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SYNTHESIS AND ASSESSMENT REPORT OF GREENHOUSE GAS (GHG) INVENTORIES SUBMITTED IN 2000[1]

Note by the secretariat

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[1] In the document symbol, 2000 refers to the year the inventories were submitted and not to the year of publication.

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I. INTRODUCTION

A. Mandate

1. The Conference of the Parties (COP), at its fifth session, 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] (hereinafter referred to as "the review guidelines"), for a trial period covering inventory submissions due in 2000 and 2001 (FCCC/CP/1999/6/Add.1).

2. At the same session, 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] (hereinafter referred to as "the reporting guidelines") (FCCC/CP/1999/6/Add.1). 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]

[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 (CRF), 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 IPCC.

3. By its decision 6/CP.5, the COP requested the secretariat to conduct 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 United Nations Framework Convention on Climate Change (UNFCCC) web site as a synthesis and assessment report, divided into two sections and an addendum. The first section will provide information allowing comparisons across Annex I Parties and describe common methodological issues. The second section will 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. The addendum will contain 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 the second section of the synthesis and assessment report, covering the national GHG inventories submitted in 2000 by those Annex I Parties that used the common reporting format (CRF) in accordance with the reporting guidelines. The report presently does not contain an addendum. However, inventory data, in tabular and graphical format, were prepared by the secretariat using the submissions of Parties for the year 2000 and were published in documents FCCC/SBI/2000/11[4] and FCCC/SBI/2000/INF.13.[5] These documents can be regarded as a substitute for the addendum to this report.

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.

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. These 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 secretariat hopes that the synthesis assessment of GHG inventories will 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.

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[4] See also FCCC/SBI/2000/11/Corr.1and 2.

[5] These documents contain information from all Annex I Parties that submitted inventories in the year 2000, no matter whether they reported the inventory data using the CRF or not.

C. Possible action by Parties

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

D. Approach

10. The analysis of the inventory data was done according to the sectors, sub-sectors 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, hereinafter referred to as the IPCC Guidelines. For the land-use change and forestry sector, tables for comparing data across Parties were not included in section I of this report due to limited disaggregated data reported by Parties. Any comments on this sector were incorporated in section II for each Party individually.

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, applying the Tier 1 level 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 sector land-use change and forestry has not been included in the calculation of the key source calculations.[8] For the purpose of this report, no other criteria for identifying *key sources* as described in the IPCC good practice guidance, such as trend assessment, have been considered. Such an assessment would only have been possible for a very limited number of Parties that, in addition to the 1998 CRF, had also provided information according to the entire CRF for 1990.

E. Limitations on this first synthesis and assessment report

12. The completeness and the scope of this report are affected by the fact that only 23 out of 40 Annex I Parties submitted their inventory using the CRF and by the limited information provided by many of these Parties using the CRF for the first time (see page 9 of this report).[9]

13. Generally, in section II of the report, more issues were identified, compared for those Parties that provide a more complete inventory submission to those Parties that provide less data. This does not mean that the quality of the submissions was lower the more issues were identified that required clarification. Quite the opposite, the information provided in this report to the expert review teams for performing their tasks will be more useful for the review of the inventory data of those Parties that provided more complete data.

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[6] Chapter 7 "Methodological choice and recalculation" of the IPCC Good Practice Guidance and Uncertainty Management, hereinafter referred to as the IPCC good practice guidance.

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

[8] Emissions and removals associated with carbon stocks in land-use, land-use change and forestry were not addressed in the current report of the IPCC good practice guidance. A separate IPCC report on good practice for this sector is planned.

[9] It should, however, be noted that the reporting guidelines were adopted in November 1999 when most Parties were already in the process of preparing their 2000 submission. It is expected that Parties provide more complete information in their 2001 submissions due to the fact they will have adequate time to prepare them and will have acquired experience in the use of the reporting guidelines and the CRF.

Phase I of the synthesis and assessment

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 data management and processing tools are still under development.[10]

15. During the first phase of the synthesis and assessment, which took place from 19 February to 3 March 2001, the secretariat compiled the information provided by Parties using the CRF and elaborated a proposal for the synthesis and assessment report. This included a preliminary draft of section I of the synthesis and assessment report, that consisted of a set of data tables to allow comparison of inventory information across Parties, and a preliminary country-by-country analysis for section II of the report.

16. For *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 (UN), International Energy Agency (IEA), and Food and Agriculture Organization (FAO) statistics. An assessment of emissions trends and implied emission factors from 1990 to 1998 was performed, where possible. Furthermore, the inventory data submitted in 2000 were compared with data in previous inventory submissions. Where possible, the national inventory report, or any other accompanying textual information, were used to assess the consistency of the provided information. Specific data checks were also carried out to verify the consistency of the reported data, detect omissions and other problems related to an inappropriate use of the CRF.

Phase II of the synthesis and assessment

17. The second phase of the synthesis and assessment exercise took place from 5 to 9 March 2001 in Bonn, with the participation of six national inventory experts from the roster of experts and one expert from an international organization. The experts invited were Michael Gillenwater (United States), Alexander Nakhutin (Russian Federation), Todd Ngara (Zimbabwe), Jos Olivier (Netherlands), Newton Paciornik (Brazil), Kristin Rypdal (Norway) and Karen Treanton (International Energy Agency). They had been selected according to their expertise in inventory preparation taking into account geographical balance.

[10] It is possible that some errors may have creeped into the data compilations provided in section I of this report, despite various checking procedures put in place by the secretariat.

18. The main task of the experts consisted in assisting 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 outline and the content of the preliminary draft of section I of the synthesis and assessment report; and

(b) The findings of potential problems included 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 23 inventory submissions for their specific sector in order to perform the above-mentioned task, they assessed to what extent specific data comparisons of section I of the report were useful and feasible for the identification of specific potential inventory issues, and, consequently, 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. Inputs received during the second phase of the synthesis and assessment have been taken into account in this report to the extent this was possible. Some suggestions that were not taken into account due to time constraints will be considered for the synthesis and assessment of the 2001 inventory submissions.

21. Section I of the draft synthesis and assessment report was sent to Parties for their comments, together with the corresponding preliminary findings on the individual Party's GHG inventory (section II). Fourteen Parties (Australia, Austria, Canada, Czech Republic, Hungary, Japan, Latvia, Netherlands, New Zealand, Norway, 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 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.

22. For those Parties whose GHG inventory was subject to an individual review,[11] the answers to the preliminary findings were provided to the experts review teams for their consideration.

[11] Parties whose GHG inventory submitted in 2000 was subject to an individual review using various approaches were: Australia (centralised and in-country), Canada (centralised), Hungary (centralised), Japan (centralised), Netherlands (desk and centralised), New Zealand (desk, centralised and in-country), United Kingdom (in-country), and the United States of America (desk and in-country).

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 (GHG) inventory information, compiled in tabular format, from the 23 Annex I Parties, hereinafter referred to as Parties that provided information in the common reporting format (CRF) as part of their annual inventory submission in 2000. 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 23 Parties and for all years in the period 1990 to 1998. For some sectors/categories, however, trend comparisons across all Parties were not possible due to the lack of data for some or all of these years (see section on status of reporting inventories in the year 2000, page 9).

Some of the tables indicate whether a source category is a key source, in terms of its absolute level of emissions, as calculated by the secretariat in accordance with the definitions given in Chapter 7 of the IPCC good practice guidance[12] for the Tier 1 level assessment.[13] This is indicated by an "L" for level in the columns 'key source'. 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

[12] Good practice guidance refers to the IPCC report "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories".

[13] Emissions and removals from land-use change and forestry have not been included in the calculations for the identification of key sources.

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.

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:		Emission factors:	
D	IPCC default	D	IPCC Default
RA	Reference approach	C	CORINAIR
T1	IPCC Tier 1	CS	Country Specific
T1a, T1b, T1c	IPCC Tier 1a, Tier 1b, and Tier 1c, respectively	PS	Plant Specific
		M	Model
T2	IPCC Tier 2		
T3	IPCC Tier 3		
C	CORINAIR		
CS	Country 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-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	megatonnes (10^{12} grams)
TJ	Terajoule (10^{12} joules)
PJ	Petajoule (10^{15} joules)
Gg CO_2 equ	Gg of CO_2 equivalent
ha	hectare

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)

2. Status of reporting GHG inventories in the year 2000

Inventories from Annex I Parties submitted in 2000 in accordance with decision 3/CP.5

- Parties that have submitted their inventories using the CRF were:

Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Netherlands, New Zealand, Norway, Slovakia, Spain, Sweden, Switzerland, the United Kingdom and the United States of America.

Table 1. Status of reporting inventories in the CRF:[14]

Reporting	Parties
Parties that have submitted complete inventories using the CRF for all years (1990-1998)	❑ Australia ❑ Japan ❑ New Zealand ❑ United Kingdom ❑ USA
Parties that have submitted complete inventories using the CRF for one or more years	❑ Austria (1998, all tables) ❑ Bulgaria (1998, all tables) ❑ Canada (1990 and 1998, all tables) ❑ Czech Republic (1998, almost all tables) ❑ Finland (1990 and 1998, all tables) ❑ Greece (1998, all tables) ❑ Hungary (1998, all tables) ❑ Ireland (1998, all tables) ❑ Norway (1998, almost all tables) ❑ Slovakia (1998, almost all tables) ❑ Sweden (1998, almost all tables) ❑ Switzerland (1998, all tables)
Parties that have submitted partial inventory data using the CRF for one or more years	❑ Belgium (1995-1998, limited number of tables) ❑ Greece (1990-1997, limited number of tables) ❑ Italy (1998, approximately two-thirds of all tables) ❑ Latvia[15] (1998, more than two-thirds of all tables) ❑ Lithuania (1998, approximately two-thirds of all tables) ❑ Netherlands (1990-1998, not all sectoral background data tables) ❑ Spain (1990-1998, limited number of tables) ❑ European Community (1990-1998, Summary tables)

- ❑ Parties that submitted a GHG inventory in 2000 but did not use the CRF were: Denmark, European Community[16], France, Germany, Iceland, Monaco, Poland, Portugal and the Russian Federation.

- ❑ Parties that did not submit an inventory in 2000 were: Croatia, Estonia, Liechtenstein, Luxembourg, Romania, Slovenia and the Ukraine.

[14] CRF tables provided by each Party can be found in the status reports on the UNFCCC secretariat web site: http://www.unfccc.int/resource/ghg/statrep2000.html

[15] In the initial inventory submission of Latvia approximately half of the tables of the CRF were reported. After receiving the draft synthesis and assessment report, Latvia submitted a revised version of the CRF for 1998, which includes corrections to the initially submitted data and shows a higher degree of completeness as for number of tables reported. It should however be noted, that information and data presented in section I of the synthesis and assessment report refers to the CRF as originally submitted. In the preliminary findings on individual national GHG inventories (section II) the revised CRF has been taken into account, as appropriate.

[16] The European Community, however, provided summary tables in the CRF.

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

Reporting	Parties	Description
Parties that provided a NIR[17]	Australia	The report includes worksheets with activity data, emission factors and other parameters used for the calculation of emission estimates, and uncertainty estimates for all sectors. In addition, methodological supplements, including modifications and additions to previously published workbooks for fuel combustion activities, fugitive fuel emissions and waste, have been provided.
	Canada	The report provides information on methodologies, activity data and emission factors used for all source categories. In addition, uncertainty estimates (rounding protocol), verification and QA/QC procedures used are described.
	Greece	The report provides information on methodologies, activity data and emission factors used for some source categories and information on differences compared to previous submissions. Although estimates of emissions and removals from the Land-Use Change and Forestry sector have not been reported in the CRF, preliminary data from this sector are provided in the report.
	Netherlands	The report provides partial information on overall uncertainty estimates and on differences compared to previous submissions.
	New Zealand	The report provides information on methodologies, activity data, emission factors, differences compared to previous submissions and uncertainty estimates in the calculations for all source categories.
	Norway	The report provides a description of verification procedures and general information on methods used. References to methodologies, emission factors, activity data and measurements are included.
	United Kingdom	The report provides information on methodologies, activity data, emission factors, differences compared to previous submissions and uncertainty estimates in the calculations for all source categories.
	United States	The report provides information on methodologies, activity data, emission factors, differences compared to previous submissions and uncertainty estimates for all source categories.
Parties that did not provide a NIR, but provided additional information	Austria	Methods used and activity data have briefly been indicated.
	Finland	A brief description of the methodologies used for the compilation of the inventory has been provided. (The secretariat was informed that a NIR will be submitted together with the GHG inventory for 1999).
	Hungary	General information on methodologies, sources of activity data and emission factors for all sectors has been provided. In addition, differences compared to previous inventory submissions and problematic elements in compiling the inventory have been discussed.

[17] 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, pages 11–12, paragraphs 32-34).

	Ireland	Explanation of the major changes made in the inventory since the previous submission (1998).
	Spain	Explanatory notes to the CRF, including information on "forest and other woody biomass stocks," and basic calculations for this category have been provided.
	Sweden	Additional information on methodologies, activity data and emission factors used for fuel combustion has been provided.
Parties that did not submit any information in addition to that in the CRF	Belgium Bulgaria Czech Republic Italy Japan Latvia Lithuania Slovakia Switzerland	

For details regarding the degree of completeness and the timeliness in reporting please refer to the Status reports on the UNFCCC web site:
http://www.unfccc.int/resource/ghg/statrep2000. html

3. Summary of key sources

Table 3. Summary of key sources – Tier 1 level assessment (disaggregation level of sources as recommended in IPCC Good Practice Guidance)

Note that Belgium, Latvia and Spain are not included in this table because data from these Parties were not reported with the necessary level of detail as to allow the identification of key sources according to the level of disaggregation recommended by the IPCC Good Practice Guidance.

Source	GHG	Parties	Total Parties
Mobile combustion - Road vehicles	CO_2	Australia, Austria, Bulgaria, Canada, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Japan, Lithuania, Netherlands, New Zealand, Norway, Slovakia Sweden, Switzerland, United Kingdom, United States	20
CH_4 from Enteric Fermentation in Domestic Livestock	CH_4	Australia, Austria, Bulgaria, Canada, Czech Republic, Finland ,Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, New Zealand, Norway, Slovakia, Sweden, Switzerland, United Kingdom, United States	19 (all except Japan)
CO_2 Stationary combustion - gas	CO_2	Australia, Austria, Bulgaria, Canada, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Japan, Lithuania, New Zealand, Norway, Slovakia, Sweden, Switzerland, United Kingdom, United States	19 (all except Netherlands)
CO_2 Stationary combustion - oil	CO_2	Australia, Austria, Bulgaria, Canada, Czech Republic, Finland Greece, Hungary, Ireland, Italy, Japan, Lithuania, New Zealand, Norway, Slovakia, Sweden, Switzerland, United Kingdom, United States	19 (all except Netherlands)
CH_4 from Solid Waste Disposal Sites	CH_4	Australia, Austria, Bulgaria, Canada, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, New Zealand, Norway, Slovakia, Sweden, Switzerland, United Kingdom, United States	19 (all except Japan)
CO_2 Stationary combustion - coal	CO_2	Australia, Austria, Bulgaria, Canada, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Japan, Lithuania, New Zealand, Norway, Slovakia, Sweden, United Kingdom, United States	18 (all except Netherlands and Switzerland)
Agricultural soils - Direct N_2O emissions	N_2O	Australia, Bulgaria, Canada, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Lithuania, New Zealand, Norway, Slovakia, Sweden, Switzerland, United Kingdom, United States	17 (all except Austria, Japan, Netherlands)
CO_2 from Cement production	CO_2	Austria, Bulgaria, Canada, Czech, Republic, Finland, Greece, Hungary, Ireland, Italy, Lithuania, Norway, Slovakia, Sweden, Switzerland, United Kingdom	15
Agricultural soils - Indirect N_2O from Nitrogen used in Agriculture	N_2O	Bulgaria, Canada, Czech Republic, Finland, Hungary, Ireland, Italy, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States	13
Fugitive emissions: oil and gas operations	CH_4	Australia, Bulgaria, Canada, Hungary, Italy, Lithuania, Netherlands, Norway, Slovakia, United Kingdom, United States	11
Fugitive emissions: coal mining and handling	CH_4	Australia, Bulgaria, Czech Republic, Hungary, New Zealand, Slovakia, United Kingdom, United States	8

Source	GHG	Parties	Total Parties
Mobile combustion - aircraft	CO_2	Australia, Canada, Finland, Greece, New Zealand, Norway, Sweden, United States	8
Agricultural soils - Animal Production	N_2O	Australia, Greece, Ireland, Italy, New Zealand, Sweden, United Kingdom	7
Mobile combustion - Road vehicles	N_2O	Austria , Canada, Italy , Sweden, Switzerland, United Kingdom, United States	7
N_2O from Nitric Acid production	N_2O	Bulgaria, Czech Republic, Finland, Ireland, Lithuania, Norway, Sweden	7
Mobile combustion - Other Transportation	CO_2	Bulgaria, Canada, Finland, Netherlands, Norway, Sweden, United States	7
Fugitive emissions: oil and gas operations	CO_2	Australia, Austria, Canada, New Zealand, Norway, United Kingdom	6
CH_4 from Manure Management	CH_4	Austria, Canada, Hungary, Ireland, Italy, United States	6
CO_2 Stationary combustion - Other Fuels	CO_2	Finland, Italy, Netherlands, Slovakia, Sweden, Switzerland	6
CO_2 from Iron and Steel industry	CO_2	Austria, Bulgaria, Canada, New Zealand, United Kingdom, United States [b]	6
Mobile combustion-waterborne navigation	CO_2	Greece, Japan, Norway, Sweden, United States	5
Wastewater handling	CH_4	Bulgaria, Hungary, Italy, Slovakia	4
N_2O from Manure Management	N_2O	Canada, Italy, Sweden, Switzerland	4
Consumption of Halocarbons and SF6 (aggregate)	HFCs	Austria, Japan (P), Netherlands [a], Sweden (P)	4
Limestone and Dolomite Use	CO_2	Japan, Lithuania, Slovakia	3
Waste Incineration	CO_2	Hungary, Japan, Switzerland	3
N_2O from Adipic Acid production	N_2O	Canada, Italy, United Kingdom	3
Ammonia production	CO_2	Ireland, Lithuania, Norway	3
Consumption of Halocarbons and SF6 (aggregate)	SF_6	Austria, Japan (P), Sweden (P)	3
Aluminium Production	CO_2	New Zealand, Norway	2
PFCs from aluminium production	CF_4+C_2F_6	Canada, Norway	2
Non - CO_2 Stationary combustion - Biomass	N_2O	Finland, Sweden	2
Non - CO_2 Stationary combustion - oil	N_2O	Greece, Italy	2
Industrial processes – Other	CO_2	Canada, Sweden	2

Source	GHG	Parties	Total Parties
Agricultural soils	CH_4	Austria, Greece	2
Consumption of Halocarbons and SF6 (aggregate)	PFCs	Japan (P), Netherlands	2
CH_4 from Savanna Burning	CH_4	Australia	1
N_2O from Savanna Burning	N_2O	Australia	1
Mobile combustion - Railways	CO_2	Canada	1
Non - CO_2 Stationary combustion - coal	N_2O	Bulgaria	1
SF_6 from Magnesium production	SF_6	Norway	1
HFC - 23 from HCFC production	HFC-23	Greece	1
Carbide Production	CO_2	Norway	1
Ferroalloys Production	CO_2	Norway	1
Fugitive emissions from solid fuels - Other	CO_2	Finland	1
Industrial processes - Other	N_2O	Netherlands	1
Agricultural soils - Other	N_2O	Austria	1
Agricultural soils	CO_2	Finland	1
Solid waste disposal	CO_2	Netherlands	1
Other (sector 7)	CO_2	Finland	1
Production of Halocarbons and SF6	HFCs	United Kingdom	1
Agricultural soils (aggregated)	N_2O	Netherlands	1
Non - CO_2 Stationary combustion - Other Fuels	N_2O	Finland	1
ODS substitutes	HFCs+PFCs	United States	1

P: Potential emissions

[a] The Netherlands reported aggregate HFCs from its total Industrial processes sector, without disaggregation into source categories.

[b] The United States reported CO_2 from iron & steel in the Industrial processes sector for information purposes only because emissions were included in the Energy sector. This source category has, however, been considered in the key sources analysis.

D. Comparison of GHG emission estimates with previous submissions / recalculations

Table 4. Comparison of base year GHG emission estimates reported in the 2000 inventory submission with data reported in previous submissions/ recalculations

	Percentage changes in base year estimates in the 2000 inventory submission relative to those of the 1999 submission									Percentage changes in base year estimates over those in previous inventory submissions					
	Data based on information provided in table 8(a) of the CRF[a]					Data based on estimates for each GHG as reported in the 1999 and 2000 submissions[b]				1999 submission relative to that of the NC2			NC2 relative to that in the NC1		
	CO_2[c] %	CH_4 %	N_2O %	PFCs %	Aggregate GHGs[c] CO_2 equ	CO_2[c] %	CH_4 %	N_2O %	Aggregate GHGs[c] CO_2 equ		Aggregate GHGs[c] CO_2 equ			Aggregate GHGs[c] CO_2 equ	
	A	B	C	D	E	F	G	H	I		J			K	
Australia	1.21	-1.26	-1.59	-0.33	0.4	1.21	-1.26	-1.57	0.4		2.8			-7.7	
Austria						0.14	16.92	0.15	2.3		-5.3			6.1	
Belgium											-1.8			2	
Bulgaria[d]	7.20	-5.59	164.16		15.4	-0.32	-0.73	160.28	11.6						
Canada	1.07	0.75	9.97		1.8	0.98	1.19	12.53	2.1		5.9			0.2	
Czech Republic											-1.2			-0.4	
Finland	-0.14	0.74	0.76		3.6	2.65	-18.65	43.22	3.7		12.3			2.8	
Greece						-0.11	2.99	-0.68	0.1		4.7			6.3	
Hungary															
Ireland															
Italy						-0.01	-19.12	0.00	-2.8						
Japan											-1.3			-0.7	
Latvia															
Lithuania															
Netherlands						0.00	0.00	2.97	0.3		0.8			0.5	
New Zealand	0.71	5.93	1.64			0.62	0.00	3.03	0.8		-5.5			3.3	
Norway	-0.16	-0.74	-4.86	19.10	0.2	-0.16	-0.71	-2.08	-0.5		-4.3			7.2	
Slovakia						2.79	-6.68	73.71	4.7						
Spain	-0.16	-24.41	41.21			-0.16	-24.41	41.21	0.2		-			0	
Sweden						0.00	0.03	-0.87	-0.1		6.7			-10.3	
Switzerland	-1.41	-0.59	-1.12		-1.2	-1.47	-0.66	-1.37	-1.4						
United Kingdom	0.01	1.10	-0.64	0	0.1	0.01	1.10	-0.64	0.1		1.7			1.2	
United States						-0.30	4.70	12.99	1.0		3.3			1.3	

NC1: First national communication NC2: Second national communication

Notes:

Values given in this table denote the percentage change in the inventory estimates of the latest annual inventory submission relative to the previously submitted inventory.

Columns J and K are reproduced from working paper No. 6 "Effects of recalculations of greenhouse gas inventories on assigned amounts and on emission limitation and reduction commitments of Annex I Parties" (see http://www.unfccc.int/sessions/workshop/000314/wp6.pdf). They show the percentage change in aggregate base year GHG emissions as provided in the 1999 inventory submission relative to aggregate GHG emissions as provided in the NC2, and of the estimates of the NC2 compared to the NC1.

Note that HFCs, PFCs and SF_6 are not included in the aggregate GHG emission estimates presented in this table. However, for Parties that reported HFCs, PFCs and SF_6 in the Recalculation table 8(a) of the CRF for 1990, these gases might be included in the aggregate GHG emission estimates of column E. Recalculations for HFCs and SF_6 for the base year have not been reported by any Party. However, in the case of New Zealand, estimates for SF_6 were reported in the 2000 submission but not in the previous submission, according to table 8(a). In the case of Spain, emission estimates for HFCs, PFCs and SF_6 were provided in the 2000 submission for the first time.

This table was prepared following the approach that was used to prepare table 11 of document FCCC/SBSTA/1998/7 (pp. 30-31). Information on how the percentage changes were calculated can be found in that document. Negative values denote that the latest submitted inventory has a lower figure.

[a] Percentage changes for each gas are reproduced in this part of the table as reported by Parties in Table 8(a)s1 of the CRF. For Parties that did not report the percentage change for the national totals for each gas (Finland, New Zealand), the secretariat calculated the percentage change on the basis of data reported by Parties in table 8(a) of the CRF for 1990. The percentage change in aggregate GHG emissions is given in this part of the table as reported by the Party in table 8(a)s2 of the CRF.

[b] Percentage changes were calculated by the secretariat using inventory data as provided in the respective tables of the 2000 submission compared to inventory data as provided in the 1999 inventory submission. In principle, values presented in column I should correspond to those given in column E.

[c] Excluding land-use change and forestry.

[d] In accordance with decision 9/CP.2, Bulgaria uses 1988 as its base year which is given in this table.

B. SECTORAL TABLES

1. Energy

Energy - Total CO_2 emissions from the Reference approach and the Sectoral approach (1998)

	CO_2 emissions from Total Fuel Combustion			
	Sectoral approach	Reference approach	Difference	Explanation for difference as reported in table 1A(c) of the CRF
	Gg		%	
Austria	51,389	63,043	22.68	CORINAIR is used as national method, considering the following items of the official Austrian energy balance (in German): "Energetischer Endverbrauch", "Umwandlungseinsatz" , "Verbrauch des Sektors Energie". Differences between national estimates and reference approach include: **Solid fuels:** Energy consumption: National approach doesn't include transformation losses of coking coal to coke oven gas and coke. CO_2 emissions: The national approach doesn't separate between fuel related and non-fuel related CO_2 emissions for metal production. All CO2-emissions are included in sector 2C: Metal Production. **Gaseous fuels:** Energy consumption: National approach doesn't include losses and non-energy-use. CO2 emissions: National approach uses sector specific carbon contents (different from IPCC reference factor). **Liquid fuels:** Energy consumption: National approach doesn't include non-energy use and energy losses. CO2 emissions: Heat values and carbon contents are sector and fuel specific. The energy statistic is mass balanced only. **Other fuels:** The national approach considers waste as an additional fuel type (= municipal and industrial waste, sludge). 90 % of CO2 emissions from waste-burning are considered biogenic.
Belgium [a]	114,623			
Canada	476,426	526,515	10.51	This comparison as programmed in the CRF is not suitable for the Canadian Inventor since the national approach does not include fossil fuel based CO2 from various industrial processes such as ammonia and aluminum production. When these sources are included in the national approach's totals for energy, the two match quite closely. 476426.48 + 29705.01 = 506131.49 which represents a 4% difference.
Hungary	54,621	56,641	3.70	876-67,585-18,942=789,47 Total-Non energy-Leak=National Appr.
Ireland	37,707	39,310	4.25	The difference is due largely to the inclusion of 19.26 PJ of natural gas in the Reference Approach which is used in Industry Feedstocks and therefore omitted from the National Approach. This accounts for 85 percent of the difference (3.68 out of 4.35).
Latvia [a]	8,051			
Lithuania	13,982	15,615	11.68	*No explanation provided.*
Norway	31,644	32,371	2.30	Sum statistical differences in 1998: 3400 ktonnes CO_2. Combustion of waste, not included in reference approach: about 120 ktonnes CO2. Landfill gas, not included in reference approach. Combustion of hazardous waste apart from waste oil is not included in reference approach (43 ktonnes CO_2). Due to the high production of crude oil and natural gas in Norway, small inaccuracies in data and conversion factors will have large effect on CO_2 emissions estimated by reference approach. Reference approach also includes carbon emitted as CO_2 accounted for in 'Fugitive missions from Fuels'. This is approximately 700 Gg (as flared natural gas is subtracted from Reference Approach). When this is accounted for the difference is less than 0.00 per cent. '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)
Slovakia	39,001	39,953	2.44	*No explanation provided.*
Spain [b]				
Sweden	52,718	60,059	13.92	An explanation for the difference between the two approaches was not provided in Table 1A(c). However, Sweden provided the following explanatory information in its submission: Data reported in the reference approach is gross supply of fuel in the country. The reference approach is based on the energy balance where data on import/export is collected from statistics on foreign trade (coal and coke) and from the oil trade (oil products). Production of fuels (biomass, peat etc.) is considered the same as the use in the industry and energy sectors. Data on stock change includes statistical differences due to surveys of different sources. The conversion to TJ is based on data on net calorific values from the individual source of information. Data reported in the sectoral approach is the fuel use in different sectors. The sectoral approach is based on surveys of use of fuel as total from the energy sector and selected industries. Included in table 1A(b) are some uses of energy that are not included in table 1A(a). - The use of fuel for non energy purposes (the emissions from non energy use are included in the industry sector) - Transmission losses, mainly in refineries - International bunkers for aviation: Statistics Sweden does not have a method for excluding these in the energy balance. International aviation bunkers are therefore included in the reference approach. - The use of oil in gas works and the use of petroleum coke

Energy - Total CO_2 emissions from the Reference approach and the Sectoral approach (1998)

	CO_2 emissions from Total Fuel Combustion			
	Sectoral approach	Reference approach	Difference	Explanation for difference as reported in table 1A(c) of the CRF
	Gg		%	
United Kingdom	522,888	547,294	4.67	A significant proportion of fuel consumption emissions occur in 1B1b Solid Fuel Transformation, 2C Metal Production and 2B1 Ammonia Production. Including these sources with 1A in the comparison reduces the discrepancy to 3.2%. 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 no 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 (1) [c]	5,383,502	4,550,400	-15.48	The energy consumption and CO2 emissions from the reference approach are 2.13 % and 15.48% lower than the national approach on the basis of table 1.A(b) and table 1.A(a) of the CRF. However, in Annex O of the National Inventory Report (NIR) the energy consumption is 2.0% lower in the reference approach and CO2 emissions from the reference approach are 0.8% higher than the national approach. In Annex O reasons given for difference include product definitions, data inconsistencies (more accurate consumption data), and carbon coefficients (default vs category-specific). Detailed explanations of results are provided in Annex O of the NIR. The reasons for the differences in the information presented in the NIR and the CRF need to be looke at closer.
United States (2) [c]	5,383,502	5,426,300	0.8	

Notes:
Parties for which the difference in CO2 emissions between the Reference and the Sectoral approach were less than 2 per cent have not been included in this table.

Only Parties that report a difference higher than 2 per cent are required to provide an explanation.

[a] No reporting of tables 1A(a), 1A(b) and 1A(c) of the CRF.
[b] No reporting of tables 1A(a), 1A(b) and 1A(c) of the CRF for 1998. The Reference approach (table 1A(b)) was, however, provided for 1990 to 1996.
[c] The two values given in this table refer to (1) the estimate from the Reference approach as provided in the CRF and (2) a modified reference approach which has been provided separately because of differences in the fuel categories between the IPCC

Energy - Stationary Combustion: liquid fuels (1998)

	Stationary Combustion - Liquid fuels (CO_2)																	
				1.A.1 Energy Industries						1.A.2 Manufacturing industries and construction			1.A.4 Other sectors					
	Keysource	percent of national total	IEF in CRF based on	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	Agriculture/ Forestry/ Fisheries
		(%)				(t/TJ)						(t/TJ)			(t/TJ)			
Australia	L	6.0	GCV	T2	CS	68.3	69.1	67.9	69.0	T2	CS	67.6	T1, T2	CS	66.6	61.8	63.1	68.8
Austria	L	15.6	NCV	C	CS	51.0	79.2			C	CS	63.4	CS	CS	74.7	75.2	74.7	74.2
Belgium [a]																		
Bulgaria	L	7.5	NCV	T3	CS, D	4.8	73.1	1.7	76.6	T2	CS, D	76.2	T2	CS, D	73.4	74.0	66.8	74.7
Canada	L	10.1	GCV	T1	CS	68.1	73.0	65.4	70.4	T1	CS	46.3	T1	CS	85.3	96.1	78.7	92.1
Czech Republic	L	7.7	NCV	T1	D	74.8	75.7	74.1	72.9	T1	D	63.9	T1	D	68.7	71.1	63.8	73.0
Finland	L	19.2	NCV	CS (T2)	CS/PS/D	73.1	76.4	71.5		CS (T2)	CS/PS/D	73.5	CS (T2, T1)	CS/D	73.6	74.0	73.4	73.7
Greece	L	21.1	NCV	C	C and CS	75.3	75.5	74.8	NO	C	C	64.5	C	C	72.8	71.9	72.8	72.9
Hungary	L	10.5	NCV	D	D	76.5	76.6	75.8	75.8	D	D	75.8	D	D	67.9	66.9	62.1	73.1
Ireland	L	17.6	NCV	T1	PS, CS	76.0	76.1	74.1	NO	T1	PS, CS	74.0	T1	CS	72.6	73.8	71.3	73.3
Italy	L	23.8	NCV			76.5	76.6	74.6	79.2			78.3			73.4	73.5	73.5	73.2
Japan	L	29.8	NCV	T1, RA, CS	D, CS	69.3	NE	NE	NE	T1, RA, CS	D, CS	72.5	T1, RA, CS	D, CS	70.1	71.0	68.0	72.4
Latvia [a]																		
Lithuania	L	26.2	NCV	RA, T1	D	76.9	75.9	84.1	71.3	RA, T1	D	74.4	RA, T1	D	67.3	72.0	61.9	72.0
Netherlands [b]																		
New Zealand	L	3.4	NCV	T1	CS/D	73.6	68.7	74.8	NE	T1	CS/D	68.6	T1	CS/D	68.5	68.4	60.7	69.4
Norway	L	16.7	NCV	T2	CS	60.9	76.3	57.8	73.5	T2	CS	68.9	T2	CS	73.5	73.5	73.2	73.6
Slovakia	L	2.5	NCV			32.4	32.4								32.4	32.4	NA	
Spain [a]																		
Sweden	L	24.4	NCV	CS	CS	76.1	76.0	76.2		CS	CS	76.2	CS	CS	76.2	75.4	75.3	79.6
Switzerland	L	33.3	NCV	RA, C	RA, CS	76.6	76.4	77.0		C	CS	74.5	C	CS	73.7	73.7	73.7	73.7
United Kingdom	L	10.1	NCV	T2	CS	71.6	76.0	71.2	70.8	T2	CS	73.8	T2	CS	72.6	73.7	71.7	72.9
United States	L	10.4	GCV	T1	D, CS	73.8	73.8	IE	IE	T1	D, CS	38.6	T1	D, CS	66.4	68.2	65.6	IE

[a] This Party did not provide table 1A(a) of the CRF. An identification of key sources according to fuel types was therefore not possible.

[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 (1998)

	Stationary Combustion - Solid fuels (1998) (CO_2)																	
				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				
	Key source	percent of national total	IEF in CRF based on	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	Agriculture/ Forestry/ Fisheries
		(%)				(t/TJ)					(t/TJ)			(t/TJ)			
Australia	L	38.5	GCV	T2	CS	90.5	91.1	72.3	T2	CS	97.1	T1, T2	CS	96.8	96.7	98.3	NA
Austria	L	9.1	NCV	C	CS	91.1	91.1		C	CS	9.7	CS	CS	93.7	95.6	93.4	
Belgium [a]																	
Bulgaria	L	37.7	NCV	T3	CS, D	77.9	107.5	2.5	T2	CS, D	97.3	T2	CS, D	99.7	97.8	99.7	100.0
Canada	L	15.3	GCV	T1	CS	91.8	91.7	111.0	T1	CS	29.3	T1	CS	88.4	56.7	88.7	
Czech Republic	L	57.0	NCV	T1	D	99.7	99.1	113.7	T1	D	107.1	T1	D	99.4	99.5	99.3	99.8
Finland	L	18.3	NCV	CS (T2)	CS/PS/D	91.2	92.7	39.7	CS (T2)	CS/PS/D	97.7	CS (T2, T1)	CS/D	93.1	100.0	93.0	93.1
Greece	L	35.5	NCV	C	C and CS	122.1	122.1	NO	C	C	94.0	C	C	100.8	NO	99.9	105.0
Hungary	L	18.5	NCV	D	D	96.3	96.1	103.0	D	D	103.0	D	D	94.0	95.2	93.8	95.9
Ireland	L	19.2	NCV	T1	PS, CS	94.7	94.7	NO	T1	PS, CS	97.5	T1	CS	99.4	100.6	99.4	NO
Italy	L	8.4	NCV			94.7	94.1	98.3			97.0			102.2	102.2	102.2	
Japan	L	24.2	NCV	T1, RA, CS	D, CS	97.6	NE	NE	T1, RA, CS	D, CS	100.1	T1, RA, CS	D, CS	104.4	104.7	101.0	
Latvia [a]																	
Lithuania	L	2.4	NCV	RA, T1	D	91.6	91.5	92.6	RA, T1	D	90.4	RA, T1	D	82.6	90.8	63.0	90.8
Netherlands [b]																	
New Zealand	L	4.1	NCV	T1	CS/D	93.0	93.0	NE	T1	CS/D	90.4	T1	CS/D	91.2	91.2	91.2	91.2
Norway	L	1.2	NCV	T2	CS	86.1	86.1		T2	CS	92.6	T2	CS	92.7		92.7	
Slovakia	L	32.1	NCV			97.1	97.1							97.1	97.1	97.1	
Spain [a]																	
Sweden	L	9.8	NCV	CS	CS	97.2	97.2		CS	CS	97.6	CS	CS	103.0			103.0
Switzerland			NCV	RA, C	RA, CS				C	CS	94.0	C	CS	94.3	95.0	94.3	
United Kingdom	L	20.6	NCV	T2	CS	88.0	88.0	89.4	T2	CS	129.7	T2	CS	90.1	87.2	90.5	89.3
United States	L	29.4	GCV	T1	D, CS	88.6	88.6	IE	T1	D, CS	87.6	T1	D, CS	89.5	89.5	89.5	IE

Note:
Finland and Italy also reported emissions from use of solid fuels for petroleum refining. The IEF reported in the CRF were 92.9 and 99.7 t/TJ, respectively.

[a] This Party did not provide table 1A(a) of the CRF. An identification of key sources according to fuel types was therefore not possible.

[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 (1998)

	Stationary Combustion - Gaseous fuels (CO_2)																		
				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			
	Key-source	percent of national total	IEF in CRF based on	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	Agriculture/ Forestry/ Fisheries
		(%)				(t/TJ)						(t/TJ)			(t/TJ)			
Australia	L	8.7	GCV	T2	CS	51.2	51.7	50.6	50.7	T2	CS	50.7	T1, T2	CS	50.7	50.7	50.7	50.7
Austria	L	18.4	NCV	C	CS	55.0	55.0		55.0	C	CS	54.8	CS	CS	55.0	55.0	55.0	
Belgium [a]																		
Bulgaria	L	8.1	NCV	T3	CS, D	55.8	55.8	NO	55.8	T2	CS, D	55.8	T2	CS, D	55.8	55.8		55.8
Canada	L	18.4	GCV	T1	CS	42.2	49.2	49.2	38.9	T1	CS	32.7	T1	CS	49.2	49.2	49.2	49.2
Czech Republic	L	12.0	NCV	T1	D	55.8	55.8	55.8		T1	D	55.8	T1	D	55.8	55.8	55.8	55.9
Finland	L	10.5	NCV	CS (T2)	CS/PS/D	55.8	55.8	55.8		CS (T2)	CS/PS/D	55.7	CS (T2, T1)	CS/D	55.8	55.8	55.8	55.9
Greece	L	1.5	NCV	C	C and CS	55.8	55.8	NO	55.8	C	C	48.7	C	C	55.8	55.8	55.8	NO
Hungary	L	26.2	NCV	D	D	55.8	55.8	55.8		D	D	55.8	D	D	55.8	55.8	55.8	55.8
Ireland	L	8.6	NCV	T1	PS, CS	54.5	53.9	65.0	NO	T1	PS, CS	54.9	T1	CS	54.9	54.9	54.9	NO
Italy	L	26.0	NCV			69.9	67.3	67.2	85.7			58.4			56.4	56.4	56.4	56.4
Japan	L	10.2	NCV	T1, RA, CS	D, CS	54.8	NE	NE	NE	T1, RA, CS	D, CS	51.8	T1, RA, CS	D, CS	51.6	51.6	51.6	
Latvia [a]																		
Lithuania	L	14.3	NCV	RA, T1	D	57.3	55.7	65.4	55.5	RA, T1	D	55.5	RA, T1	D	55.5	55.5	55.5	55.5
Netherlands [b]																		
New Zealand	L	11.0	NCV	T1	CS/D	54.1	52.9	60.3	NE	T1	CS/D	33.3	T1	CS/D	52.4	52.4	52.4	NE
Norway	L	13.8	NCV	T2	CS	57.1			57.1	T2	CS	58.2	T2	CS				
Slovakia	L	25.0	NCV			57.5	57.5								57.5	57.5	57.5	
Spain [a]																		
Sweden	L	7.6	NCV	CS	CS	78.3	77.5	65.1	80.8	CS	CS	68.9	CS	CS	61.8	60.3	64.2	57.1
Switzerland	L	10.8	NCV	RA, C	RA, CS	57.5	55.0	59.3		C	CS	55.0	C	CS	55.0	55.0	55.0	55.0
United Kingdom	L	27.9	NCV	T2	CS	62.8	58.9	58.0	75.9	T2	CS	58.0	T2	CS	58.0	58.0	58.0	58.0
United States	L	16.3	GCV	T1	D, CS	50.0	50.0	IE	IE	T1	D, CS	48.2	T1	D, CS	50.0	50.0	50.0	IE

[a] This Party did not provide table 1A(a) of the CRF. An identification of key sources according to fuel types was therefore not possible.

[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 used or type of emission factor 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 used or type of emission factor for all subcategories within the category "1.A.2 Manufacturing industries and constr

[e] 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.4 Other sectors".

Energy - Stationary Combustion: other fuels (1998)

	Stationary Combustion - Other fuels (CO_2)															
	Key-source	percent 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	Agriculture/ Forestry/ Fisheries
		(%)				(t/TJ)				(t/TJ)			(t/TJ)			
Australia						NA	NA			NA				NA	NA	NA
Austria			NCV					C	CS	8.3	CS	CS	10.0	10.0		
Belgium																
Bulgaria						NO	NO			NO						
Canada																
Czech Republic																
Finland	L	11.1	NCV	CS (T2)	CS/PS/D	103.8	103.8	CS (T2)	CS/PS/D	103.1	CS (T2, T1)	CS/D	104.9	104.9	105.0	104.9
Greece						NO	NO			NO				NO	NO	NO
Hungary																
Ireland			NCV	T1	PS, CS	54.9	54.9			NO				NO	NO	NO
Italy[a]	L	0.9	NCV			76.6	76.4			78.1			62.4	62.4	62.4	62.4
Japan						NO	NO			NO			NO	NO	NO	NO
Latvia																
Lithuania											RA, T1	D	76.1	235.7	71.9	72.0
Netherlands	L	60.1		CS	PS, CS			CS	PS, CS		CS	CS				
New Zealand						NO	NO			NO				NO	NO	NO
Norway			NCV	T2	CS	45.8	45.8									
Slovakia	L	4.9	NCV			57.5	57.5						57.5	57.5		
Spain																
Sweden	L	0.8	NCV	CS	CS	32.7	32.7	CS	CS	28.4						
Switzerland	L	5.0	NCV					C	CS	76.0	C	CS	73.7			73.7
United Kingdom			NCV	T2	CS	36.6	36.6	T2	CS	94.3						
United States			GCV	T1	D, CS	7.1	7.1			IE				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 CQ IEFs may not be comparable.

[a] Italy also reported emissions from the use of other fuels for petroleum refining and manufacture of solid fuels and other energy industries (IEF: 79.37 and 76.46 t/TJ, respectively).

