, inclusion in the future would be investigated.
  The Party explained that it will be reporting detailed accounting of indirect CO_2 emissions related to the atmospheric oxidation of CH_4, CO, and NMVOCs in its 2002 inventory submission.

3.D. Other

No activity data was provided, though NMVOC emissions for graphics, surface coating and aggregated NMVOC emissions for other industrial and non-industrial uses of solvent were reported.
The United States explained that its estimates of ambient air pollutant emissions (CO, NO_X, and NMVOCs) are based on detailed facility, activity, and regional-specific methodologies, and therefore do not use aggregate activity data for the purpose of estimation.

AGRICULTURE

Source category 4.E Prescribed burning of savannas was reported as not occurring (NO).

Key sources

4.A. Enteric fermentation – CH_4

- CH_4-IEF. CH_4-IEF for dairy cattle is relatively low compared to IPCC default for North America (94.7 versus 118 kg CH_4/hd/yr), while CH_4-IEF for non-dairy cattle seems high compared to the

same reference (68 versus 47 kg CH_4/hd/yr). These values changed considerably compared to those of the 2000 inventory submission.
In its responses to review stages of the 2000 inventory submission, the United States explained that since the inventory submitted in 2000, the methodology used for enteric fermentation had improved; for example, an enhanced population characterization method for cattle resulted in a drop in the IEF from 156.9 to 94.7 kg CH_4/hd/yr for dairy cattle.

- Trends in IEF. CH_4 IEF for dairy and non-dairy cattle decreased by 2.1 and 4.9%, respectively from 1990 to 1999, with annual fluctuations of –4 per cent in some years (dairy cattle).
- Trend in emissions. CH_4 emissions from sheep decreased by 36.5% from 1990 to 1999.

4.D. Agricultural soils

IPCC default method and emission factors were used to estimate N_2O emissions from agricultural soils.

4.D.1 Direct soil emissions and 4.D.3 indirect N_2O emissions from soils
4.D.2 Animal production, N_2O
(This source has been identified as key only according to the trend assessment)

- N_2O-IEF. IEF for crop residues is by far the highest value compared to the rest of the Parties' values (higher by a factor of 10); IEF for N-fixing crops is among the lower values compared to those of other Parties.
  The United States explained that it is investigating the reporting of activity data for crop residues, but it believes that submitted emission estimates are accurate.[1]
- Fractions used to estimate N_2O emissions from agricultural soils –The FracR (fraction of crop residue removed from the field as crop) is reported to be 0.
  The United States explained that it did report zero (0) for the FracR values because there are no residues removed as crop product. This value may have more appropriately been reported as "NO." Additionally, the current definition in the CRF is inconsistent with the definition of crop products, which cannot be residues. The United States believes that this definition problem was solved in the good practice guidance and similar changes should be made in the CRF.
- Activity data for pasture range and paddock. N excretion value is slightly lower than the corresponding value in table 4.B(b) (total N excretion for AWMS pasture range and paddock).
  The United States explained that it had identified reporting errors in this field of its CRF submission. For selected years, values were entered incorrectly (e.g., the 1990 value is actually the 1991 value, etc.). These errors, however, did not have any effect on reported emissions and reported IEFs were insignificantly affected. The proper values were used in estimating emissions for the NIR and emissions reported in the CRF.

4.B. Manure management – CH_4
(This source has been identified as key only according to the trend assessment)

- Trends in CH_4-IEF. The IEF for dairy cattle increased by 52.6% from 1990 to 1999 (from 29.8 to 45.5 kg CH_4/hd/yr) with annual increases of more than 5 per cent in some years. IEF for swine increased by 22.8% within that period, also with annual increases of more than 5 per cent in some years.
  The United States explained that these increases in the IEFs for both dairy cattle and swine between 1990 and 1999 are due primarily to the shift to larger management facilities for these animals over the period. In shifting to more concentrated and larger operations, there was a corresponding shift to more liquid-based waste management systems for these animals. These

[1] The United States further noted the following regarding table 4.D: ***The calculation of the IEF for N_2O from agricultural soils is complicated due to the fact that the CRF asks for the data in units of dry biomass, rather than requesting crop residue and N-fixing crops in units of nitrogen, as is requested in the IPCC good practice equation. As a result, the IEF will not calculate out to the actual emission factor utilized (i.e., it should end up being about 0.01, which is the default EF provided by IPCC for nitrogen applied to soils).***

liquid systems produce more methane than the 'dry' systems they replace. This shift in management systems is described in the NIR (see page 5-5). A secondary reason for the increase in the dairy cattle IEF is that milk production increased over the period, while dairy cow populations decreased (i.e., increased productivity). The result has been more waste excreted by fewer cows, thus increasing the per head IEF.