Energy - Energy Industries (all fuels):

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year [(a)]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		141,807	145,297	148,513	149,791	150,851	156,807	163,335	169,404	187,222
Austria		12,377	13,400	9,808	9,133	9,395	10,922	11,418	11,883	11,642
Belgium									27,876	27,287
Bulgaria	37,823	39,664	37,626	34,127	34,632	31,574	32,246			27,521
Canada		144,599	143,299	151,415	145,494	148,411	154,328	154,517	162,941	181,201
Finland		18,513	NE	17,428	19,849	24,526	22,262	27,819	24,414	21,395
Greece		43,658	42,526	44,902	45,320	47,111	47,107	45,287	48,614	50,612
Hungary	36,928	29,746	28,520	27,476	27,575	26,290	26,431	26,610	26,537	24,161
Ireland		11,057	11,546	12,224	12,233	12,749	13,239	13,959	14,643	15,047
Italy		142,927	137,489	137,592	127,476	129,069	140,299	134,219	135,346	154,457
Japan		338,908	341,967	349,458	331,667	369,322	359,370	360,447	356,849	347,918
Netherlands		52,550	52,190	54,130	53,800	55,980	56,040	57,000	56,100	58,500
New Zealand		6,079	6,151	7,628	6,598	5,457	4,728	5,367	6,944	5,262
Norway		7,382	7,574	8,386	8,751	9,294	9,044	9,938	10,419	10,025
Slovakia		51,621	45,949	41,551	39,691	36,471	37,688	38,330	37,079	35,003
Spain		74,783	75,028	83,033	77,114	78,029	83,568	71,307	83,658	79,161
Sweden		8,849	9,973	10,592	10,681	11,068	10,493	14,295	9,600	9,728
Switzerland		891	1,201	1,280	962	1,039	1,094	1,267	1,176	1,423
United Kingdom		229,142	227,148	217,139	200,476	198,016	199,388	198,949	184,883	189,846
United States		1,747,763	1,735,235	1,733,398	1,798,604	1,811,270	1,811,566	1,881,158	1,953,876	2,016,379

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	2.5	2.2	0.9	0.7	3.9	4.2	3.7	10.5	32.0
Austria	8.3	-26.8	-6.9	2.9	16.3	4.5	4.1	-2.0	-5.9
Belgium								-2.1	
Bulgaria	-5.1	-9.3	1.5	-8.8	2.1				-27.2
Canada	-0.9	5.7	-3.9	2.0	4.0	0.1	5.5	11.2	25.3
Finland			13.9	23.6	-9.2	25.0	-12.2	-12.4	15.6
Greece	-2.6	5.6	0.9	4.0	0.0	-3.9	7.3	4.1	15.9
Hungary	-4.1	-3.7	0.4	-4.7	0.5	0.7	-0.3	-9.0	-34.6
Ireland	4.4	5.9	0.1	4.2	3.8	5.4	4.9	2.8	36.1
Italy	-3.8	0.1	-7.4	1.2	8.7	-4.3	0.8	14.1	8.1
Japan	0.9	2.2	-5.1	11.4	-2.7	0.3	-1.0	-2.5	2.7
Netherlands	-0.7	3.7	-0.6	4.1	0.1	1.7	-1.6	4.3	11.3
New Zealand	1.2	24.0	-13.5	-17.3	-13.4	13.5	29.4	-24.2	-13.4
Norway	2.6	10.7	4.4	6.2	-2.7	9.9	4.8	-3.8	35.8
Slovakia	-11.0	-9.6	-4.5	-8.1	3.3	1.7	-3.3	-5.6	-32.2
Spain	0.3	10.7	-7.1	1.2	7.1	-14.7	17.3	-5.4	5.9
Sweden	12.7	6.2	0.8	3.6	-5.2	36.2	-32.8	1.3	9.9
Switzerland	34.8	6.6	-24.8	8.0	5.3	15.8	-7.2	21.0	59.7
United Kingdom	-0.9	-4.4	-7.7	-1.2	0.7	-0.2	-7.1	2.7	-17.1
United States	-0.7	-0.1	3.8	0.7	0.0	3.8	3.9	3.2	15.4

Note:
The Czech Republic, Latvia and Lithuania are not included in this table because data for years other than 1998 were not reported.

Energy - Manufacturing Industries and Construction (all fuels):

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		50,029	49,405	47,228	47,423	48,180	51,144	52,159	51,387	51,346
Austria		7,434	6,815	6,949	6,849	6,661	7,510	7,852	8,268	8,147
Belgium									30,400	30,759
Bulgaria	35,756	19,890	12,051	9,694	10,752	11,984	14,582			14,354
Canada		56,067	53,333	52,790	49,961	53,045	53,483	55,303	55,226	53,129
Finland		14,358	NE	13,717	13,491	14,098	13,785	13,669	15,122	15,282
Greece		10,107	9,987	9,568	9,300	9,107	9,884	10,607	10,842	10,953
Hungary	10,893	7,893	6,380	5,131	5,548	6,306	6,352	6,199	4,905	8,629
Ireland		3,833	3,839	3,620	3,599	3,702	3,527	3,512	3,988	3,917
Italy		83,220	80,031	78,619	82,399	84,619	89,380	87,394	92,843	85,630
Japan		339,227	337,590	327,780	332,138	340,622	345,719	352,685	353,466	343,278
Netherlands		41,440	42,660	42,510	39,920	40,950	43,430	42,100	44,400	43,900
New Zealand		4,812	5,157	4,818	4,962	5,303	5,448	5,847	5,882	5,977
Norway		3,010	2,779	2,668	2,951	3,629	3,253	3,785	3,813	4,038
Spain		48,817	50,038	49,176	47,361	51,310	55,333	49,440	56,135	60,058
Sweden		13,050	12,231	11,759	12,691	13,938	13,541	14,400	13,959	12,200
Switzerland		5,237	5,410	4,994	4,862	4,861	5,098	4,853	4,736	4,893
United Kingdom		94,504	95,207	93,647	92,263	93,786	91,334	92,373	90,419	88,579
United States		1,047,111	1,019,591	1,069,075	1,065,257	1,087,209	1,093,835	1,124,487	1,126,702	1,100,141

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-1.2	-4.4	0.4	1.6	6.2	2.0	-1.5	-0.1	2.6
Austria	-8.3	2.0	-1.4	-2.7	12.7	4.5	5.3	-1.5	9.6
Belgium								1.2	
Bulgaria	-39.4	-19.6	10.9	11.5	21.7				-59.9
Canada	-4.9	-1.0	-5.4	6.2	0.8	3.4	-0.1	-3.8	-5.2
Finland			-1.6	4.5	-2.2	-0.8	10.6	1.1	6.4
Greece	-1.2	-4.2	-2.8	-2.1	8.5	7.3	2.2	1.0	8.4
Hungary	-19.2	-19.6	8.1	13.7	0.7	-2.4	-20.9	75.9	-20.8
Ireland	0.2	-5.7	-0.6	2.9	-4.7	-0.4	13.5	-1.8	2.2
Italy	-3.8	-1.8	4.8	2.7	5.6	-2.2	6.2	-7.8	2.9
Japan	-0.5	-2.9	1.3	2.6	1.5	2.0	0.2	-2.9	1.2
Netherlands	2.9	-0.4	-6.1	2.6	6.1	-3.1	5.5	-1.1	5.9
New Zealand	7.2	-6.6	3.0	6.9	2.7	7.3	0.6	1.6	24.2
Norway	-7.7	-4.0	10.6	23.0	-10.4	16.4	0.7	5.9	34.2
Spain	2.5	-1.7	-3.7	8.3	7.8	-10.7	13.5	7.0	23.0
Sweden	-6.3	-3.9	7.9	9.8	-2.8	6.3	-3.1	-12.6	-6.5
Switzerland	3.3	-7.7	-2.6	0.0	4.9	-4.8	-2.4	3.3	-6.6
United Kingdom	0.7	-1.6	-1.5	1.7	-2.6	1.1	-2.1	-2.0	-6.3
United States	-2.6	4.9	-0.4	2.1	0.6	2.8	0.2	-2.4	5.1

Note:
The Czech Republic, Latvia, Lithuania and Slovakia are not included in this table because data for years other than 1998 were not reported.

[a] In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987). For these Parties, the values in the column "percentage change from 1990 to 1998" refers to the base year data.

Energy - Other sectors (commercial/institutional, residential, agriculture/forestry/fisheries) (all fuels):

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage chang

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		12,486	12,559	12,895	13,376	13,492	13,961	14,045	14,572	14,801
Austria		13,305	15,795	14,351	14,741	14,714	14,839	16,455	14,965	14,847
Belgium									31,257	31,757
Bulgaria	7,612	5,381	4,086	4,612	4,117	3,325	2,621			2,989
Canada		69,190	68,595	70,856	73,624	73,243	73,714	79,197	76,318	67,845
Finland		7,571	NE	6,794	6,060	6,706	7,116	7,572	6,789	6,659
Greece		8,168	8,499	8,139	8,002	8,046	8,132	10,060	10,268	10,612
Hungary	23,174	20,877	21,749	17,306	17,591	16,960	16,762	18,091	16,221	13,451
Ireland		9,726	9,640	9,388	9,049	9,495	9,317	9,092	9,421	9,974
Italy		75,553	83,867	78,459	78,500	69,661	76,878	78,280	71,372	77,669
Japan		158,233	164,502	169,778	168,984	167,049	177,029	173,326	171,613	166,784
Netherlands		35,360	40,390	37,330	40,060	38,460	38,930	45,200	36,700	36,100
New Zealand		2,845	2,701	2,956	2,717	2,926	2,797	2,658	2,755	2,857
Norway		3,875	3,354	3,039	2,987	3,176	3,184	3,931	3,506	3,469
Spain		24,070	27,534	26,881	25,863	26,936	26,605	27,635	27,654	28,089
Sweden		10,672	10,281	10,230	10,088	10,148	9,903	11,016	9,964	9,615
Switzerland		18,631	19,810	19,830	19,100	18,023	19,013	19,810	18,785	19,401
United Kingdom		112,032	123,385	120,084	123,276	118,156	113,974	127,173	118,211	118,320
United States		549,330	560,838	570,239	591,399	580,627	589,314	621,629	608,094	570,707

Relative Change to Previous Year (%

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.6	2.7	3.7	0.9	3.5	0.6	3.8	1.6	18.5
Austria	18.7	-9.1	2.7	-0.2	0.9	10.9	-9.1	-0.8	11.6
Belgium								1.6	
Bulgaria	-24.1	12.9	-10.7	-19.2	-21.2				-60.7
Canada	-0.9	3.3	3.9	-0.5	0.6	7.4	-3.6	-11.1	-1.9
Finland			-10.8	10.7	6.1	6.4	-10.3	-1.9	-12.0
Greece	4.1	-4.2	-1.7	0.5	1.1	23.7	2.1	3.3	29.9
Hungary	4.2	-20.4	1.6	-3.6	-1.2	7.9	-10.3	-17.1	-42.0
Ireland	-0.9	-2.6	-3.6	4.9	-1.9	-2.4	3.6	5.9	2.5
Italy	11.0	-6.4	0.1	-11.3	10.4	1.8	-8.8	8.8	2.8
Japan	4.0	3.2	-0.5	-1.1	6.0	-2.1	-1.0	-2.8	5.4
Netherlands	14.2	-7.6	7.3	-4.0	1.2	16.1	-18.8	-1.6	2.1
New Zealand	-5.1	9.4	-8.1	7.7	-4.4	-5.0	3.6	3.7	0.4
Norway	-13.4	-9.4	-1.7	6.3	0.2	23.4	-10.8	-1.0	-10.5
Spain	14.4	-2.4	-3.8	4.2	-1.2	3.9	0.1	1.6	16.7
Sweden	-3.7	-0.5	-1.4	0.6	-2.4	11.2	-9.5	-3.5	-9.9
Switzerland	6.3	0.1	-3.7	-5.6	5.5	4.2	-5.2	3.3	4.1
United Kingdom	10.1	-2.7	2.7	-4.2	-3.5	11.6	-7.0	0.1	5.6
United States	2.1	1.7	3.7	-1.8	1.5	5.5	-2.2	-6.1	3.9

Note:
The Czech Republic, Latvia, Lithuania and Slovakia are not included in this table because data for years other than 1998 were not reported.

[a] In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).
For these Parties, the values in the column "percentage change from 1990 to 1998" refers to the base year data.

Energy - Energy Industries by fuel type: Liquid

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	8,780	9,206	8,354	8,739	8,804	9,690	10,021	8,865	8,904
Canada	37,683								42,463
Finland	2,603								2,844
Japan	161,303	154,719	159,106	133,524	157,787	136,610	128,391	112,674	103,201
New Zealand	224	227	408	275	168	271	214	153	193
United Kingdom	38,962	37,828	35,456	33,975	30,868	30,891	30,148	24,544	22,983
United States	96,804	91,150	73,888	81,805	74,986	50,951	56,030	64,098	90,761

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	4.9	-9.2	4.6	0.7	10.1	3.4	-11.5	0.4	1.4
Canada									12.7
Finland									9.3
Japan	-4.1	2.8	-16.1	18.2	-13.4	-6.0	-12.2	-8.4	-36.0
New Zealand	1.5	79.5	-32.5	-39.0	61.5	-21.1	-28.5	26.5	-13.7
United Kingdom	-2.9	-6.3	-4.2	-9.1	0.1	-2.4	-18.6	-6.4	-41.0
United States	-5.8	-18.9	10.7	-8.3	-32.1	10.0	14.4	41.6	-6.2

Energy - Energy Industries by fuel type: Solid

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	119,873	124,606	127,768	127,720	128,058	131,690	137,985	144,820	161,263
Canada	79,302								99,137
Finland	9,279								8,171
Japan	100,499	105,104	108,854	116,531	124,765	134,545	139,789	148,514	146,238
New Zealand	491	229	913	446	389	561	614	1,199	767
United Kingdom	180,801	179,415	168,239	140,228	132,575	126,668	117,122	99,728	102,653
United States	1,499,681	1,493,231	1,509,982	1,571,738	1,574,725	1,587,527	1,677,435	1,729,951	1,750,220

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	3.9	2.5	0.0	0.3	2.8	4.8	5.0	11.4	34.5
Canada									25.0
Finland									-11.9
Japan	4.6	3.6	7.1	7.1	7.8	3.9	6.2	-1.5	45.5
New Zealand	-53.4	299.4	-51.2	-12.8	44.3	9.6	95.2	-36.0	56.3
United Kingdom	-0.8	-6.2	-16.6	-5.5	-4.5	-7.5	-14.9	2.9	-43.2
United States	-0.4	1.1	4.1	0.2	0.8	5.7	3.1	1.2	16.7

Energy - Energy Industries by fuel type: Gaseous

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	13,154	11,485	12,390	13,332	13,988	15,428	15,328	15,718	17,056
Canada	27,614								39,601
Finland	2,659								4,738
Japan	77,105	82,144	81,498	81,613	86,770	88,215	92,267	95,660	98,478
New Zealand	3,583	4,233	4,523	4,225	3,548	2,935	3,807	5,227	3,978
United Kingdom	9,241	9,765	13,274	26,036	34,043	41,285	51,040	59,838	63,344
United States	151,058	150,646	149,321	144,867	161,381	172,967	147,693	159,686	175,265

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-12.7	7.9	7.6	4.9	10.3	-0.6	2.5	8.5	29.7
Canada									43.4
Finland									78.2
Japan	6.5	-0.8	0.1	6.3	1.7	4.6	3.7	2.9	27.7
New Zealand	18.1	6.9	-6.6	-16.0	-17.3	29.7	37.3	-23.9	11.0
United Kingdom	5.7	35.9	96.1	30.8	21.3	23.6	17.2	5.9	585.5
United States	-0.3	-0.9	-3.0	11.4	7.2	-14.6	8.1	9.8	16.0

Energy - Energy Industries

Relative contribution (%) of each fuel type to total CO_2 emissions from Energy Industries for 1990 and 1998

	Liquid		**Solid**		**Gaseous**	
	1990	**1998**	**1990**	**1998**	**1990**	**1998**
Australia	6.2	4.8	84.5	86.1	9.3	9.1
Canada	26.1	23.4	54.8	54.7	19.1	21.9
Finland	14.1	13.3	50.1	38.2	14.4	22.1
Japan	47.6	29.7	29.7	42.0	22.8	28.3
New Zealand	3.7	3.7	8.1	14.6	58.9	75.6
United Kingdom	17.0	12.1	78.9	54.1	4.0	33.4
United States	5.5	4.5	85.8	86.8	8.6	8.7

Note:
The following Parties are not included in these tables because data for years other than 1998 were not reported:
Austria, Belgium, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Slovakia, Spain, Sweden and Switzerland.

Energy - Manufacturing Industries and Construction by fuel type: Liquid

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	10,908	10,413	10,130	10,491	10,547	10,918	12,178	11,401	11,465
Canada	13,557								9,540
Finland	4,294								4,101
Japan	153,532	151,150	149,147	152,195	157,882		161,489	157,079	157,825
New Zealand	733	706	763	639	690	704	732	708	603
United Kingdom	27,588	29,292	30,131	30,504	30,387	27,572	27,329	24,782	22,859
United States	366,518	345,508	382,084	359,507	373,838	357,433	378,931	387,832	373,208

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-4.5	-2.7	3.6	0.5	3.5	11.5	-6.4	0.6	5.1
Canada									-29.6
Finland									-4.5
Japan	-1.6	-1.3	2.0	3.7	-100.0		-2.7	0.5	2.8
New Zealand	-3.7	8.1	-16.2	8.0	1.9	4.0	-3.3	-14.9	-17.8
United Kingdom	6.2	2.9	1.2	-0.4	-9.3	-0.9	-9.3	-7.8	-17.1
United States	-5.7	10.6	-5.9	4.0	-4.4	6.0	2.3	-3.8	1.8

Energy - Manufacturing Industries and Construction by fuel type: Solid

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	24,941	24,614	22,836	22,541	22,779	24,071	23,737	23,637	23,374
Canada	6,869								6,058
Finland	6,410								5,780
Japan	178,866	178,635	170,165	170,319	172,024		178,799	182,756	171,522
New Zealand	2,004	1,987	1,775	2,000	1,944	1,798	1,733	1,693	1,678
United Kingdom	37,983	38,282	37,937	35,457	34,107	32,637	30,587	30,681	28,676
United States	248,382	235,036	226,599	225,105	227,094	225,038	216,956	215,313	214,003

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-1.3	-7.2	-1.3	1.1	5.7	-1.4	-0.4	-1.1	-6.3
Canada									-11.8
Finland									-9.8
Japan	-0.1	-4.7	0.1	1.0	-100.0		2.2	-6.1	-4.1
New Zealand	-0.8	-10.7	12.7	-2.8	-7.5	-3.6	-2.3	-0.8	-16.2
United Kingdom	0.8	-0.9	-6.5	-3.8	-4.3	-6.3	0.3	-6.5	-24.5
United States	-5.4	-3.6	-0.7	0.9	-0.9	-3.6	-0.8	-0.6	-13.8

Energy - Manufacturing Industries and Construction by fuel type: Gaseous

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	14,181	14,378	14,261	14,391	14,854	16,155	16,244	16,349	16,508
Canada	35,641								37,531
Finland	2,093								2,672
Japan	6,829	7,805	8,468	9,625	10,716		12,398	13,631	13,930
New Zealand	2,076	2,464	2,279	2,322	2,669	2,946	3,381	3,482	3,696
United Kingdom	28,933	27,633	25,579	26,302	29,250	31,040	34,372	34,887	36,993
United States	432,211	439,047	460,392	480,645	486,278	511,363	528,600	523,557	512,931

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	1.4	-0.8	0.9	3.2	8.8	0.5	0.7	1.0	16.4
Canada									5.3
Finland									27.7
Japan	14.3	8.5	13.7	11.3	-100.0		9.9	2.2	104.0
New Zealand	18.7	-7.5	1.9	14.9	10.4	14.8	3.0	6.2	78.1
United Kingdom	-4.5	-7.4	2.8	11.2	6.1	10.7	1.5	6.0	27.9
United States	1.6	4.9	4.4	1.2	5.2	3.4	-1.0	-2.0	18.7

Energy - Manufacturing Industries and Construction

Relative contribution (%) of each fuel type to total CO_2 emissions from Manufacturing Industries and Construction for 1990 and 1998

	Liquid		**Solid**		**Gaseous**	
	1990	**1998**	**1990**	**1998**	**1990**	**1998**
Australia	21.8	22.3	49.9	45.5	28.3	32.1
Canada	24.2	18.0	12.3	11.4	63.6	70.6
Finland	29.9	26.8	44.6	37.8	14.6	17.5
Japan	45.3	46.0	52.7	50.0	2.0	4.1
New Zealand	15.2	10.1	41.6	28.1	43.1	61.8
United Kingdom	29.2	25.8	40.2	32.4	30.6	41.8
United States	35.0	33.9	23.7	19.5	41.3	46.6

Note:
The following Parties are not included in these tables because data for years other than 1998 were not reported:
Austria, Belgium, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Slovakia, Spain, Sweden and Switzerland.

Energy - Other Sectors (commercial/institutional, residential, agriculture/forestry/fisheries) by fuel type: Liquid

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	5,500	5,521	5,627	5,851	5,878	5,927	5,959	6,061	6,174
Canada	22,287								17,776
Finland	7,274								6,265
Japan	136,229	142,134	146,723	144,155	141,618	149,455	144,625	142,901	137,349
New Zealand	1,601	1,464	1,787	1,451	1,676	1,612	1,489	1,615	1,725
United Kingdom	20,147	21,169	21,451	21,728	21,229	20,445	21,916	20,021	19,810
United States	153,779	152,004	149,959	150,747	147,531	149,304	153,224	149,666	149,525

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.4	1.9	4.0	0.5	0.8	0.5	1.7	1.9	12.2
Canada									-20.2
Finland									-13.9
Japan	4.3	3.2	-1.8	-1.8	5.5	-3.2	-1.2	-3.9	0.8
New Zealand	-8.5	22.0	-18.8	15.5	-3.8	-7.7	8.5	6.9	7.8
United Kingdom	5.1	1.3	1.3	-2.3	-3.7	7.2	-8.6	-1.1	-1.7
United States	-1.2	-1.3	0.5	-2.1	1.2	2.6	-2.3	-0.1	-2.8

Energy - Other Sectors (commercial/institutional, residential, agriculture/forestry/fisheries) by fuel type: Solid

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	583	537	455	407	415	372	337	309	301
Canada	191								154
Finland	57								26
Japan	5,048	4,260	4,275	4,651	5,171	5,842	6,041	5,626	5,769
New Zealand	806	788	693	770	737	671	637	613	598
United Kingdom	19,007	20,193	17,443	18,642	15,534	11,190	11,642	10,828	8,979
United States	14,564	13,286	13,506	13,394	12,979	12,707	13,003	13,721	13,527

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-8.0	-15.3	-10.5	1.9	-10.2	-9.6	-8.3	-2.5	-48.4
Canada									-19.7
Finland									-54.9
Japan	-15.6	0.4	8.8	11.2	13.0	3.4	-6.9	2.5	14.3
New Zealand	-2.3	-12.0	11.0	-4.3	-8.9	-5.1	-3.8	-2.4	-25.8
United Kingdom	6.2	-13.6	6.9	-16.7	-28.0	4.0	-7.0	-17.1	-52.8
United States	-8.8	1.7	-0.8	-3.1	-2.1	2.3	5.5	-1.4	-7.1

Energy - Other Sectors (commercial/institutional, residential, agriculture/forestry/fisheries) by fuel type: Gaseous

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	6,402	6,501	6,813	7,118	7,199	7,662	7,749	8,202	8,327
Canada	46,712								49,915
Finland	99								241
Japan	16,957	18,108	18,780	20,179	20,261	21,732	22,660	23,086	23,666
New Zealand	438	449	475	497	513	513	532	528	533
United Kingdom	72,878	82,024	81,190	82,907	81,393	82,339	93,615	87,361	89,530
United States	380,987	395,548	406,774	427,258	420,116	427,304	455,402	444,706	407,656

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	1.5	4.8	4.5	1.1	6.4	1.1	5.8	1.5	30.1
Canada									6.9
Finland									144.4
Japan	6.8	3.7	7.5	0.4	7.3	4.3	1.9	2.5	39.6
New Zealand	2.4	5.9	4.5	3.2	0.2	3.7	-0.9	1.1	21.7
United Kingdom	12.5	-1.0	2.1	-1.8	1.2	13.7	-6.7	2.5	22.8
United States	3.8	2.8	5.0	-1.7	1.7	6.6	-2.3	-8.3	7.0

Energy - Other Sectors (commercial/institutional, residential, agriculture/forestry/fisheries)

Relative contribution (%) of each fuel type in total CO_2 emissions from Other sectors for 1990 and 1998

	Liquid		**Solid**		**Gaseous**	
	1990	**1998**	**1990**	**1998**	**1990**	**1998**
Australia	44.1	41.7	4.7	2.0	51.3	56.3
Canada	32.2	26.2	0.3	0.2	67.5	73.6
Finland	96.1	94.1	0.7	0.4	1.3	3.6
Japan	86.1	82.4	3.2	3.5	10.7	14.2
New Zealand	56.3	60.4	28.3	20.9	15.4	18.7
United Kingdom	18.0	16.7	17.0	7.6	65.1	75.7
United States	28.0	26.2	2.7	2.4	69.4	71.4

Note:
The following Parties are not included in these tables because data for years other than 1998 were not reported:
Austria, Belgium, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Slovakia, Spain, Sweden and Switzerland.

Energy - Fuel Combustion

Total Energy Consumption from Fuel combustion by Fuel Type: 1990 to 1998 (TJ and annual percentage change):

Solid Fuels

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	1,572,278	1,618,578	1,640,943	1,638,163	1,648,489	1,699,793	1,760,009	1,849,469	2,029,195
Canada	1,099,891								1,288,149
Finland	167,071								148,994
Japan	2,881,515	2,928,835	2,871,199	2,957,735	3,072,533	133,654	3,274,088	3,386,043	3,266,836
New Zealand	36,094	32,889	36,880	35,163	33,570	33,110	32,599	38,172	33,371
United Kingdom	2,503,191	2,520,437	2,365,577	2,047,001	1,909,931	1,810,597	1,685,483	1,484,114	1,486,962
United States	19,985,226	19,736,210	19,846,579	20,507,765	20,550,417	20,655,051	21,584,953	22,147,530	22,351,990

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	2.9	1.4	-0.2	0.6	3.1	3.5	5.1	9.7	29.1
Canada									17.1
Finland									-10.8
Japan	1.6	-2.0	3.0	3.9	-95.7	2349.7	3.4	-3.5	13.4
New Zealand	-8.9	12.1	-4.7	-4.5	-1.4	-1.5	17.1	-12.6	-7.5
United Kingdom	0.7	-6.1	-13.5	-6.7	-5.2	-6.9	-11.9	0.2	-40.6
United States	-1.2	0.6	3.3	0.2	0.5	4.5	2.6	0.9	11.8

Liquid Fuels

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	1,237,313	1,241,029	1,269,174	1,292,190	1,341,265	1,395,382	1,383,803	1,452,405	1,259,860
Canada	3,115,442								3,357,343
Finland	372,298								366,470
Japan	8,930,758	9,014,070	9,199,060	8,915,604	9,448,038	3,382,673	9,310,788	9,055,925	8,879,177
New Zealand	146,671	145,936	160,098	157,068	167,336	178,289	179,601	187,434	191,372
United Kingdom	2,897,503	2,897,035	2,892,306	2,899,718	2,852,017	2,786,673	2,858,381	2,735,895	2,672,516
United States	34,148,365	33,478,702	34,267,622	34,647,124	35,601,619	35,479,041	36,762,808	37,264,495	37,940,667

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.3	2.3	1.8	3.8	4.0	-0.8	5.0	-13.3	1.8
Canada									7.8
Finland									-1.6
Japan	0.9	2.1	-3.1	6.0	-64.2	175.2	-2.7	-2.0	-0.6
New Zealand	-0.5	9.7	-1.9	6.5	6.5	0.7	4.4	2.1	30.5
United Kingdom	0.0	-0.2	0.3	-1.6	-2.3	2.6	-4.3	-2.3	-7.8
United States	-2.0	2.4	1.1	2.8	-0.3	3.6	1.4	1.8	11.1

Gaseous Fuels

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	657,379	630,809	652,617	679,848	703,601	760,119	761,664	784,095	825,195
Canada	2,763,972								3,346,514
Finland	91,838								143,722
Japan	1,855,107	1,988,791	2,004,977	2,056,830	2,174,306	93,902	2,353,945	2,452,797	2,522,990
New Zealand	129,529	155,262	155,106	152,753	151,799	154,291	187,706	219,470	195,115
United Kingdom	1,883,968	2,027,117	2,027,749	2,275,727	2,429,153	2,572,112	2,993,107	3,055,597	3,191,628
United States	20,321,525	20,663,759	21,230,426	22,022,413	22,457,388	23,356,859	23,774,333	23,765,672	23,090,017

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-4.0	3.5	4.2	3.5	8.0	0.2	2.9	5.2	25.5
Canada									21.1
Finland									56.5
Japan	7.2	0.8	2.6	5.7	-95.7	2406.8	4.2	2.9	36.0
New Zealand	19.9	-0.1	-1.5	-0.6	1.6	21.7	16.9	-11.1	50.6
United Kingdom	7.6	0.0	12.2	6.7	5.9	16.4	2.1	4.5	69.4
United States	1.7	2.7	3.7	2.0	4.0	1.8	0.0	-2.8	13.6

Biomass

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	179,114	178,072	164,874	182,513	191,239	200,040	199,970	219,380	221,780
Canada	630,781								749,808
Finland	169,787								250,617
Japan	IE	IE	IE	IE	IE	IE	IE	IE	IE
New Zealand	27,420	29,280	28,030	29,430	33,390	33,690	34,030	32,600	34,009
United Kingdom	47,165	37,641	40,198	41,602	45,418	48,342	50,527	53,047	56,213
United States	2,690,392	2,718,879	2,858,146	2,844,431	2,974,696	3,106,056	3,200,569	3,043,169	3,110,305

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-0.6	-7.4	10.7	4.8	4.6	0.0	9.7	1.1	23.8
Canada									18.9
Finland									47.6
Japan									
New Zealand	6.8	-4.3	5.0	13.5	0.9	1.0	-4.2	4.3	24.0
United Kingdom	-20.2	6.8	3.5	9.2	6.4	4.5	5.0	6.0	19.2
United States	1.1	5.1	-0.5	4.6	4.4	3.0	-4.9	2.2	15.6

Other Fuels

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	22,440	33,396	33,350	37,760	41,860	51,650	56,160	60,600	0
Canada	35,357								27,154
Finland	54,175								82,057
Japan	274,023	292,809	286,669	256,483	261,790	260,828	290,230	310,301	272,654
New Zealand	18,444	16,878	16,617	17,402	20,474	20,961	19,333	16,444	16,117
United Kingdom	4,403	4,451	5,422	7,518	14,156	15,030	16,280	19,877	24,189
United States	53,903	50,118	48,568	47,242	58,937	51,266	18,722	35,211	33,495

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	48.8	-0.1	13.2	10.9	23.4	8.7	7.9	-100.0	-100.0
Canada									-23.2
Finland									51.5
Japan	6.9	-2.1	-10.5	2.1	-0.4	11.3	6.9	-12.1	-0.5
New Zealand	-8.5	-1.5	4.7	17.7	2.4	-7.8	-14.9	-2.0	-12.6
United Kingdom	1.1	21.8	38.7	88.3	6.2	8.3	22.1	21.7	449.3
United States	-7.0	-3.1	-2.7	24.8	-13.0	-63.5	88.1	-4.9	-37.9

All Fuels

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	3,668,524	3,701,885	3,760,958	3,830,473	3,926,453	4,106,984	4,161,606	4,365,948	4,336,030
Canada	7,645,442								8,768,968
Finland	855,170								991,860
Japan	13,941,402	14,224,505	14,361,905	14,186,652	14,956,666	3,871,057	15,229,051	15,205,065	14,941,657
New Zealand	358,158	380,245	396,732	391,816	406,569	420,340	453,269	494,120	469,983
United Kingdom	7,336,231	7,486,680	7,331,251	7,271,565	7,250,674	7,232,754	7,603,778	7,348,530	7,431,508
United States	77,199,411	76,647,668	78,251,341	80,068,975	81,643,057	82,648,273	85,341,386	86,256,078	86,526,474

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.9	1.6	1.8	2.5	4.6	1.3	4.9	-0.7	18.2
Canada									14.7
Finland									16.0
Japan	2.0	1.0	-1.2	5.4	-74.1	293.4	-0.2	-1.7	7.2
New Zealand	6.2	4.3	-1.2	3.8	3.4	7.8	9.0	-4.9	31.2
United Kingdom	2.1	-2.1	-0.8	-0.3	-0.2	5.1	-3.4	1.1	1.3
United States	-0.7	2.1	2.3	2.0	1.2	3.3	1.1	0.3	12.1

Relative contribution (%) of each fuel type to Total Energy Consumption from Fuel combustion for 1990 and 1998

	Liquid		**Solid**		**Gaseous**		**Biomass**		**Other Fuels**	
	1990	**1998**	**1990**	**1998**	**1990**	**1998**	**1990**	**1998**	**1990**	**1998**
Australia	33.7	29.1	42.9	46.8	17.9	19.0	4.9	5.1	0.6	0.0
Canada	40.7	38.3	14.4	14.7	36.2	38.2	8.3	8.6	0.5	0.3
Finland	43.5	36.9	19.5	15.0	10.7	14.5	19.9	25.3	6.3	8.3
Japan	64.1	59.4	20.7	21.9	13.3	16.9	0.0	0.0	2.0	1.8
New Zealand	41.0	40.7	10.1	7.1	36.2	41.5	7.7	7.2	5.1	3.4
United Kingdom	39.5	36.0	34.1	20.0	25.7	42.9	0.6	0.8	0.1	0.3
United States	44.2	43.8	25.9	25.8	26.3	26.7	3.5	3.6	0.1	0.0

Note:
The following Parties are not included in these tables because data for years other than 1998 were not reported:
Austria, Belgium, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Slovakia, Spain, Sweden and Switzerland.

Energy - Road Transportation (1998)

Party	1.A.3.b Road Transportation (CO_2 and N_2O)											
	Methods and EF used[a]		IEF in CRF based on	CO_2 emissions				N_2O emissions				
						CO_2 IEF				N_2O IEF	
	Methods	EF		Key source	percent of national total	Gasoline	Diesel Oil	Key source	percent of national total	Gasoline	Diesel Oil
					(%)	(t/TJ)			(%)	(kg/TJ)	
IPCC Default EF[b]			**NCV**			**72.1 (US) 73.0 (Europe)**	**72.1 (US) 74.0 (Europe)**			**3-43 (US) 1-20 (Europe)**	**1-14 (US) 3-4 (Europe)**
Australia	T1, T2	CS	GCV	L	12.7	65.3	69.0	L	0.8	18.5	1.8
Austria	M	CS	NCV	L	20.5	73.5	74.2	L	0.7	16.7	2.6
Belgium											
Bulgaria	T2	C, CS, D	NCV	L	6.1	71.4	76.1			0.9	1.9
Canada	CS	CS	GCV	L	17.6	68.1	70.6	L	0.8	14.1	2.6
Czech Republic	T1	D	NCV	L	7.0	68.7	73.3			16.5	3.0
Finland	CS (M)	CS	NCV	L	14.2	72.8	74.9			11.7	3.0
Greece	C	C	NCV	L	12.6	68.7	73.4			6.3	3.7
Hungary	D	D	NCV	L	9.6	68.6	73.3			1.5	0.6
Ireland	T1	CS	NCV	L	13.0	70.0	73.3			10.5	4.2
Italy			NCV	L	19.3	68.2	73.3	L	0.6	7.5	6.2
Japan	T1, RA, CS	D, CS	NCV	L	16.9	70.6	72.3			5.0	3.6
Latvia											
Lithuania	RA, T1	D	NCV	L	14.2	67.9	72.6			0.6	0.1
Netherlands	CS	CS	NCV	L	13.2	73.0	73.0			14.9	10.1
New Zealand	T1	CS/D	NCV	L	13.7	NE[c]	NE[c]			NE[c]	NE[c]
Norway	M, T1, CS/T2	CS	NCV	L	16.0	71.3	73.6			15.5	1.9
Slovakia[d]	COPERT	COPERT	NCV	L	8.7						
Spain											
Sweden	CS	CS	NCV	L	23.6	76.3	80.9	L	0.6	8.7	1.6
Switzerland	CS	CS	NCV	L	26.7	73.9	73.6	L	1.2	12.0	2.9
United Kingdom	T2	CS	NCV	L	17.0	70.2	72.7	L	0.6	10.7	3.1
United States	T1, T2	D, CS	GCV	L	19.3	66.5	66.4	L	0.9	11.8	2.1

Notes:

[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 3.1 kg/TJ).

[d] Slovakia reported activity data for gasoline and diesel oil but CO_2 and N_2O emissions were reported as totals for the whole Road Transportation sub-category.

Energy - Transport:

Trends in CO_2 Emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year [a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		59,288	58,577	60,095	60,832	62,378	64,870	66,915	68,488	68,434
Austria		13,570	15,059	15,054	15,104	16,163	15,432	15,379	15,793	16,753
Belgium									24,334	24,697
Bulgaria	12,639	10,864	6,525	6,435	7,444	6,547	6,845			6,475
Canada		145,833	140,611	144,669	147,814	155,224	159,440	163,928	170,335	174,252
Finland		12,475	NE	11,592	10,993	11,414	11,126	10,994	11,531	12,299
Greece		15,358	16,135	16,562	16,761	16,867	16,972	17,258	18,040	19,790
Hungary	7,741	8,208	7,383	7,189	7,141	7,212	7,001	6,612	7,741	8,381
Ireland		4,961	5,206	5,625	5,591	5,829	6,306	7,063	7,684	8,768
Italy		95,616	94,849	99,426	102,031	103,849	105,300	108,310	110,188	110,167
Japan		205,633	215,313	220,473	222,474	233,425	240,292	246,874	251,376	251,132
Netherlands		28,560	28,550	29,830	30,460	30,800	32,030	33,821	34,333	34,715
New Zealand		8,660	8,662	9,047	9,458	10,160	10,869	10,989	11,242	11,435
Norway		11,646	11,616	11,833	12,394	12,180	12,554	13,154	13,391	13,752
Slovakia		5,070	4,426	4,116	4,029	4,189	4,216	4,164	4,591	4,950
Spain		58,004	60,804	64,695	61,161	65,756	66,747	71,874	71,892	78,390
Sweden		18,650	18,613	19,099	18,322	18,685	19,341	19,573	18,957	21,140
Switzerland		14,144	14,668	14,983	13,933	14,117	13,815	13,885	14,462	14,689
United Kingdom		116,721	116,194	117,647	118,822	119,175	118,066	122,679	123,756	122,899
United States		1,413,363	1,381,486	1,420,962	1,451,270	1,494,606	1,523,797	1,570,220	1,582,575	1,607,581

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-1.2	2.6	1.2	2.5	4.0	3.2	2.4	-0.1	15.4
Austria	11.0	0.0	0.3	7.0	-4.5	-0.3	2.7	6.1	23.5
Belgium								1.5	
Bulgaria	-39.9	-1.4	15.7	-12.0	4.5				-56.7
Canada	-3.6	2.9	2.2	5.0	2.7	2.8	3.9	2.3	19.5
Finland			-5.2	3.8	-2.5	-1.2	4.9	6.7	-1.4
Greece	5.1	2.6	1.2	0.6	0.6	1.7	4.5	9.7	28.9
Hungary	-10.1	-2.6	-0.7	1.0	-2.9	-5.5	17.1	8.3	7.8
Ireland	4.9	8.0	-0.6	4.2	8.2	12.0	8.8	14.1	76.8
Italy	-0.8	4.8	2.6	1.8	1.4	2.9	1.7	0.0	15.2
Japan	4.7	2.4	0.9	4.9	2.9	2.7	1.8	-0.1	22.1
Netherlands	0.0	4.5	2.1	1.1	4.0	5.6	1.5	1.1	21.6
New Zealand	0.0	4.5	4.5	7.4	7.0	1.1	2.3	1.7	32.0
Norway	-0.3	1.9	4.7	-1.7	3.1	4.8	1.8	2.7	18.1
Slovakia	-12.7	-7.0	-2.1	4.0	0.6	-1.2	10.3	7.8	-2.4
Spain	4.8	6.4	-5.5	7.5	1.5	7.7	0.0	9.0	35.1
Sweden	-0.2	2.6	-4.1	2.0	3.5	1.2	-3.1	11.5	13.3
Switzerland	3.7	2.1	-7.0	1.3	-2.1	0.5	4.2	1.6	3.9
United Kingdom	-0.5	1.3	1.0	0.3	-0.9	3.9	0.9	-0.7	5.3
United States	-2.3	2.9	2.1	3.0	2.0	3.0	0.8	1.6	13.7

The Czech Republic, Latvia and Lithuania are not included in this table because data for years other than 1998 were not reported.

Trends in N_2O emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year [a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		5.27	5.95	7.22	8.12	9.03	9.92	10.65	11.32	11.91
Austria		1.05	1.30	1.47	1.61	1.80	1.84	1.82	1.81	1.90
Belgium									1.57	1.65
Bulgaria	0.23	0.25	0.15	0.14	0.16	0.14	0.14			0.13
Canada		20.77	21.14	22.93	25.10	27.50	28.35	28.33	28.66	28.08
Finland		2.05	NE	1.30	1.10	1.18	1.81	1.94	2.04	2.45
Greece		0.65	0.77	0.92	1.00	1.09	1.12	1.14	1.26	2.00
Ireland		0.28	0.30	0.33	0.44	0.53	0.55	0.69	0.83	1.02
Italy		3.67	3.71	3.87	4.68	5.51	5.63	7.60	8.31	12.50
Japan		12.91	13.43	13.73	13.68	13.86	14.28	14.47	14.69	14.64
Netherlands		6.60	6.20	7.20	7.20	7.20	7.40	7.12	7.03	6.43
New Zealand		0.37	0.37	0.39	0.40	0.43	0.46	0.47	0.48	0.49
Norway		0.65	0.70	0.74	0.81	0.96	1.09	1.25	1.43	1.64
Slovakia		0.21	0.20	0.19	0.16	0.30	0.34	0.37	0.45	0.53
Spain		2.75	2.91	3.12	3.24	3.75	4.11	4.65	4.97	5.72
Sweden		2.14	2.60	3.00	2.70	2.90	2.90	2.82	2.86	1.76
Switzerland		0.98	1.13	1.29	1.40	1.53	1.61	1.68	1.74	2.01
United Kingdom		4.19	4.37	4.78	5.93	7.43	8.89	10.40	11.75	13.25
United States		162.66	172.23	185.27	194.92	202.30	205.92	206.70	204.55	203.32

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	12.9	21.3	12.5	11.2	9.9	7.4	6.3	5.2	126.0
Austria	23.8	13.1	9.5	11.8	2.2	-1.1	-0.5	5.0	81.0
Belgium								5.2	
Bulgaria	-40.0	-6.7	14.3	-12.5	0.0				-40.0
Canada	1.8	8.5	9.5	9.6	3.1	-0.1	1.2	-2.0	35.2
Finland			-15.4	7.3	53.4	7.2	5.2	20.1	19.5
Greece	18.5	19.5	8.7	9.0	2.8	1.8	10.5	58.7	207.7
Ireland	7.1	10.0	33.3	20.5	3.8	25.5	20.3	22.9	264.3
Italy	1.1	4.3	20.9	17.7	2.2	35.0	9.3	50.4	240.6
Japan	4.0	2.2	-0.4	1.3	3.0	1.3	1.5	-0.3	13.4
Netherlands	-6.1	16.1	0.0	0.0	2.8	-3.8	-1.3	-8.5	-2.6
New Zealand	0.0	5.4	2.6	7.5	7.0	2.2	2.1	2.1	32.4
Norway	7.7	5.7	9.5	18.5	13.5	14.7	14.4	14.7	152.3
Slovakia	-4.8	-5.0	-15.8	87.5	13.3	8.8	21.6	17.8	152.4
Spain	5.8	7.2	3.8	15.7	9.6	13.1	6.9	15.1	108.0
Sweden	21.5	15.4	-10.0	7.4	0.0	-2.8	1.4	-38.5	-17.8
Switzerland	15.3	14.2	8.5	9.3	5.2	4.3	3.6	15.5	105.1
United Kingdom	4.3	9.4	24.1	25.3	19.7	17.0	13.0	12.8	216.2
United States	5.9	7.6	5.2	3.8	1.8	0.4	-1.0	-0.6	25.0

The Czech Republic, Hungary, Latvia and Lithuania are not included in this table because data for years other than 1998 were not reported.

[a] In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).
For these Parties, the values in the column "percentage change from 1990 to 1998" refers to the base year data.

Energy - Road Transportation:

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	52,766	51,683	52,615	53,805	55,168	56,907	58,500	59,886	60,753
Canada	102,894								121,527
Finland	11,111								10,807
Japan	184,492	193,088	198,001	199,776	209,888	215,797	221,596	224,723	225,513
Netherlands							30,365	30,812	31,182
New Zealand	7,552	7,641	7,984	8,262	8,816	9,527	9,727	10,067	10,269
United Kingdom	109,180	108,381	109,820	111,082	111,682	110,623	114,895	116,340	115,606
United States	1,121,537	1,108,307	1,129,328	1,159,492	1,192,300	1,215,571	1,249,473	1,268,224	1,296,586

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-2.1	1.8	2.3	2.5	3.2	2.8	2.4	1.4	15.1
Canada									18.1
Finland									-2.7
Japan	4.7	2.5	0.9	5.1	2.8	2.7	1.4	0.4	22.2
Netherlands							1.5	1.2	
New Zealand	1.2	4.5	3.5	6.7	8.1	2.1	3.5	2.0	36.0
United Kingdom	-0.7	1.3	1.1	0.5	-0.9	3.9	1.3	-0.6	5.9
United States	-1.2	1.9	2.7	2.8	2.0	2.8	1.5	2.2	15.6

Trends in N_2O emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	5.1	5.8	7.0	7.9	8.8	9.7	10.4	11.1	11.7
Canada	12.0								18.5
Finland									1.1
Japan	12.2	12.7	13.0	13.0	13.1	13.6	13.7	13.9	13.9
Netherlands							6.4	6.3	5.7
New Zealand	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5
United Kingdom	3.2	3.3	3.7	4.9	6.4	7.9	9.4	10.9	12.4
United States	153.3	163.0	175.9	185.7	192.8	196.4	196.9	195.2	194.2

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	13.2	21.7	13.0	11.4	10.0	7.3	6.3	5.6	129.7
Canada									54.2
Finland									
Japan	4.2	2.4	-0.2	1.3	3.2	1.3	1.5	0.1	14.6
Netherlands							-1.6	-9.5	
New Zealand	2.9	2.9	5.6	5.3	7.5	2.3	2.3	2.2	35.3
United Kingdom	4.4	11.8	32.4	31.2	22.7	19.1	15.7	13.9	290.9
United States	6.4	7.9	5.6	3.8	1.9	0.3	-0.9	-0.5	26.7

Note:
The following Parties are not included in these tables because data for years other than 1998 were not reported:
Austria, Belgium, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Norway, Slovakia, Spain, Sweden and Switzerland.

Energy - Domestic Aviation and Marine Transport: Emission factors (1998)

	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	
	Methods	EF		Key source	percent of national total	CO_2 IEF		CO_2 IEF		Key source	percent of national total	CO_2 IEF		CO_2 IEF	
						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			72.8	73.8	72.8				0.0	74.1		
Belgium															
Bulgaria	T2	C, CS, D	NCV			70.6	70.8	70.6	70.8			75.9	76.3	80.7	76.3
Canada	CS	CS	GCV	L	1.8	70.1	69.5	70.1	69.5	L	0.7	74.1	70.6	74.1	70.6
Czech Republic	T1	D	NCV			69.3		70.8					73.7		
Finland	CS (M)	CS	NCV	L	0.6	70.8	72.7	70.8				76.7	73.3	76.6	73.4
Greece	C	C	NCV	L	1.0	70.8		70.8	NO	L	2.16	76.6	73.3	76.6	73.3
Hungary	D	D	NCV					70.8					68.6		
Ireland	T1	CS	NCV			NE	NE	71.3	70.0			76.0	73.3	76.0	73.3
Italy			NCV	L	0.4	70.8	68.6	70.7				0.0	73.3	76.7	73.8
Japan[c]	T1, RA, CS	D, CS	NCV			70.7	NO	74.4	NO	L	1.08	NO	72.3	79.1	76.1
Latvia															
Lithuania	RA, T1	D	NCV			70.1	68.1					75.8	72.6	75.8	72.6
Netherlands	CS	CS				73.0		73.1					73.0	77.0	73.0
New Zealand[d]	T1	CS/D	NCV	L	1.1	NE	NE	NE	NE			NE	NE	NE	NE
Norway	M, T1, CS/T2	CS	NCV	L	1.8	73.1	71.3	73.1		L	4.82	78.8	73.6	78.8	73.6
Slovakia	COPERT	COPERT	NCV			NA[e]	[f]						75.0		
Spain															
Sweden	CS	CS	NCV	L	1.1	80.3	75.3	80.3	75.3	L	0.81	88.2	77.3	93.1	80.9
Switzerland	CS	CS	NCV			73.2		73.2				0.0	74.0		
United Kingdom	T2	CS	NCV			71.8	70.6	71.8	IE			75.9	72.7	75.9	72.7
United States	T1, T2	D, CS	GCV	L	2.1	66.5	64.9	66.5	NE	L	0.68	73.9	66.4	73.9	124.0

Notes:

[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 ocean-going ships, boats; IPCC Guidelines (Volume 3, pages 1.89, 1.91).

[c] Japan reported implied emission factors for 3 types of heavy oil under other fuels (average CO_2 EF 74.59 t/TJ).

[d] New Zealand reported aggregate total activity data and emissions data for all fuels used for Aviation and Marine Transport

[e] Slovakia reported only emissions from Jet kerosene. Activity data were reported as NA.

[f] In the CRF, Slovakia indicated that emissions from Aviation Gasoline were "included in jet kerosene".

Energy - Domestic and International Aviation Transport: Activity data (1998)

	Domestic and International Aviation Transport											
	Activity data in CRF based on	1.A.3.a Civil Aviation (Domestic)							International Aviation			
		Jet Kerosene			Aviation Gasoline			share of fuel used for domestic[b]	Jet Kerosene			share of fuel used for international[c]
		CRF	IEA[a]	Difference	CRF	IEA[a]	Difference	CRF	reported in CRF	IEA[a]	Difference	CRF
		(TJ)		(%)	(TJ)		(%)	(%)	(TJ)		(%)	(%)
Australia	GCV	60,246	71,478	18.6	3,368	3,270	-2.9	37.8	104,820	105,484	0.6	62.2
Austria	NCV	1,614	11,861	634.7	93	0		6.3	25,198	12,039	-52.2	93.7
Belgium										65,503		
Bulgaria	NCV	1,681	892	-46.9	18	45	149.7	30.0	3,922	5,618	43.2	70.0
Canada	GCV	175,674	172,563	-1.8	3,818	3,674	-3.8	81.4	41,014	40,265	-1.8	18.6
Czech Republic	NCV	202	3,255	1511.4				6.0	3,175	5,083	60.1	94.0
Finland	NCV	6,202	6,376	2.8	110	134	22.2	31.1	13,984	14,447	3.3	68.9
Greece	NCV	17,523	15,339	-12.5	0	0		33.6	34,601	35,895	3.7	66.4
Hungary	NCV								7,848	8,338	6.2	100.0
Ireland	NCV	NE	981		NE	45			19,217	18,460	-3.9	
Italy	NCV	31,335	12,931	-58.7	309	269	-13.0	25.9	90,537	124,807	37.9	74.1
Japan	NCV	147,274	172,162	16.9	NO	269		37.4	246,184	266,113	8.1	62.6
Latvia										1,516		
Lithuania	NCV	1,135	0		17	0		100.0		1,249		
Netherlands		4,300	3,790	-11.9		134		3.2	130,000	137,783	6.0	96.8
New Zealand	NCV	NE	11,504		NE	627			NE	24,257		100.0
Norway	NCV	13,695	6,421	-53.1	90	0		55.2	11,207	21,894	95.4	44.8
Slovakia	NCV	NA	1,293		NA	0						
Spain			56,540			493				105,857		
Sweden	NCV	9,743	18,683	91.8	55	179	228.0	29.0	23,855	19,486	-18.3	71.0
Switzerland	NCV	3,483	2,586	-25.7	0	269		5.7	57,792	60,687	5.0	94.3
United Kingdom	NCV	36,926	166,455	350.8	1,618	1,523	-5.8	10.3	336,139	243,551	-27.5	89.7
United States	GCV	2,071,643	2,570,435	24.1	37,452	39,603	5.7	71.1	855,758	811,716	-5.1	28.9

Notes:

[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, table 1-3).

[b] The percentage values given in this column indicate the share of fuel used for domestic aviation compared to the total fuel used for aviation (domestic and international).

[c] The percentage values given in this column indicate the share of fuel used for international aviation compared to the total fuel used for aviation (domestic and international).

Energy - Transport: Civil Aviation

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		2,555	3,225	3,868	3,648	3,824	4,442	4,831	5,034	4,384
Canada		10,385								12,582
Finland		403								447
Japan		6,846	7,379	7,829	8,274	8,817	9,301	9,225	9,649	10,406
Netherlands								300	300	314
New Zealand		781	663	639	684	839	861	830	811	841
United Kingdom		2,158	2,121	2,221	2,281	2,326	2,448	2,550	2,641	2,764
United States		127,534	117,721	119,723	121,582	124,338	129,402	133,225	138,183	140,217

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	26.2	19.9	-5.7	4.8	16.2	8.8	4.2	-12.9	71.6
Canada									21.2
Finland									11.0
Japan	7.8	6.1	5.7	6.6	5.5	-0.8	4.6	7.9	52.0
Netherlands							0.0	4.7	
New Zealand	-15.2	-3.6	7.1	22.5	2.7	-3.6	-2.3	3.7	7.6
United Kingdom	-1.7	4.7	2.7	2.0	5.2	4.2	3.6	4.7	28.1
United States	-7.7	1.7	1.6	2.3	4.1	3.0	3.7	1.5	9.9

Note:
The following Parties are not included in this table because data for years other than 1998 were not reported:
Austria, Belgium, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Norway, Slovakia, Spain, Sweden and Switzerland.

Energy - International Bunkers: Aviation

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		4,345	4,520	4,796	5,199	5,354	5,858	6,312	6,540	7,233
Austria		941	1,101	1,172	1,143	1,201	1,332	1,471	1,522	1,835
Belgium									3,912	4,013
Bulgaria	892	892	320	565	739	632	549			280
Canada		2,729	2,483	2,685	2,472	2,461	2,604	3,074	2,992	2,878
Finland		1,800	1,700	2,164	1,694	1,318	1,044	1,181	1,286	1,658
Greece		2,452	2,130	2,206	2,907	2,787	2,613	2,503	2,421	2,449
Hungary			376	154	154	154	154	154	154	556
Ireland		1,116	1,209	1,299	1,379	1,161	1,146	1,269	1,325	1,373
Italy		3,780	3,737	4,346	4,457	4,691	4,926	5,446	5,660	5,683
Japan		13,184	13,849	14,109	14,222	14,885	16,834	18,161	19,095	18,311
Netherlands		4,450	4,960	5,910	6,500	6,720	7,670	8,300	9,000	9,500
New Zealand		1,352	1,293	1,323	1,341	1,444	1,583	1,649	1,724	1,637
Norway		605	542	556	624	621	571	682	760	819
Spain		3,161	3,173	3,557	6,484	5,869	6,211	6,554	7,072	8,518
Sweden		2,045	1,779	1,894	1,926	1,947	1,968	1,302	1,934	1,926
Switzerland		3,200	3,100	3,300	3,440	3,550	3,770	3,900	4,050	4,230
United Kingdom		14,791	14,570	16,121	17,241	17,856	19,012	20,238	21,552	24,122
United States		46,728	46,682	47,143	47,615	48,327	51,093	52,135	55,899	56,917

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	4.0	6.1	8.4	3.0	9.4	7.8	3.6	10.6	66.5
Austria	17.0	6.5	-2.5	5.2	10.8	10.4	3.5	20.6	95.0
Belgium								2.6	
Bulgaria	-64.1	76.5	30.7	-14.4	-13.1				-68.6
Canada	-9.0	8.2	-7.9	-0.5	5.8	18.1	-2.7	-3.8	5.4
Finland	-5.6	27.3	-21.7	-22.2	-20.8	13.1	8.9	28.9	-7.9
Greece	-13.1	3.6	31.8	-4.1	-6.2	-4.2	-3.3	1.2	-0.1
Hungary		-59.1	0.0	0.0	0.0	0.0	0.0	261.4	
Ireland	8.3	7.4	6.2	-15.8	-1.3	10.7	4.5	3.6	23.0
Italy	-1.1	16.3	2.6	5.3	5.0	10.6	3.9	0.4	50.3
Japan	5.0	1.9	0.8	4.7	13.1	7.9	5.1	-4.1	38.9
Netherlands	11.5	19.2	10.0	3.4	14.1	8.2	8.4	5.6	113.5
New Zealand	-4.4	2.3	1.4	7.7	9.6	4.2	4.5	-5.0	21.1
Norway	-10.4	2.5	12.2	-0.5	-8.0	19.4	11.4	7.8	35.4
Spain	0.4	12.1	82.3	-9.5	5.8	5.5	7.9	20.5	169.5
Sweden	-13.0	6.5	1.7	1.1	1.1	-33.8	48.5	-0.4	-5.8
Switzerland	-3.1	6.5	4.2	3.2	6.2	3.4	3.8	4.4	32.2
United Kingdom	-1.5	10.6	6.9	3.6	6.5	6.4	6.5	11.9	63.1
United States	-0.1	1.0	1.0	1.5	5.7	2.0	7.2	1.8	21.8

Note:
The Czech Republic, Latvia, Lithuania and Slovakia are not included in this table because data for years other than 1998 were not reported.

[a] In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).
For these Parties, the values in the column "percentage change from 1990 to 1998" refers to the base year data.

Energy - Domestic and International Marine Transport: Activity data (1998)

	Domestic and International Marine Transport													
	Activity data in CRF based on	1.A.3.d Navigation (Domestic)							International Marine Transport						
		Residual Oil			Gas/Diesel Oil			share of fuel used for domestic[b]	Residual Oil			Gas/Diesel Oil			share of fuel used for international[c]
		CRF	IEA[a]	Difference	CRF	IEA[a]	Difference	CRF	CRF	IEA[a]	Difference	CRF	IEA[a]	Difference	CRF
		(TJ)		(%)	(TJ)		(%)	(%)	(TJ)		(%)	(TJ)		(%)	(%)
Australia	GCV	10,289	10,170	-1.2	2,628	6,870	161.4	42.9	25,450	25,109	-1.3	5,590	5,323	-4.8	57.1
Austria	NCV				783			100.0							
Belgium															
Bulgaria	NCV	42	40	-4.3	84	87	3.7	0.8	10,109			2,703	3,033	12.2	99.2
Canada	GCV	30,254	27,771	-8.2	36,649	35,314	-3.6	56.6	43,211	39,668	-8.2	8,165	7,886	-3.4	43.4
Czech Republic	NCV				434			100.0		0					
Finland	NCV	1,640	1,608	-2.0	1,785	1,820	2.0	13.5	15,129	14,830	-2.0	6,800	6,933	2.0	86.5
Greece	NCV	21,622	21,622	0.0	13,996	15,252	9.0	19.6	112,452	112,452	0.0	32,844	32,844	0.0	80.4
Hungary	NCV				58	43	-25.3	100.0		0					
Ireland	NCV	921	884	-4.0	628	650	3.5	18.6	2,052	2,010	-2.0	4,689	4,680	-0.2	81.4
Italy	NCV				12,227	9,143	-25.2	18.3	71,315	74,231	4.1	24,170	34,317	42.0	81.7
Japan [d]	NCV	NO	121,535		7,611	67,855	791.5	45.1	235,355	221,045	-6.1	797	8,406	954.6	54.9
Latvia															
Lithuania	NCV	40	40	0.5	148	40	-72.8	8.2	1,146	1,166	1.7	949	173	-81.8	91.8
Netherlands	NCV				11,600	28,165	142.8	2.2	434,000	420,307	-3.2	88,000	88,870	1.0	97.8
New Zealand	NCV	NE			NE	5,286			NE	10,168		NE	3,683		100.0
Norway	NCV	731	723	-1.0	35,981	31,934	-11.2	49.0	17,422	17,242	-1.0	20,751	20,322	-2.1	51.0
Slovakia	NCV				2,213			100.0							
Spain															
Sweden	NCV	3,982	1,487	-62.7	3,234	4,030	24.6	11.6	52,250	53,332	2.1	2,700	12,219	352.5	88.4
Switzerland	NCV				973	217	-77.7	100.0					477		
United Kingdom	NCV	4,309	4,059	-5.8	36,784	42,550	15.7	25.9	69,111	67,680	-2.1	48,689	60,489	24.2	74.1
United States	GCV	91,918	2,237	-97.6	585,623			48.5	627,552	700,048	11.6	91,788	308,648	236.3	51.5

Notes:

[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, table 1-3).

[b] The percentage values given in this column indicate the share of fuel used for domestic navigation compared to the total fuel used for navigation (domestic and international).

[c] The percentage values given in this column indicate the share of fuel used for international navigation compared to the total fuel used for navigation (domestic and international).

[d] Japan reported consumption of 3 types of heavy oil under other fuels (total consumption 186,066 TJ).

Energy - Transport: Navigation (Domestic)

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		2,224	1,941	1,939	1,741	1,760	1,951	2,008	1,980	1,710
Canada		4,733								4,827
Finland		227								257
Japan		13,353	13,915	13,717	13,567	13,871	14,367	15,235	16,219	14,429
Netherlands								798	847	847
New Zealand		250	258	300	289	366	332	285	210	177
United Kingdom		3,461	3,718	3,557	3,538	3,282	3,102	3,415	3,252	3,001
United States		55,290	52,825	67,678	63,386	62,185	62,394	66,521	50,176	45,707

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-12.7	-0.1	-10.2	1.1	10.8	2.9	-1.4	-13.7	-23.1
Canada									2.0
Finland									13.1
Japan	4.2	-1.4	-1.1	2.2	3.6	6.0	6.5	-11.0	8.1
Netherlands							6.1	0.0	
New Zealand	3.0	16.3	-3.5	26.3	-9.2	-14.3	-26.1	-15.9	-29.3
United Kingdom	7.4	-4.3	-0.6	-7.2	-5.5	10.1	-4.8	-7.7	-13.3
United States	-4.5	28.1	-6.3	-1.9	0.3	6.6	-24.6	-8.9	-17.3

Note:
The following Parties are not included in this table because data for years other than 1998 were not reported:
Austria, Belgium, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Norway, Slovakia, Spain, Sweden and Switzerland.

Energy - International Bunkers: Marine

Trends in CO2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		2,056	1,858	1,789	1,788	1,886	2,675	2,719	2,519	2,240
Belgium									17,605	18,070
Bulgaria	874	874	878	873	844	850	882			1,233
Canada		2,995	3,099	3,181	2,838	3,189	3,312	3,086	3,046	3,776
Finland		974	900	811	762	802	868	957	965	990
Greece		8,028	7,368	8,422	9,819	10,470	11,214	9,864	9,891	11,059
Ireland		56	107	54	171	125	368	497	484	503
Italy		8,651	8,467	8,009	7,695	7,670	7,491	7,651	7,231	7,523
Japan		17,621	19,187	19,987	22,465	22,609	20,494	14,259	17,543	18,687
Netherlands		35,560	36,330	36,490	37,780	36,140	36,480	37,200	39,530	39,830
New Zealand		1,032	912	866	915	1,324	1,125	1,062	1,112	1,062
Norway		1,478	1,252	1,567	1,677	1,846	2,256	2,480	3,080	2,899
Spain		11,780	12,496	12,655	11,079	10,027	10,296	15,029	18,536	19,551
Sweden		2,162	2,552	2,922	2,929	3,453	3,399	3,597	4,266	5,084
United Kingdom		6,559	6,340	6,640	6,573	6,150	6,599	7,210	8,064	8,788
United States		71,237	73,337	62,822	52,270	49,690	49,921	50,062	53,889	57,783

Relative Change to Previous Year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-9.6	-3.8	0.0	5.5	41.8	1.6	-7.3	-11.1	9.0
Belgium								2.6	
Bulgaria	0.5	-0.6	-3.3	0.8	3.8				41.0
Canada	3.5	2.7	-10.8	12.4	3.9	-6.9	-1.3	24.0	26.1
Finland	-7.6	-9.9	-6.0	5.3	8.3	10.2	0.8	2.6	1.6
Greece	-8.2	14.3	16.6	6.6	7.1	-12.0	0.3	11.8	37.8
Ireland	89.9	-49.9	219.5	-26.9	194.3	35.2	-2.7	3.8	793.4
Italy	-2.1	-5.4	-3.9	-0.3	-2.3	2.1	-5.5	4.0	-13.0
Japan	8.9	4.2	12.4	0.6	-9.4	-30.4	23.0	6.5	6.0
Netherlands	2.2	0.4	3.5	-4.3	0.9	2.0	6.3	0.8	12.0
New Zealand	-11.6	-5.0	5.6	44.7	-15.0	-5.5	4.7	-4.5	3.0
Norway	-15.3	25.1	7.0	10.1	22.2	10.0	24.2	-5.9	96.2
Spain	6.1	1.3	-12.4	-9.5	2.7	46.0	23.3	5.5	66.0
Sweden	18.0	14.5	0.2	17.9	-1.6	5.8	18.6	19.2	135.2
United Kingdom	-3.3	4.7	-1.0	-6.4	7.3	9.3	11.9	9.0	34.0
United States	2.9	-14.3	-16.8	-4.9	0.5	0.3	7.6	7.2	-18.9

Note:
The Czech Republic, Hungary, Latvia, Lithuania and Slovakia are not included in this table because data for years other than 1998 were not reported. Austria and Switzerland reported zero.

[a] In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).
For these Parties, the values in the column "percentage change from 1990 to 1998" refers to the base year data.

Energy - Fugitive emissions from fuels: coal mining and handling (1998)

	1.B.1 Fugitive Emissions from Solid Fuels (CH_4)												
	Key source	percent of national total	Methods and EF used [c]		1.B.1.a Coal Mining and Handling								
					Activity data					CH_4 IEF			
					CRF			IEA[a]	Difference	Underground mines		Surface mines	
			Methods	EF	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	3.9	T2	CS	78.8	187.7	266.5	284.6	6.8	7.66	0.39	1.36	NA
Austria			C	CS		1.1	1.1	1.1	0.9			0.01	NE
Belgium													
Bulgaria	L	1.6	T1	D	3.0	27.1	30.1	30.1	0.0	11.73	1.68	0.80	0.07
Canada			CS	CS	3.9	91.5	95.4	75.4	-21.0	7.70	IE	0.38	IE
Czech Republic	L	3.6	T3	CS	15.9	48.6	64.5	67.5	4.7	11.83	1.56	0.77	0.07
Finland			CS	CS									
Greece			T1	IPCC	NA	60.9	60.9	60.9	0.0	NO	NO	0.78	0.07
Hungary	L	2.4	D	D	6.5	8.6	15.1	14.7	-2.8	11.72	1.68	0.80	0.07
Ireland			NA	NA	NO	NO				NO	NO	NO	NO
Italy						0.0	0.0	0.2					
Japan			T2	CS	3.1	0.6	3.7	3.7	-0.9	15.10	0.60	0.77	0.07
Latvia								0.0					
Lithuania								0.0					
Netherlands					NO	NO				NO	NO	NO	NO
New Zealand	L	0.7	T1	CS/D	0.9	2.4	3.3	3.3	-0.1	22.83	1.60	0.77	0.07
Norway			T1	D	0.3		0.3	0.3	-0.1	14.00			
Slovakia	L	1.1	IPCC	IPCC	4.0		4.0	4.0	0.0	6.70	0.30		
Spain								26.0					
Sweden													
Switzerland					0.0	0.0	0.0	0.0					
United Kingdom	L	0.8	T2	CS	25.0	15.0	40.0	40.0	0.0	9.17	1.16	0.34	IE
United States	L	1.0	T2/3	CS	377.4	637.0	1014.4	1013.4	-0.1	5.25	1.58	0.71	0.11

Notes:

[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 1998 (Gigagrams and annual percentage change)

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		757.3	760.4	789.8	787.0	758.6	795.8	837.2	807.7	889.3
Austria		0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Belgium									13.2	13.2
Bulgaria	91.9	75.8	65.1	71.5	71.4	66.7	69.2			63.7
Canada		91.2	99.4	87.4	87.3	84.1	81.6	84.1	78.1	65.0
Finland		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Greece		44.1	44.8	46.8	46.6	48.2	49.0	50.8	50.0	51.8
Hungary	222.9	167.0	160.6	124.4	109.5	104.8	105.9	107.8	107.7	94.3
Italy		5.1	5.1	4.3	4.0	3.4	3.2	3.1	2.9	2.9
Japan		107.4	107.4	106.8	101.0	94.2	88.9	87.2	52.6	49.6
New Zealand		11.8	10.6	10.9	11.0	13.2	19.8	30.0	18.7	24.7
Norway		4.2	4.6	5.0	3.8	4.2	4.1	3.2	5.4	4.6
Slovakia		33.4	29.0	24.7	24.8	25.4	26.3	26.8	27.4	27.7
Spain		107.6	101.2	101.1	96.7	90.8	90.1	87.8	78.6	74.8
United Kingdom		828.7	847.2	811.9	525.5	334.9	368.8	346.6	326.7	271.6
United States		4,183.7	3,975.4	3,834.9	3,355.8	3,389.9	3,550.0	3,301.0	3,274.1	3,104.2

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.4	3.9	-0.4	-3.6	4.9	5.2	-3.5	10.1	17.4
Austria	-50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-50.0
Belgium									
Bulgaria	-14.1	9.8	-0.2	-6.6	3.7				-30.6
Canada	9.0	-12.1	0.0	-3.7	-3.0	3.1	-7.2	-16.8	-28.8
Finland			0.0	0.0	0.0	0.0	0.0	0.0	0.0
Greece	1.5	4.5	-0.4	3.4	1.8	3.6	-1.6	3.5	17.3
Hungary	-3.8	-22.6	-12.0	-4.3	1.0	1.7	-0.1	-12.4	-57.7
Italy	0.8	-16.1	-6.3	-15.1	-7.6	-2.8	-4.9	-1.0	-43.1
Japan	0.1	-0.5	-5.4	-6.8	-5.7	-1.8	-39.8	-5.6	-53.8
New Zealand	-10.6	3.1	0.5	20.4	49.8	51.5	-37.6	32.2	109.0
Norway	9.0	8.7	-25.3	12.5	-3.1	-21.5	68.5	-15.2	8.3
Slovakia	-13.2	-14.8	0.4	2.4	3.5	1.9	2.2	1.1	-17.1
Spain									
United Kingdom	2.2	-4.2	-35.3	-36.3	10.1	-6.0	-5.8	-16.9	-67.2
United States	-5.0	-3.5	-12.5	1.0	4.7	-7.0	-0.8	-5.2	-25.8

Note:
The Czech Republic, Latvia, Lithuania, the Netherlands and Sweden are not included in this table because data for years other than 1998 were not reported. Ireland and Switzerland reported zero.

[a] In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).
For these Parties, the values in the column "percentage change from 1990 to 1998" refers to the base year data.

Energy - Fugitive emissions from fuels: Oil and Natural Gas (1998)

	1.B.2 Fugitive emissions from Oil and Natural Gas (CH_4)																	
	Key source	percent 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							
					Production		Transport		Refining (R)/ Storage (S)		Production/Processing [b]		Transmission [b]		Distribution [b]		Other leakage [b]	
		(%)	Methods	EF	value	unit	value	unit	value	unit	value	unit	value	unit	value	unit	value	unit
IPCC Default EF [c]					**300-5,000**	**kg/PJ**	**745**	**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	1.4	T2	CS	209	kg/PJ	745	kg/PJ	1,119	kg/PJ	1,295	kg/PJ	8,499	kg/PJ	503,765	kg/PJ	NE	
Austria			C	CS	NE		NE		NE		NE				698	kg/Mm^3 GAS		
Belgium																		
Bulgaria	L	2.7	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	6,661	kg/10^3 km^3			NE		1,707	kg/10^6 m^3	3,240	kg/10^6 m^3	744	kg/10^6 m^3	NA	
Czech Republic			T1, T3	D,CS	5,190	kg/PJ			1,400	kg/PJ	51,923	kg/PJ	17,251	kg/PJ				
Finland			CS	PS													1,000	kg/t
Greece			C	C	3	kg/GJ					NO		NO		NO		NO	
Hungary	L	7.7	T1	D	2,600	kg/PJ			750	kg/PJ	250,000	kg/PJ	458,000	kg/PJ				
Ireland			T1	CS	NO		NO		NO		NE		NE		100,162	kg/PJ	NO	
Italy	L	1.1																
Japan			T1	D	2,650	kg/PJ	NO		880	kg/PJ	49,500	kg/PJ	95,000	kg/PJ	NO		NO	
Latvia													0.5[d]	kg/PJ				
Lithuania	L	1.5	RA, T1	D,CS	3,000	kg/PJ	713	kg/PJ							117,984	kg/PJ		
Netherlands	L	1.3	CS	CS											86,000	kg/PJ		
New Zealand	L	0.9	T1	CS/D	NA		NA				NA		195,284	kg/PJ	NA		NA	
Norway	L	1.0	CS	CS			2,596	kg/PJ										
Slovakia	L	3.8	IPCC, T1	IPCC	2,650	kg/PJ			745	kg/PJ	67,000	kg/PJ	5,000	kg/PJ			340,000	kg/PJ
Spain																		
Sweden																		
Switzerland			C	CS					1,023	kg/PJ					123,145	kg/PJ		
United Kingdom	L	1.4	T3	CS	5,602	kg/PJ	1,813	kg/PJ	43	kg/PJ	IE		IE		123,374	kg/PJ	NE	
United States	L	2.2	T3	CS	471,038	kg/MM Bbl/yr	2,601	kg/MM Bbl/yr	11,840	kg/MM Bbl/yr	110,627	kg/bill ft^3/yr	110,387	kg/bill ft^3/yr	66,307	kg/bill ft^3/yr	IE	

[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 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 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)

[d] The imbedded formula in the CRF was overwritten. If the formula were used the value of the IEF would be approximately 500,000 kg/PJ.

Energy - Fugitive emissions from fuels: Oil and Natural Gas (1998) *continued*

	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	NA		94,016	kg/PJ	NE		NA		10,059	kg/PJ
Austria										
Belgium										
Bulgaria	18,000	kg/PJ	2,000	kg/PJ	NE		NE		NE	
Canada	NA		NA		NA		NA		142	$kg/10^6\ m^3$
Czech Republic										
Finland	NE									
Greece										
Hungary										
Ireland	NO		NE		NE		NO		NO	
Italy										
Japan	NO		NO		NO	-	NO		NO	
Latvia										
Lithuania										
Netherlands										
New Zealand	NA		NA		NA		NA		NA	
Norway					23,999	kg/PJ	1,023	kg/PJ		
Slovakia										
Spain										
Sweden										
Switzerland	227	kg/PJ								
United Kingdom	IE		IE		IE		IE		310,201	kg/PJ
United States	IE		IE		IE		IE		IE	

[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, Vol. 3, p. 1.119-1.121. Emission factors (in kg/PJ) for Venting & Flaring from Gas Production by regions are provided in the table below.

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

Energy - Fugitive Emissions from Fuels: Oil and natural gas

Trends in CH_4 Emissions from Oil and Natural Gas, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		327.3	293.6	312.7	272.2	276.6	329.7	306.5	334.7	327.9
Austria		4.3	4.5	4.4	4.7	4.8	5.2	5.6	5.4	5.5
Belgium									35.5	35.5
Bulgaria	166.7	176.7	151.1	133.2	125.0	125.6	150.4			107.8
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
Finland		0.2	0.2	0.2	0.2	0.2	0.2	0.6	0.4	0.4
Greece		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
Hungary	225.4	199.0	292.1	259.0	275.7	274.3	292.5	317.4	299.7	305.2
Ireland		6.1	5.8	5.5	5.3	5.0	4.8	4.7	4.6	4.0
Italy		331.2	326.8	313.9	302.8	288.6	280.0	280.6	283.4	282.5
Japan		52.4	57.1	60.5	65.1	67.1	71.4	74.4	77.8	79.2
Netherlands		178.8	188.1	163.1	158.0	168.5	174.0	177.5	158.9	149.6
New Zealand		15.0	14.3	13.7	13.4	14.2	13.7	14.8	17.0	18.3
Norway		13.6	15.3	19.7	23.0	24.5	24.7	24.8	28.0	25.4
Slovakia		88.2	84.6	77.8	81.1	80.4	87.1	91.4	92.5	94.3
Spain		50.0	55.3	58.3	56.5	61.3	71.6	81.5	97.3	103.4
Switzerland		14.6	14.5	14.2	13.8	13.3	12.8	12.7	12.6	12.5
United Kingdom		540.2	523.3	521.0	508.5	506.5	502.6	489.1	476.7	466.0
United States		7,063.7	7,146.5	7,185.8	7,248.5	7,162.8	7,098.4	7,184.3	7,103.1	6,967.6

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-10.3	6.5	-13.0	1.6	19.2	-7.0	9.2	-2.0	0.2
Austria	5.7	-1.8	5.5	2.9	9.2	6.4	-3.6	2.6	29.4
Belgium								0.0	
Bulgaria	-14.5	-11.8	-6.2	0.5	19.8	-100.0			-35.4
Canada	4.7	9.1	4.3	5.8	6.3	6.8	0.1	-0.7	42.3
Finland	0.0	0.0	0.0	0.0	0.0	194.0	-30.3	-2.4	100.0
Greece	1.1	-15.8	-20.0	-6.3	-13.3	11.5	-8.6	-32.1	-61.7
Hungary	46.8	-11.3	6.4	-0.5	6.6	8.5	-5.6	1.8	35.4
Ireland	-4.3	-4.3	-4.5	-4.7	-4.0	-2.7	-2.5	-12.2	-33.4
Italy	-1.3	-4.0	-3.5	-4.7	-3.0	0.2	1.0	-0.3	-14.7
Japan	9.1	6.0	7.6	3.0	6.4	4.2	4.5	1.8	51.3
Netherlands	5.2	-13.3	-3.1	6.6	3.3	2.0	-10.5	-5.9	-16.3
New Zealand	-4.5	-4.6	-1.9	5.5	-3.3	8.0	14.7	7.7	21.7
Norway	12.1	28.6	17.2	6.3	0.9	0.6	12.9	-9.4	86.3
Slovakia	-4.1	-8.0	4.2	-0.9	8.3	4.9	1.2	2.0	7.0
Spain	10.6	5.5	-3.2	8.6	16.7	13.8	19.4	6.2	106.7
Switzerland	-1.2	-2.0	-2.8	-3.6	-3.7	-0.8	-0.8	-0.8	-14.7
United Kingdom	-3.1	-0.5	-2.4	-0.4	-0.8	-2.7	-2.5	-2.2	-13.7
United States	1.2	0.6	0.9	-1.2	-0.9	1.2	-1.1	-1.9	-1.4

Note:
The Czech Republic, Latvia, Lithuania and Sweden are not included in this table because data for years other than 1998 were not reported.

[a] In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987).
For these Parties, the values in the column "percentage change from 1990 to 1998" refer to the base year data.

2. Industrial Processes

Industrial processes - Mineral products, CO_2 (1998)

	2.A Mineral products												
	Methods and EF used[a]		2.A.1 Cement production							2.A.2 Lime production[e]	2.A.3 Limestone and dolomite use		
	Methods	EF	Key source	percent of national total	Activity data (production)				CO_2 IEF	CO_2 IEF	Key source	percent of national total	CO_2 IEF
					Description[b]	CRF	U.N.[c]	Difference[d]					
				%		kt	kt	%	t / t	t / t		%	t / t
IPCC Default EF [f]									0.499 (cement)	0.79 - 0.91			0.44 -0.48
IPCC Default EF [f]									0.507 (clinker)				
Australia	T2	CS	L	3.0	Clinker	6,232	6,952	11.55	0.518	0.69			0.41
Austria	C, CS	CS			Cement	3,800	3,944	3.79	0.656	0.37			
Belgium							6,929						
Bulgaria	D	D	L	1.0	Cement	1,742	1,742	-0.02	0.499	0.79			0.48
Canada	T1	CS	L	1.0	Cement	12,064	12,064	0.00	0.500	0.79			0.57
Czech Republic	T1	D	L	2.0	Cement	4,874	4,604	-5.54	0.499				
Finland	D	PS/D	L	1.0	Cement	1,232	960	-22.09	0.471	0.79			NE
Greece	C	C	L	6.0	Cement	14,800	13,660	-7.70	0.499	0.79			NE
Hungary	D	D	L	2.0	Cement	2,999	2,999	0.01	0.500	0.79			
Ireland	D	D	L	2.0	Clinker	2,000	2,000	0.00	0.500	0.75			NO
Italy			L	3.0		27,328	35,512	29.95	0.600	0.79			
Japan	D	D				IE	81,328		IE	IE	L	3.8	0.43
Latvia					Cement	366	366	0.00	0.498	0.79			0.44
Lithuania	RA, T1	D, C	L	2.0		788	788	-0.04	0.499	0.79	L	5.6	0.46
Netherlands	CS	PS, CS					3,300						
New Zealand	T1	CS			Cement	955	976	2.16	0.501	0.69			NE
Norway	D	CS	L	2.0		C	1,690						
Slovakia	IPCC	IPCC	L	2.0		2,875	3,066	6.64	0.411	0.79	L	5.8	0.44
Spain							27,860						
Sweden	CS	CS	L	2.0		3,486	2,372	-31.96	0.440	0.79			
Switzerland	C	C	L	4.0	Cement	3,450	4,000	15.94	0.590	0.37			
United Kingdom	T1	D	L	1.0	Clinker	12,372	14,995	21.20	0.507	0.44			0.45
United States	D,CS	D,CS			Clinker	75,859	83,931	10.64	0.517	0.68			0.45

[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, Vol.LIV, no. 12, December 2000.

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

[e] Lime production was not a key source for any Party.

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

Industrial processes - mineral products

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		4,827	4,503	4,389	4,598	5,238	5,123	5,147	5,078	5,471
Austria		3,318	3,277	3,429	3,289	3,415	2,730	2,727	2,801	2,716
Belgium									5,200	5,200
Bulgaria	4,629	4,264	2,472	1,979	1,746	1,917	2,328			1,410
Canada		8,161	6,981	6,636	6,875	7,507	7,691	8,034	8,168	8,361
Finland		1,130	1,000	1,025	858	840	810	840	900	921
Greece		6,984	6,979	7,022	7,253	7,046	7,392	7,621	7,774	7,924
Hungary	3,587	3,568	1,265	1,118	1,267	1,397	1,438	1,548	1,587	1,971
Ireland		941	924	962	932	1,085	1,068	1,080	1,190	1,192
Italy		22,715	22,587	22,939	19,300	18,858	19,422	19,107	19,342	19,973
Japan		55,418	57,055	57,643	57,150	57,913	57,909	57,626	56,135	50,754
Netherlands		730	700	750	1,050	1,050	1,130	900	1,100	1,100
New Zealand		449	437	500	553	566	586	581	598	566
Norway		683	629	689	875	884	917	903	969	916
Slovakia	5,546	5,546	4,125	4,645	4,262	4,516	4,720	4,499	4,734	4,770
Spain		14,289	13,756	12,542	11,878	13,835	14,809	14,482	18,285	20,506
Sweden		2,018	2,021	1,977	1,948	2,013	2,676	1,953	1,850	1,977
United Kingdom		9,419	8,049	7,518	7,561	8,331	8,437	8,668	9,491	9,598
United States		53,627	52,357	52,630	54,225	57,534	60,767	62,030	64,728	66,033

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-6.7	-2.5	4.8	13.9	-2.2	0.5	-1.3	7.7	13.3
Austria	-1.2	4.7	-4.1	3.8	-20.1	-0.1	2.7	-3.0	-18.1
Belgium								0.0	
Bulgaria	-42.0	-20.0	-11.8	9.8	21.5	-100.0			-66.9
Canada	-14.5	-4.9	3.6	9.2	2.5	4.5	1.7	2.4	2.5
Finland	-11.5	2.5	-16.3	-2.1	-3.6	3.7	7.1	2.4	-18.4
Greece	-0.1	0.6	3.3	-2.9	4.9	3.1	2.0	1.9	13.5
Hungary	-64.6	-11.6	13.3	10.3	2.9	7.6	2.6	24.2	-44.7
Ireland	-1.9	4.1	-3.1	16.4	-1.6	1.2	10.2	0.2	26.6
Italy	-0.6	1.6	-15.9	-2.3	3.0	-1.6	1.2	3.3	-12.1
Japan	3.0	1.0	-0.9	1.3	0.0	-0.5	-2.6	-9.6	-8.4
Netherlands	-4.1	7.1	40.0	0.0	7.6	-20.4	22.2	0.0	50.7
New Zealand	-2.7	14.4	10.6	2.4	3.5	-0.9	2.9	-5.4	26.1
Norway	-8.0	9.7	26.9	1.0	3.7	-1.5	7.2	-5.4	34.1
Slovakia	-25.6	12.6	-8.3	6.0	4.5	-4.7	5.2	0.8	-14.0
Spain	-3.7	-8.8	-5.3	16.5	7.0	-2.2	26.3	12.1	43.5
Sweden	0.1	-2.2	-1.5	3.3	32.9	-27.0	-5.3	6.9	-2.0
United Kingdom	-14.5	-6.6	0.6	10.2	1.3	2.7	9.5	1.1	1.9
United States	-2.4	0.5	3.0	6.1	5.6	2.1	4.3	2.0	23.1

Note:
The following Parties are not included in these tables because data for years other than 1998 were not reported:
Czech Republic, Latvia, Lithuania and Switzerland.

Cement production
Trends in CO_2 emissions , 1990 to 1998 (Gigagrams and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		3,168.1	2,899.8	2,734.5	2,831.4	3,180.5	3,162.9	3,001.8	2,944.3	3,228.2
Belgium									3,398.0	3,398.0
Canada		5,872.5								6,032.0
Finland		777.5								580.9
New Zealand		366.7	343.3	405.4	461.2	486.8	503.3	502.8	503.4	478.7
United Kingdom		6,693.2	5,499.5	5,006.1	5,069.0	5,842.3	5,766.2	5,886.9	6,156.7	6,273.8
United States		33,278.3	32,535.2	32,791.8	34,623.6	36,086.5	36,847.1	37,079.3	38,323.5	39,226.6

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-8.5	-5.7	3.5	12.3	-0.6	-5.1	-1.9	9.6	1.9
Belgium								0.0	
Canada									2.7
Finland									-25.3
New Zealand	-6.4	18.1	13.7	5.6	3.4	-0.1	0.1	-4.9	30.6
United Kingdom	-17.8	-9.0	1.3	15.3	-1.3	2.1	4.6	1.9	-6.3
United States	-2.2	0.8	5.6	4.2	2.1	0.6	3.4	2.4	17.9

Trends in CO_2 implied emission factors, 1990 to 1998 (t/t)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia			0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Belgium										
Canada		0.5								0.5
Finland		0.47								0.47
New Zealand		0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.49	0.5
United Kingdom		0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
United States		0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia		0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Belgium									
Canada									0.00
Finland									0.00
New Zealand	0.00	0.00	0.00	0.00	0.00	0.00	-0.04	0.02	-0.02
United Kingdom	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

Note:
The following Parties are not included in these tables because numerical information for years other than 1998 was not reported:
Austria, Bulgaria, Czech Republik, Greece, Hungary, Japan, Ireland, Italy, Latvia, Lithuania, Netherlands, Norway, Slovakia, Spain, Sweden and Switzerland.

Industrial processes - Chemical industry, CO_2 and N_2O (1998)

	2.B Chemical industry																		
	Methods and EF used [a]		CO_2						Methods and EF used [d]		N_2O								
			2.B.1 Ammonia production								2.B.2 Nitric acid production						2.B.3 Adipic acid production		
	Method	EF	Key source	percent of national total	Activity data (production)			CO_2 IEF	Methods	EF	Key source	percent of national	Activity data (production)			N_2O IEF	Key source	percent of total	N_2O IEF
					CRF	U.N. [b,c]	Difference						CRF	U.N. [e]	Difference				
				%	kt	kt	%	t / t				%	kt	kt	%	t / t		%	t / t
IPCC Default EF [f]								1.5 - 1.6								0.002 - 0.009			0.264 - 0.3
Australia	NE	NA			NE	450			T1	D			300			0.006			NO
Austria	C	PS			473			0.86	C	PS			484			0.001			
Belgium						287										0.006			
Bulgaria	T1b	D			527	527	0.01	0.86	D	D	L	1.1	521	521	0.06	0.006			NO
Canada	T1	CS			4,737	4,737	0.00	0.82	NA	NA			935	935	-0.04	0.003	L	0.7	NA
Czech Republic	IE				365	324	-11.23		T2	PS	L	0.8	533	433	-18.69	0.007			
Finland					NO	-			D	PS	L	1.7	452			0.009			NO
Greece	C	C			C				C	C			402			0.004			NA
Hungary	D	D			6	293	4492.48	1.50	D	D			1			0.006			
Ireland	D,T1a	D	L	1.7	460	465	1.09	2.30	D	CS	L	1.3	260			0.010			NO
Italy					750	445	-40.67	2.88					479				L	1.1	0.174
Japan	D	CS			C	1,689		NE	D	CS, PS			631	631	0.03	0.004			0.250
Latvia																			
Lithuania	RA, T1	D, C	L	3.1	501	496	-0.90	1.50	RA, T1	D, C	L	12.0	488			0.019			
Netherlands	NO					2,500			T1, CS	CS (=T1)									
New Zealand	T1	CS			163	80	-50.98	0.00					NA						NA
Norway	D	CS,D	L	0.9	C	279			CS3)	PS	L	3.0							
Slovakia						311			IPCC	CS			420			0.001			
Spain						579								465					
Sweden	CS	CS							C	CS	L	1.0	401	90	-77.53				
Switzerland	C	C							C	C			65			0.005			
United Kingdom	T1	CS			43	642	1385.42	25.69	PS	CS			2,496			0.004	L	2.2	0.293
United States	D	D			17,920	14,700	-17.97	1.50	D	CS,PS			8,504	8,423	-0.95	0.008			0.027

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 "2.B Chemical industry".

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

[c] Data for Australia, Ireland, Italy, the Netherlands, New Zealand, Norway, and the United Kingdom are for 1997

[d] 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.B Chemical industry".