- Activity data. Population size data reported in tables 4.B(a) and (b) for manure management differ from those reported in table 4.A for enteric fermentation, particularly in the case of non-dairy cattle, for which activity data was 26 per cent lower in table 4.B compared to table 4.A. ***The difference in population for non-dairy cattle as reported in Tables 4.A and 4.B(a) is due the fact that calves (age 0-6 months) are not included in the enteric fermentation inventory, but are included in the manure management inventory. In the enteric fermentation simulation model used for the inventory, calves of 0-6 months are not included in the inventory since most of the feed energy consumed prior to weaning is derived from milk that is not fermented in the rumen. However, these calves do produce manure and are, therefore, included in the manure management inventory. The population of calves of 0-6 months (23,000) is approximately 26 percent of the total non-dairy cattle population reported under the manure management inventory (which accounts for the 26% difference cited in the S&A review for this item). When reviewing these categories, it is suggested that reviewers check that the totals of cattle populations between the enteric and manure categories are not equal, since the young calves should not be included in the enteric fermentation inventory (depending upon the methodology employed by the Party).***

Non-key sources

4.B. Manure management – N_2O

- N_2O-IEF. IEF for anaerobic lagoons is higher compared to other Parties' values. This value dropped considerably as compared to the 2000 submission; for liquid systems and "other" AWMS N_2O IEFs are also among the higher values.
  In relation to the IEF for anaerobic lagoons, the United States explained in its responses to review stages of the 2000 inventory submission that, as a result of improvements in the methodology for manure management since the inventory submitted in 2000 (revision of swine population characterization, waste characteristics and typical animal mass data) the IEF for anaerobic lagoons dropped from 0.785 to 0.006 kg N_2O-N/kg N.
- N excretion rates. For all livestock types the N excretion rates were relatively low compared to the IPCC default values for North America, particularly for sheep and swine, which were also among the lowest among Parties (84.1 versus 100 for dairy cattle, 48.1 versus 70 for non-dairy cattle, 4.1 versus 16 for sheep, and 7.1 versus 20 kg N/hd/yr for swine). These values were considerably lower than those reported in the 2000 inventory submission, particularly in the case of cattle and swine.
  In its responses to review stages of the 2000 inventory submission, the United States explained that as a result of improvements in the methodology for manure management since the inventory submitted in 2000, the N excretion rate for dairy cattle has dropped from 420 to 84 kg N/hd/yr and for swine from 113 to 7.1 kg N/hd/yr.
- Trends in N_2O-IEF. The IEFs for anaerobic lagoons and liquid systems declined from 1990 to 1999 by 19 and 11 per cent, respectively.

4.F. Field burning of agricultural residues – CH_4 and N_2O

Trends in emissions. Annual fluctuations of around 20 per cent or more in CH_4 emissions from 1991 to 1992 (+18%), from 1992 to 1993 (-20%), from 1993 to 1994 (+34%), and from 1994 to 1995 (-18%). There is an annual increase of 34 per cent in N_2O emissions from 1993 to 1994.

The United States explained the fluctuations in emissions from this source category as being due to changes in crop production over time. In the future the United States will attempt to better explain the reason behind emission trends in the NIR.

LAND-USE CHANGE AND FORESTRY

Overview

- The USA applied a country-specific approach, including carbon flux modelling, to estimate CO_2 emissions and removals from 5.A. (Changes in Forest and Other Woody Biomass Stocks) for temperate forest and harvested wood, from 5.D. (CO_2 emissions/removals from soils) for cultivation of organic soils and from 5.E. (Others) for landfilling
- IPCC default method and emission factors were applied for liming of agricultural soils.
- No estimates of non-CO_2 gas emissions were provided.
- Net removals show some large annual changes: +23.9% for 1991/92 and –21.1% for 1992/93.
  The Party explained that the methodology for estimating LUCF fluxes takes a stock approach where both emissions and removals are implicitly accounted for. The "inventories" performed to estimate these stocks are completed only every few years and the United States currently does not "smooth" out the step-changes in fluxes following carbon stock inventory years.
- Gross emissions did not change between 1996 and 1997 (reported to be 31300 Mt C)

5.A. Changes in forest and other woody biomass stocks

- No activity data and emission factors were provided.