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

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

Industrial process - chemical industry

Ammonia production

Trends in CO2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium									653	653
Canada		3,127								3,898
Japan		3,377	3,327	3,356	3,183	3,391	3,328	3,453	3,366	3,055
United Kingdom		1,358	1,358	1,379	1,379	1,379	1,379	1,379	888	1,111
United States		23,138	23,364	24,391	23,399	24,316	23,682	24,390	24,346	26,880

Relative change to previous year

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Belgium								0.0	
Canada									24.7
Japan	-1.5	0.9	-5.1	6.5	-1.8	3.8	-2.5	-9.2	-9.5
United Kingdom	0.0	1.5	0.0	0.0	0.0	0.0	-35.6	25.0	-18.2
United States	1.0	4.4	-4.1	3.9	-2.6	3.0	-0.2	10.4	16.2

Trends in CO_2 implied emission factors, 1990 to 1998 (t/t)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium										
Canada		0.84								0.82
Japan		NE	NE	NE	NE	NE	NE	NE	NE	NE
United Kingdom		29.13	28.36	28.58	28.58	28.58	28.58	28.58	22.33	25.69
United States		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

Relative change to previous year

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Belgium									
Canada									-2.4
Japan									
United Kingdom	-2.6	77.6	0.0	0.0	0.0	0.0	-21.9	15.0	-11.8
United States	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note:
The following Parties are not included in this table because numerical information for years other than 1998 was not reported:
Australia, Austria, Bulgaria, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, New Zealand, Norway, Slovakia, Spain, Sweden and Switzerland.

Nitric acid production:

Trends in N_2O emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		1.62	1.51	1.83	1.60	1.39	1.40	1.56	1.56	1.65
Canada		2.51								2.49
Finland		5.15								4.26
Japan		2.47	2.46	2.48	2.44	2.50	2.46	2.40	2.32	2.55
United Kingdom		12.81	12.80	12.89	12.80	14.03	9.73	10.01	9.45	11.10
United States		57.57	57.53	59.05	59.90	63.24	64.16	66.81	68.46	68.03

Relative change to previous year

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-6.8	21.2	-12.6	-13.1	0.7	11.4	0.0	5.8	1.9
Canada									-0.8
Finland									-17.3
Japan	-0.4	0.8	-1.6	2.5	-1.6	-2.4	-3.3	9.9	3.2
United Kingdom	-0.1	0.7	-0.7	9.6	-30.6	2.9	-5.6	17.5	-13.3
United States	-0.1	2.6	1.4	5.6	1.5	4.1	2.5	-0.6	18.2

Note:
The following Parties are not included in this table because numerical information for years other than 1998 was not reported:
Austria, Belgium, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, New Zealand, Norway, Slovakia, Spain, Sweden and Switzerland.

Adipic acid production

Trends in N2O emissions 1990 to 1998 (Gigagrams and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		NA	NA	NA	NA	NA	NA/NO	NA	NA/NO	NA/NO
Canada		34.58								16.34
Japan		21.45	19.38	19.11	18.72	21.51	21.31	24.24	25.81	22.27
United Kingdom		81.09	75.00	57.85	47.25	57.22	51.32	55.22	57.31	48.28
United States		59.03	61.93	56.87	61.46	65.47	65.58	67.07	55.20	23.40

Relative change to previous year

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia									
Canada									-52.7
Japan	-9.7	-1.4	-2.0	14.9	-0.9	13.7	6.5	-13.7	3.8
United Kingdom	-7.5	-22.9	-18.3	21.1	-10.3	7.6	3.8	-15.8	-40.5
United States	4.9	-8.2	8.1	6.5	0.2	2.3	-17.7	-57.6	-60.4

Trends in N_2O implied emission factors, 1990 to 1998 (t/t)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia										
Canada										
Japan		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
United Kingdom		0.31	0.28	0.28	0.3	0.33	0.33	0.36	0.37	0.29
United States		0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.06	0.03

Relative Change to Previous Year

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia									
Canada									
Japan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
United Kingdom	-9.7	0.0	7.1	10.0	0.0	9.1	2.8	-21.6	-6.5
United States	0.0	0.0	0.0	0.0	0.0	0.0	-25.0	-50.0	-62.5

Note:
The following Parties are not included in these tables because numerical information for years other than 1998 was not reported:
Austria, Belgium, Bulgaria, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, New Zealand, Norway, Slovakia, Spain, Sweden and Switzerland.

Industrial processes - Metal production, CO_2 (1998)

	2.C Metal production																			
	Methods and EF used [a]		2.C.1 Iron & steel [b]												2.C.3 Aluminium production					
						2.C.1.1 Steel				2.C.1.2 Pig Iron							Activity data (production)			
						Activity data (production)				Activity data (production)										
	Methods	EF	Key source	percent of national total	CO_2 IEF	CRF	U.N.[c]	Difference	CO_2 IEF	CRF	U.N.[d]	Difference	CO_2 IEF	Key source	percent of national total	CRF	U.N.[e]	Difference	CO_2 IEF
				%	t / t	kt	kt	%	t / t	kt	kt	%	t / t		%	kt	t	%	t / t
IPCC Default EF [f]					1.5 - 1.6														1.5 - 1.8
Australia	T2	CS				8,356	8,088	-3.21	NA	NA	7,716					1,589	1,617,600	1.80	1.5
Austria	C	CS, PS	L	10.4		4,707	6,525	38.61			4,021								
Belgium							11,425				8,616								
Bulgaria	D	D	L	2.2		2,238	2,237	-0.04	0.82	1,390	1,500	7.90				7			1.7
Canada	CS	CS	L	1.2		NA	15,800			NA	8,937					2,339	2,374,100	1.49	1.6
Czech Republic	IE					7,059	6,061	-14.14		5,276	4,980	-5.61							
Finland					IE	IE	3,929			2,878	2,916	1.32				NO			
Greece	C	C				NA	1,104			NA						C	146,400		
Hungary	T1b	D					1,940				1,259					92	92,200	0.01	1.9
Ireland	NA	NA			NE	NE	355			NE						NE			
Italy						25,782	25,782	0.00		10,792	10,516	-2.56				201	187,000	-6.97	1.6
Japan	-	-			IE	IE	93,548		IE	IE	74,279		IE			NE	51,400		NE
Latvia							471												
Lithuania							1												
Netherlands	NO						6,377				5,562						263,700		
New Zealand	T1	CS	L	1.9	1.96	740	700	-5.37	2.0	NA				L	0.7	318	317,500	-0.03	1.7
Norway	D, CS3)	D, PS					639			C	70			L	3.1	965	995,500	3.15	1.8
Slovakia [g]	included in RA	CS; IPCC					3,388				2,756					108	114,900	6.39	
Spain							14,819				4,236						360,400		
Sweden	CS	CS				5,443	5,172	-4.98		3,186	3,156	-0.95	0.02			106	95,700	-9.47	1.8
Switzerland	C	C				760	1,000	31.58	0.10							27	32,100	18.89	1.6
United Kingdom	T1	CS	L	0.6		3,779	11,681	209.10	0.01	12,746	12,746	0.00	-0.01			258	258,400	0.00	1.6
United States [h]	D	D,CS	L	NE	NA	IE	98,600			50,100	48,200	-3.79	1.60			3,713	3,713,000	0.00	1.5

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 "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 and the United Kingdom.

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

[d] Pig iron production from: 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 primary aluminium production data: 1998 Industrial Commodity Statistics Yearbook, Production statistics 1989-1998, Department of Economic and Social Affairs, Statistics Division, United Nations, New York 2000.

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

[g] Activity data for aluminium production was reported in the sectoral background data tables for PFCs but not for CO_2 as the Party reported that these emissions were included elsewhere (energy), therefore the value for the activity data given here has been taken from the sectoral background data table for PFCs.

[h] Although emissions associated with iron and steel were included in the energy sector, they are still considered a key source here. However, it is not possible to calculate the percent of the key source.

Industrial processes - metal production

Iron and steel production

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		NA	NA	NA	NA	NA	NA	NA	NA	NA
Belgium									1,500	1,501
Canada		7,585								8,316
New Zealand		1,328	1,452	1,564	1,589	1,454	1,535	1,502	1,351	1,450
United Kingdom		2,760	1,794	1,781	1,880	4,755	4,924	5,539	4,557	4,409
United States		87,600	70,560	75,840	77,120	79,040	81,440	79,040	79,360	80,160

Relative change to previous year

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia									
Belgium								0.1	
Canada									9.6
New Zealand	9.3	7.8	1.6	-8.5	5.6	-2.2	-10.1	7.4	9.2
United Kingdom	-35.0	-0.7	5.6	153.0	3.6	12.5	-17.7	-3.3	59.7
United States	-19.5	7.5	1.7	2.5	3.0	-2.9	0.4	1.0	-8.5

Trends in CO_2 implied emission factors , 1990-1998 (t/t)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		0	0	0	0	NA	0	0	0	0
Belgium										
Canada										
New Zealand		1.94	1.93	2.07	1.89	1.81	1.82	1.88	1.85	1.96
United Kingdom										
United States										

Relative change to previous year

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia									
Belgium									
Canada									
New Zealand	-0.52	7.25	-8.70	-4.23	0.55	3.30	-1.60	5.95	1.03
United Kingdom									
United States									

Note:
The following Parties are not included in this table because numerical information for years other than 1998 was not reported:
Austria, Bulgaria, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Netherlands, Norway, Slovakia, Spain, Sweden and Switzerland.

Aluminium production

Trends in CO_2 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		1,827	1,827	1,822	1,922	2,039	1,895	1,963	2,060	2,353
Canada		2,636								3,817
New Zealand		458	455	423	467	468	470	493	504	541
United Kingdom		450	456	380	371	359	369	372	384	401
United States		5,951	6,058	5,942	5,432	4,850	4,961	5,258	5,296	5,458

Relative change to previous year

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.0	-0.3	5.5	6.1	-7.1	3.6	4.9	14.2	28.8
Canada									44.8
New Zealand	-0.6	-7.0	10.2	0.2	0.5	4.9	2.2	7.4	18.1
United Kingdom	1.3	-16.7	-2.3	-3.3	2.9	0.9	3.2	4.3	-11.0
United States	1.8	-1.9	-8.6	-10.7	2.3	6.0	0.7	3.1	-8.3

Trends in CO_2 implied emission factors 1990 to 1998 (t/t)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		1.48	1.48	1.48	1.48	1.48	1.47	1.47	1.48	1.48
Canada		1.68								1.63
New Zealand		1.73	1.73	1.73	1.73	1.73	1.73	1.73	1.62	1.7
United Kingdom		1.55	1.55	1.56	1.55	1.55	1.55	1.55	1.55	1.55
United States		1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47

Relative change to previous year

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.0	0.0	0.0	0.0	-0.7	0.0	0.7	0.0	0.0
Canada									-3.0
New Zealand	0.0	0.0	0.0	0.0	0.0	0.0	-6.4	4.9	-1.7
United Kingdom	0.0	0.6	-0.6	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

Note:
The following Parties are not included in this table because numerical information for years other than 1998 was not reported:
Austria, Belgium, Bulgaria, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Netherlands, Norway, Slovakia, Spain, Sweden and Switzerland.

Industrial processes - PFC and SF_6 emissions from Metal production (1998)

	2.C Metal production (PFCs and SF_6)																	
	2.C. Metal production - PFCs										2.C. Metal production - SF_6							
	Methods and EF used[h]		2.C.3 Aluminium production - PFCs								Methods and EF used[i]		2.C.4.2 SF_6 Used in Magnesium Foundries					
	Methods	EF	Key source	Percent of national total	Activity data (Aluminium production)			IEF		Ratio[d]	Methods	EF	Key source	percent of national total	Activity data		SF_6-IEF	Actual emission SF_6[j]
					CRF[a]	UN[b]	Difference	CF_4	C_2F_6	IEF CF_4 / IEF C_2F_6					Description	Value		
				%	t	t	%	kg / t	kg / t					%		t	kg/t	t
IPCC default[c]								0.02 - 1.19	0.001 - 0.14								1000[g]	
Australia	T1c	CS			1,589,000	1,617,600	1.8	0.120	0.012	10.0	T2	CS			(SF6 consumption)	0.15	1000	0.15
Austria	-	-				0					-	-			Production	3000	1.67	5
Belgium																		NO
Bulgaria[f]	D	D			6,685			1.400	0.140	10.0	NE	NE						NE
Canada			L	0.9	2,339,325	2,374,100	1.5	0.354	0.030	11.8					Point Source SF6 Data from Magnesium Foundries	NA		64.28
Czech Republic					NO													NO
Finland					NO						D	NA			SF6 consumption	C		C
Greece					C	146,400		C	C	10.0					NE	NE		NE
Hungary	T1b	D			92,192	92,200	0.0	0.853	0.085	10.0	D	D						
Ireland	NA	NA			NO						NA	NA			NO	NO		NO
Italy					201,000	187,000				10.0								
Japan	-	-			NE	51,400		NE	NE		-	-			NE	NE		NE
Latvia																		
Lithuania																		
Netherlands	CS	PS				263,700					NO							
New Zealand	CS	PS			317,600	317,500	0.0	0.026	0.003	10.0	T1	PS			SF6 consumption	0.12	1000	0.12
Norway	T3	CS	L	2.3	991,282	995,500	0.4	0.186	0.007	26.1	T2	CS	L	1.0		51774	0.46	
Slovakia					108,000	114,900	6.4	0.028	0.003	10.0								
Spain						360,400				11.2								
Sweden	T1a, T1c	PS			105,709	95,700	-9.5	0.381	0.042	9.0								
Switzerland	T1c	M			27,000	32,100				10.6	T1c	M						0.1
United Kingdom	T2/PS	CS			258,397	258,400	0.0	0.128			T2/PS	CS			SF6 consumption	30	1000	30
United States[e]	CS	PS			3,713,000	3,713,000	0.0	0.381	0.033	11.4	CS	CS			Magnesium production and casting	131290	3.5	460

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] 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). Czech Republic reported NO in Summary table 3.

[b] Primary aluminium production from: 1998 Industrial Commodity Statistics Yearbook, Production statistics 1989-1998, Department of Economic and Social Affairs, Statistics Division, United Nations, New York 2000.

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

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

[e] 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.

[f] Bulgaria used CF_4 emissions as activity data for C_2F_4 emissions. The IEF displayed here refers to activity data to be comparable with other countries.

[g] IPCC guidelines state that emissions equal consumption (IPCC Guidelines, Volume 3, page 2.39).

[h] 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".

[i] 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".

[j] Additional information from Summary table 3 is included here for Bulgaria and the Czech Republic.

Industrial processes - metal production

Aluminum Production:

Trends in actual CF_4 emissions, 1990 to 1998 (tonnes and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		655.0	655.0	481.0	429.0	276.0	193.0	173.0	153.0	190.7
Canada		813.9								827.7
New Zealand		80.1	86.4	84.6	30.3	30.6	24.3	24.3	27.8	8.3
Spain		114.3	108.5	107.7	108.9	107.4	108.0	103.0	105.7	99.7
United Kingdom		300.0	230.0	110.0	70.0	60.0	55.0	44.0	35.0	33.0
United States		2,668.9	2,321.8	2,184.6	1,881.5	1,574.8	1,572.6	1,602.6	1,490.3	1,415.7

Relative change to previous year

	1991	1992	1993	1994	1995	1996	1997	1998	Change from 1990 to 1998
Australia	0.0	-26.6	-10.8	-35.7	-30.1	-10.4	-11.6	24.6	-70.9
Canada									1.7
New Zealand	7.9	-2.1	-64.1	0.9	-20.6	0.0	14.4	-70.0	-89.6
Spain	-5.1	-0.7	1.1	-1.3	0.6	-4.6	2.6	-5.7	-12.8
United Kingdom	-23.3	-52.2	-36.4	-14.3	-8.3	-20.0	-20.5	-5.7	-89.0
United States	-13.0	-5.9	-13.9	-16.3	-0.1	1.9	-7.0	-5.0	-47.0

Note:
The following Parties are not included in this table because numerical information for years other than 1998 was not reported:
Austria, Bulgaria, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Norway, Sweden, Slovakia and Switzerland.
In the case of Belgium and the Netherlands, data was only reported for 1997 and 1996, respectively.

Consistency check

The following check has been performed in order to verify the consistency of the data provided in various CRF tables (1998):
Note that only Parties that provided numerical information and for which differences in the data or any other inconsistencies were found were included in the table below.

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**
Bulgaria	7	6,685	9
Italy	201		
Norway	965	991,282	991,282
Slovakia		108,000	108,000
Switzerland	27		
United Kingdom	258	258,397	IE
United States of A	3,713	3,713	3,713

Note: Bulgaria reported CF_4 emissions as activity data for C_2F_6 emissions.

Industrial processes - Production of Halocarbons and SF_6 (1998)

	2.E Production of Halocarbons and SF_6										
	2.E Production of Halocarbons and SF_6 - HFCs							2.E Production Halocarbons and SF_6 - PFCs		2.E Production Halocarbons and SF_6 - SF_6	
	Methods and EF used[d]		2.E.1 By-product emissions, production of HCFC-22					Methods and EF used		Methods and EF used	
	Methods	EF	Key source	Percent of national total	Activity data (HCFC-22 production)		IEF	Method	EF	Method	EF
					CRF	International[a]	CF_4				
				%	t	t	kg / t				
IPCC default[b]							40				
Australia	NA	NA			NO			NA	NA	NA	NA
Austria	-	-						-	-	-	-
Belgium											
Bulgaria	NE	NE			NO			NE	NE	NE	NE
Canada	NA	NA			NO	x		NA	NA	NA	NA
Czech Republic	NO							NO		NO	
Finland					NO						
Greece	T1	D	L	3.0	C	x		CS	CS		
Hungary [e]	NO							NO		NO	
Ireland	NA	NA			NE			NA	NA	NA	NA
Italy						x					
Japan	-	-			NE	x	NE	-	-	-	-
Latvia											
Lithuania											
Netherlands	CS	PS				x		NO		NO	
New Zealand					NA						
Norway	-	-									
Slovakia[e]	NO							NO		NO	
Spain			L	2.1		x					
Sweden	T1a							T1a		T1a	
Switzerland								T1c	M	T1c	M
United Kingdom[c]	T2/PS	CS	L	2.4	IE	x		T2/PS	CS	NO	NO
United States	M	M			C	x		M	M	CS	CS

[a] An 'X' in this column indicates whether 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.

[b] Source of default emission factors: IPCC Guidelines, Vol. 3, page 2.35.

[c] The United Kingdom reported aggregated HFC emissions from 2.E.1 production and 2.E.2 Fugitive. Under that category, UK reports for 1998 activity data 38,830t and implied emission factor 36.79.

[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 HFCs for all subcategories within the category "2.E. Production of Halocarbons and SF6".

[e] Hungary and Slovakia reported NO in table 7 of the CRF.

Industrial processes - By-product emissions

Production of HCFC-22:
Trends in HFC-23 emissions, 1990 to 1998 (tonnes and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Spain		247.3	220.0	245.2	193.0	332.0	477.6	524.2	635.0	635.0
United Kingdom[a]		972.3	1,012.3	1,052.4	1,092.9	1,137.0	1,200.4	1,231.4	1,350.0	1,428.6
United States		2,977.2	2,632.5	2,977.2	2,726.5	2,695.2	2,319.1	2,663.8	2,569.8	3,416.0

Relative Change to Previous Year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Change from 1990 to 1998
Spain	-11.0	11.5	-21.3	72.0	43.9	9.8	21.1	0.0	156.8
United Kingdom[a]	4.1	4.0	3.8	4.0	5.6	2.6	9.6	5.8	46.9
United States	-11.6	13.1	-8.4	-1.1	-14.0	14.9	-3.5	32.9	14.7

Note
The following Parties are not included in this table because numerical information for years other than 1998 was not reported:
Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, New Zealand, Norway, Slovakia, Sweden and Switzerland.
The Netherlands reported data for 1996 only.

[a] Emissions for the United Kingdom are all aggregated HFCs from 2.E.1 by-production and 2.E.2 Fugitive emissions.

Industrial processes - HFC emissions from Consumption of Halocarbons and SF6 (1998)

	2.F. Consumption of Halocarbons and SF6 - HFCs																														
	Method and EF used[d]		Key source[a]	Percent of national total[b]	HFC-23			HFC-32			HFC-41			HFC-43-10mee			HFC-125			HFC-134			HFC-134a		
	Method	EF			P	A		P	A		P	A		P	A		P	A		P	A		P	A	
					2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	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.			Gg CO_2 equ.			Gg CO_2 equ.		
Australia	NE	NA			NE	NE		NE	NE		NE	NE		NE	NE		NE	NE		NE	NE		NE	NE	
Austria	CS	CS	L	1.0				4.88									206.85	11.73	17.64				2,202.25	750.97	2.93
Belgium											NO			NO			139.69	24.19	5.77	NO			1,014.00	456.44	2.22
Bulgaria	T1a	D			349.60												45.89						70.31		
Canada	T2	D			29.27	31.61	0.93	0.10	0.02	4.11							20.79	147.62	0.14				923.93	527.30	1.75
Czech Republic	D																								
Finland	T1a, T2, CS	D, CS			1.93	0.29	6.60	1.16	0.41	2.86							151.17	50.70	2.98				330.50	119.10	2.77
Greece																									
Hungary	T1a, D	CS															30.80	12.94	2.38				277.21	120.59	2.30
Ireland	NA	NA			NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Italy						5.30			15.51									174.57						1,080.68	
Japan[e]	-	-	L	2.4	18,099.90	NE	NE	121.55	NE	NE	C, IE, NE	NE	NE	C, IE, NE	NE	NE	492.80	NE	NE	C, IE, NE	NE	NE	12,499.50	NE	NE
Latvia																									
Lithuania																									
Netherlands[c]	CS	CS	L	2.8																					
New Zealand	T1a				NA	NA		NE	NE		NA	NA		NA	NA		67.40	NE		NA	NA		214.92	NE	
Norway	T2	CS			1.17	0.78	1.50	1.07	0.22	4.98							175.19	41.25	4.25				337.47	49.66	6.80
Slovakia	IPCC	IPCC; CS				0.54		0.04	0.04	1.00							8.34	1.22	6.87				94.47	37.93	2.49
Spain						122.85												31.44						605.66	
Sweden[f]			L	1.9	0.00			14.49									240.24						915.46		
Switzerland	T2	M			15.21	1.17	13.00	6.44	0.33	19.80					104.78		161.56	31.92	5.06				622.18	289.64	2.15
United Kingdom	T2	D/CS			5,784.18	3,649.91	1.58		IE			IE			IE			IE			IE			IE	
United States	M	M				9,415.40									1,956.92			2,875.66						36,000.43	

	HFCs																								
	HFC-152A			HFC-143			HFC-143a			HFC-227ea			HFC-236fa			HFC-245ca			Total		
	P	A		P	A		P	A		P	A		P	A		P	A		P	A	
	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	2.F.(a)	Ratio P/A	2.F.(p)	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.			Gg CO_2 equ.			Gg CO_2 equ.		
Australia	NE	NE		NE	NE		NE	NE		NE	NE		NE	NE		NE	NE		NE	NE	
Austria							257.87	16.08	16.04										2,671.85	778.77	3.43
Belgium	0.51	2.92	0.18	NO			268.65	43.17	6.22				NO			NO			1,422.85	526.72	2.70
Bulgaria	0.06						110.81												576.65		
Canada	6.67	5.73	1.16				12.66	141.08	0.09	29.72	10.69	2.78							1,023.13	864.07	1.18
Czech Republic																			362.69		
Finland	10.34	4.29	2.41				210.67	71.67	2.94										705.77	246.45	2.86
Greece																					
Hungary							49.40	20.75	2.38										357.41	154.27	2.32
Ireland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Italy								160.84												1,436.90	
Japan	1.68	NE	NE	C, IE, NE	NE	NE	338.20	NE	NE	C, IE, NE	NE	NE	C, IE, NE	NE	NE	C, IE, NE	NE	NE	31,553.63	NE	NE
Latvia																					
Lithuania																					
Netherlands																					
New Zealand	0.14	NE		NA	NA		90.55	NE		NA	NA		NA	NA		NA	NA		373.01	NE	
Norway	6.97	0.67	10.40				165.64	39.64	4.18	1.69	0.43	3.95							689.20	132.64	5.20
Slovakia	0.31	0.05	6.89				10.26	1.75	5.86	5.92	2.06	2.87							119.34	43.58	2.74
Spain								51.79			21.75									833.49	
Sweden	0.43						214.70												1,385.33		
Switzerland	9.48	9.00	1.05				189.24	31.54	6.00										1,004.10	468.38	2.14
United Kingdom		IE			IE			IE			IE			IE			IE		5,784.18	3,649.91	1.58
United States								1,923.71						933.04						53,105.16	

[a] Due to the rapid increase in the use of HFCs, it is likely that this source is a key source for many countries, if the trend assessment is taken into account. The trend assessment has not been performed for this first synthesis and assessment report.

[b] The ratio refers to the actual emissions, if available, otherwise to potential emissions. This is the case for Japan and Sweden.

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

[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 HFCs for all sub categories within the category "2.F. Consumption of Halocarbons and SF6".

[e] This source is a key source for Japan, since only potential emissions were reported.

[f] This source is a key source for Sweden, since only potential emissions were reported.

Industrial processes - PFC and SF_6 emissions from Consumption of Halocarbons and SF_6 (1998)

	2.F. Consumption of Halocarbons and SF6 - PFCs																																		
	Method and EF used[c]		Key-source[a]	Percent of national total[b]	CF_4			C_2F_6			C_3F_8			C_4F_{10}			c-C_4F_8			C_5F_{12}			C_6F_{14}			Total									
	Method	EF			P	A	Ratio P/A	P	A	Ratio P/A	P	A	Ratio P/A	P	A	Ratio P/A	P	A	Ratio P/A	P	A	Ratio P/A	P	A	Ratio P/A	P	A	Ratio P/A						
					2.F.(p)	2.F.(a)		2.F.(p)	2.F.(a)		2.F.(p)	2.F.(a)		2.F.(p)	2.F.(a)		2.F.(p)	2.F.(a)		2.F.(p)	2.F.(a)		2.F.(p)	2.F.(a)		2.F.(p)	2.F.(a)								
				%	Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.			Gg CO_2 equ.			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		NE	NE		NE	NE		NE	NE								
Austria	CS	CS			8.91	5.85	1.52	17.20	14.72	1.17																26.11	20.57	1.27							
Belgium					NO									NO			NO			NO			NO												
Bulgaria	NE	NE																																	
Canada	T2	PS																																	
Czech Republic	D																									102.79									
Finland	T1a, CS	NA			0.16	0.16	1.00																	0.74	0.74	1.00	0.90	0.90	1.00						
Greece																																			
Hungary	T1a	CS																						26.64	13.32	2.00	26.64	13.32	2.00						
Ireland	NA	NA			NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE						
Italy																																			
Japan[d]	-	-	L	1.3	1,287.00	NE	NE	5,492.40	NE	NE	364.00	NE	NE	C, IE, NE	NE	NE	52.20	NE	NE	10,590.00	NE	NE	IE	NE	NE	17,785.60	NE	NE							
Latvia																																			
Lithuania																																			
Netherlands[e]	CS	CS	L	0.9																															
New Zealand	T1a				NA	NA		NA	NA		140.00	NA			NA			NA			NA			NA		140.00	NA							
Norway											7.00	0.39	18.10													7.00	0.39	18.10						
Slovakia	IPCC	IPCC; CS			2.81	1.55	1.81																			2.81	1.55	1.81						
Spain												10.50															10.50							
Sweden					5.20			13.80			4.20															23.20								
Switzerland	T2	M			3.25	0.65	5.00	16.56	4.60	3.60				7.00			3.48	0.87	4.00	12.00	0.75	16.00	2.22	0.74	3.00	44.51	7.61	5.85						
United Kingdom	T2	D/CS			1,670.52	428.33	3.90		IE			IE			IE			IE			IE			IE		1,670.52	428.33	3.90						
United States	M	M							7,700.00																		7,700.00							

[a] Due to the rapid increase in the use of PFCs, it is likely that this source is a key source for many countries, if the trend assessment is taken into account. The trend assessment has not been performed for this first synthesis and assessment report.

[b] The ratio refers to the actual emissions, if available, otherwise to potential emissions. This is the case for Japan.

[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 PFCs for all subcategories within the category "2.F. Consumption of Halocarbons and SF6".

[d] This source is a key source for Japan, since only potential emissions were reported.

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

	2.F. Consumption of Halocarbons and SF_6 - SF_6						
	Method and EF used[c]		Key-source[a]	Percent of total[b]	P	A	Ratio P/A
	Method	EF			2.F.(p)	2.F.(a)	
				%	Gg CO_2 equ.		
Australia	NE	NA			NE	NE	
Austria	CS	CS	L	1.1	11,139.79	847.73	13.14
Belgium					478.00	206.29	2.32
Bulgaria	NE	NE					
Canada	T3	PS			1,536.21		
Czech Republic	D				57.91		
Finland	T1a, T2	CS, D			96.56	29.57	3.27
Greece							
Hungary	D	CS			177.34	101.10	1.75
Ireland	NA	NA			NE	NE	NE
Italy						349.76	
Japan[d]	-	-	L	3.7	49,998.80	NE	NE
Latvia							
Lithuania	T1	T1					
Netherlands[e]	CS						
New Zealand					62.96	28.97	2.17
Norway					1,024.57	124.26	8.25
Slovakia	IPCC	IPCC; CS				12.24	
Spain						182.84	
Sweden[f]			L	2.9	2,143.83		
Switzerland	T2	M			1,056.38	138.62	7.62
United Kingdom	T2	CS			2,856.05	572.33	4.99
United States	CS	CS				25,668.60	

[a] Due to the rapid increase in the use of SF_6, it is likely that this source is a key source for all countries, if the trend assessment is taken into account. The trend assessment has not been performed for this first synthesis and assessment report.

[b] The ratio refers to the actual emissions, if available, otherwise to potential emissions. This is the case for Japan and Sweden.

[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 SF_6 for all sub categories within the category "2.F. Consumption of Halocarbons and SF_6".

[d] This source is a key source for Japan, since only potential emissions were reported.

[e] The Netherlands reported aggregated emissions of all PFCs for the industrial process sector.

[f] This source is a key source for Sweden, since only potential emissions were reported.

Industrial processes - Consumption of Halocarbons and SF_6 (HFCs)

Trends in actual HFC-134a emissions, 1990 to 1998 (tonnes and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium							248.3	295.9	351.1	351.1
Spain							1.6	167.7	338.3	465.9
United States		564.1	564.1	626.5	2,884.7	6,407.7	14,596.2	19,350.3	24,065.4	27,692.6

Relative change to previous Year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Change from 1990 to 1998
Belgium						19.2	18.7	0.0	
Spain						10253.7	101.7	37.7	
United States	0.0	11.1	360.5	122.1	127.8	32.6	24.4	15.1	4809.2

Note:
The trend in HFC-134a emissions is presented here, since HFC-134a is the most commonly used HFC.
The following Parties are not included in this table because numerical information for years other than 1998 was not reported:
Australia, Austria, Bulgaria, Canada, Czech Republic, Finland, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, New Zealand, Norway, Slovakia, Sweden, Switzerland and the United Kingdom.
In the case of the Netherlands, data was only reported for 1996.

Industrial processes - Consumption of Halocarbons and SF_6 (SF_6)

Trends in actual SF_6 emissions, 1990 to 1998 (tonnes and annual percentage change)

	base year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Belgium							8.6	8.6	8.6	8.6
Finland		2.3								1.2
New Zealand		NE	NE	NE	NE	1.0	0.7	1.0	1.1	1.2
Spain		4.4	4.5	4.6	4.7	5.1	6.0	6.4	7.1	7.7
United Kingdom		10.3	12.5	14.8	17.2	19.4	22.4	23.2	22.8	24.0
United States		859.1	902.1	945.1	988.0	1,031.0	1,073.9	1,073.9	1,073.9	1,074.0

Relative change to previous Year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Change from 1990 to 1998
Belgium						0.0	0.0	0.0	
Finland									-45.1
New Zealand					-33.0	55.2	4.8	11.0	
Spain	2.5	2.9	1.7	8.1	19.6	6.1	10.1	8.4	75.9
United Kingdom	21.2	18.9	15.9	12.8	15.6	3.3	-1.4	4.9	132.5
United States	5.0	4.8	4.5	4.3	4.2	0.0	0.0	0.0	25.0

Note:
The following Parties are not included in this table because numerical information for years other than 1998 was not reported:
Australia, Austria, Bulgaria, Canada, Czech Republic, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Norway, Slovakia, Sweden and Switzerland.
In the case of the Netherlands data was only reported for 1996.

Industrial processes: Activity data from international sources

Aluminium production 1998 in thousands of metric tons

Source	Monthly Bulletin of Statistics			ICS 1998[a]	
	Type	Monthly average	in 1998	Primary	Total
Australia	A	134.8	1617.6	1617.6	1721.6
Austria	B	7.8	93.6	0	126.4
Belgium					0
Bulgaria					
Canada	A	197.8	2373.6	2374.1	2485.1
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	187	689.6
Japan	A	25.8	309.6	51.4	1206.8
Latvia					
Lithuania					
Netherlands	A+B	34.4	412.8	263.7	365.7
New Zealand	A	26.5	318	317.5	325.5
Norway	A+B	88.2	1058.4	995.5	1057.9
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	258.4	533.2
United States	A	309.4	3712.8	3713	7153
	Type A: primary (virgin) aluminium from domestic and imported ores.			unwrought primary	unwrought total
	Type B: secondary, I.e. derived from scrap.				

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 SF6 emissions from Metal production (1998)".

Total HFC-134a Sales by Region (metric tons)

	Northern Hemisphere		Southern Hemisphere	
Year	30-90 Degrees North	0-30 Degrees North	0-90 Degrees South	TOTAL
	(plus fugitive emissions)			
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)

Annual Global Fluorocarbon Production (metric tons)

	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)

3. Agriculture

Agriculture - enteric fermentation, CH_4 (1998)

	4.A Enteric fermentation (CH_4)																
	Methods and EF used[a]		Key source	Per cent 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
				%	(1000 heads)		%	kg CH_4/head/yr		(1000 heads)		%		(1000 heads)		%	
IPCC default EF[c]								*56 - 118[d]*	*44 - 56[d]*				*8*				*1.5*
Australia	CS	CS	L	12.6	26,815	26,710	-0.4	107.1	74.2	118,860	117,494	-1.1	6.6	2,662	2,768	4.0	1.1
Austria	C	CS	L	3.4	2,172	2,198	1.2	92.0	38.0	361	384	6.3	8.0	2,843	3,680	29.4	1.5
Belgium			L	3.0	0	3,184					155				7,436		
Bulgaria	T1	D	L	2.0	642	612	-4.6	81.0	56.0	2,811	2,848	1.3	8.0	1,601	1,480	-7.5	1.5
Canada	T1	D	L	2.6	13,715	13,272	-3.2	99.3	54.3	443	613	38.5	13.2	12,163	11,985	-1.5	1.5
Czech Republic	T2	CS	L	1.2	1,690	1,701	0.7	68.2	23.6	94	94	-0.5	5.0	3,995	4,013	0.5	3.4
Finland	T2	CS/D	L	2.0	1,117	1,101	-1.5	100.5	38.7	128	128	0.0	8.0	1,401	1,541	10.0	1.5
Greece	T1	D	L	2.4	600	596	-0.6	81.0	59.7	9,195	8,952	-2.6	7.9	1,424	938	-34.1	1.5
Hungary [(e)]	D	D	L	2.0	873	871	-0.2				858			5,479	4,931	-10.0	
Ireland	D	CS, D	L	16.3	7,385	6,992	-5.3	100.0	50.0	6,954	5,634	-19.0	8.0	1,759	1,717	-2.4	1.5
Italy			L	2.4	0	7,166					10,894				8,281		
Japan	D	CS			4,651	4,708	1.2	90.0	53.9	16	16	0.0	4.1	9,863	9,904	0.4	1.1
Latvia			L	5.8	434	434	0.1	81.0	56.0	29	29	1.3	8.0	421	421	0.0	1.5
Lithuania	RA	D	L	6.4	928	1,016	9.6	81.0	56.0	16	24	50.9	8.0	1,168	1,200	2.7	1.5
Netherlands	CS	CS	L	3.0	4,284	4,292	0.2	80.9	48.5	1,394	1,465	5.1	8.0	13,446	11,438	-14.9	1.5
New Zealand	T1	CS	L	39.0	8,919	8,873	-0.5	76.8	67.5	46,136	45,956	-0.4	15.1	396	351	-11.4	NE
Norway	T1	D	L	3.5	1,031	1,036	0.5	100.0	48.0	2,717	2,399	-11.7	8.0	641	689	7.6	1.5
Slovakia	IPCC; CS	IPCC; CS	L	2.2	705	803	14.0	92.0	56.0	326	417	27.9	8.0	1,593	1,810	13.6	1.5
Spain			L	3.5		5,884					24,857				21,562		
Sweden	T1, T2	CS	L	4.1	1,739	1,739	0.0	154.0	49.2	421	421	0.0	6.8	2,286	2,286	0.0	1.7
Switzerland	CS	CS	L	4.6	1,641	1,641	0.0	99.2	43.0	422	420	-0.5	6.9	1,487	1,487	0.0	1.0
United Kingdom	T2	D/CS	L	2.7	11,519	11,519	0.0	92.9	44.3	44,471	44,471	0.0	4.7	8,147	8,146	0.0	1.5
United States	M	M	L	1.8	97,773	99,744	2.0	156.9	47.0	7,817	7,825	0.1	8.0	62,043	61,158	-1.4	1.5

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 the various livestock types within the category CH_4 from "4.A enteric fermentation".

[b] Source of international statistics: FAO, http://apps.fao.org/page/collections?subset=agriculture.

[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] Hungary: Activity data (population size) presented in this table are as reported in CRF table 4B(b) as CRF tables 4A and 4B(a) were not provided by the Party.

Agriculture - enteric fermentation

Trends in CH_4 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	Base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		3,065	3,072	3,021	2,962	2,902	2,876	2,865	2,881	2,887
Austria		154	151	144	142	141	135	133	131	131
Belgium									205	206
Bulgaria	193	180	165	135	104	87	82			82
Canada		762	769	760	795	834	861	867	875	855
Finland		83	79	77	77	76	72	72	73	71
Greece		140	138	137	137	137	138	140	142	143
Hungary	157	126	122	105	90	85	84	82	79	81
Ireland		453	457	458	460	462	468	477	488	494
Italy		646	656	628	615	624	637	629	628	628
Japan		345	350	351	348	344	339	335	331	328
Netherlands		505	517	505	497	483	476	365	353	341
New Zealand		1,474	1,441	1,418	1,416	1,422	1,420	1,406	1,394	1,389
Norway		86	87	89	88	91	92	92	92	94
Slovakia		116	101	87	74	69	71	68	62	55
Spain		589	577	580	591	578	575	620	620	620
Sweden		147	188	179	179	184	179	146	147	143
Switzerland		130	132	131	130	127	128	126	124	120
United Kingdom		913	900	900	900	907	898	905	893	883
United States		5,712	5,732	5,804	5,876	6,016	6,094	6,032	5,973	5,885

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.2	-1.7	-1.9	-2.0	-0.9	-0.4	0.5	0.2	-5.8
Austria	-2.1	-4.6	-1.8	-0.8	-3.8	-1.8	-1.1	-0.4	-15.4
Belgium								0.0	
Bulgaria	-8.4	-17.9	-23.0	-16.3	-5.5	-100.0			-61.8
Canada	1.0	-1.2	4.7	4.8	3.3	0.7	1.0	-2.2	12.3
Finland	-4.9	-2.6	-0.4	-0.4	-5.4	-0.1	1.0	-2.3	-14.3
Greece	-1.3	-0.7	-0.2	0.4	0.4	1.2	1.4	0.9	2.2
Hungary	-2.7	-14.0	-13.9	-5.8	-2.0	-2.0	-3.7	2.8	-60.1
Ireland	0.9	0.1	0.5	0.5	1.2	2.1	2.2	1.2	9.0
Italy	1.6	-4.3	-1.9	1.4	2.1	-1.2	-0.1	0.0	-2.8
Japan	1.2	0.3	-0.7	-1.2	-1.4	-1.2	-1.1	-1.1	-5.1
Netherlands	2.4	-2.3	-1.6	-2.8	-1.5	-23.2	-3.5	-3.2	-32.4
New Zealand	-2.3	-1.6	-0.1	0.4	-0.1	-1.0	-0.9	-0.4	-5.8
Norway	1.4	1.9	-1.3	3.7	1.1	0.3	0.3	1.5	9.2
Slovakia	-13.3	-13.9	-14.8	-6.4	2.3	-4.2	-8.1	-12.0	-52.8
Spain	-2.1	0.4	2.0	-2.2	-0.5	7.8	0.0	0.0	5.2
Sweden	27.9	-4.8	0.0	2.6	-2.4	-18.3	0.2	-2.4	-2.5
Switzerland	1.1	-0.8	-0.6	-1.9	0.3	-1.3	-1.5	-3.0	-7.5
United Kingdom	-1.4	-0.1	0.0	0.8	-0.9	0.8	-1.4	-1.2	-3.4
United States	0.4	1.3	1.2	2.4	1.3	-1.0	-1.0	-1.5	3.0

Notes:

The Czech Republic, Latvia and Lithuania are not included in this table because data for years other than 1998 were not reported.

[a] In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987). For these Parties, the values in the column "percentage change from 1990 to 1998" refer to the base year data.

Agriculture - enteric fermentation: dairy and non-dairy cattle

Dairy cattle:

Trends in CH_4 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	263.5	261.5	262.1	271.3	280.8	292.0	302.1	315.4	322.9
Belgium[a]								198.2	199.3
Canada	196.4								173.1
Finland	46.2								38.5
Japan	182.5	182.7	181.2	177.6	174.1	171.4	169.4	166.6	163.3
Netherlands							262.2	252.1	247.8
New Zealand	262.6	266.1	272.7	285.9	301.7	314.7	323.2	330.2	334.1
United Kingdom	295.9	288.9	285.2	285.8	291.5	283.5	284.7	280.8	278.8
United States	1,473.9	1,464.9	1,472.5	1,468.1	1,470.9	1,473.1	1,454.1	1,453.2	1,443.1

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-0.8	0.2	3.5	3.5	4.0	3.5	4.4	2.4	22.6
Belgium[a]								0.5	
Canada									-11.9
Finland									-16.6
Japan	0.1	-0.8	-2.0	-2.0	-1.6	-1.2	-1.7	-2.0	-10.5
Netherlands							-3.8	-1.7	
New Zealand	1.3	2.5	4.8	5.5	4.3	2.7	2.2	1.2	27.2
United Kingdom	-2.4	-1.3	0.2	2.0	-2.7	0.4	-1.4	-0.7	-5.8
United States	-0.6	0.5	-0.3	0.2	0.2	-1.3	-0.1	-0.7	-2.1

[a] Belgium reported CH_4 emissions from cattle without differentiating between dairy and non-dairy cattle. These data are included in this table.

Trends in CH_4 implied emission factors, 1990 to 1998 (kg/head/yr)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	102.7	103.4	104.5	105.6	106.0	106.5	106.5	107.0	107.1
Canada	98.7								99.3
Finland	94.3								100.5
Japan	88.2	88.2	88.1	88.3	88.6	89.0	89.4	89.7	90.0
Netherlands							80.0	80.0	80.9
New Zealand	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8	76.8
United Kingdom	87.6	87.4	88.3	88.3	89.1	89.5	89.1	91.3	92.9
United States	147.3	148.2	151.6	151.7	154.8	155.2	154.5	156.1	156.9

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.7	1.0	1.1	0.4	0.5	0.1	0.5	0.0	4.3
Canada									0.6
Finland									6.6
Japan	0.0	0.0	0.1	0.4	0.5	0.4	0.3	0.4	2.1
Netherlands							0.0	1.1	
New Zealand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
United Kingdom	-0.3	1.1	0.0	1.0	0.4	-0.4	2.4	1.8	6.0
United States	0.6	2.3	0.1	2.0	0.3	-0.4	1.0	0.5	6.5

Non-Dairy cattle:

Trends in CH_4 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	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
Canada	537.7								649.9
Finland	33.0								28.4
Japan	149.6	154.0	157.0	158.2	157.7	156.0	154.2	153.3	153.0
Netherlands							66.1	63.0	59.2
New Zealand	312.0	315.5	321.6	331.6	338.3	336.7	325.4	314.3	308.4
United Kingdom	396.1	391.3	393.1	391.0	393.4	394.2	403.7	392.0	377.2
United States	3,951.5	3,978.8	4,039.1	4,120.3	4,255.8	4,340.5	4,304.7	4,245.6	4,165.2

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	2.2	0.8	0.4	0.0	0.9	0.5	1.0	0.2	6.1
Canada									20.9
Finland									-14.0
Japan	3.0	1.9	0.8	-0.3	-1.1	-1.1	-0.6	-0.2	2.3
Netherlands							-4.6	-6.0	
New Zealand	1.1	1.9	3.1	2.0	-0.5	-3.3	-3.4	-1.9	-1.1
United Kingdom	-1.2	0.5	-0.5	0.6	0.2	2.4	-2.9	-3.8	-4.8
United States	0.7	1.5	2.0	3.3	2.0	-0.8	-1.4	-1.9	5.4

Trends in CH_4 implied emission factors, 1990 to 1998 (kg/head/yr)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	75.0	75.1	75.2	75.3	74.9	74.5	74.2	74.3	74.2
Canada	54.3								54.3
Finland	38.0								38.7
Japan	53.4	53.4	53.4	53.4	53.5	53.7	53.8	53.8	53.9
Netherlands							51.8	50.0	48.5
New Zealand	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5
United Kingdom	44.9	45.0	45.2	45.4	45.3	45.4	45.6	45.8	44.3
United States	47.4	47.5	47.7	47.7	47.6	47.5	47.5	47.1	47.0

Relative Change to Previous Year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.1	0.2	0.1	-0.5	-0.5	-0.4	0.1	-0.1	-1.1
Canada									-0.1
Finland									1.9
Japan	-0.1	0.0	0.0	0.3	0.2	0.2	0.1	0.2	1.0
Netherlands							-3.6	-3.0	
New Zealand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
United Kingdom	0.1	0.5	0.4	-0.2	0.2	0.6	0.4	-3.3	-1.4
United States	0.3	0.3	0.1	-0.2	-0.3	0.1	-0.9	-0.2	-0.8

Note:

The following Parties are not included in these tables because data for years other than 1998 were not reported:
Austria, Belgium, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Norway, Slovakia, Spain, Sweden and Switzerland.

Agriculture - enteric fermentation: sheep and swine

Sheep

Trends in CH_4 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	1124.50	1097.36	1032.04	957.21	890.09	838.08	808.37	793.06	786.86
Belgium								0.81	0.81
Canada	5.71								5.71
Finland	0.83								1.03
Japan	0.12	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.07
Netherlands							13.00	11.72	11.15
New Zealand	853.57	814.42	781.08	757.30	740.54	727.04	714.13	702.00	696.66
United Kingdom	205.23	203.95	204.91	205.67	204.57	203.50	199.73	201.85	208.08
United States	90.87	89.39	86.38	81.61	78.60	71.86	67.66	64.12	62.53

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-2.4	-6.0	-7.3	-7.0	-5.8	-3.5	-1.9	-0.8	-30.0
Belgium									
Canada									0.0
Finland									24.1
Japan	0.0	-8.3	-9.1	-10.0	-11.1	-12.5	0.0	0.0	-41.7
Netherlands							-9.8	-4.9	
New Zealand	-4.6	-4.1	-3.0	-2.2	-1.8	-1.8	-1.7	-0.8	-18.4
United Kingdom	-0.6	0.5	0.4	-0.5	-0.5	-1.9	1.1	3.1	1.4
United States	-1.6	-3.4	-5.5	-3.7	-8.6	-5.8	-5.2	-2.5	-31.2

Trends in CH_4 implied emission factors, 1990 to 1998 (kg/head/yr)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	6.68	6.70	6.73	6.74	6.70	6.67	6.65	6.63	6.62
Belgium									
Canada	13.87								13.19
Finland	8.00								8.00
Japan	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15
Netherlands							7.99	8.00	8.00
New Zealand	15.10	15.10	15.10	15.10	15.10	15.10	15.10	15.10	15.10
United Kingdom	4.62	4.62	4.60	4.63	4.37	4.70	4.75	4.71	4.68
United States	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.3	0.4	0.1	-0.6	-0.4	-0.3	-0.3	-0.2	-0.9
Belgium									
Canada									-4.9
Finland									0.0
Japan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands							0.1	0.0	
New Zealand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
United Kingdom	0.0	-0.4	0.7	-5.6	7.6	1.1	-0.8	-0.6	1.3
United States	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note

The following Parties are not included in these tables because data for years other than 1998 were not reported:
Austria, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Norway, Slovakia, Spain, Sweden and Switzerland.

Swine

Trends in CH_4 emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	2.94	2.90	2.89	2.96	2.96	2.91	2.83	2.87	2.92
Belgium								5.45	5.58
Canada	15.32								18.24
Finland	2.09								2.10
Japan	12.46	12.09	11.83	11.55	11.24	10.95	10.82	10.81	10.80
Netherlands							21.60	22.78	20.17
United Kingdom	11.32	11.54	11.56	11.78	11.84	11.44	11.38	12.11	12.22
United States	80.91	84.72	87.80	87.02	89.93	88.35	84.33	88.09	93.06

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-1.4	-0.3	2.4	0.0	-1.7	-2.7	1.4	1.7	-0.7
Belgium								2.4	
Canada									19.1
Finland									0.5
Japan	-3.0	-2.2	-2.4	-2.7	-2.6	-1.2	-0.1	-0.1	-13.3
Netherlands							5.5	-11.5	
United Kingdom	1.9	0.2	1.9	0.5	-3.4	-0.5	6.4	0.9	8.0
United States	4.7	3.6	-0.9	3.3	-1.8	-4.6	4.5	5.6	15.0

Trends in CH_4 implied emission factors, 1990 to 1998 (kg/head/yr)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Belgium									
Canada	1.50								1.50
Finland	1.50								1.50
Japan	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Netherlands							1.50	1.50	1.50
United Kingdom	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
United States	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belgium									
Canada									0.0
Finland									0.0
Japan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands							0.0	0.0	
United Kingdom	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

Notes:
The following Parties are not included in these tables because numerical information for years other than 1998 was not reported:
Austria, Bulgaria, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, New Zealand, Norway, Slovakia, Spain, Sweden and Switzerland.

Agriculture - manure management, CH_4 (1998)

	4.B Manure management (CH_4)							
	Methods and EF used[a]		Key source	percent of national total	4.B.1 Cattle		4.B.3 Sheep	4.B.8 Swine
	Methods	EF			Dairy cattle	Non-dairy cattle		
					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			8.02	0.03		18.07
Austria	C	CS	L	0.7	8.70	4.30	0.22	4.30
Belgium								
Bulgaria	T1, T2	D, CS			18.27	12.26	0.28	9.93
Canada	T1	D	L	0.7	36.00	1.00	0.32	10.00
Czech Republic	T2	CS			3.29	1.01	0.23	7.87
Finland	T2	CS/D			6.98	1.93	0.19	3.40
Greece	T1	D			19.00	13.00	0.28	7.00
Hungary	D	D	L	0.9				
Ireland	D	CS, D	L	2.3	15.90	6.40	0	5.40
Italy			L	0.7				
Japan	D, CS	D, CS			4.93	5.73	0.28	7.92
Latvia					6.00	4.00	0.19	4.00
Lithuania	RA	D			6.00	4.00	0.19	4.00
Netherlands	CS	CS						
New Zealand	T1	CS			0.89	0.91	0.18	NE
Norway	T2	D, CS			14.41	8.55	0.63	1.98
Slovakia	IPCC; CS	IPCC; CS			6.00	4.00	0.19	4.00
Spain								
Sweden	T1, T2	CS			12.37	2.23	0.19	2.58
Switzerland	CS	CS			13.98	3.37	0.13	3.54
United Kingdom	T2	D/CS			10.45	4.38	0.11	3.00
United States	M	M	L	1.2	101.46	2.56	0.33	39.89

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 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.

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, N_2O (1998)

	4.B Manure management (N_2O)												
	Methods and EF used[a]		Key source	percent 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					*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			0.001	0.001	0.020	0.005	112.6	41.6	9.7	6.5	
Austria	-	-											
Belgium													
Bulgaria	D	D			0.001	0.001	0.020	0.005	70.0	50.0	20.0	16.0	0.60
Canada	T1	D	L	0.7		1,666.155	63,400.131	12,145.360	70.5	56.4	15.0	6.8	0.45
Czech Republic [d]	D	D				1.000	19.995	5.007	100.0	70.0	20.0	20.0	1.00
Finland	D	D/CS				0.001	0.024		100.0	36.0	11.0	17.0	0.40
Greece	T1	D				0.001	0.020	0.005	70.0	50.0	16.0	12.0	0.60
Hungary	D	D				0.001	0.020	1.475	70.0	50.0	20.0		0.60
Ireland	D	CS, D			0.001	0.001	0.020		92.5	50.0	12.0	8.0	0.60
Italy			L	0.7									
Japan	D	CS						954.910	0.2	0.4	0.1		0.00
Latvia					0.001	0.001	0.020	0.005	70.0	50.0	20.0	16.0	0.60
Lithuania					0.001	0.001	0.020		70.0	50.0	20.0	16.0	0.60
Netherlands	CS	CS											
New Zealand					0.001		0.020	0.005	86.7	63.1	16.0	11.8	0.60
Norway	D	D, CS											
Slovakia	IPCC; CS	IPCC; CS				0.001	0.020		90.0	56.0	20.0	16.0	0.60
Spain													
Sweden			L	0.8		0.001	0.020	0.020	118.0	41.6	8.7	5.8	0.40
Switzerland			L	0.8		0.001	0.020		108.7			16.0	0.52
United Kingdom	T1	D/CS			0	0.001	0.016	0.003	108.3	47.8	10.1	6.7	0.71
United States	M	M			0.785				420.5	105.0	112.8	10.7	0.35

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 N2O from "4.B manure management".

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

[c] Source of default N excretion rates: IPCC Guidelines, Volume 3, Table 4-20 pg. 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	

[d] The Czech Republic reported activity data for N excretion per AWMS in the unit *t N/year i*nstead of *kg N/year* as required in the CRF. After converting the activity data into *kg N/year* the N_2O IEF (in kg N_2O-N/kg N) per AWMS should read as follows: Liquid systems: 0.001; Solid storage and dry lot: 0.02; Other: 0.005.

Agriculture - agricultural soils, N_2O (1998)

	4.D. Agricultural soils (N2O)													
	Methods and EF used[a]		4.D.1 Direct soil emissions									4.D.2 Animal production		
					Synthetic fertilizers		Animal wastes applied to soils	N-fixing Crops	Crop Residue	Cultivation of histosols				
					Activity data	N_2O IEF	N_2O IEF							
	Methods	EF	Key source[b]	percent of national total[b]	Use of synthetic fertilizers						Key source	per cent of national total	Pasture range and paddock (grazing)	
													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	
				%										
IPCC default EF						***0.0125 (0.0025 - 0.0225)*** [c]				***5, 10 (2-15)*** [d]			***0.02 (0.005-0.03)*** [e]	
Australia	CS	CS	L	2.4	810,420,667	0.0125	0.0180			0.29	L	0.9	0.0043	
Austria	CS	CS												
Belgium			L	*2.0*										
Bulgaria	D	D, CS	L	10.0	108,105,300	0.0100	0.0040	0.0312	0.000003	0.003			0.0200	
Canada	T1	D	L	3.6	1,652,706,000	0.0055	0.0090	0.0016	0.0002	5.00			0.0200	
Czech Republic	D	D	L	1.8	185,181,300	0.0125	0.0130	0.0127	0.0125				0.0200	
Finland	D	D/CS	L	3.6	168,908,000	0.0125	0.0130	0.0126	0.0125	8.00			0.0190	
Greece	T1	D	L	1.7	306,354,000	0.0112	0.9570	0.0299			L	3.0	0.0199	
Hungary	D	D	L	9.3	223,200,000	0.0125	0.0190			2.00			0.0200	
Ireland	D	CS, D	L	4.7	415,584,000	0.0125	0.0130	NE	NE	NE	L	4.9	0.0200	
Italy			L	1.8							L	0.4		
Japan	D	CS			338,352,567	0.0059	NE	NE	NE	NE			NE	
Latvia			L	*8.6*		0.0125	0.0130	0.0125	0.0125	0.01			0.0100	
Lithuania	RA	D	L	1.3	29,340,000	0.0080	0.0120						0.0050	
Netherlands	CS	CS	L	*3.3*										
New Zealand	D	CS/D	L	2.3	133,312,500	0.0125	0.0120	0.0008	0.0002	4.98	L	7.8	0.0100	
Norway	D	D, CS	L	3.4	112,327,000	0.0119	0.0100			5.00			0.0194	
Slovakia	IPCC; CS	IPCC; CS	L	3.8	97,000,000	0.0112	0.0090	0.0125	0.0125	5.00			0.0200	
Spain			L	*5.1*										
Sweden[f]	D	D	L	3.4	205,600	12.3937	12.5000	0.0004	0.0001	3.25	L	0.7	20.0000	
Switzerland			L	2.3	55,084,000	0.0125	0.0130	0.0004	0.0001	5.00			0.0200	
United Kingdom	T1	D	L	2.0	1,473,210,000	0.0112	0.0125	0.0003	0.0002	500.00	L	0.8	0.0159	
United States	D	D	L	2.7	11,155,981,080	0.0114	0.0100	0.0004	0.0002	8.00			0.0160	

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 N2O from "4.D agricultural soils".

[b] Information on key sources and the percent of national total refers to sub-category 4.D.1 direct soil emissions, except for Belgium, Latvia, Netherlands and Spain, where the informatior refers to the entire category 4.D agricultural soils.

[c] Source of default emission factors: IPCC guidelines, Volume 3; Table 4-18, pg. 4.89 (See also Good Practice Guidance, Table 4.17, pg. 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 N_2O implied emission factors because of the use of different units; the unit of default emission factors is kg N_2O-N/ kg N, while in the CRF the unit relates to the amount of dry biomass (kg N_2O-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, pg. 4.60 of IPCC good practice guidance).

[e] Source of default emission factor: IPCC Guidelines, Volume 3, Table 4-22, pg. 4.104 (pasture range and paddock). See also IPCC good practice guidance, Table 4-12, pg. 4.43.

[f] In its response to the draft synthesis and assessment report, Sweden explained that the amount of fertilizer was by mistake reported in tons instead of kilograms in the CRF. The corrected N_2O IEF values for fertilizer and pasture range should be 0.012 and 0.02 kg N_2O-N/ kg N, respectively (see also preliminary findings on individual national GHG inventories for Sweden in section II of this report).

Agriculture - Agricultural soils (1998):

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 [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	0.10		0.02	0.030	0.015	0.100	0.10	0.20	0.30
Canada	0	0	0	0.030	0.015	0.450	0.10	0.20	0.30
Czech Republic									
Finland	NZ	0	0.30	0.015	0.030	0.450	0.01	0.30	0.15
Greece	0.10	0		0.030	0.015	0.500	0.10	0.20	
Hungary									
Ireland	NO	NO	0.65	NA	NA	NA	0.04	0.17	0.04
Italy									
Japan									
Latvia									
Lithuania	0	0	0.02				0.10	0.20	0.30
Netherlands									
New Zealand	0.05	0		0.030	0.015	0.450	0.10	0.20	0.15
Norway	0	NO	0.23	NE	NE	NE	0.05	0.20	0.18
Slovakia			0.06				0.10	0.20	0.07
Spain									
Sweden	0	0	0.36	0.010	0.019	0.212	0.37	0.08	0.21
Switzerland	0	0					0.07		0.20
United Kingdom		0		0.030	0.015		0.10	0.20	0.30
United States	0.03	NA	0.01	0.008	0.030	0	0.10	0.20	0.30

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 or crop residue removed from the field as crop
FracBURN	Fraction of crop residue burned
FracGASF	Fraction of synthetic fertilizer N applied to soils that volatizes as NH_3 and NO_x.
FracGASM	Fraction livestock N excretion that volatizes as NH_3 and NO_x
FracLEACH	Fraction of N input to soils that is lost through leaching and runoff

Notes:

[a] Source of IPCC default fractions: IPCC Guidelines, Volume 3, Tables 4-19 and 4-24, pg. 4.94 and 4.106 (See also IPCC good practice guidance, Table 4.19, pg. 4.74).

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

Trends in N_2O emissions, 1990 to 1998 (Gigagrams and annual percentage change)

	base year[a]	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia		46.9	47.3	46.9	47.7	48.0	47.1	46.7	49.7	51.8
Austria		3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Belgium									9.3	9.3
Bulgaria	53.9	54.0	49.2	41.9	37.8	36.3	37.0			33.7
Canada		116.0	116.0	114.1	119.3	125.1	125.6	131.9	130.6	130.8
Finland		13.8	12.8	11.6	11.8	11.8	12.3	12.0	11.7	11.5
Greece		20.7	20.6	19.5	19.2	19.3	18.5	18.7	19.0	19.0
Hungary	4.6	4.1	1.7	1.6	1.5	1.8	1.6	1.7	1.7	32.9
Ireland		20.8	20.8	20.5	21.0	21.6	22.2	22.5	21.7	23.0
Italy		65.3	68.1	68.6	69.4	68.6	67.4	66.2	69.0	69.0
Japan		3.8	3.6	3.6	3.6	3.5	3.3	3.1	3.1	3.1
Netherlands		21.5	22.2	25.5	25.4	25.6	26.8	26.8	25.3	25.2
New Zealand		36.8	36.4	36.4	36.8	37.3	37.4	37.2	37.2	37.3
Norway		8.6	8.6	8.3	8.5	8.3	8.5	8.4	8.4	8.5
Slovakia		13.0	10.6	9.3	7.6	7.0	7.3	7.3	7.4	7.3
Spain		58.2	57.6	53.9	46.6	53.5	50.9	61.1	61.1	61.1
Sweden		15.0	0.2	0.2	0.2	0.2	0.2	14.6	13.8	13.8
Switzerland		7.8	7.7	7.6	7.6	7.5	7.4	7.3	7.1	7.1
United Kingdom		95.1	94.6	89.2	87.5	89.9	90.5	90.9	93.8	90.7
United States		890.9	902.9	925.1	913.7	987.6	951.5	974.9	996.3	991.9

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	0.8	-0.8	1.7	0.6	-1.8	-1.0	6.5	4.2	10.4
Austria	0.3	0.3	0.3	-0.9	-1.2	0.0	0.0	0.0	-1.2
Belgium									
Bulgaria	-8.9	-14.8	-9.9	-3.8	1.8	-100.0			-37.5
Canada	0.0	-1.7	4.5	4.9	0.4	5.0	-1.0	0.1	12.7
Finland	-7.0	-9.5	2.0	-0.2	4.2	-2.4	-2.0	-2.3	-16.6
Greece	-0.5	-5.3	-1.5	0.5	-4.1	1.1	1.6	0.0	-8.2
Hungary	-59.0	-3.0	-10.4	23.3	-10.6	4.3	-0.6	1870.7	691.5
Ireland	0.2	-1.5	2.3	2.8	2.9	1.3	-3.4	5.7	10.5
Italy	4.3	0.8	1.2	-1.2	-1.7	-1.9	4.3	0.0	5.7
Japan	-5.6	-0.3	-0.3	-1.7	-6.3	-4.3	-0.6	0.0	-17.7
Netherlands	3.3	14.9	-0.4	0.8	4.7	0.0	-5.7	-0.3	17.1
New Zealand	-1.1	0.0	1.2	1.2	0.3	-0.5	0.1	0.2	1.2
Norway	0.1	-3.4	2.3	-2.1	2.0	-1.9	0.7	0.5	-1.9
Slovakia	-18.5	-12.3	-18.3	-7.5	4.3	-0.7	1.5	-0.4	-43.4
Spain	-1.0	-6.4	-13.5	14.8	-4.9	20.0	0.0	0.0	5.0
Sweden	-98.7	0.0	0.0	0.0	0.0	7215.0	-5.9	0.3	-8.0
Switzerland	-0.6	-1.0	-0.8	-1.3	-1.5	-1.2	-1.7	-1.3	-9.0
United Kingdom	-0.5	-5.8	-1.9	2.7	0.7	0.4	3.2	-3.3	-4.6
United States	1.3	2.5	-1.2	8.1	-3.7	2.5	2.2	-0.4	11.3

Note:

The Czech Republic, Latvia and Lithuania are not included in this table because data for years other than 1998 were not reported.

[a] In accordance with decision 9/CP.2, some Parties with economies in transition use base years other than 1990: Bulgaria (1988) and Hungary (average of 1985-1987). For these Parties, the values in the column "percentage change from 1990 to 1998" refer to the base year data.

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 (1998):
All consistency checks described below have been performed on 1998 inventory data.
Note that only Parties that provided numerical information and for which differences in the data or any other inconsistencies were found were 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 fo*dairy* and *non-dairy cattle, swine* and *sheep.*

	Dairy Cattle			Non-dairy cattle			Swine			Sheep		
	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	
	Population size		Difference	Population size		Difference	Population size		Difference	Population size		Difference
	1000 heads		%	1000 heads		%	1000 heads		%	1000 heads		%
Netherlands	3,062	no data reported		1,222	no data reported		13,446	no data reported		1,394	no data reported	
United States	9,199.5	9,199.5	-	88,573.14	90,729.58	2.4	62,043.10	62,043.10	-	7,816.60	7,816.60	-

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	2,066,849,938	2,117,284,014	-50,434,075	2.4
Canada	107	321,772,154	-321,772,047	300,721,539.4
Czech Republic [a]	32,617,000	32,618,320	-1,320	0.0
Finland	23,255,276	23,455,277	-200,001	0.9
Greece	383,051,000	383,052,000	-1,000	0.0
Japan	NO	NE		
Lithuania	13,723	13,855	-133	1.0
Norway		20,501,417	no data reported in table 4.B(b)	
Sweden [b]		53,395	no data for pasture range and paddock reported in table 4.B(b)	
United States	8,385,909,981	4,922,790,675	3,463,119,305	-41.3

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

[b] In its response to the draft synthesis and assessment report, Sweden explained that the amount of N from pasture range and paddock was by mistake reported in tons instead of kilograms in the CRF. The corrected value should be 53,395,000 kg N (see also preliminary findings on individual national GHG inventories for Sweden in section II of this report).

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 1998 inventory data.
Note that only Parties that provided numerical information and for which differences in the data or any other inconsistencies were found were included in the tables below.

	population size * N excretion	sum N excretion all AWMS	Difference (B-A)/A*100
	kt	kt	%
	A	B	C
Dairy cattle			
Canada	844.0	0.0001	-100.0
Czech Republic [a]	64.4	48.9	-24.0
Greece	16.7	13.7	-18.0
Hungary	28.5	28.2	-1.0
Japan	0.5	0.0005	-99.9
Lithuania	37.9	0.0375	-99.9
Slovakia [a]	25.6	25.5	-0.2
United States of America	5,463.0	NA	NA
Non-dairy cattle			
Canada	98.4	0.0001	-100.0
Czech Republic [a]	73.2	87.9	20.1
Greece	18.0	14.8	-18.0
Japan	0.7	0.0007	-99.9
Lithuania	19.3	1.6	-91.9
Slovakia [a]	23.6	23.5	-0.2
Sheep			
Canada	3.0	0.0001	-100.0
Lithuania	0.3	0.0003	-99.9
Slovakia [a]	5.22	5.16	-1.1
United States of America	83.9	76.3	-9.0

[a] For some of the data to be reported in table 4B(b) of the CRF, the Czech Republic and Slovakia did not report their data in the units required by the CRF. In these cases, data were re-converted to CRF units to facilitate data comparison across Parties.

4. Waste

Waste - solid waste disposal on land, waste-water handling and waste incineration (1998)

	6. Waste																							
	Activity data		6.A Solid Waste Disposal on Land							6.B Wastewater 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	Percent of national total	emissions per capita[c]	CH_4 IEF		Methods and EF used		key source	percent of national total	emissions per capita[c]	CH_4 IEF				emissions per capita[c]	N_2O IEF	Methods and EF used		key source[b]	IEF
	CRF	IEA[a]	Methods	EF				managed	unmanaged	methods[h]	EF				domestic/ commercial		industrial				methods	EF		
						%	kg	t/t	t/t				%	kg	waste water	sludge	waste water	sludge	kg	kg N_2O -N/kg sewage N				kg/t
IPCC default EF[d]																				0.01 (0.002-0.12)					
Australia	18.85	18.75	T2	M	L	2.9	35.8	0.06	NE	T2	D			3.48					NE	NE	T2	CS		NA
Austria	8.07	8.08	CS	CS	L	5.5	26.1	0.06		C	CS			1.77							C	CS		3,224
Belgium		10.20				2.6	17.6							0.24										
Bulgaria	8.23	8.26	D	CS	L	7.1	34.4	0.09		D	CS	L	1.90	9.44	0.06	0.06	0.04	0.04	0.074	0.01				NA
Canada		30.30		CS	L	3.1	33.6			CS	CS			0.62					0.101		CS	CS		
Czech Republic[g]		10.30	T1,T3	CS	L	2.4	7.9	0.05		D	D,CS			1.62	0.04	0.01	0.01	0.01	0.063	24.98[g]				3,500
Finland	5.16	5.15	D	D	L	2.4	17.0	0.05		D	CS			0.31	0.01		0.00		0.055					
Greece	11.35	10.51	T1	D	L	2.5	14.3	0.04	0.04	T1	D			0.73	0.25				NE	NE				
Hungary	10	10.11	CS	CS	L	1.8	7.2			D	D	L	1.40	5.54							CS	CS	L	1.71[e]
Ireland	3.52	3.71	D	CS,D	L	2.5	20.5	0.07	0.04	NA	NA			NE	NA	NA	NA	NA	NE	NE	NA	NA		NA
Italy		56.98			L	1.8	8.0					L	0.50	2.27										
Japan		126.49	M,CS	CS			2.8	0.37	NO	CS	CS			0.06			NE	NE	NE	NE	CS	CS	L	2,555
Latvia	2.45	2.45			L	5.0	11.1	0.60	0.160										0.101					
Lithuania	3.80	3.70	RA	D	L	6.0	18.4	0.05						0.14	-									
Netherlands		15.70	M,CS	CS	L	4.0	28.3	80.89						0.08					0.039					
New Zealand	3.80	3.79	D,CS	D	L	3.3	31.4	0.04		D,CS	D,CS			1.78					0.124					
Norway		4.42	M	CS	L	7.1	43.0	0.12		M	CS			0.09					0.087					
Slovakia	5.39	5.39	IPCC,T1	CS	L	1.8	8.6			IPCC,T1, ISI	IPCC,C S	L	1.08	5.06	0.13	0.19	0.03	0.18	0.093	0.01				
Spain		39.37			L	4.1	18.5												0					
Sweden		8.85	CS	CS	L	1.7	6.9							1.38										
Switzerland	7.12	7.11	CS	CS	L	2.0	8.7			CS	CS			0.22					0.010		CS	CS	L	[f]
United Kingdom	59.24	59.24	M	CS	L	2.4	13.1	9.65	NA	M	CS			0.59	IE	0.02	NE	NE	0.009	0.01	T2	CS		
United States		269.09	M	M	L	3.0	38.2	30.19		D	D			0.61	0.03				0.095	0.01	CS	CS		2,827

Notes:

[a] Source of population data: CO_2 emission from fuel consumption, 1971-1998, IEA, Paris, 2000.

[b] For Hungary, Japan and Switzerland, CO2 from waste incineration represented 0.7, 1.8 and 2.4 percent of the national total, respectively.

[c] Emissions per capita were calculated using population data from the IEA (see footnote a).

[d] Source of default emission factor: IPCC Good Practice Guidance, Vol. 3, p. 6.28.

[e] For Hungary the IEF refers to biogenic and non-biogenic wastes which were reported all together.

[f] No IEF for CO2 from non-biogenic wastes was reported because activity data was reported for biogenic and non-biogenic wastes all together.

[g] In its response to the draft synthesis and assessment report, the Czech Republic explained that the N_2O IEF value for human sewage was accidentally misreported in the CRF.

The corrected value should be 0.16 (see also preliminary findings on individual national GHG inventories for the Czech Republic in section II of this report).

Waste - solid waste disposal on land

Trends in CH_4 emissions per capita*, 1990 to 1998
(kg CH4 per capita and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	37.96	37.92	37.97	38.88	38.29	36.87	36.63	36.77	35.84
Austria	33.55	32.48	31.67	30.59	29.76	28.95	28.33	27.35	26.07
Belgium								18.09	17.60
Bulgaria	80.25	87.60	83.97	77.14	48.08	47.58			34.42
Canada	31.75	32.43	32.66	32.99	33.00	32.74	32.79	33.20	33.61
Finland	34.76	31.54	27.85	24.14	22.26	22.06	20.36	18.74	17.02
Greece	23.05	23.65	24.40	25.19	26.07	26.85	27.62	28.23	29.20
Hungary		6.60	6.58	6.62	6.64	6.66	6.69	6.71	7.16
Ireland	24.21	24.50	24.94	24.98	25.14	25.24	25.25	23.95	20.46
Italy	7.68	7.78	6.93	7.07	8.01	8.16	8.14	8.06	8.05
Japan	3.14	3.04	2.96	2.92	2.91	2.92	2.88	2.84	2.84
Netherlands	37.60	36.90	35.57	34.15	32.84	30.98	30.71	29.72	28.34
New Zealand	40.63	39.23	36.92	38.30	37.85	35.82	35.36	32.42	31.37
Norway	42.85	43.22	42.89	43.50	43.60	44.00	44.38	44.01	42.97
Slovakia	9.52	9.52	9.47	9.43	9.40	9.55	11.16	9.48	8.50
Spain	10.61	11.31	11.87	12.82	13.76	14.62	15.58	16.65	18.53
Sweden	9.93	9.86	9.79	9.75	6.95	6.91	6.90	6.89	6.89
Switzerland	9.97	9.58	9.46	9.45	9.29	9.20	9.02	8.86	8.71
United Kingdom	19.41	18.61	17.72	16.88	16.18	15.56	14.83	14.00	13.07
United States	40.70	40.18	40.41	40.41	40.09	40.15	39.57	39.39	38.16

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-0.1	0.1	2.4	-1.5	-3.7	-0.7	0.4	-2.5	-5.6
Austria	-3.2	-2.5	-3.4	-2.7	-2.7	-2.1	-3.5	-4.7	-0.2
Belgium								-2.7	
Bulgaria	9.2	-4.1	-8.1	-37.7	-1.0				-57.1
Canada	2.1	0.7	1.0	0.0	-0.8	0.2	1.2	1.2	5.9
Finland	-9.3	-11.7	-13.3	-7.8	-0.9	-7.7	-8.0	-9.2	-51.0
Greece	2.6	3.2	3.2	3.5	3.0	2.9	2.2	3.5	26.7
Hungary		-0.3	0.6	0.3	0.3	0.4	0.3	6.8	
Ireland	1.2	1.8	0.1	0.6	0.4	0.1	-5.2	-14.6	-15.5
Italy	1.3	-11.0	2.0	13.4	1.9	-0.3	-0.9	-0.2	4.8
Japan	-3.1	-2.6	-1.3	-0.5	0.5	-1.6	-1.4	0.0	-9.5
Netherlands	-1.9	-3.6	-4.0	-3.8	-5.7	-0.9	-3.2	-4.7	-24.6
New Zealand	-3.4	-5.9	3.8	-1.2	-5.4	-1.3	-8.3	-3.2	-22.8
Norway	0.9	-0.8	1.4	0.2	0.9	0.9	-0.8	-2.4	0.3
Slovakia	0.0	-0.6	-0.4	-0.4	1.6	16.9	-15.1	-10.3	-10.8
Spain	6.6	5.0	8.0	7.3	6.2	6.6	6.9	11.3	74.7
Sweden	-0.7	-0.7	-0.5	-28.7	-0.6	-0.1	-0.1	0.0	-30.6
Switzerland	-3.9	-1.3	0.0	-1.7	-0.9	-2.0	-1.8	-1.7	-12.7
United Kingdom	-4.1	-4.8	-4.7	-4.1	-3.8	-4.7	-5.6	-6.7	-32.7
United States	-1.3	0.6	0.0	-0.8	0.1	-1.4	-0.4	-3.1	-6.2

Note
The following Parties are not included in this table because data for years other than 1998 were not reported: Czech Republic, Lativa, Lithuania
* Emissions per capita were calculated using population data from the IEA.

Waste - waste-water handling

Trends in CH_4 emissions per capita*, 1990 to 1998
(kg CH4 per capita and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	3.47	3.44	3.44	3.48	3.48	3.48	3.48	3.48	3.48
Austria	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.77
Belgium								0.24	0.24
Bulgaria	18.78	15.19	14.05	12.97	10.44	16.74			9.44
Canada	0.61	0.61	0.61	0.61	0.61	0.61	0.62	0.62	0.62
Finland	0.34	0.31	0.30	0.31	0.32	0.32	0.31	0.30	0.31
Greece	0.71	0.71	0.72	0.71	0.72	0.72	0.73	0.73	0.73
Hungary		18.26	18.18	18.24	18.23	18.23	18.24	18.23	5.54
Italy	2.05	2.06	2.08	2.07	2.16	2.21	2.22	2.28	2.27
Japan	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06
Netherlands	0.42	0.42	0.42	0.41	0.33	0.10	0.04	0.08	0.08
New Zealand	1.83	1.77	1.78	1.84	1.84	1.80	1.80	1.80	1.78
Norway	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Slovakia	6.84	6.33	5.96	5.24	5.31	5.35	5.27	5.29	5.06
Spain	1.13	1.16	1.17	1.19	1.26	1.29	1.31	1.35	1.38
Switzerland	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.22	0.22
United Kingdom	0.58	0.54	0.60	0.59	0.62	0.59	0.59	0.59	0.59
United States	0.60	0.60	0.60		0.60	0.60	0.60	0.60	0.61

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia	-1.0	0.0	1.2	0.0	-0.1	0.0	0.0	-0.1	0.0
Austria	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
Belgium								-0.2	
Bulgaria	-19.1	-7.5	-7.7	-19.5	60.4				-49.7
Canada	0.0	0.0	0.0	0.1	0.1	1.1	0.1	-0.1	1.3
Finland	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-9.8
Greece	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7
Hungary		0.0	0.0	0.0	0.0	0.0	0.0	-0.7	
Italy	0.3	0.9	-0.3	4.2	2.3	0.5	2.6	-0.2	10.8
Japan	2.7	0.0	7.8	-6.4	-1.4	8.9	5.7	3.8	21.9
Netherlands	-0.3	0.0	-1.9	-19.5	-70.7	-62.2	128.6	-0.6	-80.2
New Zealand	-3.5	0.6	3.5	-0.2	-2.2	0.0	0.0	-0.8	-2.7
Norway	0.0	0.5	-0.5	-0.1	0.3	0.0	0.1	-0.1	0.2
Slovakia	-7.4	-5.9	-12.0	1.3	0.7	-1.4	0.4	-4.4	-26.0
Spain	2.7	0.9	2.1	5.1	2.5	1.4	3.6	1.8	21.9
Switzerland	-1.2	0.7	2.9	0.9	1.1	1.6	1.7	1.7	9.8
United Kingdom	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.0
United States	-0.2	0.0			0.0	0.0	-0.3	0.9	0.7

Note
The following Parties are not included in this table because data for years other than 1998 were not reported: Czech Republic, Lativa, Lithuania and Sweden. Ireland reported zero for all years.
* Emissions per capita were calculated using population data from the IEA.

Trends in N_2O emissions per capita*, 1990 to 1998
(kg N2O per capita and annual percentage change)

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Australia	NE	NE	NE	NE	NE	NE	NE	NE	NE
Bulgaria	0.091	0.088	0.082	0.080	0.077	0.077			0.074
Canada	0.101	0.101	0.101	0.101	0.101	0.101	0.102	0.102	0.101
Finland	0.072	0.069	0.066	0.063	0.063	0.062	0.059	0.058	0.055
Greece	NE	NE	NE	NE	NE	NE	NE	NE	NE
Japan	NE	NE	NE	NE	NE	NE	NE	NE	NE
Netherlands	0.033	0.033	0.033	0.033	0.033	0.032	0.036	0.040	0.039
New Zealand	0.131	0.125	0.126	0.129	0.130	0.126	0.127	0.125	0.124
Norway	0.069	0.069	0.068	0.071	0.074	0.077	0.081	0.087	0.087
Slovakia	0.097	0.091	0.085	0.090	0.084	0.086	0.086	0.086	0.085
Switzerland	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010	0.010
United Kingdom	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
United States	0.092	0.093	0.093	0.093	0.095	0.093	0.094	0.094	0.095

Relative change to previous year (%)

	1991	1992	1993	1994	1995	1996	1997	1998	Percentage change from 1990 to 1998
Australia									
Bulgaria	-3.3	-6.8	-3.2	-3.3	0.5				-18.6
Canada	0.0	0.0	0.0	0.0	0.0	1.0	-0.1	-0.8	0.1
Finland	-4.2	-4.2	-4.3	-0.5	-1.3	-4.2	-2.3	-5.7	-23.8
Greece									
Japan									
Netherlands	-0.8	-0.7	-0.7	-0.6	-0.5	11.5	10.1	-0.6	18.1
New Zealand	-4.5	0.8	2.6	0.8	-3.6	0.8	-1.3	-0.8	-5.3
Norway	-0.5	-0.7	3.1	5.3	3.2	5.9	7.3	-0.5	25.4
Slovakia	-5.9	-6.8	6.3	-6.6	2.6	-0.2	-0.7	-0.2	-11.6
Switzerland	-1.8	0.9	2.3	0.4	1.2	2.5	1.2	1.1	8.1
United Kingdom	4.6	0.0	-4.6	0.2	0.0	0.0	0.0	0.0	0.0
United States	0.6	0.0	0.0	2.5	-1.9	0.6	0.6	0.2	2.4

Note
The following Parties are not included in this table because data for years other than 1998 were not reported: Belgium, Czech Republic, Hungary, Italy, Lativa, Lithuania and Sweden. Austria, Ireland and Spain reported zero for all years.

* Emissions per capita were calculated using population data from the IEA.

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 to 1998 using the CRF, which included all requested tables. The CRF was accompanied by an NIR that includes worksheets with activity data, emission factors and other parameters used for the calculation of emissions estimates. The NIR contains methodology supplements to previously published workbooks for fuel combustion activities, fugitive fuel emissions and waste. Indicators were used throughout all tables of the CRF.

Consistency of information between the CRF and the 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 emissions estimates in the worksheets that were incorporated in the NIR.

Verification procedures

The NIR (see quality control sections) mentions that, for each IPCC sector, quality control checks for emission estimates, emission factors and data input were made.

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 findings below.

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 1997.

The effect of the recalculations (as reported in the CRF tables) was an increase of 0.35 per cent in the total CO_2 equivalent emissions without land-use change and forestry for the base year (1990) and 0.43 per cent if land-use change and forestry is taken into account. For the year 1997, the effect of the recalculations was 0.02 per cent and 0.53 per cent, respectively.[1]

[1] If the summation formulas in the CRF are corrected the above percentages become 0.34 per cent and 0.43 per cent for 1990 and –0.02 per cent and 0.48 per cent for 1997.

Sector-by-sector findings

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. There is a difference of only -0.96 per cent between the estimates.
Australia explained that considerable effort is devoted to ensuring that both activity data and emission factors are applied consistently between the two approaches, notwithstanding the appreciable differences in methodologies and derivations.

Key sources

Fuel combustion

- GHG emissions from fuel combustion were calculated on the basis of fuel consumption data expressed in gross calorific value (GCV). No information was provided to allow the calculation of the activity data on the basis of net calorific value (NCV). This means that the implied emission factors (IEFs) are about 5 per cent lower for solid and liquid fuels and about 9-10 per cent lower for gaseous fuels than would have been the case if the data were given on a net calorific value basis.
  The Party explained that in all Australian national energy statistics, the specific energy content of fuels and hence energy consumption by each sector of the economy are expressed in terms of GCV. The possible implications on IEFs if values were given on a NCV basis sound appropriate as in the transport workbook the IEA is quoted as stating that NCV is 5 per cent lower for oil and coal, and 10 per cent lower for natural gas (OECD 1991).

- For 1.A.4.a Commercial/institutional – liquid fuels in 1998, the value of the CO_2 IEF varies considerably for the period 1990 to 1998 with a maximum value of 85.93 t/TJ in 1994 and a minimum value of 60.82 t/TJ in 1997. (The Australian workbook on fuel combustion activities (stationary sources) lists emission factors for CO_2 from petroleum fuels that range from 59.4 t/TJ for LPG to 80.7 t/TJ for bitumen.)
  Australia explained that a transcription error occurred in the 1994 spreadsheet. The 1994 IEF should be 63.16 t/TJ. Corrected CRF tables for the 9 years (provided in the 2001 inventory submission) show an IEF ranging from 63.75 t/TJ in 1990 to a low of 60.82 t/TJ in 1997, the slight downward trend being explained by a slow fuel mix shift away from diesel and fuel oil and towards LPG.

Fugitive emissions

- 1.B.1.a Coal mining and handling: activity data for underground mines in 1997 (253.02 Mt) was significantly higher compared to data reported for other years (range: 58.18 – 78.81 Mt). This resulted in a smaller IEF for CH_4 for 1997.
  Australia explained that this was an error; the correct value should be 72.9 Mt and total tonnage mined is 253.0 Mt. However, this makes no difference to the emission estimate, which has been separately derived; the activity figures are copied in at the end of the process.

  The CH_4 IEF for mining activities in 1998 was about 25 per cent lower compared to its value for 1990.

Australia explained that the reduction in IEF is caused by, firstly, a marked decline in the share of production from gassy (Class A) underground mines, and secondly, a marked increase in CH_4 capture and mitigation, by both utilization (electricity generation) and mitigation (flaring).

The IEF for surface mines is higher than reported from other countries (at the upper boundary of the range given in the IPCC Guidelines). At the same time the IEF for post-mining (underground mines) is low.
According to the Party, IEF values are the implied numbers resulting from the regression equations which were derived on the basis of measurements made at mines in the early 1990s, as described in Workbook 2.1. Australia acknowledged that there is a clear need for more field measurement and analytical work in Australia (and probably in other countries also).

- 1.B.2 Fugitive emissions from oil and natural gas: CO_2 and CH_4 IEFs for the categories reported varied considerably from year to year. No information was provided on methodological changes for this sector.
Australia clarified as follows:
Flaring: only occurs at a few small fields that are frequently starting up or shutting down. When one of these events occurs there is a sharp jump in emissions.
Venting: due to the shifting of production between a small number of fields that have significantly different CO_2 contents. As production shifts between fields the amount vented can change significantly between years.
Australia considers the IEF not to be a good indicator for this source category as the production of oil and gas does not directly relate to the amount of vented and flared emissions.

Non-key sources

- CH_4 from biomass: The IEF is high compared to those from other countries.
It was explained that in Australia a high proportion of biomass is consumed in the residential sector, and within that sector a high proportion is consumed in open fireplaces and in low efficiency stoves. This would account for the apparently high IEFs for CH_4.

INDUSTRIAL PROCESSES

Key sources

No key source was identified in this industrial processes sector.

Non-key sources

- *2.A.2 Lime production:* CO_2 IEF is relatively low.
Australia explained that the IEF is a function of the emission factor derived from the stoichiometric relationship and the fractional purity of lime. Neither commercial lime nor in-house lime is 100 per cent pure, as assumed with the IPCC default methodology. Australia has adjusted the emission factor to account for purity ranging from 85 to 95 per cent.

- *2.A.4 Soda ash production* was reported as a sink. The methodology used by Australia is also referred to in the IPCC Guidelines.
  Australia referred to the IPCC Guidelines that state 'Available experimental data from Australia indicate that approximately 0.23 tons of CO_2 is sequestered from the ocean for each ton of soda ash produced (Workbook, Australia, 1995).'

- *2.B.1 Ammonia production:* reported as NE. According to international data sources 450 kt of ammonia have been produced in 1998.
  Australia explained that industry does not supply data for the national GHG inventory.

- *2.C.1 Iron and steel production:* No estimates for CO2 provided in the industrial sector.
  Australia referred to its methodology Workbook 7.1 which states: 'Carbon dioxide and carbon monoxide emissions resulting from metallurgical coke production and use have previously been accounted for indirectly from a consideration of the carbon content of coking coal in the Workbook for Fuel Combustion Activities (Stationary Sources) 1.1 1996. To avoid double counting, CO_2 and CO emissions from metallurgical coke production and use are not included in the industrial process emissions total for Iron and Steel in this workbook.'

- "2.F Consumption of halocarbons and SF_6[2] - HFCs, PFCs and SF_6" and "2.F.6 Other Electricity transmission and distribution - SF_6" were not calculated because "available data are unreliable"
  Australia explained that the requirement for emissions data for synthetic gases is relatively recent compared to the other major greenhouse gases. Mechanisms have not been put in place for gathering statistics on synthetic gases. Priority is being placed on the development of comprehensive data gathering arrangements for synthetic gases.

AGRICULTURE

Key sources

4.A Enteric fermentation - CH_4

- For dairy and non-dairy cattle the CH_4 IEF for 1998 seem higher compared to the IPCC default emission factors for the region of Oceania and also relatively high compared to other Parties.
  Australia explained this as follows:
  Dairy: IEF is significantly higher than Oceania default, which assumes average milk production of 1700 kg/hd/yr. Actual production in 1998 ranged from 3964 – 5472 kg/hd/yr.
  Non-Dairy: two factors influencing higher IEF. Firstly, used methodology for cattle on tropical feeds based on Kurihara et al. (1999 British J. Nutrition 81:263-272). Method estimates CH_4 conversion rates in the order of 9-11 per cent compared with the 6 per cent assumed in the IPCC Guidelines. Secondly, Australian methodology incorporates daily liveweight gain while this is assumed to be zero in the IPCC Guidelines. Liveweight gain is known to strongly influence intake and hence CH_4 emissions.

[2] The category "2.F. Consumption of halocarbons and SF_6" was not identified as a key source in the level assessment since it was not reported. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

- For dairy cattle the CH_4 IEF increases by 4 per cent from 1990–98.
  According to the Party the cause for this increase in the IEF was a 30 per cent increase in average milk production since 1990.