5.D. CO_2 emissions/removals from soils

- No activity data and emission factors were provided.
- CO_2 emissions were the same for 1995 and 1996.

5.E. Others

- No activity data and emission factors were provided.
- Some annual changes were just over 10%.

The United States explained that the reporting fields in the CRF are not applicable to its methodology; however, it expressed its intention to further disaggregate the values from the models used to develop LUCF estimates, and report them in future CRF submissions.

WASTE

Key sources

6.A. Solid waste disposal on land

- CH_4 IEF from managed waste disposal on land (28.87 t/t in 1999) appeared to be the highest amongst reporting Parties.
- Annual kg CH_4 emissions per capita is the highest amongst reporting Parties (37.48kg/capita).

The Party expressed the belief that its methodology for estimating landfill methane emissions was reasonably accurate. The method relied on a detailed landfill population characterization and methane recovery statistics. Because solid waste disposal regulations are stringent in the United States, conditions for methane formation may be more favourable than in other countries.

6.C. Waste incineration

- No activity data for biogenic waste incinerated was provided (reported as NE).

The Party replied that the relevant waste statistics were provided for nonbiogenic materials for CO_2 emission estimates, and total municipal solid waste (MSW) statistics (both biogenic and nonbiogenic) were provided for N_2O emission estimates. The United States incorrectly reported

total MSW under "plastics and other nonbiogenic" but this did not affect emission calculations or reported IEFs.

- Hazardous waste incinerated was not provided (reported as NE).

The response from the Party indicated that the methodology used to estimate CO_2 emissions from hazardous waste combustion used detailed waste characterization and management statistics, and therefore it was difficult to report an overall waste combustion activity data value.

- Recalculated differences in CO_2 emissions from waste incineration appear very high, increasing from 69.86% in 1990 to as high as 108.35 % in 1996. Actual CO_2 emissions for 1998 were 12,888.99 Gg in the 2000 submission, and equalled 25,144.7 Gg after recalculation.

The United States replied that changes to the emission estimate reported by the United States for waste combustion are discussed and documented in the NIR (on page xxiii). The waste combustion section of the waste chapter has been revised substantially. Formerly, only CO_2 emissions from the combustion of plastics and N_2O emissions from municipal solid waste were included. Carbon dioxide from the combustion of tyres, synthetic rubber, synthetic fabrics and hazardous waste have been added. These updates have increased the average emissions from waste combustion by 10.5 Tg CO_2 eq. (91.5 percent) for 1990 through 1998.

Non-key sources

6.B. Wastewater handling

- Emissions from industrial wastewater were not calculated due to lack of adequate data (reported as NE).

The Party replied that the emissions from industrial wastewater handling were discussed in the NIR (see page S-6). The United States inventory submission in 2002 would include an estimate of industrial wastewater emissions.

On the methodological approach related to this issue the United States noted the following. Methane (CH_4) may be produced during the biodegradation of organics in wastewater if other suitable electron-acceptors (i.e. oxygen, nitrate or sulphate) besides CO_2 are unavailable. Such conditions are called methanogenic. Methane produced from domestic wastewater treatment plants is accounted for in the waste chapter. These emissions are estimated by assuming an average five-day biological oxygen demand (BOD_5) per capita contribution in conjunction with the approximation that 15 percent of wastewater's BOD_5 is removed under methanogenic conditions. This method itself needs refinement. It is not clear if industrial wastewater sent to domestic wastewater treatment plants, which may contain biodegradable material, is accounted for in the average BOD_5 per capita method when this wastewater is sent to domestic wastewater treatment plants. Additionally, CH_4 emissions from methanogenic processes at industrial wastewater treatment plants are not currently estimated. Further research and methodological development is needed if these emissions are to be accurately estimated. (See Wastewater Treatment in the Waste chapter.)

- Protein consumption (kg protein/person/yr) is the highest among reporting Parties (41.975kg/person/yr for 1999)
- N_2O IEF for human sewage (kg N_2O -N/kg-N) is the lowest among Parties that provided numerical data.

The Party noted that the IEF for N_2O from human sewage reported by the United States in its CRF submission is equal to the IPCC default value.