- High annual percentage changes in emissions, activity data and IEF for some livestock types for which activity data in general was relatively small (buffaloes, camels and lamas, deer, goats, horses, mules and asses, ostriches/emus, other)**.**
  Australia explained that these animal classes represent a very minor source category in terms of percentage of overall emissions, and have not been a priority for effort on methodology and data improvement.
  Activity data estimates for these livestock types are highly uncertain as the national agricultural census/survey does not capture all establishments and has not collected information on all classes in all years. Consequently, there is a significant sampling error in these small industries. IEFs do not differ between years as emissions are estimated using the tier 1 methodology.

4.D Agricultural soils - N_2O

- Direct soil emissions (4.D.1): The N_2O IEF for 1998 for cultivation of histosols is very low compared to IPCC defaults and to other Parties (lower by a factor of 10).
  The Party explained that this is due to reporting N_2O emissions from soil disturbance in Australia. The methodology used has no corresponding category in the IPCC methodology. Reporting of these emissions under Cultivation of histosols was assumed to be the closest match.
  The emission factor is based on Australian studies, which are combined to give an average enhancement in annual N_2O due to conversion of land from native vegetation to improved pasture/cropping systems.

- Animal production (4.D.2): The N_2O IEF for 1998 is the lowest (0.0043 kg N_2O-N/kg N) compared across the reporting Parties (median value: 0.02);
  Australia explained this low IEF by the fact that the Australian methodology uses an emission factor for urine deposition of 0.4 per cent of N while the IPCC default is 1.25 per cent. The Australian emission factor is based on an analysis of a number of studies including research undertaken in Australia.

- Animal production (4.D.2): The reported activity data for 1998 (N excretion on pasture range and paddock) is 2.4 per cent higher than the total N excretion for pasture range and paddock reported in table 4B(b).
  Australia explained that this was due to an error in table 4B(b): Nitrogen excreted in the pasture range and paddock for the 'other' livestock classes (goats, horses, deer etc) have been left out of the table.

4.E Prescribed burning of savannas – CH_4 and N_2O

- The ecological zones (territories for Australia) were entered in different order for different years, notably for 1998. Need to check activity data and emission estimates for consistency.
  Australia clarified that the ecological zones are entered in the same order in all tables, but a transcription error in the row headers has occurred in the 1990-1997 tables. The correct row headings are those given in the 1998 CRF.

- Percentage change between 1997 and 1998 for non-CO_2 emissions was a 13 per cent increase – as a result of fires during the 1997 El Nino event (see NIR, page A-25).

Non-key sources

4.B Manure management

- Dairy and non-dairy cattle: the CH_4 IEFs for 1998 are very low compared to the IPCC default emission factors(region of Oceania) and to other countries, in particular for non-dairy cattle, where the IEF is lower by a factor of 100.
  Australia explained that for dairy cattle the MCF used for pasture/range is 1 per cent compared with the 1.5 per cent in the IPCC Guidelines. For non-dairy cattle, the IEF is an anomaly of the reporting table. Australian methodology assumes no CH_4 emissions from range kept beef cattle. However, emissions do result from cattle kept in feedlots (emission factors: approx 1.1 kg/hd/yr).
- N-excretion rates: for dairy cattle, this parameter seems higher than for other countries and the corresponding IPCC default value, while for non-dairy cattle, swine and sheep this parameter seems lower.
  Australia explained that for cattle and sheep, the methodology is based on a mass balance approach where $N_{output} = N_{input} - N_{storage}$. It is not possible to assess the cause for the difference with Table 4-20 in IPCC Guidelines. For swine, the excretion is assumed to be 60-65 per cent of nitrogen intake, based on Australian industry information.

LAND-USE CHANGE AND FORESTRY

Tables 5.A to 5.D of the CRF have not been provided. However, a supplement to its NIR contained the worksheets used for estimating emissions and removals for this sector.

CO_2 emission and removal estimates were provided in table 5 of the CRF for categories 5.A. 5.B, 5.D and 5.E.

- *5.B Forest and grassland conversion:* 25 per cent decrease in CO_2 emissions in 1991.
  Australia explained that this drop in emissions is due to a significant drop in the currently available estimates of the rate of land clearing between 1990 and 1991. There is high uncertainty associated with these emission estimates. Robust estimates of land clearing are currently being produced through Australia's National Carbon Accounting System.

- *5.D CO_2 emissions and removals from soils:* the same value was reported for all years.
  According to the Party this estimate is highly uncertain and relies on limited data. Data to modify this estimate are not available. The emissions from this source category are currently being reviewed through Australia's National Carbon Accounting System.

WASTE

Non-key sources

- *6.C Waste incineration:* inconsistent time series for CO_2 emissions in sectoral tables are provided. Emissions reported for 1996-1998; zero reported for 1990, NA reported for

1992-1993, and no entries made for 1991 and 1994. However, in trend tables (table 10), NE was reported for 1990-1995. There was no estimate of N_2O from waste incineration (NA).

The Party clarified that CO_2 emissions from waste should be as those reported in the Trend Tables (Table 10).

Emissions of N_2O from waste incineration should be reported as NE and not as NA. There would be trace amounts of N_2O from incineration but appropriate methodologies and emission factors would need to be developed. These issues will be considered in the context of periodic reviews and revisions of the methodologies.

- *6.B Waste-water handling:* there was no estimate of N_2O from human sewage. The completeness table (table 9)documented it as "methodology not yet developed"; IPCC default methodology was not used.

  The Party explained that the Australian Methodology states that further research under Australian conditions was required to confirm the N_2O emission factor (p. 42). The omission of N_2O would then be reconsidered. The IPCC Guidelines (p.4.110) state: "For the Phase II methodology N_2O associated with sewage treatment and land disposal is assumed to be negligible. This assumption should be reviewed in the future, as new data become available." These issues might be considered in the context of periodic reviews and revisions of the methodologies.

AUSTRIA

General

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

Austria provided inventory data for the year 1998 using the CRF and included all requested tables. An NIR was not submitted. However, the CRF was accompanied by a short inventory report, giving brief information on the relation to earlier reported data, method of reporting and data basis (2 pages) and a number of summary tables containing emissions estimates for the years 1990 to 1998 (corresponding to the trend tables in the CRF).

Austria indicated that a detailed NIR is foreseen for the 2001 submission before the end of the year.

Consistency of information between the CRF and the NIR

Not applicable in relation to the NIR. The information provided in the 1998 CRF is consistent with the emissions data provided in the summary tables that accompanied the CRF.

Verification procedures

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

Austria explained that CO_2 emissions have been verified by the Austrian Institute for Economic Research (WIFO) in 1999; also the assessment of uncertainty by the Austrian Research Centre Seibersdorf is a kind of independent verification. Austria indicated that both of these issues will be addressed in the NIR.

Time series consistency

In depth analysis was not possible, since only data for 1998 were provided in detail. Emissions data do not indicate any notable annual fluctuations in national totals.

- 1.A.2 Manufacturing industries and construction CH_4 seems to indicate a change in methodology for the year 1993 to 1994.
- For 6.D Waste other (sludge spreading, compost production) the same value for CH_4 emissions has been reported for all years.

  Austria indicated that the 2001 submission will include detailed data according to the CRF for the whole time series (all years since 1990).

  Austria explained that emission data for sector 6.D have not been updated but are based on one single study, the reason being limited resources. It is planned to update activity data as part of the inventory improvement programme.

Comparison with previous submissions

In the accompanying information it was stated that emission data have been revised, while the check list (table 11) of the CRF indicated that no changes have been made. Also, recalculation tables 8(a) and 8(b) of the CRF have not been provided. However, comparison of data submitted in 2000 with data submitted in 1999 indicate that 1990 estimates have been recalculated. Total CO_2 emissions for 1990 changed only by 0.1 per cent, while total CH_4 for 1990 and 1997 were revised upwards by 17 per cent and 7 per cent respectively, mainly due to increased waste emissions.

Austria confirmed that emissions data have been revised and indicated that table 11 will be changed accordingly in the future. Information on recalculation will be included in the NIR.

Sector-by-sector findings

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. The reference approach results in 11 per cent more energy consumption and 22 per cent more CO_2 emissions, which is the highest difference in CO_2 emissions among the reporting Parties. Reasons for this difference were provided in the documentation box. ***Austria explained that deviations of CO_2 from liquid fuels are mainly caused by the inclusion of refinery emissions under category 1.B.2.a., and deviations of CO_2 from solid fuels are mainly caused by the inclusion of the iron and steel industry under category 2.C.1.***

Comparison with international data

Although the energy data in the reference approach are only 0.4 per cent different from those reported by the IEA, this masks many fairly large differences. The CRF data are 3.3 per cent lower for liquid fuels and 11.1 per cent higher for solid fuels. Specific differences include the following:

- Even if NGLs have been included in crude oil, this still does not explain all the difference in the liquid fuels.
- Gasoline stock changes have opposite signs in the two data sets.
- Jet kerosene exports in the CRF are 12,973 TJ whereas the IEA shows 267 TJ. (It is not clear if this is because of military use.)
- Gas diesel imports in the CRF are 105,749 TJ whereas the IEA shows 87,793 TJ.
- It appears that naphtha, bitumen and lubricants have been included with "other oil" in the CRF.
- No indication was provided on where the imports of refinery feedstocks have been included.
- Other bituminous coal seems to have been reported as coking coal, but this still does not account for all of the difference in solid fuels.
- Lignite imports are 5,243 TJ in the CRF whereas the IEA shows 143 TJ.
- Coke oven gas imports are 23,402 TJ in the CRF whereas the IEA shows 19,750 TJ.

Austria explained that one reason might be differences in national energy statistics compared to IEA energy statistics. The national statistics division Statistic Austria, which is responsible for the national energy statistics used for the national approach, as well as for the reports to the IEA, will enhance consistency in the near future. Austria stated that further assessment is needed to identify additional reasons, if any.

Key sources

Fuel combustion

- 1.A.1. b Petroleum refining - liquid fuels: activity data were reported but the corresponding emissions were reported as 'IE' (no explanation as to where). This results in a substantially lower CO_2 implied emission factor (IEF) for 1.A.1. Energy industries – liquid fuels (51 t/TJ) compared to the mean across the reporting Parties (71 t/TJ). For

other fuels (solid fuels, gaseous fuels, biomass and other fuels) zero emissions were reported.
Austria explained that emissions are reported under category 1.B.2.

- In 1.A.1.c Manufacture of solid fuels and other energy industries: zero emissions for liquid fuels, solid fuels, biomass, other fuels were reported.
  Austria explained that this category includes only emissions from pipeline compressors, which are operated by natural gas.
- 1.A.2 Manufacturing industries and construction: emissions were not further disaggregated into (a) Iron and steel, (b) Non-ferrous metals, (c) Chemicals, (d) Pulp, Paper and Print, (e) Food processing, Beverages and Tobacco, but 'IE' was used.
  Austria explained that emissions stem from direct industry reporting which did not allow for a further disaggregation.
- 1.A.2 Manufacturing industries and construction - solid fuels: The CO_2 IEF was smaller by a factor of 10 compared to other Parties.
  Austria explained that emissions from solid fuels used in the iron and steel industry are reported under category 2.C.1 Iron and steel production whereas the solid fuels consumption is reported under 1.A.2.a and 1.A.2.f which is almost 90 per cent of total solid fuels of category 1.A.2. This results in an IEF of only 10 per cent of the expected value.
- 1.A.3.b Road transportation – gasoline: The N_2O IEF was amongst the highest across reporting Parties. The distribution of this IEF is, however, very scattered.
  Austria explained that the large number of cars with catalytic converters in Austria causes the high N_2O IEF of gasoline.

Fugitive emissions

- For 1.B.2 Fugitive emissions from oil and natural gas, CO_2 and CH_4 emissions and activity data were reported according to SNAP codes, which are at a higher level of disaggregation than required by the CRF. No additional information was provided. Emissions of CH_4 (and other pollutants) from venting and flaring were not estimated.
  Austria informed that methodological change from CORINAIR to IPCC in the context of the inventory improvement programme will provide a higher level of disaggregation.

Non-key sources

- 1.B.1 Fugitive emissions from coal mining: The CH_4 IEF for surface mines (0.01 kg/t) was low compared to other reporting Parties and outside the range suggested in the IPCC Guidelines (0.20 - 1.34 kg/t). However, the amount of coal mined is small and the corresponding emissions will in any case be small.
  Austria explained that a national study supports the comparatively low emission factor.

INDUSTRIAL PROCESSES

Key sources

2.A.1 Cement production – CO_2

- The value of the CO_2 IEF (0.656 t/t) was the highest for all reporting Parties and higher than the IPCC default (0.499 t/t for cement).
  Austria provided the following explanation:
  The IPCC emission factor considers only CO_2 emission 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). Therefore the emission factor is higher than the IPCC default value.
  Due to the following reasons, CO_2 emissions from calcination and from burning fuels (or waste) are counted together: The cement industry measures the total amount of emitted CO_2. It is possible to calculate the CO_2 generated by the chemical reaction of carbon-containing minerals (for Austria, an emission factor of 0,432 t/t cement was calculated).
  By discounting the amount of process-specific CO_2 from total CO_2 emissions, the total amount of pyrogen CO_2 can be calculated, but as there are no fuel-specific or fuel-substitute-specific emission factors for the cement industry it is not possible to calculate fuel-related pyrogen emissions.
  Therefore the IPCC category 2.A.1 contains the total CO_2 emissions from cement production in the Austrian inventory.

2.C.1 Iron and steel production

- Although some disaggregated activity data were reported, all emissions were reported in aggregate form.
  Austria provided the following explanation:
  Aggregated emissions from iron and steel production were reported, because CO_2 emissions are reported directly by industry and thus represent plant-specific data. In Austria, iron and steel (basic oxygen furnace) production is mainly concentrated at two integrated sites operated by the same company. This company also operates the sinter plants and coke oven in Austria. This company has reported the total amount of CO_2 emissions from iron and steel production. This total includes process related CO_2 emissions from sinter plants, blast furnaces and basic oxygen steel plant. Included are also pyrogen emissions from the sinter plants, coke oven, rolling mills and energy supply.

2.F.(a). Consumption of halocarbons and SF6 – SF6 and HFCs

- Only totals were given for individual gases at the level of 2.F. Table 2(II).F of the CRF was not filled in.
- The trend tables included emissions for 1995 and 1998 only.
- The ratios of potential and actual emissions for 2.F Consumption of HFC-125 (17.6), HFC-143a (16.0) and SF_6 (13.14) was the highest of all Parties.
  Austria stated that in the 2001 submission for the inventory year 1999 table 2(II)F of the CRF will be filled in completely, the trend table covering 1990 to 1999 will be included, the estimates for the ratios of potential and actual emissions will be revised and consumption and emission data for HFCs and SF_6 will be updated. In the 2000 submission, no trend tables for 1990 to 1999 were included, because emissions of halocarbons and SF_6 in Austria were determined only for 1990, 1995 and 1998.

Austria also provided the following explanation:
HFC-125 and HFC-143a 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 correspond to the respective stock of equipment installation.
(Could it be that other countries have not considered the composition of the blends?)
SF_6 is used mainly in the sector Noise insulation windows and for electrical transmission/distribution. In the electrical transmission and distribution sector the potential emissions correspond to the respective stock of equipment installation. In Austria, all switchgear/controlgear companies use SF_6 in their systems. Therefore, potential emissions are very high.
The actual emissions from the sector Noise insulation windows are the annual congestion losses based on annual production data plus the leakage losses (1 per cent) of the total stock of insulation glasses filled with SF_6. The potential emissions correspond to the SF_6 used to fill all insulate glasses minus the amount of SF_6 which escapes by diffusion.

Non-key sources

2.A.2 Lime production

- The value of the CO_2 IEF (0.37 t/t) was lower than for most Parties and lower than the IPCC default values (0.79-0.91 t/t).
  Austria explained that the emission factor of 0.37 t/t lime was taken from [BUWAL, 1995].

2.B.1 Ammonia production

- The value of the CO_2 IEF (0.86 t/t) was lower than for most Parties and lower than the IPCC default values (1.5-1.6 t/t).
  Austria informed that in the 2001 submission for the inventory year 1999 the value of the IEF will be 0.96 t/t. The factor is based upon plant-specific data from the only ammonia producer in Austria.

2.B.2 Nitric acid production

- The value of the N_2O IEF (0.001 t/t) was lower than for most Parties and lower than the IPCC default values (0.002-0.009 t/t).
  Austria explained that the source for the emission factors used is a study about N_2O emissions in Austria [ORTHOFER, KNOFLACHER, ZÜGER, 1995]. The emission factor in this study is based on direct inquiries at the only nitric acid producer in Austria and thus represents plant-specific data. At this plant, the N_2O emissions are measured regularly.

AGRICULTURE

The possibility of comparing IEFs and other parameters with those of other countries and defaults from the IPCC, as well as performing specific checks to verify the consistency of activity data and related parameters, was limited due to a lack of reporting in many instances.
Austria explained that the reason for the significant gaps in reporting in this sector is a lack of data and lack of resources to assess the data. To close the gaps will be part of the inventory improvement programme.

Key sources

4.A. Enteric fermentation

- For non-dairy cattle the CH_4 IEF (38 kg CH_4/head/year) was lower compared to other Parties and lower than the IPCC default for the region (48 kg CH_4/head/year).
  Austria reported that it plans to use the IPCC default emission factor in the 2002 submission as part of its implementation of the good practice guidance. If resources are available, a specific Austrian emission factor may be estimated.

- For swine, the reported activity data were lower than the corresponding value from the FAO (29 per cent difference).
  Austria explained that the reference for swine-population data (as well as for all other animal population data) is Statistic Austria (i.e., official statistics) and that it gives concise national information. For emission calculation purposes, the number of piglets below 20 kg are not counted. It is planned to use the IPCC default emission factor in the 2002 submission as part of its implementation of the good practice guidance which also addresses piglets below 20kg.

4.B Manure management

- For dairy and non-dairy cattle and swine, the CH_4 IEFs were relatively low compared to the IPCC defaults for the climate region 'temperate'.
  Austria stated that it plans to use the IPCC default emission factor in the 2002 submission as part of its implementation of the good practice guidance. If resources are available, a specific Austrian emission factor may be estimated.

4.D. Agricultural soils

- No disaggregated reporting according to subcategories; no reporting of activity data and consequently no IEFs were calculated. Only an aggregated N_2O emission estimate was provided, which was reported under "other".
  Austria explained that the national method uses different categories compared to the 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. As part of the implementation of the good practice guidance it is planned to improve reporting of this sector.

Non-key sources

4.B Manure management

- N_2O emissions from this source category were reported as 'zero'. Table 4.B(b) has not been filled in except for livestock population data.
  Austria explained that, due to lack of information on emission factors for the national method and lack of resources, N_2O emissions were not estimated for this category. It is planned to use the IPCC default methodology and default emission factor in the 2002 submission as part of its implementation of the good practice guidance. If resources are available, a specific Austrian emission factor may be estimated.

LAND-USE CHANGE AND FORESTRY

CO_2 emissions/removals were reported only for category 5.A, Changes in forest and other woody biomass stocks (Temperate forests). Sectoral background data table 5.A was provided for reporting data of this source/sink category.

- Table 5: Emissions and removals were not reported separately. Instead, only the net CO_2 removals were reported.

Austria stated that it plans to use the IPCC default methodology and default emission factors in the 2002 submission as part of its implementation of the good practice guidance to close any gaps in sector 5.

WASTE

Non-key sources

6.B Waste-water handling

- Waste water activity data and related information were not reported, preventing comparisons with other Parties.
  Austria explained that a different methodology for the calculation of the methane emission is used. The number of inhabitants is used as the basis for activity data. The difference between industrial and domestic and commercial waste-water handling is taken into account by the emission factor.
- N_2O estimates from human sewage were not reported. No explanation was given in the documentation box or Completeness table (Table 9).
  Austria explained that emissions of N_2O have not been reported, because up to now the data have not been estimated in Austria due to limited resources and its focus on significant sources. It is planned to use the IPCC default methodology and default emission factors in the 2002 submission as part of its implementation of the good practice guidance to close this gap.
- Reported "sludge spreading" emissions of CH_4 under "6.D Other" instead of under waste-water handling.
  Austria indicated that emissions of CH_4 due to "sludge spreading" will be reported under wastewater handling in the future.

6.C Waste incineration

- CH_4 and N_2O emissions from "open burning of agricultural wastes" were reported under the Waste sector (i.e. waste incineration) instead of the Agriculture sector, as requested in the IPCC Guidelines.
  Austria stated its intention to report emissions of CH_4 and N_2O from "open burning of agricultural wastes" under sector 4 in the future.

- CO_2, CH_4 and N_2O emissions from several categories were reported under non-biogenic waste incineration. Several of these categories appear to be of biogenic origin.

6. D Other

- CH_4 emissions from compost production were reported under this category. It would be needed to check that they have not been treated under solid waste disposal.

BELGIUM

General

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

Belgium provided partial inventory data for 1995 to 1998 using the CRF. The CRFs for 1995 and 1996 contained information on HFCs, PFCs and SF_6 only. CRFs for 1997 and 1998 were also incomplete in that no sectoral background data tables were provided, except table 2(II)C.E related to HFCs, PFCs and SF_6. Indicators were used in a limited way. An NIR was not submitted.

Consistency of information between the CRF and the NIR

Not applicable since neither an NIR nor any other additional information were provided.

Verification procedures

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

Time series consistency

Analysis of time series is very limited given that trends were only provided for HFCs, PFCs and SF_6 (Table 10, sheet 4 of the CRF). Emissions data do not indicate notable annual fluctuations for those gases.

Comparison with previous submissions

The submission does not provide any information on recalculations. However, the figures of the national inventory for the year 1997 provided in the 2000 submission differ from those provided in the 1999 submission for the same year. There are minor changes in CO_2 and CH_4 emissions totals. Changes in N_2O totals account for 11 per cent. In addition, the reported CO_2 removals decreased from –2057 Gg to –976 Gg (200 per cent).

5.D CO_2 emissions and removals from soils: This category was reported for the first time in the 1998 inventory of the 2000 submission.

The effect of recalculations on the base year inventory could not be assessed, because inventory information for the base year was not reported.

Sector-by-sector findings

The analysis of trends in implied emission factors (IEF), activity data and emissions at category levels was hampered because sectoral background data tables were not provided. Trends and methods tables were not provided either. For these reasons the analysis on sector-by-sector basis and comparisons with data from other Parties is very limited, even for key sources.

Belgium did not provide disaggregated data for most sectors because the corresponding sectoral background data tables were not provided. For this reason, key sources have been identified at the level of category disaggregation as provided in Summary table 1.A of the CRF, instead of at the recommended level of disaggregation by the IPCC good practice guidance. Therefore the analysis of key sources presented below differs to that of other Parties.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

No reference approach was given, so no comparison could be done.

Comparison with international data

Activity data for 1998 were not given in the reference approach, so no comparison could be done.

Key sources

Fuel combustion

In accordance with the level of disaggregation mentioned above, the categories *1.A.4 Other sectors (commercial/institutional/residential), 1.A.2 Manufacturing Industries and Construction, 1.A.1 Energy Industries*, and *1.A.3 Transport* constitute key sources for the year 1998. Emissions from these categories account for 82 per cent of the total GHG emissions.

Non-key sources

Fugitive emissions

- Emissions from coal mining were not reported (According to international statistics Belgium is extracting a small amount of coal.).
- 1.B.2 Fugitive oil and gas: emissions (presumably from refineries and gas networks) may seem low compared to the throughput, but more details are needed such as the corresponding sectoral background data table in order to make a proper assessment.

Bunker fuels

Bunker emissions (CO_2) were slightly different from what was published by IEA.

INDUSTRIAL PROCESSES

Key sources

In categories *2.A Mineral products* and *2.B Chemical industry* only emissions from the following industrial activities were independently reported: *2.A.1 Cement production* and *2.A.2 Lime production* and *2.B.1 Ammonia production*. Other industrial emissions were reported in the category *Other*, but they were not specified as required.

2.B.2 Nitric acid production: No N_2O emissions were reported, but NOx and CO emissions were reported. This appears to be an omission because N_2O emissions were reported in the total of that category. These emissions were reported in the corresponding 1997 sectoral table.

Non-key sources

2.C Metal production: Only CO_2 emissions from iron and steel production were reported.

2.F Consumption of Halocarbons and SF_6:[3] Actual emissions of HFC-152a of this source category are reported higher than potential emissions, and therefore the ratio P/A is lower than 1. This appears to be not possible.
No data on PFC emissions were reported from any source.

AGRICULTURE

Key sources
4.A Enteric fermentation and *4.B Manure management - CH_4*. Emissions from cattle were not disaggregated into dairy and non-dairy cattle.
4.D Agricultural Soils - N_2O. Only an aggregate N_2O emission estimate was provided without disaggregation in source-categories.

LAND-USE CHANGE AND FORESTRY

5.D CO_2 emissions and removals from soils: Only an aggregate CO_2 emission estimate was provided without disaggregating into sub-categories.
5.E Other: Large removals were reported as "other" without specifying the source/sink category considered.
Table 5: Emissions and removals were not reported separately, instead only the net CO_2 emissions/removals were reported.

WASTE

Non-key sources
6.B Waste-water handling: CH_4 emissions from industrial waste-water and N_2O emissions from human sewage were not reported.
CH_4 emissions were reported under "*6.D. Other*" without documentation on the sources of these emissions in the CRF.

[3] "2.F. Consumption of Halocarbons and SF_6" was not identified as key source in the level assessment. This source, due to the expected rapid increase, is likely to be key source in many countries using the trend assessment.

BULGARIA

General

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

Bulgaria provided inventory data for the year 1998 using the CRF and included all requested tables. However, information on recalculation was limited to the base year (1988) and trend tables only covered information for the base year (1988), 1990-1995 and 1998. An NIR was not submitted, nor was any textual explanation to the numerical information.

Consistency of information between the CRF and the NIR

Not applicable since neither an NIR nor any other additional information were provided.

Verification procedures

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

Time series consistency

The CRF contained detailed inventory data for 1998 only and, hence, a comprehensive analysis of the time series consistency was not possible. In addition, the trend data reported in table 10 of the CRF did not contain estimates for 1996 and 1997. Still, based on the information provided on the trend, some unexplained significant changes and variations of emission estimates from year to year could be noted. This includes estimates of CO_2 from industrial processes, N_2O emissions from chemical industry and CH_4 emissions from transport. This also includes an almost three-fold drop in CO_2 emissions from International aviation bunkers between 1990 and 1998 and an almost two-fold drop in CH_4 emissions from waste for the same period.

Comparison with previous submissions

Bulgaria provided recalculated estimates (tables 8 (a)) and explanatory information (tables 8 (b)) for its base year (1988). The effect of recalculations for the base year emissions was an increase of 15.4 per cent in the total CO_2 equivalent emissions, excluding land-use change and forestry, and 16 per cent if land-use change and forestry is taken into account. Recalculation of emissions from several sources contributed to such an increase. This encompasses an increase by 119 per cent of N_2O emissions from fuel combustion and a 42 per cent increase of CO_2 emissions from industrial processes. Emissions from international bunkers have also been significantly revised upwards.

Sector-by-sector findings

The analysis of trends in implied emission factor (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 1997. Sectoral background data tables were only reported for 1998.

ENERGY

Reference approach

General comments

In the reference approach, activity data for jet kerosene and gas/diesel oil used for international bunkers have not been included.

Comparison of the reference approach with the national approach

There is a difference of –1.12 per cent in the CO_2 emissions estimated using the reference approach and the national approach.

Comparison with international data

- The CRF reference approach is not showing any imports of naphtha, refinery feedstocks, white spirit or "other oil". In total, this represents about 2,266 TJ in the IEA data.
- There are differences in coal production and imports between the CRF and the IEA data.
- There is a difference in the natural gas import figures: the CRF figure is 137,072 TJ; the IEA figure is 130,593 TJ.

Key sources

Fuel Combustion

- 1.A.1 Energy Industries - liquid fuels: the CO_2 IEF is much lower compared to other reporting Parties. The explanation of the low value in 1.A.1.b Petroleum refining, stems from the explanation given on the comparison between the reference approach and the sectoral approach. It states, "crude oil used in petroleum refining is excluded in order to avoid double counting". In fact, the activity data reported under liquid fuels 1.A.1.b includes the inputs of crude oil into oil refineries, but not the output of petroleum products. This means that the activity data for this item are much too high, and therefore the IEF is much too low.
- 1.A.1.c Manufacture of solid fuels and other energy industries: the problem mentioned for the 1.A.1.b category arises for the activity data and the IEF for this category as well.
- 1.A.3.b Road transport: the N_2O IEF for gasoline is the second smallest value reported compared to other reporting Parties.

Fugitive Emissions

- 1.B Fugitive emissions from fuels: emission estimates from this sector seem complete and transparent compared to the reporting of many other countries. Emissions from venting, but not flaring, are reported. IEF for CH_4 from natural gas transmission seems high.

Bunker fuels

The CO_2 emissions from bunkers for 1998 deviate from those given in the IEA statistics. The data for marine bunkers are, however, fluctuating from year to year, and for 1996 (as an example) there is a correspondence between the two sets of data. Similarly, for aircraft bunkers there is correspondence for some years only.

Other comments

- Only a small amount of fuels (0.9 per cent) is reported to be used for domestic navigation.
- IEF for CH_4 from biomass combustion is the smallest value compared to other Parties.

- The IEF for N_2O from coal combustion in the energy industries is by far the highest value compared to other Parties.

INDUSTRIAL PROCESSES

Key sources
CO_2 emissions were only reported under steel, although activity data were reported for steel, pig iron, sinter and coke separately.

Non-key sources
- *2.B.1 Ammonia production*: CO_2 IEF is lower than for most Parties and relatively low compared to the IPCC default values.
- *2.F Consumption of Halocarbons and SF_6*: [4] only potential emissions were reported.
- No data were reported on SF_6 emissions from any source.

AGRICULTURE

IPCC tier 1 default method and default emission factors were used to estimate CH_4 emissions from enteric fermentation. For N_2O from agricultural soils the IPCC default method has been used, while for emission factors both defaults and country specific values were used.

Key sources
4.A. Enteric Fermentation - CH_4
For cattle and swine, the reported activity data is higher than the corresponding value from the FAO (4.6 and 7.5 per cent difference, respectively).

4.D.1 Agricultural Soils, Direct soil emissions - N_2O
- 4.D.1.4 Crop residue: IEF is lower by a factor of 100 compared to most other Parties.
- 4.D.1.5 Cultivation of histosols: IEF is lower by a factor of 1000 compared to most other Parties and to the IPCC defaults.

LAND-USE CHANGE AND FORESTRY

CO_2 emissions/removals were reported only for category 5.A, Changes in forest and other woody biomass stocks, namely for 5.A.2, Temperate forests, and for Harvested wood and other fuel use which were both reported under 5.A.5 'Other'. Sectoral background data table 5.A was provided for reporting data of this source/sink category.

[4] "2.F. Consumption of Halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

WASTE

Key sources

6.A Solid waste disposal on land – CH_4

- There is a sharp decrease in CH_4 emissions from solid waste disposal in 1994.
- IPCC default method was used to estimate emissions from this category.

6.B Waste-water handling– CH_4

- CH_4 per capita emissions are an order of magnitude greater compared to the other Parties.
- There are large fluctuations in CH_4 estimates from waste-water handling over the entire time series and unexplained differences in the trend of CH_4 and N_2O emissions from the same source.

CANADA

General

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

The CRF was provided for 1998 and 1990 and included all requested tables. Indicators were used appropriately. The CRF was accompanied by an NIR that provided information on methodologies, activity data, emission factors and uncertainty estimates. Information on uncertainties describes the use of a rounding protocol (page 114 of the NIR).

Consistency of information between the CRF and the NIR

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

Verification procedures

The NIR describes the process of reviewing and considering inventory data, mainly in the energy sector, aimed at improving data collection and data quality. The NIR recognizes that the internal review process is informal in nature and that there is a need for a formalized quality assurance/quality control (QA/QC) protocol. This is planned to be developed in the near future (see pages 109-112 of the NIR).

Time series consistency

There were no major deviations in emissions found in the trend tables (table 10 of the CRF) with the exception of land-use change and forestry.

Comparison with previous submissions

Canada regularly recalculates emission estimates based on methodological changes and revised activity data. In the 2000 submission, it provided recalculated estimates (tables 8(a)) and explanatory information (tables 8(b)) for the years 1990 to 1997.
The main reasons behind the recalculations are revised figures for activity data, mainly in energy.

The effect of the recalculations (as reported in the CRF tables) for 1990 was an increase of 1.8 per cent in the total CO_2 equivalent emissions without land-use change and forestry, and 1.83 per cent if land-use change and forestry is taken into account. For other years (1990-1997) the change for each individual year, compared to the previous submission, ranged from 0.8 to 1.8 per cent. In all cases, the new figure was larger than that in previous submissions. The average for the period of 8 years is 1.12 per cent (without LUCF).

Sector-by-sector findings

The analysis of trends in the implied emission factor (IEF), activity data and emissions at category levels that are more detailed than those in the trend table, was hampered due to a lack of data for the years 1991 to 1997.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

For the sectoral (national) approach, data have been given on a gross calorific value basis while, for the reference approach, data have been given on a net calorific value basis. Energy consumption and CO_2 emissions from the reference approach are 0.7 per cent lower and 10.5 per cent higher respectively compared to the national approach**.** The reason given for the difference (documentation box of table 1.A(c)) is that the national approach does not include fuel-based CO_2 from various industrial processes such as ammonia and aluminum production. In accordance with the explanations, when these sources are included in the national approach's total energy, the two match closely, with only 4 per cent difference. The difference of 4 per cent is not explained. The reasons for the differences in the information presented need to be looked at more closely.

Comparison with international data

The reference approach energy data for 1998 are 6.2 per cent higher than those reported to the IEA. The CRF is 12 per cent higher for liquid fuels and 2.4 per cent higher for solid fuels. Natural gas corresponds very closely. Specific differences include the following:

- Production of crude oil and NGLs in the CRF is 505,069 TJ higher than the IEA numbers.
- Crude oil and residual fuel oil imports are higher in the CRF.
- Liquid fuel stock changes are 65,618 TJ different and, in fact, the CRF shows a stock build whereas the IEA shows a stock draw.
- Coal imports are 19,597 TJ higher in the CRF.
- Coal stock changes are much higher in the IEA numbers.

Most of the above comments are also applicable to the 1990 data where the CRF data are 5.2 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. The CRF has grown by 16 per cent and the IEA by 15 per cent. However, liquid fuels are growing faster in the CRF, and solid fuels are growing faster in the IEA data.

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.

- The CO_2 IEF from gaseous fuels in all subcategories of the stationary combustion (1.A.1; 1.A.2; 1.A.3; 1.A.4) are the lowest among all Parties reporting data for these categories.
- 1.A.2 Manufacturing industries and construction: The calculated CO_2 IEF from gaseous fuels is the lowest among all Parties for the year 1998. This value is very similar to that of New Zealand, which excludes in its calculation of IEF, carbon stored in final products (methanol, synthetic petrol, ammonia and urea). This may be the reason for this low value.
- Other IEF in the energy sector appear to be very different when comparing them with IEF of other countries. Those are:
  a) CO_2 IEF for solid fuels in 1.A.2. *Manufacturing industries and construction* and 1.A.4.a.*Commercial/institutional* (low values);

Canada explained that this was due to an error in reporting activity data (TJ) in the CRF.

b) CO_2 IEF for liquid fuels in 1.A.4.c. *Agriculture/ forestry /fisheries* (high value).
Canada explained that this was due to an error in reporting activity data (TJ) in the CRF.

- *1.A.2 Manufacturing industries and construction*: The calculated CO_2 IEF from solid fuels in 1998 has a lower value (90.43 t/TJ) compared to the IEF for the years 1990 to 1997 and compared to the IEF for other activities in the energy sector (91.2 t/TJ as also mentioned in the NIR).
  Canada explained that this was due to an error in reporting activity data (TJ) in the CRF.

Fugitive emissions

- 1.B.2 Fugitive emissions from oil and natural gas: Under 1.B.2.a Oil, Canada did not report emissions estimates from oil refining and distribution of oil products ("NE" reported). For subcategories Oil transport and Natural gas exploration, Canada reported emissions estimates but did not provide activity data.
  CH_4 emissions from this source have increased by 40 per cent since 1990.
  Canada confirmed that it reported all emissions from the entire oil and gas industry, but owing of the structure of the CRF, Canada could not provide full coverage of activity data.

Non-key sources

- 1.B.1.a Coal mining and handling – underground mines: The IEF for CH_4 in underground activities has decreased from 11.6 kg/t in 1990 to 7.7 kg/t in 1998.

INDUSTRIAL PROCESSES

Key sources

- *2.B.3 Adipic acid production:* This is reported as a point source. No production data have been provided. The methodology changed from that used for reporting 1990 to 1997, when an emission factor was used. In the NIR it is mentioned that emission abatement technology was installed at the only plant in Canada.

- *2.C.3 Aluminium production* - PFCs: methods were not specified in the CRF, but outlined in the NIR.

- *2.B Chemical industry*: There was a large decrease of N_2O emissions (46 per cent) between 1997 and 1998. This decrease caused a decrease in the total annual N_2O emissions of 7 per cent.

- *2.G Other industrial processes* are not specified in the CRF, but are described in the NIR.

Non-key sources

- *2.A.3 Limestone/dolomite use - CO_2*: IEF has increased from 0.49 t/t to 0.57 t/t from 1990 to 1998. The IPCC default value is 0.44 t/t for limestone and 0.47 for dolomite use. ***The Party explained that this is due to a reporting error of activity data in the CRF.***

- *2.B.2 Nitric acid production*: The N_2O IEF is low (2.66 kg/t) but still within the IPCC range (2 to 9 kg/t).

- *"2.F. Consumption of halocarbons and SF_6*:[5] Actual emissions of HFC-23, HFC-125, HFC-143a are reported higher than potential emissions, and therefore the ratio P/A is lower than 1.

AGRICULTURE

Key sources

IPCC tier 1 method and default emission factors were used to estimate CH_4 emissions from enteric fermentation, CH_4 and N_2O from manure management, and N_2O emissions from agricultural soils.

4.A Enteric fermentation – CH_4

- IEFs for 1998 for dairy cattle are lower than the IPCC default for the region (100 vs. 118 kg/head/year) but higher than the IPCC defaults for non-dairy cattle and sheep (54 vs. 47, and 13 vs. 8, respectively). For sheep, the reported value is the second largest among all reporting Parties.
  Canada confirmed the use of the IPCC tier 1 methodology for CH_4 emissions from enteric fermentation. Canada explained that IPCC emission factors were used for dairy cows (118 kg CH_4/head/year), heifers for slaughter (47 kg CH_4/head/year), steers (47 kg CH_4/head/year), and calves (47 kg CH_4/head/year) based on the IPCC defaults. However, the emission factors were 75 kg CH_4/head/year for bulls, 72 kg CH_4/head/year for beef cows, and 56 kg CH_4/head/year for dairy heifers and beef heifers. These deviate from the IPCC defaults, and are based on an early study of Cassada and Safley (1990). Thus, it is not surprising that the calculated IEFs for dairy and non-dairy cows are quite different from those of the IPCC. Canada stated to be on the way to make proper changes in these emission factors solely based on the IPCC guidelines for the next inventory year.

- For sheep, the reported activity data for 1998 is lower than the corresponding value from the FAO (38 per cent difference); the CH_4 IEF for sheep declined by 5 per cent in 1998 compared to 1990.
  The Party explained that it had checked its sheep population data, and provided the reference source. The reported sheep population for the year 1998 was 443,000 based on Statistics Canada - Cat. No. 23-603-XPE. However, Canada is attempting to find out what was the source of data being used by FAO.

[5] "2.F. Consumption of halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to its expected rapid increase, is likely to be a key source in many countries using the trend assessment.

4.B Manure management – N_2O:

- IEF for animal waste management systems is higher by a factor of 10^6 than IPCC default and values of other Parties. The corresponding values for total N excretion per animal waste management system are very low compared to other countries.
- Differences of factor 10^3 to 10^6 when comparing the sum of Nitrogen excretion over all animal waste management systems per livestock to the corresponding Nitrogen excretion per animal multiplied with the population (for dairy and non-dairy cattle, sheep).
- The 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.

  As for preliminary findings on N_2O from manure management, Canada explained that IEFs and other data comparisons calculated based on Table 4.B(b) are wrong because the percentage of animal manure management systems was reported in this table rather than the total animal nitrogen excretion for each animal waste management system.

- N-excretion rates for livestock: these seem low compared to the corresponding IPCC default factors (dairy and non-dairy cattle, swine, sheep, poultry).
  Canada explained that the average amount of annual nitrogen excretion for various domestic animals is based on the research conducted in the United States (MWPS-18, 1993), and not the default values from the IPCC Guidelines.

4.D Agricultural soils

- 4.D.3 Indirect emissions, Nitrogen leaching and run-off: N_2O IEF is higher by a factor of 10 compared to the IEF of other countries.
  Canada explained that for indirect emissions from nitrogen leaching and runoff, the N_2O IEF should be 0.0274 instead of 0.174 kg N2O-N /kg N which would be comparable to other countries.

- CO_2 emissions from agricultural soils are reported in the *Agriculture soils category* (the IPCC allow for reporting them in either the Agriculture or the LUCF sector). These emissions have decreased from 7,255 Gg in 1990 to 875 Gg in 1998. The NIR indicates that the decrease is mainly due to changes in farming practices, in particular to the increase of the use of conservation tillage. Canada uses the Century model to estimate these emissions, which is described in the NIR.
  Canada provided the following references:
  Cassada, M.E. and L.M. Safley, Jr. 1990. Global methane emissions from livestock and poultry manure. Biological and Agricultural Engineering Department, North Carolina State University.
  MWPS-18. 1993. Livestock waste facilities handbook - Third Edition. Iowa State University, Ames, Iowa.

LAND-USE CHANGE AND FORESTRY

Canada uses specific methods to estimate emissions and removals in this category. Sectoral background data tables have been used, 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 one.
Canada explained that it used the best and most reliable national data available in the LUCF sector, and hence reflect Canada's national circumstances. However, it should be noted that special care has been taken to develop an accounting model which closely follows the IPCC methodology.

- 5.A Changes in Forest and other woody biomass stocks:
  Species were not specified as required in table 5.A of the CRF. An aggregate value of the Canadian wood production forest is reported. The NIR describes the method used which relies on information and data provided by the Canadian forest inventory (pages 56 and 57 of the NIR).
  Canada explained that the Canadian forest inventory distinguishes softwood, hardwood and mixed wood forests. This classification does not correspond to the CRF "temperate" and "boreal" forest categories. A reclassification is impossible at this point, as all three forest types occur in the temperate and boreal zones.

  Comparison of "area of forest/biomass stocks" with data from the FAO on "forest cover": for Canada, data from the FAO is about 50 per cent higher than data reported in the CRF. It can be assumed the other part of the forest which is not reported in the CRF does not have a carbon uptake (see also page 80 of the NIR).
  Canada confirmed that it understands that the UNFCCC LUCF greenhouse gas reporting involves the "managed" part of the Canadian forests, as opposed to its entire area: "Natural, unmanaged (for wood products) forests are not considered to be either an anthropogenic source or sink, and are excluded from the calculations." (IPCC Guidelines, page 5.11 of the Reference manual).
  Hence the area of forest/biomass stocks reported in Table 5.A of the LUCF inventory (123 Mha) represents the non-reserved, stocked, timber-productive, accessible forests which are not under policy constraint, as defined in the Canadian forest inventory. This is indeed approximately half of the total timber-productive forest (245 Mha). Excluded from the assessment are the timber-unproductive forests, the timber-productive forests that are reserved or otherwise unavailable by law, and those which are not physically accessible.

- 5.D CO_2 emissions and removals from soils: Emissions exceeded removals in this category. Both emissions and removals have increased since 1990 to 36 and 23 per cent, respectively. The net CO_2 emissions have increased by almost 50 per cent between 1990 and 1998.
  Canada explained that post-1996 estimates of emissions and removals in this sub-category rely on forecasted data, hence they may change when actual data become available.

  Table 5.D has not been used to report activity data from this source category (indicators only), hence, no IEFs were calculated. Instead, a separate data sheet has been provided.

Canada noted that it has opted to report net CO_2 fluxes from agricultural soils in the Agriculture sector rather than under the land-use change and forestry sector[6]. The separate table covers CO_2 emissions and removals from soils associated with land-use changes (forest conversion and abandonment of managed agricultural lands).

- 5.E Other: Canada reported the following sources not included in the IPCC Guidelines: prescribed burning, other anthropogenic fires in wood production and anthropogenic fires outside wood production (wild fires). Methods are described in the NIR.

- Aggregate net emissions (removals in the case of Canada) from LUCF display relatively large changes in most years (more than 25 per cent in 6 of the 10 years in the time series). Changes in the source category changes in forest and other woody biomass stocks are also relatively large between the years in the time series. CO_2 emissions from soil present a large increase between 1996 and 1997 (exactly double). The change in emissions from "Other: anthropogenic fires in the wood production forest" between years 1992, 1993 and 1994 were of a magnitude of 3 and 5 times, which corresponds to the characteristics of this source category.
  Canada explained that the variability of aggregate net removal estimates in the LUCF sector reflects that of the main component of the LUCF inventory, Changes in forest and woody biomass stocks (5.A).
  The accounting model is very sensitive to the impact of anthropogenic activities, especially harvesting, on the wood production forest. Harvesting data provided to the FAO - data on annual production of industrial roundwood, which displayed strong fluctuations in the 1990s.
  Canada also explained that CO_2 emissions from soil tended to decrease until 1995 and increase steeply thereafter, with a sudden doubling of emissions between 1996 and 1997. Based on data from previous years, the model projected a substantial increase in the area of grassland conversion to agricultural lands in 1997. However, these remain projections; their accuracy will not be confirmed until the release of the next Agricultural census in the year 2001.

WASTE

Key sources

6.A Solid waste disposal on land - CH_4

- A limited set of activity data or additional information were provided in table 6.A.
- Annual fluctuations in CH_4 emissions for the years 1995 and 1996 were relatively small compared to fluctuations for the other years.

Non-key sources

- CH_4 emissions from industrial waste-water handling were not estimated.
- No activity data were provided in tables 6.B and 6.C (documented in the Completeness table (table 9)).

[6] The IPCC Guidelines allow for reporting CO_2 emissions and removals from agricultural soils under 4.D Agriculture soils category or in the Land-use Change and Forestry sector under 5.D CO_2 Emissions and Removals from soils category.

CZECH REPUBLIC

General

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

The Czech Republic provided inventory data for the year 1998 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 in sectoral reports and sectoral background data tables was limited. An NIR was not submitted, nor was any textual explanation on the numerical information.

Consistency of information between the CRF and the NIR

Not applicable since neither an NIR nor any other additional information were provided.

Verification procedures

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

Time series consistency

Analysis of the time series was not possible since data other than for 1998 were not reported. The corresponding trend tables of the CRF (table 10) were not submitted.

Comparison with previous submissions

Information on recalculations was not provided in the CRF. Comparison of data with previous submissions was not possible because the 2000 submission did not include any emission data for the years prior to 1998.

The Czech Republic explained that the NIR has not been submitted because only a version in Czech language is available. Tables with emission trends were not provided because all necessary recalculations have not yet been completed. The Czech Republic stated that for the 2002 submission (data of the year 2000) it plans to edit the English version of the NIR and to provide all trend data in the submission.

Sector-by-sector findings

Since neither emissions estimates, activity data, nor related information was reported for 1990 to 1997, an analysis of trends was not possible for any sector.

ENERGY

Reference approach

General comments

- No information on some fuel types.
- Feedstocks: no explanation on what they are used for.

Comparison of the reference approach with the national approach

There is a difference of 1.5 per cent in the CO_2 emissions estimates between the reference approach and the sectoral approach.

Comparison with international data

The reference approach energy data for 1998 are 3.2 per cent lower than those reported to the IEA. The CRF is 8.7 per cent lower for liquid fuels and 2.1 per cent lower for solid fuels. Natural gas corresponds very closely. Specific differences include:

- Imports of naphtha, bitumen, lubricants, petroleum coke, refinery feedstocks, white spirit, paraffin waxes and "other oil" do not seem to have been reported in the CRF. The difference in liquid fuels imports is 13.6 TJ.
- Exports of solid fuels are 19.4 TJ higher in the CRF.
- Stock changes for liquid fuels and solid fuels seem to be different between the two data sets.
- Aviation bunker fuel emissions as published by the IEA are higher than those reported in the CRF. Reported domestic emissions from aviation are small and cannot explain the difference.

The Czech Republic explained that imports of naphtha, bitumen and other non-energy fuel types are not reported in CRF, because they are not reported in the official Czech energy balance either. The Party recognizes that, nevertheless, it would be possible to gather these data from other sources and use them in the calculations.

As for the export of solid fuels, the Czech Republic explained that the differences are due to two reasons:

(i) the "final" Czech energy balance reports a lower value for solid fuel exports by about 10 PJ than the version which was available for the compilation of the inventory;

(ii) when comparing the official Czech energy balance with the IEA data, the coal data expressed in mass units are in good agreement. However, when comparing the corresponding values in energy units (PJ), some difference appears due to slightly lower heating values used by IEA. Therefore, all IEA values related to coal expressed in PJ are slightly lower, not only coal export data.

Differences in jet kerosene consumption, according to the Party, are due to the fact that preliminary statistical data used for calculations were indeed rather lower than definitive values.

Key sources

Fuel combustion

- No use of notation keys, therefore no information, on e.g., aviation gasoline, navigation residual oil, and many other possible sources.
- N_2O emission estimates from road traffic are reasonable compared to implied emission factors (IEF) of other Parties. There is not enough information to assess the trend (an increase would be expected).
- 1.A.2 No split of Manufacturing industries and construction into its sub-sources – all data reported under 'other'(1.A.2.f).
  The Czech Republic informed that no reliable data for splitting into more detailed sub-sources are available.

- 1.A.1 Energy industries (total) and 1.A.1.a Public electricity and heat production - solid fuels: CO_2 IEF seems high compared to other Parties.

The Czech Republic explained this by the fact that consumption of brown coal (carbon emission factor = 27.6 t C/TJ) prevails in the Czech Republic.

- 1.A.1.c Manufacture of solid fuels and other energy industries – solid fuels: CO_2 IEF is the highest among all reporting Parties (Gaseous fuels derived from coal (coke oven gas and blast furnace gas) are included in Solid fuels. Therefore CO_2 emission factors of Solid fuels for category 1.A.1.c exceed 100).
- 1.A.2 Manufacturing industries and construction - solid fuels: CO_2 IEF is the second highest among all reporting Parties (Gaseous fuels derived from coal (coke oven gas and blast furnace gas) are included in Solid fuels. Therefore CO_2 emission factors of Solid Fuels for category 1.A.2 exceed 100).
  Regarding 1.A.1.c and 1.A.2, the Czech Republic further explained that iron and steel industries (including coke production) are still important to the Czech economy. For illustration - blast furnace gas: EF(CO_2) = 241 t CO_2/TJ, coke: EF(CO_2) = 106 t CO_2/TJ.

- 1.A.3.b Road transportation – gasoline: N_2O IEF is among the highest values compared to other Parties.

Fugitive emissions

- 1.B.1.a Coal mining and handling: CH_4 emissions from coal mining are a key source. Reporting seems reasonable; however, it is not possible to assess the trend. Information whether the amount of coal produced is based on run-of-mine (ROM) or saleable production was not reported.
  The Czech Republic stated that CH_4 trend information for 1990-1998 was not reported in the 2000 submission, but is available and will be reported in the next submission (see comment under General). The Party explained that activity data have been taken from the "Czech Mining Yearbook", where saleable production is presented.

- 1.B.2 Oil and natural gas: Reporting is detailed for fugitive emissions from oil and gas (minor source), but it is difficult to compare reporting for these sources. No data have been reported for venting and flaring.
  According to the national experts, the amount of gas flared or vented can be neglected (if any).

- 1.B.2.b Natural gas - CH_4 from transmission and distribution: low IEF compared to IPCC default for that region.
  The Czech Republic stated that its national experts are aware of this – the entire system of gas transmission and distribution was reconstructed in the early 1990s and operates well.

Bunker fuels

- Only aviation-jet kerosene reported (no information reported on the remainder of sources from bunkers).

INDUSTRIAL PROCESSES

General comments

There was no information on the following source categories:

- Limestone and dolomite use; Soda ash; Asphalt roofing; Road paving with asphalt; Adipic acid production; Carbide production; Ferroalloys production; Aluminium production; Other production.

The Czech Republic explained the information gaps as follows:
Limestone and dolomite use = NE, Soda ash = NO, Asphalt roofing = NE, Road paving with asphalt = NE, Adipic acid production = NO, Carbide production = NO, Aluminium production = NO. Emissions from limestone and dolomite use are negligible (if any).

The Czech Republic also indicated that in the 2001 submission notation keys have been used.

Key sources

2.A.1 Cement production – CO_2

- IPCC tier 1default methods and default emission factors were used to estimate CO_2 from 2.A Mineral products.

Non-key sources

- *2.A.2 Lime production*: although production activity data were provided, CO_2 emissions (and consequently the IEF) were reported as zero. In the description it is noted that "emissions = removals".
- *2.B.1 Ammonia production - CO2:* emissions were included in energy sector (production data provided here, but no IEF was calculated)
  The Czech Republic confirmed that emissions have been included in the energy sector and further clarified that the value for production was presented as an indicator for illustration purposes.

- *2.C.1 Iron and steel production - CO2:* 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 IEF were calculated for any of the iron and steel subcategories.
  The Czech Republic confirmed that emissions have been included in the energy sector, under 1.A.2 (especially as blast furnace gas combustion). Emissions of CO_2 presented in table 2(I) A-G are only a rough estimate (11,570 Gg). This value has not been placed in the right column intentionally, in order to prevent double-counting. Production data have been reported as indicators for illustrative purposes.

- "2.F Consumption of halocarbons and SF_6:[7] For HFCs, PFCs and SF_6 only potential emissions were provided. No disaggregation by gas-species nor specification of the

[7] "2.F. Consumption of halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to its expected rapid increase, is likely to be a key source in many countries using the trend assessment.

sub-sources were provided. (Aggregated, non-specified estimate in CO_2 equivalent for total consumption reported under 2.F 'other').

The Czech Republic explained that only potential emissions estimates are available due to lack of data for the tier 2 approach. The Party indicated that in the 1999 inventory both disaggregation by gas-species and by sub-source have been provided.

AGRICULTURE

Key sources

4.A. Enteric fermentation - CH_4

- Dairy and non-dairy cattle: IEFs are relatively low compared to IPCC default for Eastern Europe and are the lowest across all reporting Parties.
- Sheep: IEF is among the lowest compared to other Parties and is also significantly lower than the IPCC default.
- Swine: IEF is twice as high as the IPCC default and the values of other Parties.

The Czech Republic explained that the original set of emission factors was obtained by agriculture experts from the Institute of Livestock, Prague-Uhrineves using IPCC tier 2 approach calculations as part of the "United States country study" compiled in 1994. In the late 1990s, all parameters were again judged and approved by different experts from 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 lower than IPCC default values. The Party further stated that as soon as resources become available, a new independent study based on "good practice guidance" should be carried out.

4.D Agricultural soils: 4.D.1 Direct soil emissions, and 4.D.2 Indirect emissions - N_2O

- No information on fractions used to estimate direct and indirect N_2O emissions provided.
- No information on cultivation of histosols.

Non-key sources

4.B. Manure management - CH_4 and N_2O

- CH_4 IEF for dairy cattle is relatively low compared to the lowest IPCC default for Eastern Europe (cool).
- N excretion rate for poultry is the highest across all countries and is also higher than the IPCC default (1.0 instead of 0.6 although default methods and emission factors were indicated to have been used).
- Multiplication of population data with corresponding annual N excretion does not equal the sum of N excretion from all animal waste management systems for cattle and non-dairy cattle – differences are around 24 and 20 per cent, respectively.
- N excretion from pasture range and paddock: after conversion of N excretion data into kg N/year in table 4.B(b), total N excretion from pasture range and paddock is lower by 1,320 kg N compared to the corresponding value given in table 4.D.

LAND-USE CHANGE AND FORESTRY

CO_2 emissions/removals were reported only for category 5.A Changes in forest and other woody biomass stocks (Temperate forests). Sectoral background data table 5.A was provided for reporting data of this source/sink category.

WASTE

Key sources

6.A Solid waste disposal on land – CH_4

- A low value for MCF was reported (0.434), which is consistent with shallow unmanaged solid waste disposal sites. However, emissions were reported under Managed waste disposal, which is expected to have an MCF closer to one (1.0).
  The Czech Republic explained that the reported MCF value is given by 0.7*0.62=0.434, where 0.7 is the methane correction factor and 0.62 is the fraction of carbon released as methane.

Non-key sources

6. B Waste-water handling

- N_2O IEF for human sewage appears high by a factor of 1000 compared to other reporting Parties. The Nitrogen fraction (0.01 versus ~0.16 kg N/kg protein) and protein consumption (0.16 versus ~30-40 kg protein/person/yr) appear to be the cause of the problem.
  The Czech Republic explained that values 0.01, 0.16 and 25 were erroneously exchanged - the value of 25 kg protein/person corresponds to the annual protein consumption and the value of 0.16 is the N fraction in kg N/kg protein, thus the IEF is 0.01 (IPCC default). The resulting N_2O emission (0.65 Gg) is not influenced by this error. Perhaps the value of 25 is somewhat lower than the expected interval 30-40 kg protein/person/yr.

6. C Waste incineration

- It was noted that non-CO_2 emissions from waste incineration were reported in table 1.A (Energy sector).

FINLAND

General

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

Finland provided its GHG inventory using the CRF for 1990 and 1998, and included all requested tables. It also provided a report entitled "Finland's annual inventory report on greenhouse gases", which describes methods and sources of data used to compile the inventory.

Consistency in information between the CRF and the NIR

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

Verification procedures

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

Time series consistency

In-depth analysis of the trend was only possible to a limited extent, since only data for 1990 and 1998 were provided in detail. The GHG trends provided in the trend table of the CRF (table 10) do not reveal any major fluctuations in national totals for key sources, except for CH_4 emissions from waste (see sectoral comments below). N_2O emissions from agricultural soils decreased by about 16 per cent from 1990 to 1992.

Comparison with previous submissions

Finland recalculated its inventory for 1990 and provided the corresponding recalculation table (table 8 (a)) and explanatory information for these recalculations (table 8 (b)). Major changes occurred in the estimates of CH_4, CO_2 and N_2O emissions from the sub-category "Other" in the Fuel combustion sector and from the Waste sector, mainly due to changes in emission factors. Changes in total emission estimates expressed in CO_2 equivalent are reported to be 3.6 per cent excluding land-use change and forestry.

Sector-by-sector findings

The analysis of trends in implied emission factor (IEF), activity data and emissions at category levels that are more detailed than those in the trend table, was limited to the years 1990 and 1998, since Sectoral background data tables were not provided for the years in-between.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

There is a difference of 1.9 per cent between the reference approach and the sectoral approach. Although the difference is less than 2 per cent, an explanation was provided in the documentation box.

Comparison with international data

The reference approach energy data for 1998 are 2.3 per cent lower than those reported to the IEA. For liquid fuels, this difference is 4.4 per cent. Specific differences include:

- Liquid fuel imports in the CRF are less by 22,693 TJ that those reported by the IEA. Most of this difference comes from crude oil and NGL.
- Stock changes for liquid fuels do not correspond well to the IEA data. The CRF crude oil stock change is –13,816 TJ, while the IEA shows –5,900 TJ. Since the CRF puts all oil product stock changes into "Other oil" it is difficult to see where the product stock problems are.

The above comments are also applicable to the 1990 data where the CRF data are 2.2 per cent lower than the IEA data. The growth rate of overall apparent consumption between 1990 and 1998 is 10 per cent for both data sets.

Key sources

Fuel Combustion

- 1.A.1.c Manufacture of solid fuels and other energy industries: the CO_2 IEF for solid fuels in this sub-category is lower than for almost all other Parties. In addition, only data on solid fuels are reported in background data tables and no notation key is used for other fuels.
- 1.A Fuel combustion (biomass): For Finland and Sweden N_2O from biomass was identified as key source, which is likely due to high activity levels. The IEF for this category is at the upper end of the IEF from other Parties.

Fugitive Emissions

- 1.B.1.a Fugitive emissions from coal mining: emissions of CH_4 from this category have not been reported. According to international statistics (IEA), Finland is producing a small amount of coal.
- 1.B.1.c Fugitive emissions from Other solid fuels: activity data were not reported, and consequently no IEF was calculated.
- 1.B.2 Fugitive emissions from oil and natural gas: reporting of emissions is not transparent as it is unclear what activities are causing the emissions. CO_2 emissions from venting are reported, but not the corresponding CH_4 emissions.

Other comments

- Inconsistent data for 1998 N_2O emissions from fuel combustion (1.A.1, 1.A.2, 1.A.3, 1.A.4, 1.A.5) in the sectoral report and sectoral background data tables. As a result the total emissions seem to be overestimated.

INDUSTRIAL PROCESSES

Key sources

- *2.A.1 Cement production*: the IEF for CO_2 is slightly lower than the IPCC default value.
- *2.B.2 Nitric acid production*: IEF for N_2O is slightly higher than the IPCC default value.

Non-key sources

- *2.F. Consumption of halocarbons and SF_6*:[8] in the sectoral background data tables several gases were reported as confidential in the various subcategories.
- *2.C.4.2 SF_6 used in magnesium foundries*: no emissions were reported due to confidentiality.

AGRICULTURE

Key sources

4.A. Enteric fermentation – CH_4

- For non-dairy cattle the IEF for 1998 is relatively low compared to the IPCC default for the region and compared to the IEF from other Parties.
- For swine, the reported activity data is lower than the corresponding value from the FAO (10 per cent difference).
- IEF for CH_4 from dairy cattle registered a 6.6 per cent increase from 1990 to 1998, while CH_4 emissions from the same category declined by 16 per cent in the same period.

4.D Agricultural soils – CO_2 estimates, 4.D.1 Direct soil emissions, and 4.D.2 Indirect emissions - N_2O:

- CO_2 emissions from agricultural soils were reported in the agriculture sector in the Summary tables of the CRF (Summary 1.A, 1.B and Summary 2). However, detailed information on this source category was reported in table 5.D CO_2 emissions and removals from soil of the land-use change and forestry sector.
- For the fraction of synthetic fertiliser N applied to soils that volatizes as NH_3 and NOx (FracGASF), Finland reported a value lower by a factor of 10 compared to the IPCC defaults and those reported by most other Parties.

Non-key sources

4.B Manure management – N_2O: N excretion rates for non-dairy cattle and swine are relatively low compared to the IPCC defaults. In the case of non-dairy cattle Finland reported almost the lowest value compared to other Parties.

LAND-USE CHANGE AND FORESTRY

CO_2 emissions/removals were reported only for category 5.A Changes in forest and other woody biomass stocks (Boreal forests). No sectoral background data tables of this sector were provided, except for table 5.D, which has been used to report CO_2 emissions from agricultural soils, which were included in the agriculture sector.

[8] "2.F. Consumption of Halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

WASTE

Key sources

6.A Solid waste disposal on land – CH_4

- Major changes occurred in CH_4 emissions estimates after recalculations. Explanations were provided in the NIR and CRF. In addition, the NIR states that the emission estimates from this source are very uncertain.
- The CH_4 emissions from this source show large and steady decreases over time. In 1998, CH_4 emissions are reported to be 50 per cent less than in 1990. An explanation was not provided in the NIR.

Non-key sources

6. B Waste-water handling - CH_4

- There are significant fluctuations in CH_4 estimates from this source in 1990 to 1994. Explanations were not provided in the NIR.
- Major changes occurred in CH_4 emissions estimates after recalculations. Explanations were provided in the NIR and CRF. The NIR also states that the emission estimates are very uncertain.
- The CH_4 IEF for both industrial and domestic/commercial waste-water appear low.

6. C Waste incineration: emissions of CO_2 and N_2O from waste incineration are included in the Energy sector (see also Table 9 on completeness).

GREECE

General

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

Greece provided the CRF for 1998 and included all requested tables. In addition, sectoral reports and summary tables for the years 1990 to 1997 using the CRF were provided. An NIR was submitted. The report provided information on methodologies, activity data and emission factors used for some source categories and on differences compared to previous submissions. Although estimates of emissions and removals from the land-use change and forestry sector have not been reported in the CRF, preliminary data from this sector were provided in the NIR.

Consistency of information between the CRF and the NIR

The data that were provided using the CRF in electronic format were reproduced in the NIR. The information provided in the 1998 CRF related to methodologies and emission factors seems consistent with the information provided in the NIR. However, in the CRF for 1990, different values are reported in Table 1 and in Summary 1.A for CO_2 emissions from 1.A.4 (Other Sectors).

Verification procedures

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

Time series consistency

Emissions data do not indicate any notable annual fluctuations in national totals. Some annual fluctuations or irregularities in trends are noted below:

- CO_2 emissions from *2.B Chemical Industries*: some jumps due to gaps in the data;
- CH_4 emissions from *1.A.2 Manufacturing Industries and Construction*: over 100 per cent increase from 1993 to 1994.

Comparison with previous submissions

Although information on recalculations was not provided in the CRF, differences to previously submitted data were briefly explained in the NIR (p. 15). Comparison with inventory data for the years 1990 and 1997 included in the 1999 submission reveals that - generally slight - recalculations have taken place across all sectors and gases.

Sector-by-sector findings

The analysis of trends in implied emission factor (IEF) and activity data was hampered due to the lack of data for the years 1990 to 1997. Sectoral background data tables were only provided for 1998.

ENERGY

Reference approach

General comments

For some fuel types the carbon emission factor is slightly different from the IPCC default (e.g. bitumen, lubricants, coke oven). For lignite the carbon emission factor used was 34.0 t C/TJ instead of 27.6 t C/TJ recommended by the IPCC.

Comparison of the reference approach with the national approach

There is a difference of only -1.8 per cent between the CO_2 emissions estimates calculated using the reference approach and the sectoral approach. Additional information on this difference was provided in the NIR.

Comparison with international data

The reference approach energy data for 1998 correspond very closely to the IEA data (only 0.3 per cent higher). Specific differences include:

- The CRF is not showing any production of natural gas.
- CRF imports of natural gas are 5,147 TJ higher than those reported to the IEA.
- CRF imports of refinery feedstocks are 18,660 TJ higher than those reported to the IEA.
- Exports of residual fuel oil are 12,539 TJ higher in the CRF.

Key sources

Fuel combustion

- 1.A.1 Energy industries - Solid Fuels: the CO_2 IEF (122.08 t/TJ) is the highest among all reporting Parties. This appears to be due to a high carbon emission factor for lignite (34.0 t C/TJ), used in 1.A.1.a Public electricity and heat production (see p. 40 of the NIR).
- 1.A.4.c Agriculture/Forestry/Fisheries – Solid Fuels: the CO_2 IEF (104.89 t/TJ) is the highest among all reporting Parties.

Other comments

- Stationary Combustion – Solid Fuels: the CH_4 IEF (2.99 kg/TJ) was low compared to that reported by other Parties.
- 1.A.2 Manufacturing industries and construction – Biomass: the CH_4 IEF (309.96 kg/TJ) was the highest among the reporting Parties.
- 1.A.3.b Road transportation: the N_2O IEF is reasonable compared to reporting from other Parties. Reported emissions (from all transport) change by 60 per cent from 1997 to 1998.
- No information was provided on Venting and Flaring, Oil exploration, transport, refining/storage and distribution (blank cells). According to international statistics, Greece is refining crude oil and is expected to have emissions from these activities.

INDUSTRIAL PROCESSES

Key sources

2.E.1. By-product emissions, Production of HCFC-22

- Activity data were not provided due to confidentiality.

Non-key sources

2.B.1 Ammonia production and 2.C.3 Aluminium production

- Activity data for these sources were not reported due to confidentiality. However, activity data for Aluminium Production are available from international statistics.
- Iron and steel production data were reported as not applicable.

2.F. Consumption of Halocarbons and SF_6: [9]

- HFC, PFC and SF_6 emissions were not reported.

AGRICULTURE

Key sources

IPCC tier 1default method and default emission factors were used to estimate CH_4 emissions from enteric fermentation and N_2O emissions from agricultural soils.

4.A Enteric fermentation

- For swine, the reported activity data was higher than the corresponding value from the FAO (34 per cent difference).

4.D Agricultural soils

- 4.D.1.2 Animal wastes applied to soils: the N_2O IEF was higher by a factor of 100 compared to other countries and to the IPCC defaults.
- For 4.D.1.4 Crop residue, activity data was provided, but no emission estimates were reported (and consequently no IEF was calculated) – it seems that emissions from crop residue are missing in the total N_2O emissions from 4.D.1 Direct soil emissions.
- For 4.D.1.5, no information was provided on the cultivation of histosols.
- 4.D.3 Indirect emissions were not included in the inventory (see NIR p. 57).

Non-key sources

4.B Manure management

- There is a difference of 18 per cent when comparing the sum of Nitrogen excretion over all animal waste management systems per livestock to the corresponding Nitrogen excretion per animal multiplied with the population (for dairy and non-dairy cattle).

4.C Rice cultivation

- The CH_4 IEF for Irrigated fields – continuously flooded is lower by a factor of 100 compared to other reporting Parties.

LAND-USE CHANGE AND FORESTRY

Although table 5 and tables 5.A to 5.D were provided, no estimates were reported (indicators only). However, preliminary data from this sector were provided in the NIR.

[9] "2.F. Consumption of Halocarbons and SF6" was not identified as a key source in the level assessment since it was not reported. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

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).

HUNGARY

General

As a general introductory remark, Hungary noted its limited capacity in the preparation of inventories. This resulted in Hungary being able to determine only very few country-specific factors and parameters. Hungary further stated its plan to revise the inventory data of earlier years in accordance with the relevant COP decisions, which will depend on the availability of capacity.

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

The CRF was provided for 1998 and included almost all the requested tables. Indicators have not been used; many cells have been left blank which resulted in many unexplained gaps in the CRF. An NIR has not been submitted; however, accompanying materials were provided. These included IPCC tables and worksheets, some trend tables, sectoral descriptions (emission trends, some information on data sources, values used, etc.). Differences compared to previous inventories and problematic elements in the inventory preparation have been discussed.

Consistency of information between the CRF and the NIR

There are no significant differences in the information reported in the CRF and the accompanying materials, but three inconsistencies were noticed:

- 1.A.1 Energy industries: accompanying materials report 23,031 Gg CO_2, while the CRF value is 24,160,65 Gg. For category 1.A.2., manufacturing industries and construction, tables in the accompanying materials report 9,759 Gg CO_2, while the CRF value is 8,629 Gg. The sum of emissions from these two categories remains the same in the accompanying materials and CRF, and the differences do not influence the total emission estimates from energy and the national totals.
  Hungary explained that in the CRF they have tried to categorize more precisely the energy consumption as required. While in the tables of accompanying materials some of these emissions are allocated under manufacturing industries and construction.

- Tables in the accompanying materials estimate emissions of NMVOC from industrial processes at 37.95 Mg, while in the CRF the corresponding value is "0".
  The Party explained that, primarily due to a lack of capacity, they have only completed information in the CRF for the six greenhouse gases, and reported the other gases in the accompanying materials. However, the Party noted that, in the CRF, NMVOCs are reported for the Solvent use sector in order to present the calculation method (taking into account the limited instructions provided in the IPCC Guidelines).

- Tables in the accompanying materials report total amount of CH_4 emissions from enteric fermentation and manure management to be 114,58 Gg, while according to the CRF this value should be 115.6 Gg.
  Hungary noted that in the CRF there was an error in the reporting of manure management CH_4 emissions for horses. The correct CH_4 emissions value for horses should have been 0.097 Gg instead of 0.97 Gg.

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

Time series consistency
In relation to the preliminary findings on consistency in the time series, Hungary noted that the Revised 1996 IPCC Guidelines had only been applied for the first time to the 1998 inventory, but not for the previous years' inventories. Thus, the database did not have updated data for all years at the time of reporting and therefore it is not possible to compare trends. This was indicated in the accompanying materials. (See also introductory remark).

Fuel combustion
The variations in several of the sectors (CO_2) seem large, the most significant being:

- 1.A.2 Manufacturing industries and construction - CO_2: 76 per cent increase between 1997-1998.
  See the comment above under time series consistency and the general introductory remark.

- 1.A.5 Other fuel combustion – CO_2: 268 per cent increase between 1994-1995, and 100 per cent decrease between 1997-1998 (no data reported for 1998). This decrease may be related to the increase in manufacturing industries' emissions for 1998.
  See the comment above under time series consistency and the general introductory remark.

- Aviation bunkers: CO_2 emissions are significantly lower for 1992-1997, as compared to 1991 and 1998.
  Hungary explained that incorrect data was used and that this had been corrected in the subsequent inventory.

- 1.A.5 Other fuel combustion – CH_4: Although representing a small contribution to emissions, the change from 1990 to1991 was substantial (557 per cent). CH_4 emissions from the other fuel combustion sectors were not estimated.
  See the comment above under time series consistency and the general introductory remark.

Fugitive fuel
- 1.B.2 Oil and natural gas - CH_4: 47 per cent increase between 1990-1991. The CH_4 fuel combustion figure (above) coincides with this upward change.
  See the comment above under time series consistency and the general introductory remark.

Industrial processes
- 2.C Metal production - CO_2: emissions displayed a large decrease from 1991 to 1992 (although in line with the general decline for most sectors for these years).
  See the comment above under time series consistency and the general introductory remark.

- 2.B Chemical industry - N_2O: 52 per cent increase between 1995-1996.
  See the comment above under time series consistency and the general introductory remark. The Party also noted that the values reported are quite small (approximately "0").

Agriculture

- 4.C Rice cultivation - CH_4: emissions for some years display significant variations, 1992-1995 emissions are constant.
  See the comment above under time series consistency and the general introductory remark. Hungary also explained that rice production has significantly decreased in Hungary.

- 4.D Agricultural soils – N_2O: significant year-to-year variations in N_2O emissions from 1991 to 1997; furthermore, 1998 data was calculated differently (1800 per cent increase from 1997 to 1998) which was indicated in the accompanying materials.
  See the comment above under time series consistency and the general introductory remark.

Waste

Hungary explained that as there are no yearly survey data on the quantity of waste generated; it calculates estimates using the previous years' survey.

- 6.A Solid waste disposal - CH_4 and CO_2: estimates for 1998 are significantly different from other years (for the CH_4 value for the other years is constant).
  See the comment above under time series consistency and the general introductory remark. Hungary also explained that the information available is not sufficient for estimating emissions following the IPCC Guidelines.

- 6.B Waste-water handling - CH_4: estimate for 1998 is significantly different from other years.
  See the comment above under time series consistency and the general introductory remark.

Comparison with previous submissions

Information on recalculations was not reported in the CRF (no recalculation tables provided). Comparisons of emissions at the summary level with previously submitted data identified the following recalculations for <u>IPCC summary level key sources:</u>

- CO_2 Mineral products – 1996: 11.2 per cent lower than previous inventory value.
- CH_4 Enteric fermentation 1995 and 1996: 35.2 per cent and 36.9 per cent higher than previous inventory values.

See the comment above under time series consistency and the general introductory remark.

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

The analysis of trends in implied emission factor (IEF) and activity data was hampered due to a lack of data for the base year and the years 1990 to 1997. Sectoral background data tables were only reported for 1998.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

There is a difference of 3.7 per cent between the CO_2 emissions calculated using the reference approach and the sectoral approach. In the CRF (documentation box) it was indicated that the difference in the energy figure between the two approaches was due to "non-energy and leak". ***The Party explained that the results were correct and commented on the fact that the IPCC Guidelines do not provide any information with respect to the possible differences between the two approaches.***

Comparison with international data

The reference approach energy data for 1998 correspond very closely to the IEA data (only 0.4 per cent lower). Apparent consumption of liquid fuels is 3.5 per cent higher in the CRF, solid fuels is 9.2 per cent lower and natural gas is the same. Specific differences include the following:

- Production of NGL is 5,002 TJ higher in the CRF.
- CRF data for imports of naphtha, lubricants, petroleum coke and paraffin waxes appear to have been reported under "other oil".
  Hungary explained that "Other" oil does not contain a detailed explanation because energy is part of the statistics as well.
- It is possible that the primary coal rows have been misreported in one of the data sets. The CRF numbers in "other bituminous coal" correspond to sub-bituminous coal in the IEA. The CRF numbers in sub-bituminous coal and in lignite have been reported under lignite in the IEA.
  Hungary explained that this is due to different names and categorization in Hungary (i.e. brown coal in Hungary is lignite according to heat value). Therefore, the total volume reported is equivalent and there is no influence on the emissions.
- The IEA shows 42,006 TJ of coking coal imports that have not been reported in the CRF.
- The CRF shows 21,660 TJ of coke oven coke/gas coke imports, whereas the IEA shows 238 TJ.
  The Party explained that coke production in Hungary – where coking coal is used – is coking on a contract basis. That is why the energy balance statistics made by the IEA do not take into consideration the import of coking coal, only the import of coke.
- Were exports of lubricants included with gasoline in the CRF?
  The Party explained that lubricants were not included with gasoline.
- No exports of coke oven gas/gas coke have been reported in the CRF.
  See above comment on coke production in Hungary.
- Were exports of residual fuel oil reported as bitumen in the CRF?
  Hungary explained that exports of residual fuel oil were reported as bitumen.

Key sources

The IPCC default method and default emission factors were used to estimate CO_2 from energy industries (1.A.1), manufacturing industries and construction (1.A.2), transport (1.A.3) and other sectors (1.A.4).

Fugitive emissions
IPCC method tier 1and default emission factors were used to estimate CH_4 from oil and natural gas; and IPCC default method and emission factors were used to estimate CH_4 from solid fuels.

- Emissions from fugitive oil and gas have been reported in a quite transparent manner, but not from flaring and venting

Non-key sources
- N_2O from road transportation
  - IEF for gasoline is among the lower values compared to that of other Parties. Data do not allow a comparison over time (IEF emission factors are expected to increase). ***Hungary explained that the national vehicle composition consists mostly of two-stroke engines and noted that the value reported was not different from the default value.***
  - IEF for diesel oil is almost the lowest compared to that of other countries. ***The Party noted that the value was not significantly different from the default value and that there generally is a large degree of uncertainty in this source.***
- Domestic aviation/international bunker fuels: emissions from aircraft have all been reported as bunkers; no data have been reported as domestic aviation. ***The Party explained that, as there is no regular air travel in Hungary (and no data is available as to the distribution of the national share), it has reported emissions as bunkers.***
- 1.A.2.d Paper, pulp and printing and 1.A.2.e Food processing, beverages and tobacco: activity data and emissions appear to have been included in "other industry". ***Hungary explained that as no information is available as to the shares of these sectors it had to report them as a group.***
- Aviation bunkers – CH_4, N_2O: no estimates were reported for CH_4 and N_2O. ***The Party noted that it does not have emission factors for CH_4 and N_2O.***

INDUSTRIAL PROCESSES

Key sources
IPCC default method and emission factors were used to estimate CO_2 from 2.A mineral products.

Non-key sources
- *2.A.6 Road paving with asphalt:* activity data were reported, but no CO_2 emissions were reported. ***Hungary noted that it does not have an emission factor for this source.***
- *2.B.2 Nitric acid production:* production data reported in the CRF (510 t in 1998 – but apparently similar in previous years) are lower than data from international statistics (310,000t in 1993) ***The Party noted that the data is possibly incorrect, but that there is only one producer, so these data are confidential. The NH_3 production data are incorrect. The correct figure is 362,000 t, instead of 640 t.***
- *2.C.1 Iron and steel production:* activity data were reported, but no CO_2 emissions. CO_2 from metal production was included in energy industries.

SOLVENT AND OTHER PRODUCT USE

Non-key sources
For N_2O estimates: activity data/IEF information insufficient.
The Party noted, with the exception of "other", that it has no activity data and no emission factors for this source.

AGRICULTURE

Key sources
IPCC default method and default emission factors were used to estimate CH_4 emissions from enteric fermentation and manure management, and for N_2O emissions from agricultural soils – it was, however, not explained which tier has been used.
The Party noted that the IPCC Workbook (Volume 2) does not provide an indication of the tiers. [1]

4.A Enteric fermentation and 4.B Manure management – CH_4: Neither activity data nor implied emission factors were reported (entire tables 4A and 4B(a) have not been provided).

4.D Agricultural soils – N2O

- 4.D.1 Direct soil emissions: N_2O IEF for the cultivation of histosols is on the very low side of the range provided by the IPCC.
  The Party noted that its value is 2.0, as compared to other countries, where it was 5-8 or higher.
- 4.D.1 Direct soil emissions: N-fixing crops and crop residues were not reported in the CRF.
  Hungary explained that the values were less than 0.00, and noted that it did provide this information in separate IPCC worksheets.
- 4.D.3 Indirect emissions: N_2O IEF for atmospheric deposition and nitrogen leaching and run-off were almost the lowest compared to other Parties (lower by a factor of 10).
  Hungary explained that data were incorrectly reported in terms of units.
- No reporting of fractions used for estimating N_2O from agricultural soils (additional information box) in the CRF. This information was however provided in the IPCC worksheets.

Non-key sources
4.B Manure management – N2O:

- For swine, the reported activity data (population size) is lower than the corresponding value from the FAO (10 per cent difference); for sheep, no population data were reported.
  The Party explained that it used the data of the Central Statistical Agency's report of the 1st of December and that the FAO data could possibly have a different date. It is also noted that activity data for sheep are missing, but the emissions are included.

- There is no explanation of what "other" animal waste management system refers to.

[1] The IPCC Reference Manual (Vol.3) does provide an indication of the tiers of the methods for CH_4 from enteric fermentation and manure management.

Hungary explained that this concerns instances where the handling method is not known.

- N excretion from anaerobic lagoons has been reported, but corresponding emissions were "0".
  Hungary explained that the value is less than 0.00.

4.D Agricultural soils - CO2: not estimated - adequate emission factor information is not available (CO_2 emissions and removals from soil only for 1998).
The Party explained that this is taken into account in the land-use change and forestry sector.

LAND-USE CHANGE AND FORESTRY

Sectoral background data tables 5.A to 5.D were provided. However, information was limited in some cases (e.g. in table 5.C) and no indicators have been used.

- 5.A Changes in forest and other woody biomass stocks: net CO_2 emissions/removals (in the case of Hungary removals) double between 1990 and 1998.
  Hungary confirmed this increase and the correctness of the values.
- 5.B Forest and grassland conversion: no estimate available for the base year nor for 1990.
- 5.D CO_2 Emissions and removals from soil - CO_2: activity data reported for cultivation of mineral soils but corresponding estimates in net change in soils carbon were zero.
  Party noted that the net change was "0". See also the comment above under time series consistency and general introductory remark.

WASTE

Key sources

- *6.A Solid waste disposal on land - CH4:* emissions were held constant for the years 1991-1997. Check methodology and activity data.
  Hungary explained that, as there are no yearly survey data on quantity of waste generated, it calculates estimates using the previous survey. Because of this, the change cannot be detected year by year.

- *6.B Waste-water handling - CH4:* extremely high CH_4 emissions per capita. Should examine accompanying materials because CRF does not provide activity and other data.
  Hungary acknowledged this, indicating that it is mainly caused by municipal data. Due to the nature of the industrial sector data, it is not possible to calculate estimates in accordance with the IPCC Guidelines. As direct measuring data for the COD were available, it was completed directly.

- *6.C Waste incineration - CO2:* emissions were reported for most years, but were held constant (600 Gg). Methodology and activity data should be checked.
  The Party noted that these are only estimated data because of the lack of factors and measurement. The incinerated amount is approximately the same every year.

- Activity data and additional information were not provided in tables 6.A, 6.B, 6.C.

Non-key sources

- *6. C Waste incineration:* N_2O emissions from waste incineration were not estimated.
- *6.B Waste water:* N_2O emissions from human sewage were not estimated; however, lack of estimate is documented in the Completeness table (table 9).
- Waste sector emissions (all gases) were not reported in the trends table (table 10) for Hungary's base year (1985-87).

IRELAND

General

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

Ireland submitted inventory data for the year 1998 using the CRF and included all requested tables. Summary inventory data for the years 1990 to 1997 were provided using the IPCC summary tables. An NIR was not submitted. The submission was accompanied by a 3-page cover letter, which explained the major changes made in the inventory since the previous submission (1998).

Consistency of information between the CRF and the NIR

Not applicable since an NIR was not provided.

Verification procedures

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

Time series consistency

In depth analysis was not possible, since only data for 1998 were provided in detail. Emissions data as reported in the trend table of the CRF (table 10) do not indicate any notable annual fluctuations in national totals.

Comparison with previous submissions

Information on recalculations was not provided in the CRF. However, in the cover letter from Ireland, it was noted that data on emissions trends are a result of recalculations for the years 1990 to 1997 using the Revised 1996 IPCC Guidelines and software and that explanations on recalculations and the corresponding data will be provided in the 1990 CRF, which is under elaboration.

Emissions data submitted in 2000 could only be compared with emission estimates for the years 1995 and 1996 that were submitted in 1998 (in 1999 a GHG inventory was not provided). The effect of the recalculations was a reduction of –3.4 per cent in the total CO_2 equivalent emissions without land-use change and forestry for the year 1995. This percentage becomes –3.2 per cent if land-use change and forestry is taken into account. For 1996, the effect of the recalculations was –1.3 per cent and –0.7 per cent, respectively.

Sector-by-sector findings

The analysis of trends in implied emission factor (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 provided for 1998.

ENERGY

Reference approach

General comments

- In the reference approach, the amount of carbon stored in natural gas used as feedstock and non-energy use was not estimated in Table 1.A (d). This amount should have been estimated and included in Table 1.A (b). See also comment in the documentation box of Table 1.A (c).
- Some Carbon emission factors do not correspond to IPCC defaults (e.g. natural gas, BKB & Patent fuel, peat, other bit coal, etc).

Comparison of the reference approach with the national approach

There is a difference of 4.3 per cent between the CO_2 emissions estimates calculated using the reference approach and the sectoral approach. An explanation for this difference was provided in the documentation box.

Comparison with international data

The reference approach energy data for 1998 correspond very closely to the IEA data (only 0.4 per cent lower). Specific differences include:

- No information on some fuel types (e.g. bitumen, lubricants, petroleum coke, refinery feedstocks, lignite) has been included in the CRF. 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.
- Check whether crude oil imports were reported as production in the CRF.

Key sources

Fuel combustion

The IPCC tier 1 method was used to estimate emissions from stationary and mobile combustion. For CO_2 emissions country-specific emissions factors were used (and plant specific for 1.A.1 and 1.A.2), while for CH_4 and N_2O emissions, the CORINAIR emission factors and methodology were used.

Bunker fuels

Bunkers emissions from shipping and aircraft are according to data in IEA statistics. Bunkers emissions from shipping are small, however, compared to other countries with a long coastline.

Non-key sources

- Emissions of CH_4 and N_2O for some sources were reported as "0" (meaning that the amount is less than half the unit used). However, for other sources the entire values have been reported although they are less than half the unit.
- Emissions of CH_4 and N_2O from biomass combustion have not been reported.
- Emissions from Transport - Civil aviation were not estimated (reported as NE). However, in the reference approach amounts for "other kerosene" were reported.
- Emissions from Coal mining were not reported (reported as NO). According to international statistics (IEA), Ireland is producing small amounts of coal.
- Emissions from Oil, Venting and flaring were not reported (reported as NO). (According to international statistics Ireland does not have a large oil and gas industry).

INDUSTRIAL PROCESSES

Key sources

- *2.B.1 Ammonia production:* the CO_2 IEF (2.88 t/t) is higher than for most reporting Parties and higher that the IPCC default value (1.5-1.6 t/t).

- *2.B.2 Nitric acid production:* the N_2O IEF (0.01 t/t) is marginally higher than the IPCC default value (0.002-0.009 t/t).

Non-key sources

- *2.F. Consumption of Halocarbons and SF_6:*[10] HFCs, PFCs and SF_6 were reported as not estimated.

AGRICULTURE

Key sources

IPCC default methods were used to estimate CH_4 emissions from enteric fermentation and manure management, and N_2O emissions from agricultural soils. It was not specified which tier had been used. Both country-specific and default emissions factors were used for those source categories.

4.A Enteric fermentation and *4.B Manure management*

- For cattle and sheep, the reported activity data were higher than the corresponding value from the FAO (5 and 19 per cent difference, respectively).

4.D Agricultural soils: 4.D.1 Direct soil emissions, 4.D.2 Animal production, 4.D.3 Indirect emissions from soils

- 4.D.1.3 N-fixing crops, 4.D.1.4 Crop residue, and 4.D.1.5 Cultivation of histosols reported as NE.
- The value of the fraction of livestock N excreted and deposited onto soils during grazing (FracGRAZ) reported (0.65) was the highest value across all reporting Parties.
- The value of the fraction of synthetic fertilizer N applied to soils that volatizes as NH_3 and NOx (FracGASF – 0.04) and the value of the fraction of N input to soils that is lost through leaching and runoff (FracLEACH – 0.04) reported were lower by a factor of 10 compared to the IPCC defaults and those reported by most other countries.

Non-key sources

4.B manure management – N_2O

- N-excretion rates for swine (12 kgN/head/yr) and sheep (8 kgN/head/yr) are relatively low compared to the IPCC default values for the region.

[10] "2.F. Consumption of Halocarbons and SF_6" was not identified as key source in the level assessment since it was not reported. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

LAND-USE CHANGE AND FORESTRY

CO_2 emissions/removals were reported for category 5.A Changes in forest and other woody biomass stocks, namely for 5.A.2 Temperate forests, and for category 5.D CO_2 emissions and removals from soils, namely for 5.D.3 Liming of agricultural soils. Tables 5.A and 5.D were provided for reporting data of this source/sink category.

- 5.A Changes in forest and other woody biomass stocks: No CO_2 emissions were reported for this category (NE reported – see table 5.A, amount of biomass removed)

WASTE

Key sources

6.A Solid waste disposal on land – CH_4

- IPCC default methods used
- Significant drop in CH_4 emissions from solid waste disposal in 1998. No explanation was provided for this reduction.

Non-key sources

- CH_4 from solid waste disposal is the only Waste-sector source category reported. CH_4 from waste-water treatment and N_2O from human sewage were reported as not estimated (NE), but no information was provided in Completeness table (table 9) or documentation box. Reported not occurring (NO) for N_2O and CO_2 emissions from waste incineration.

ITALY

General

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

Italy provided inventory data for the year 1998 using the CRF. Emission estimates for the years 1990 to 1997 were reported using the IPCC Sectoral Tables. An NIR was not submitted.

Consistency of information between the CRF and the NIR

Not applicable since neither an NIR nor any other additional information were provided.

Verification procedures

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

Time series consistency

In-depth analysis was not possible, since only data for 1998 were provided in detail. Emissions data in the trend tables do not indicate any notable annual fluctuations in national totals. Some annual fluctuations or irregularities in trends are noted below:

- The N_2O emissions for 1998 from 1.A.1 Energy Industries, 1.A.2 Manufacturing Industries and Construction and 1.A.4 Other Sectors were significantly lower compared to estimates reported for previous years.
- For 1.B Fugitive Emissions for Fuels, CO_2 emissions for 1998 were less than 50 per cent compared to estimates reported for previous years.
- For 2.B Chemical Industry, CH_4 emissions were significantly lower compared to estimates reported for previous years.
- For 2.C Metal Production, CO_2 emissions for the years 1995-1998 have the same value. For the same category, CH_4 emissions for 1998 were approximately 4 times higher compared to estimates reported for previous years.

Comparison with previous submissions

Information on recalculations was not provided in the CRF. However, Italy has recalculated its emission estimates for the years 1990 to 1995 that were submitted in 1999. The effect of the recalculations was a reduction of –2.9 per cent in the total CO_2 equivalent emissions without land-use change and forestry for the base year (1990). This percentage becomes –3.1 per cent if land-use change and forestry is taken into account. For 1995, the effect of the recalculations was –2.4 per cent and –2.2 per cent, respectively.

Sector-by-sector findings

The analysis of trends in implied emission factor (IEF) and activity data was hampered due to lack of data for the years 1990 to 1997. Sectoral background data tables were only provided for 1998.

ENERGY

Reference approach

General comments

- For Feedstocks and Non-Energy Use of Fuels it was assumed that 100 per cent of all carbon contained in fuels was stored.

Comparison of the reference approach with the national approach

There is a difference of only –1.4 per cent between the CO_2 emission estimates calculated using the reference approach and the sectoral approach.

Comparison with International data

The Italian reference approach energy data for 1998 are 3.0 per cent higher than the data reported to the IEA. Most of this difference is due to liquid fuels. Specific differences include:

- The CRF shows crude oil production that is 4.0 TJ (70 per cent) higher than the IEA data.
- CRF crude oil imports are also 4.0 TJ higher than the IEA. The CRF shows no imports and exports of refinery feedstocks. It appears that refinery feedstocks trade may have been included with crude oil.

Key sources

Fuel Combustion

- Stationary Combustion - Gaseous fuels: the CO_2 IEF for 1998 (61.26 t/TJ) had the second highest value among the reporting Parties. This appears to be due to a higher value for 1.A.1 Energy Industries, which averages 69.86 t/TJ (for 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries the value was 85.73 t/TJ) compared to other fuel combustion activities (58.37 t/TJ for 1.A.2 Manufacturing Industries and Construction and 56.35 t/TJ for 1.A.4 Other Sectors).
- Stationary Combustion - Other fuels: it was indicated that for the Commercial, Domestic and Agricultural sectors, Other fuels referred to LPG (see documentation box of Table 1.A(a), sheet 4). However, for the other activities (Energy Industries, and Manufacturing Industries and Construction), no such information was provided.
- 1.A.3.b Road Transportation: N_2O emissions fluctuated from 1997 to 1998 (some decrease was expected). The IEF for diesel vehicles was high compared to other reporting Parties and quite close to the one derived for gasoline vehicles.

Fugitive Emissions

- 1.B.2 Fugitive emissions from Oil and Natural Gas: activity data were not reported, and consequently, IEFs were not calculated. Emissions from refineries were not reported (Italy is refining crude oil according to international statistics). Emissions from Venting were not reported. For flaring, only CO_2 emissions were reported.

Non-key sources

- Emissions from biomass combustion were not reported.

Bunker fuels

- Bunker fuel emissions (shipping and aircraft) differ from data published by the IEA.

INDUSTRIAL PROCESSES

Key sources

2.A.1 Cement Production

- A description of the activity data (cement or clinker) was not provided. However, reported activity data are lower compared to international data for cement production, maybe indicating that data are for clinker production. The CO_2 IEF for 1998 (0.6 t/t) was the second highest among the reporting Parties.

2.B.3 Adipic Acid Production,

- The N_2O IEF (174 g/t) was lower than the value suggested by the IPCC Guidelines (300 g/t).

Non-key sources

- *2.B.1 Ammonia Production*: The CO_2 IEF for (2.9 t/t) was higher compared to most other reporting Parties and higher than the IPCC default value (1.5 – 1.6 t/t).

- *2.B.2 Nitric Acid Production:* Activity data were reported but emissions were not reported.

- *2.C.1 Iron and Steel Production:* CO_2 emissions (451 Gg) have been reported as "other" without any specification as to the source.

Other comments

- No reporting of HFC, PFC and SF_6 emissions from any source,[11] while aluminium production data are available in the CRF for estimating CO_2 emissions.

AGRICULTURE

Analysis of data other than emission estimates was not possible because activity data and other related information were not reported, and consequently IEFs were not calculated for any category in the agriculture sector.

LAND-USE CHANGE AND FORESTRY

CO_2 emission and removal estimates were provided in Table 5. Sectoral background data tables 5.A to 5.D of the CRF or any alternative tables were not provided. Emission and removals were not reported separately, instead only the net CO_2 emissions or removals were reported.

[11] "2.F Consumption of halocarbons and SF_6 was not identified as a key source in the level assessment since it was not reported. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

WASTE

Key sources

6.A Solid waste disposal on land

- For this and all other categories in the Waste sector, activity data and other related information were not reported, and consequently no IEFs were calculated.

Non-key sources

- *6.B.2 Domestic and Commercial Waste-water:* N_2O emissions from human sewage were not estimated and no explanation was provided in the Completeness table.

- *6.C Waste incineration:* CH_4 emissions from waste incineration appear high, but no activity data were provided in the CRF.

- *6.D Other:* 83.2 Gg of CH_4 emissions were reported without any specification as to the source. Documentation was not provided in the CRF.

JAPAN

Japan informed the secretariat that due to the short notice available for preparing comments, its comments on the synthesis and assessment report are provisional. The Party therefore secures the right to revise these comments as final comments at a later stage.

General

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

The CRF was provided for 1990 to 1998 and included all requested tables, except tables on recalculations. Indicators were used appropriately. Many source categories have been reported as not estimated (NE). An NIR was not submitted at the time of submitting the CRF.

On 11 May 2001, Japan submitted the background data for its GHG inventory to the secretariat to be used during the centralized review held in Bonn, 5-9 May 2001, in which the Japanese inventories of the years 1990 to 1998 were reviewed. The Party indicated that these background data (125 electronic Excel files) constituted its NIR.[12] Japan also indicated that in the year 2000 the CRF was prepared for the first time and was accidentally submitted without an NIR.

Japan also stated its intention to make an effort to estimate emissions from the source categories reported as "NE", through an investigation by experts.

Consistency of information between the CRF and the NIR

Not applicable.[13]

The Party considers its data to be consistent, because the emission data of the CRF refer to the corresponding parts of the NIR.

Verification procedures

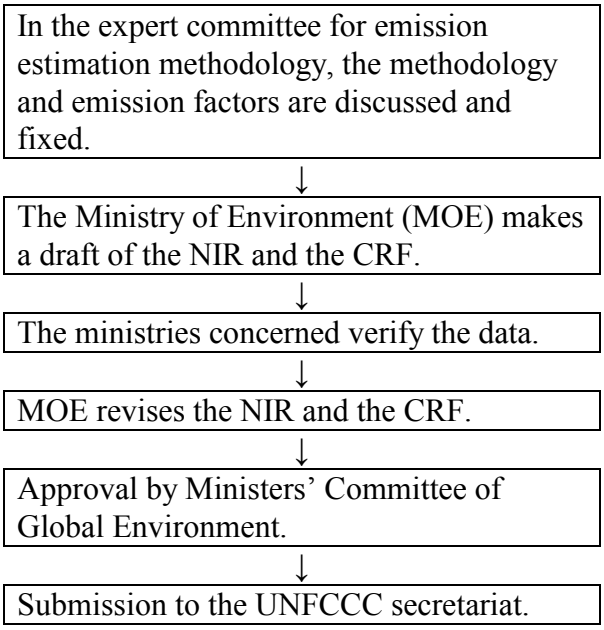
Information as to whether the inventory has been verified nationally was not provided.

In its comments on the synthesis and assessment report, Japan provided the following scheme of the general verification procedures for the preparation of the national inventory:

[12] Most textual explanations of that submission are in the Japanese language.

[13] At the time of preparing the synthesis and assessment report, the NIR had not yet been submitted.

National self-verification:



Time series consistency

Emissions data do not indicate any notable annual fluctuation for national totals. However, in fuel consumption from 1.A.1 Energy industries (liquid, solid and gas) there is a sudden decrease in AD in 1995; the corresponding implied emission factors (IEFs) are 20-fold higher in that year.

Japan stated that the sudden decrease was caused by a mistake in the CRF, and that the

[Unit : PJ]

F. Y.	1990	1991	1992	1993	1994	1995	1996	1997	1998
Category 1A1	4, 698	4, 753	4, 841	4, 577	5, 091	4, 933	4, 946	4, 883	4, 784
Category 1A2	4, 035	4, 030	3, 922	3, 990	4, 115	4, 183	4, 241	4, 237	4, 158
Category 1A3	2, 889	3, 025	3, 096	3, 122	3, 275	3, 370	3, 464	3, 528	3, 526
Category 1A4	2, 311	2, 408	2, 490	2, 490	2, 461	2, 608	2, 564	2, 545	2, 473
Category 1A5	8	9	12	8	14	10	14	13	1
TOTAL	13, 941	14, 225	14, 362	14, 187	14, 957	15, 105	15, 229	15, 205	14, 942

accurate data are as shown in the table below:

Comparison with previous submissions

Japan did not provide recalculation tables 8(a) and 8(b) of the CRF. However, a comparison with data from the 1999 submission indicates that slight recalculations have taken place in some categories (0.02 per cent in the total CO_2 equivalent emissions without land-use change and forestry).

Japan explained that it did not provide recalculation tables, because it considered that the starting point of recalculation is that of the first submission of the CRF. In addition, the Party clarified that in the previous submission (1999), it reported emission estimates from waste incineration in 1997 as those of 1998. It also stated that, in the latest submission (2000), this mistake was corrected without filling in the recalculation tables.

Sector-by-sector findings

ENERGY

Reference approach

Comparison of the reference approach with the national approach

There is a difference of only 0.43 per cent between the CO_2 emissions estimates calculated using the reference approach and the sectoral approach.

Comparison with international data

The Japanese reference approach energy data for 1998 correspond very closely to the IEA data (only 0.2 per cent lower). In 1990, the CRF was 1.5 per cent higher than the IEA. This means that the growth in total apparent consumption in the CRF between 1990 and 1998 was 7.1 per cent and in the IEA data it was 9.0 per cent.

Japan thinks this difference is caused by an increase in the consumption ratio of naphtha transformed into petrochemical products, and referred to the corresponding calculation sheet in its NIR.

Key sources

Fuel combustion

- 1.A.1 Energy industries: only aggregate information on consumption data and CO_2 emissions were reported.
- 1.A.4 Other sectors (commercial/institutional and residential), total – solid fuels: The CO_2 IEF is the highest across all reporting Parties.
  Japan referred to the relevant calculation sheets of its NIR, where disaggregated emission factors by fuel type can be found, and provided a copy of these values.

Non-key sources

Fuel combustion

- 1.A.3 .b Road transport – gasoline: The N_2O IEF is relatively low compared to other OECD countries, but within the range of IPCC defaults. This emission factor has been kept constant since 1990 (it is expected that the average should increase as new technology is introduced).
  Japan reported that due to insufficient emissions measurement data, constant emission factors were applied from 1990 to 1998.

- 1.A.3.a Civil aviation: N_2O from jet kerosene reported as NE.
  The Party explained that it did not estimate emissions from this source because it does not have any reliable N_2O emission factor for aviation, and default values are not indicated neither in the IPCC Guidelines, nor in the IPCC good practice guidance.[14]

- 1.A.5 Other – other fuels: very high IEF for CO_2.
- Other fuels (consumption) reported as NO – however, CH_4 and N_2O emissions from other fuels have been reported for many subcategories.

[14] The Reference Manual of the IPCC Guidelines (page 1.36, table 1-8) provides for aviation an N_2O default emission factor of 2 kg/TJ for oil without further specification (e.g. for jet kerosene).

Japan explained that national emission factors from the reference approach were used because they are considered more suitable for national circumstances. In addition, it was explained that 1.A.5 "Other" is applied to eliminate the difference between these two approaches.
The Party also explained that CH_4 and N_2O emissions are estimated using other statistics (Comprehensive Investigation for Air Pollutant Emissions) than "Comprehensive Energy Statistics" which are used to estimate CO_2 emissions in Japan. In addition, the Party explained that, in the former statistics, some types of fuel from stationary sources are accounted for in "other fuels", because these cannot be classified under solid, liquid or gaseous fuels.

Fugitive emissions

- Reported as NO: CO_2 emissions from coal mining, solid fuel transformation, oil exploration, transport, distribution, natural gas exploration, distribution, other leakage, flaring (oil, gas, combined).
- CH_4 emissions from venting and flaring are reported together. CO_2 and N_2O from flaring are then not estimated.
- Venting from oil and gas: no IEF calculated (reported as NO) although both activity data and CH_4 emissions have been reported.

The Party indicated that "NE" is the correct notation key to be used for N_2O fugitive emissions. It also reported that emissions from these source categories are very small in Japan and, in some sources, the emission factors and methods of estimation are not indicated in either the IPCC Guidelines or in the IPCC good practice guidance report. In the case of venting and flaring, Japan referred to the IPCC Guidelines, where CH_4 emission factors were not distinguished. CO_2 and N_2O emission factors were provided for the first time in the IPCC good practice guidance report. Hence, Japan only estimated CH_4 emissions. For venting from oil and gas, Japan explained that IEF had erroneously not been calculated.

Bunker fuels

- Marine bunkers (CO_2 emissions) are slightly higher than those in the IEA statistics.
- Aviation: N_2O from jet kerosene reported as NE.
In relation to N_2O emissions from jet kerosene the Party provided the same explanation as for subcategory 1.A.3.a above.

Other comments

- Reporting of negative emissions in some fuel combustion categories (CH_4 and N_2O). In some categories, negative emissions are masked in the sum totals, giving low IEF. This makes it impossible to further analyse IEF for these gases in stationary combustion.
Japan refers to the relevant calculation sheet in its NIR (relevant part in Japanese only) to address the reporting of negative emissions in some categories.

INDUSTRIAL PROCESSES

Key sources

2.A.3 Limestone and dolomite use

- No disaggregated reporting of 2.A Mineral products – all activity data and CO_2 emissions are included under limestone and dolomite use.
- 2.A Mineral products: the international value for annual cement production in Japan is ~ 81,000 kt. This would correspond to a default emission estimate of approximately 40,000 Gg CO_2, or 80 per cent of the emissions from mineral products reported for 1998.
  In relation to both comments mentioned above, Japan referred to the relevant calculation sheets of its NIR to address disaggregated reporting under this source category.

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

- Only potential emissions have been reported. Actual emissions were reported as "NE". The potential emissions may be considerably larger than the actual ones. This may affect the identification of other key sources.
  Japan reported that country-specific actual emission factors for these substances are currently under development.

Non-key sources

- Reported as NE: other production, aluminium production, soda ash, asphalt roofing, road paving with asphalt, carbide production, ferroalloys production, production of halocarbons and SF_6.
  Japan stated its intention to estimate emissions from those source categories reported as "NE" through an investigation by experts.

- *2.C Metal production – CO_2 and CH_4*: no numerical information reported for this category. All activity data were reported as "IE" (iron and steel production) or "NE" (ferroalloys and aluminium production). As for CO_2 from iron and steel production, these emissions have been included under 2.A.3 Limestone and dolomite use subcategory of the Mineral product subsector, because "CO_2 emissions from iron and steel production are estimated by consumption of limestone and dolomite" (table 9 of CRF).
  Japan also referred to the relevant calculation sheets of its NIR to address reporting under Limestone and dolomite use, and confirmed that emissions accompanying the utilization of limestone and dolomite in iron and steel production are included under limestone and dolomite use.

- *2.C. 3 Aluminium production – PFCs*: international statistics indicate aluminium production, but no PFC emissions were estimated (reported as NE).
  Japan confirmed the reporting of "NE" to be correct, and stated its intention to make an effort to estimate emissions from the source categories reported as "NE" through investigation by experts.

AGRICULTURE

Key sources

No key source was identified in the agriculture sector.

Non-key sources

4.A Enteric fermentation - CH_4

IEF for dairy and non-dairy cattle seem relatively high compared to the IPCC default for Asia, while for sheep it seems relatively low compared to the IPCC default.

Japan explained that emission factors are based on the measurement of each species of livestock in Japan. Values for cattle are relatively high, chiefly because the productivity of cattle in Japan is higher than in other Asian countries.

4.B Manure management - CH_4

IEF for dairy cattle seems relatively low compared to the IPCC default for Asia, while IEF for non-dairy cattle seems relatively high compared to the IPCC default for Asia.

Japan explained that the manure management systems are different for dairy and non-dairy cattle. The manure of non-dairy cattle is usually composted and its process generates much more CH_4 than that of other manure management systems so that IEF for non-dairy cattle is relatively high.

4.B Manure management – N_2O

- All animal waste management systems (AWMS) reported as NO except "other" which is unexplained – the resulting IEF for N_2O is very high compared to IEF from AWMS in other countries.
  Japan explained that there is no clear correspondence between the classification indicated in the IPCC Guidelines and the national classification, therefore all subcategories of the national classification are accounted for under "other". Japan stated that it would like to reconsider the classification through investigation by experts.

- N-excretion rates: lowest rates across all countries and very low compared to the IPCC defaults (lower by a factor of 100).
- The number of dairy cattle multiplied with the corresponding N excretion factor for dairy cattle (in kg N/head/yr) does not correspond to the total N from all AWMS. There is a difference of a factor of 1000. This is also the case for non-dairy cattle.
  In relation to both comments above, Japan explained that, accidentally, values for emission factors (kg N_2O/year/head) instead of N-excretion rates were entered in table 4.B(b). Estimated N_2O emissions are, however, correct.

- Table 4.B(b): the activity data for dairy and non-dairy cattle have been interchanged in this table (compared to the data provided in tables 4.A and 4.B(a) – it is not clear whether the other data provided in this table have also been interchanged for dairy and non-dairy cattle.
  Japan explained that correct activity data are those reported in tables 4.A and 4.B(a).

4.D Agricultural soils – N_2O

- Only emissions from subcategory 4.D.1.1 Synthetic fertilizers have been estimated. All other subcategories have been reported as "NE". However, for pasture range and paddock "NO" was reported in table 4.B(b).
  Japan explained that "NO" should be replaced with "NE".

- 4.D.1.1 Synthetic fertilizers: almost the lowest IEF across all countries (lower by a factor of 10)
  Japan explained that the emission factor used in its inventory is based on field measurements in Japan. Japan further referred to the relevant calculation sheet in its NIR.

4.E Field burning of agricultural residues

- IEF for 4.F.1.6 Rice (both CH_4 and N_2O) seem relatively high compared to other reporting countries. IEF for both gases fluctuate from –22 to +27 per cent.
  Japan explained that IEF fluctuate because field burning of rice consists of "straw of wetland rice" and that of "chaff of wetland rice". The emission factors used are based on measurements in Japan. Japan further referred to the relevant calculation sheet in its NIR.

LAND-USE CHANGE AND FORESTRY

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

- No estimates for intensively managed and natural forest provided for 1996-1998 (reported as NE).
  Japan explained that this category was not estimated for 1996 to 1998 due to the lack of activity data.

- Although CO_2 emissions were reported in table 5A, NO was reported for CO_2 emissions in table 5.
  Japan explained that CO_2 emissions should also be reported in table 5.

- Data for net CO_2 emissions or removals is inconsistent between table 5 and table 5.A.
  Japan stated that the correct data can be found in its NIR and referred to the relevant calculation sheets. The data given in table 5.A should be replaced with that of the NIR.

- Increase of 81 per cent in the area of forest/biomass stocks and in the carbon uptake increment in "temperate forest - other- green space conservation zones" in 1992.
  Japan explained that, according to the Ministry of Construction (actually, Ministry of Land, Infrastructure and Transport), the area of green space conservation zones increased by 14 km^2 in 1992. Japan referred to the relevant calculation sheets in its NIR.

- Table 5.A: For the years 1990 to 1995 there seems to be a double-counting of the total annual growth increment (Gg C) because a subtotal has been inserted manually in the table (CRF also calculates the total C from all species reported).
  Japan explained that the correct figure for total LUCF CO_2 removals is as reported in table 5.

5.B *Forest and grassland conversion* - natural forest (reported under "other"):
annual fluctuation up to 29 per cent in the average annual net loss of biomass from decay of above-ground biomass.
Japan explained that the area of forest which consists of "intensively managed forest" and "natural forest" increased until 1984. In 1985, the area of forest started to decrease. For

this reason, the average area converted (10 year average), which remained "0" until 1984, suddenly increased from 1985 onwards. Japan further referred to the relevant calculation sheets in its NIR.

WASTE

Key sources

6. C Waste Incineration

- CO_2 emissions per capita are about 3 to 18 times higher than for other countries for the period of 1995 -1998.
  Japan believes that this is partly because the incineration rate of waste is higher than in other countries, since it is necessary in Japan to reduce the volume of waste due to the lack of landfill sites.

Non-key sources

6.A Solid waste disposal on land

- CO_2 was reported as NE in summary tables, but as NO in sectoral table (table 6A). Completeness table (table 9) notes that CO_2 is of biogenic origin and is accounted for under CO_2 emissions from biomass.
  Japan informed that "NO" in table 6.A should be replaced with "NE".
  Japan referred to the IPCC Guidelines that note that CO_2 from non-biologic or inorganic waste sources should be reported. However, no methodology is provided in those Guidelines. Japan further explained that CO_2 emissions from biomass are reported in the Completeness table as reference for the data which are not included in the national total CO_2 emissions.

6. B Waste-water handling - CH_4

- CH_4 emissions per capita appear low by an order of magnitude. No activity data or other related information are provided in the CRF for examination.
  Japan believes that the reason for CH_4 emissions per capita being low is that some sub-sources of this category were not estimated. Japan referred to the relevant calculation sheets of its NIR where activity data and other related information are provided.

- Reported NE for N_2O from human sewage and CH_4 from Industrial wastewater and sludge. Documentation provided in completeness table (table 9 of the CRF); however, explanation is unclear ("There is no confidential data of measurement and survey").
  Japan expressed its will to make an effort to estimate emissions from these source categories reported as "NE" through investigation by experts. It further clarified that the explanation given in table 9 should be replaced with "There is no <u>reliable</u> data of measurement and survey."

LATVIA

General

Common reporting format (CRF) and National Inventory Report (NIR)

Latvia, in its original 2000 inventory submission, provided partial inventory data for the year 1998 using the CRF. However, in response to the draft synthesis and assessment report in May 2001, Latvia submitted a revised CRF for 1998[15] that included almost all required tables and some corrections to the previously submitted data. Not provided were tables on recalculations, as well as some sectoral background data tables. An NIR was not submitted as part of the 2000 submission.

Consistency of information between the CRF and the NIR

Not applicable since neither an NIR nor any other additional information were provided in the 2000 submission.

Verification procedures

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

Time series consistency

Analysis of the time series was not possible since data other than for 1998 were not reported. The corresponding trend tables of the CRF (table 10) were not submitted.
In its revised CRF for 1998 Latvia provided trend tables for CO_2, CH_4, N_2O and CO_2 equivalent estimates for 1990 to 1998.

Comparison with previous submissions

Information on recalculations was not provided in the CRF. It was not possible to compare data with previous submissions because the 2000 submission did not include any emissions data for the years prior to 1998.
See comment under time series consistency. Latvia explained that a comparison with previously submitted data has not been done.

Sector-by-sector findings

Since neither emissions estimates, activity data nor related information was reported for 1990 to 1997, an analysis of trends was not possible for any sector.
See comment under time series consistency.

ENERGY

Reference approach

The reference approach was not provided.
Latvia explained that the reference approach could not be provided due to lack of human resources.

[15] The revised CRF for 1998 will be fully considered during the synthesis and assessment report of the 2001 inventory submissions. For the purpose of this synthesis and assessment report, information provided in the revised CRF is used to comment on the preliminary findings identified that arose from the analysis of the CRF originally submitted to the secretariat in April 2000.

Key sources

Fuel combustion

- Emissions from the Energy sector were provided only as totals at the summary level of table 1. No information was provided on activity data and emission estimates for each fuel category. It was not possible to compare implied emission factor (IEF) values against data from other Parties.
  In its revised CRF, Latvia provided table 1.A(a), and provided activity data and emissions estimates for some source categories according to fuel type categories, as well as calculations of IEF.
  Sheet 2 of table 1.A(a) for manufacturing industries and construction has not been filled in, since this category could not be provided at the required level of detail due to the way in which the data in the energy balance is available. Consequently, CO_2 data corresponding to the national approach in table 1.A(c) are incomplete.
  Latvia confirmed that activity data were calculated using net calorific value.

- N_2O emissions from road traffic cannot be assessed due to aggregated reporting, but the reported emissions can seem low compared to other countries (taking into account the population size.
  Table 1.A(a) sheet 3 of the revised CRF provides emissions estimates and corresponding IEF for road transportation as well as for railways, domestic aviation and marine transport.

Fugitive emissions

- The CH_4 IEF for Natural gas transmission –0.5 kg/PJ– is the lowest among the reporting Parties. (The imbedded formula in table 1.B.2 was overwritten. If the formula had been used, the value of the IEF would be approximately 499,000 kg/PJ, which is within the range suggested by the IPCC for Former USSR and Central & Eastern European countries.)
  As for fugitive emissions from solid fuels (1.B.1) Latvia explained that such emissions do not occur in Latvia.
  On fugitive CH_4 emissions from oil and natural gas (1.B.2):
  1.B.2.a Oil: This category does not occur in Latvia, except for (iii) Transport (only gasoline - NMVOC emissions).
  1.B.2.b Natural gas: Latvia explained that for natural gas transmission, the CH_4 emission factor (IEF) is 500,000 kg/PJ.
  1.B.2.c Venting and flaring: Latvia explained that this activity does not occur in Latvia.

Bunker fuels

- Emissions from International bunkers were not provided (neither aviation nor marine).
  Latvia explained that emissions were not estimated due to a lack of data.

Other comments

- Emissions from biomass combustion have not been estimated.
  Regarding methods and emission factors used, Latvia explained that, for energy, in general IPCC tier 1 methodology and default emission factors were used, except for transport, where a tier 1/country-specific method and default emission factors were used. This information is also provided in Summary 3 of the revised 1998 CRF.

INDUSTRIAL PROCESSES

Key sources

- For this sector, only CO_2 emission estimates from Mineral products (key source) were reported.
  In its revised CRF, Latvia reported all source categories other than CO_2 from Mineral products as NO, except for NOx, CO, NMVOC and SO_2 gases.
  Latvia explained that the CO_2 IEF for cement production is 0.499. CO_2 emissions estimates have been revised compared to the data in the CRF submitted previously.

Non-key sources

- Steel production was not reported in the CRF, although steel production data were available in the United Nations statistics.
  As for metal production, Latvia explained that gases estimated were NOx, CO, NMVOC and SO_2 which are reported in table 2(I) of the revised CRF.

- Emissions of HFCs, PFCs and SF_6 [16] from Industrial processes were not reported for any source.
  Latvia explained that for HFCs, PFCs and SF_6 and consumption of such gases, these could be only potential figures in Latvia. These have not been estimated because data are not available.

Regarding methods and emission factors used, Latvia explained that, for industrial processes, the IPCC tier 1 methodology and default emission factors were used, as is also reported in summary 3 of the revised 1998 CRF.

AGRICULTURE

Information on methods and emission factors used (Summary 3 of the CRF) was not provided for any category.
In its revised 1998 CRF, Latvia reported information on methods and emission factors used in table Summary 3 for all sectors. For agriculture, IPCC tier 1 methodology and default emission factors have been used.

Key sources

4.A Enteric fermentation – CH_4

4.D Agricultural soils – N_2O

- The values of the N_2O IEFs do not correspond to the activity data and emission estimates reported. Imbedded formulas in table 4.D were overwritten. Units of the activity data reported need to be checked.
- The value of the N_2O IEF for Cultivation of histosols is lower by a factor of 1000 compared to other Parties and to the IPCC defaults.

[16] "2.F. Consumption of halocarbons and SF_6" was not identified as a key source in the level assessment since it was not reported. This source, due to its expected rapid increase, is likely to be a key source in many countries using the trend assessment.

In relation to Agricultural soils, Latvia provided the following explanations:

- Parameters (fractions used to estimate N_2O emissions in the agricultural soils category, direct and indirect emissions) are shown in table 4.D under additional information.

- Emissions estimates from agriculture have changed in the revised CRF because the previous inventory for 1998 did not use statistical data for 1998.

- In table 4.D, under Activity data and other related information, statistical data have been entered, but for emission calculation all necessary factors are considered. That is: Synthetic fertilizers activity data from Statistics is 10000000 kg N/yr, applying relevant formula results in:

$$F_{SN} = N_{FERT} * (1-0,1) \text{ is } 9000000 \text{ kg N/yr.}$$

- Cultivation of Histosols - Area of cultivated organic soils (ha): In Latvia it is assumed that nitrogen rich soil is 7 per cent from total arable land.

- Animal production: The N_2O IEF for pasture range and paddock is 0.02 (table 4.D of revised CRF).

LAND-USE CHANGE AND FORESTRY

CO_2 emission and removal estimates were provided in the CRF table 5. Estimates were provided for category 5.A changes in forest and other woody biomass stocks and for category 5.D CO_2 emissions and removals from soils. Only sectoral background data table 5.D was provided.

- Table 5: Signs for CO_2 emissions and removals from LUCF were not used correctly.
- 5.A Changes in forest and other woody biomass stocks: Only an aggregate CO_2 removal estimate was provided for this category.
- 5.D CO_2 emissions and removals from soils: The carbon conversion factor for limestone is 30 times higher than for other reporting countries.

WASTE

Key sources

6.A Solid waste disposal on land

- The values of CH_4 IEFs do not correspond to the activity data and emission estimates reported. The imbedded formulas in table 6.A were overwritten. The values for MCF are the same as the values for the IEF: 0.6 for managed and 0.16 for unmanaged disposal on land. (IPCC default MCF values are 1.0 and 0.6, respectively).
- No information about the methods and emission factors used (Summary 3 of the CRF) was provided.

Latvia explained that emissions in the waste sector have been updated in the revised CRF using corrected activity data for the rate of waste generation.

Regarding methods and emission factors used, Latvia explained that, for waste, the IPCC tier 1 methodology and default emission factors were used, as is also reported in Summary 3 of the revised 1998 CRF.

Non-key sources

- CH_4 emissions from waste-water handling and CO_2 and N_2O from waste incineration were not estimated. Corresponding CRF tables were left blank.
  In its revised CRF, Latvia reported waste incineration as not occurring. Latvia explained that CH_4 emissions from waste-water handling have not been estimated due to a lack of data.

- The reported nitrogen fraction for N_2O from human sewage estimate appears high (0.6 kg N/kg protein, while the IPCC default is 0.16).
  In the revised CRF, a value of 0.16 for the nitrogen fraction for N_2O from human sewage was reported.
  Latvia explained that the N_2O emission factor is 0.01 kg (table 6.B).

LITHUANIA

General

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

Lithuania provided partial inventory data for the year 1998 using the CRF. An NIR was not submitted.

Consistency of information between the CRF and the NIR

Not applicable since neither an NIR nor any other additional information were provided.

Verification procedures

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

Time series consistency

Analysis of the time series was not possible since data was not reported other than for 1998. The corresponding trend tables of the CRF (table 10) were not submitted.

Comparison with previous submissions

Information on recalculations was not provided in the CRF. It was not possible to compare data with previous submissions because the 2000 submission did not include any emission data for the years prior to 1998.

Sector-by-sector findings

Since neither emissions estimates nor activity data or related information was reported for 1990 to 1997, analysis of trends was not possible for any sector.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

There is a difference of 11.68 per cent between the CO_2 emissions estimates calculated using the reference approach and the sectoral approach. Although the difference is higher than 2 per cent, an explanation was not provided in the documentation box.

Comparison with international data

Although there are some differences in classification, on an aggregate level, the reference approach energy data for 1998 correspond very closely to the IEA data (only 0.1 per cent higher).

Key sources

Fuel Combustion

- 1.A.1.b Petroleum Refining – Liquid Fuels: the CO_2 implied emission factor (IEF) (84.12 t/TJ) was the highest among the reporting Parties.
- 1.A.4.a Commercial/Institutional - Other Fuels: the CO_2 IEF (235.71 t/TJ) was very high compared to other types of fuel (70 – 90 t/TJ) and other reporting Parties

(10-104.93 t/TJ). No information was provided on what fuels were included under this category.
- 1.A.4.b Residential - Solid Fuels: the CO_2 IEF (62.96 t/TJ) was the lowest among the reporting Parties (88.65-102.20 t/TJ).

Fugitive emissions
- 1.B.2 Fugitive oil and gas: emissions from oil production and transport were estimated, but not for refining (according to international statistics there are some refinery activities). Emissions from venting and flaring were not reported (and are expected to occur in a country with oil production).

Non-key sources
- 1.A.3.b Road Transportation: The N_2O IEFs (0.59 kg/TJ and 0.10 kg/TJ for gasoline and diesel oil, respectively) were the lowest among all reporting Parties and lower than the IPCC default emission factors. Trends of N_2O emissions could not be assessed.
- Fugitive emissions from coal mining were not reported (according to international statistics there is a very small amount of coal produced).

Bunker fuels
Bunkers emissions from aviation have not been reported.

INDUSTRIAL PROCESSES

Key sources
2.B.2 Nitric Acid production
- The N_2O IEF (0.019 t/t) was the highest among all reporting Parties and higher than the IPCC default value (0.002-0.009). The N_2O emissions from this sector also make up an unusually large share (12 per cent) of total national emissions.

Non-key sources
- *2.C.1 Iron and steel production*: Emissions from steel production were not reported, although steel production data were available in the UN statistics (very small quantity).
- Emissions of HFCs, PFCs and SF_6[17] from Industrial processes were not reported for any source.

AGRICULTURE

Key sources
IPCC default methods and emission factors were used to estimate CH_4 emissions from enteric fermentation and N_2O emissions from agricultural soils.

[17] "2.F Consumption of Halocarbons and SF_6 was not identified as a key source in the level assessment since it was not reported. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

4.A Enteric fermentation

- For cattle and sheep, the reported activity data were lower than the corresponding value from the FAO (10 and 51 per cent difference, respectively).

Non-key sources

4.B Manure management

- There were differences of factor 1000 when comparing the sum of nitrogen excretion over all animal waste management systems per livestock to the corresponding Nitrogen excretion per animal multiplied with the population (for dairy cattle and sheep).

4.D.3 Indirect emissions

- The N_2O IEF for Atmospheric deposition (0.7 kg N_2O-N/kg N) was higher by a factor of 10 compared to other Parties.

LAND-USE CHANGE AND FORESTRY

Table 5 and sectoral background data tables 5.A, 5.B and 5.C were provided.

- Table 5: Signs for LUCF were not used correctly. It seems that "net CO_2" should be an "emission" rather than a "removal" as reported in table 5. According to the information provided in the corresponding sectoral background data tables estimates for net CO_2 emissions/removals should read as follows:
  5A: -8,623 Gg (removals)
  5B: 17,370 Gg (emissions)
  5C: -1,035 Gg (removals)
  This would result for total land-use change and forestry:
  Total CO_2 emissions: 17,370 Gg;
  Total CO_2 removals: 9,658 Gg;
  Net CO_2 emissions/removals: +7,712 Gg.

WASTE

Key sources

6.A Solid waste disposal on land

- IPCC default method was used. One (not categorized) CH_4 IEF was calculated for emissions from solid waste disposal.

Non-key sources

6.A Solid waste disposal on land

- CO_2 emissions from solid waste disposal were reported. It should be checked whether emissions were from non-biogenic carbon.

6. B Waste-water handling

- N_2O from human sewage and CO_2 and N_2O from waste incineration were not estimated (tables were left blank). No documentation was provided in the Completeness table (Table 9).

- Emissions from commercial/domestic and industrial waste-water were reported together (see note in the documentation box).

THE NETHERLANDS

General

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

The Netherlands submitted inventory data for the years 1990 to 1998 using the CRF. However, some tables, such as trend tables and some sectoral background data tables were not provided in the CRF. Some of the CRF tables were only provided for a particular year, but not for the entire time series. Indicators have been used in a very limited manner. The CRF was accompanied by an NIR that includes information on uncertainties in the calculation of all source categories and differences compared to previous submissions. The NIR also includes a summary table providing data on HFCs, PFCs and SF_6 for 1990-1996, and summary tables with emission trends for CO_2, CH_4, N_2O, NOx, CO, NMVOC and SO_2.

Consistency of information between the CRF and the NIR

The data provided in the CRF were reproduced in the NIR. The data are generally consistent, a slight difference occurred due to presenting rounded values in the NIR. A big difference between the CRF and NIR in the estimations of CO_2, CH_4, and N_2O emissions from category 1.A.2 Manufacturing industries and construction in 1991 is due to an accidental double counting in the CRF table 1A(a) sheet 2.

The Netherlands explained that indeed an incorrect change to the summation formula in the CRF was made. This will be corrected in the 2001 inventory submission.

Verification procedures

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

Time series consistency

Emission data do not indicate any notable annual fluctuations in national totals. A few large annual fluctuations of significant changes are noted below:

- Fuel combustion: (CO_2, CH_4, N_2O) the year-to-year changes are not notable, with the most obvious differences coming from error (see above comment on manufacturing industries) or from the year-to-year variation in the statistical difference values in the "other" fuel combustion category.

- Fugitive fuel emissions: CO_2 emissions from oil and natural gas increased 400 per cent between 1994 and 1995, then stayed constant at the increased levels through 1998.

- Industrial processes:
  - 40 per cent change from 1992-1993 in CO_2 emissions from 2.A Mineral products;
  - Declining CO_2 emissions over time for 2.G "other" industrial processes;
  - CO_2 emissions from "other – misc." under 2.B Chemical industry reported for 1997, but for no other years (probably due to accidental double-counting with "other" industries).

    The Netherlands explained that from 1997 onwards a different source allocation was used; hence no double-counting occurred in the years prior to 1997. The preliminary estimate for 1998 was probably made at a higher aggregation level.

- Agriculture: Apparent inconsistencies in trends of CH_4 from 4.A Enteric fermentation and 4.B Manure management. These are due to the fact that CH_4 emissions from manure

management are reported in the category *4.A Enteric fermentation, Other* for the period 1990-1995; and in the category *4.B Manure management* for the years 1996-1998.
The Netherlands explained that, for 1990-1995, CH_4 from manure management (unspecified) was reported under 4.A, because table 4.B(a) does not allow for reporting of "other" under 4.B.

- Waste:
  - CO_2 emissions from waste were only reported for the period 1996-1998;
    The Netherlands explained that these CO_2 emissions were incorrectly allocated to the waste sector, but should be under 1.A Fuel combustion, since incineration of waste also produces electricity or heat for energy purposes. This will be corrected in the 2001 inventory submission.
  - Significantly lower CH_4 emissions from 6.B Waste-water handling for the period 1995-1998 than for the period 1990-1994.
    The Netherlands explained that the varying emission levels compared to previous years is due to different source definitions, and thus allocations, in the national emission data set for different years.

Comparison with previous submissions
Recalculation tables were provided only for 1996 and data was reported for four categories only: CO_2 emissions from energy industries, N_2O from transport, CH_4 from oil and natural gas distribution, and HFCs for consumption of halocarbons. The Party provided explanations for the revisions to these categories in the CRF.
The Netherlands explained that a recalculation table was only provided for 1996 and for the sectors and gases where changes occurred, since for other years no recalculations were made.

In the NIR some information was given as to the above and other changes in data and methodologies. However, it was indicated that the changes were not applied to all years; 1990-1995 data were not recalculated, except for actual HFC emissions for 1994 and 1995. Changes (according to the NIR) should be largely due to reallocation of some sources and some changes in methodologies (details given in the NIR).

Comparisons of emissions at the summary level with previously submitted data for 1996 identified the following recalculations for key sources:

- CO_2: Energy industries; Manufacturing industries and construction; Transport; Other fuel combustion;
- CH_4: Oil and natural gas.

As for CO_2 emissions from transport, the Netherlands explained that the recalculation of this source was accidentally omitted from the recalculation table of the CRF, but is discussed in the NIR.

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 sectoral report tables was hampered in those source categories in which sectoral background data tables were not provided for the 1990-1998 period.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

The Party made provisional calculations for the reference approach. The CRF and NIR provided only totals for CO_2 emissions from liquid, solid and gaseous fuels. The NIR contains explanations of the difficulties with input values for such calculations and a sensitivity analysis for the different values for crude oil, NGL and other refinery inputs.

On the basis of these preliminary calculations, the reference approach estimates CO_2 emissions to be 1.48 per cent lower than the national approach. However, since no activity data or emission factors are provided, no verification is possible.

Comparison with international data

Since only a preliminary estimation of emissions using the reference approach was submitted (as indicated above), a comparison with international data is impossible.

Key sources

1.A Fuel combustion

- IEF for CO_2 for "other fuels" seems to be too high (4425 t/TJ). This problem could be related to missing activity data;
- Emissions from several categories of fuel combustion are not reported in a disaggregated manner by fuel types.

1.A Fuel combustion - 1.A.3 transport

- N_2O IEF for transport: the IEF for diesel oil is the highest value among Parties (10.14 kg/TJ). IPCC default value is 3 to 4 kg/TJ;
  The Netherlands explained that this value was found to be correct according to the Dutch country-specific calculation method used by the Netherlands.

- N_2O from road transport: IEF is decreasing over time;

1.B Fugitive emissions

- IEF was calculated only for CH_4 for oil and natural gas distribution; for other reported categories either only activity data or only emissions were reported.
- Reporting of fugitive emissions from fuel is not transparent. It is consequently unclear as to whether or not this includes refineries, the transport of oil products and extraction activities (venting and flaring).

Bunker fuels
Emissions from marine bunkers (CO_2) are slightly different from those estimated by IEA statistics.

Non-key sources
N_2O and CH_4 emissions from biomass combustion have not been estimated.

INDUSTRIAL PROCESSES

Key sources
2. G Industrial processes - Other
- Only aggregated data are reported for emissions from key sources, while the CRF indicated that country-specific methods were used;
- No activity data were reported for this sector, hence no IEFs were calculated for any category;
- Consumption of halocarbons and SF_6: HFCs and PFCs: potential and actual emissions of HFCs, PFCs and SF_6 were only reported in table 2(II) for the year 1996. For the other years, total aggregate figures were provided in tables Summary 1.A and 1.B for HFCs (1994, 1995, 1997, 1998), for PFCs (1995, 1997, 1998) and for SF_6 (1990-1995, 1997, 1998).

Non-key sources
CRF indicated that for PFCs and SF_6 emissions "no recent, full survey of all possible sources has been completed". International statistics indicate the possible presence of aluminium foundries, and therefore SF_6 emissions from magnesium may be possible.

AGRICULTURE

Key sources
4.A Enteric fermentation – CH_4
- Activity data, IEF and other related information is only available for the period 1996 to 1998, as table 4.A was not reported for the period 1990 to 1995. Also, CH_4 emissions were not reported by livestock types in table 4 for the period 1990 to 1995. Trend analysis was therefore limited.
- Population data for swine (1998) reported in the CRF are approx. 15 per cent higher than those from the FAO.
- Decrease of 23 per cent in CH_4 emissions from enteric fermentation in 1996.
- CH_4 IEF for non-dairy cattle decreased by 4 and 3 per cent in 1997 and 1998, respectively, and by 21 per cent in 1997 for horses.
- CH_4 emissions from goats and horses increased by 19 and 26 per cent, respectively, in 1997. For sheep and swine emissions decreased by 10 and 11 per cent, respectively, in 1997 and 1998.

4.D Agricultural soils – N_2O
- No reporting of subcategories within the category agricultural soils. Only one aggregated estimate for N_2O provided which has been reported under "other".

- No activity data and other related information have been reported (consequently no N_2O IEF has been calculated), as table 4.D has not been filled in.

Non-key sources

4.B Manure management

- No activity data and other related information have been reported (consequently no CH_4 and N_2O IEFs have been calculated), as tables 4.B(a) and 4.B(b) were not provided.
- N_2O emissions fluctuate from –13 to +14 per cent between 1993 and 1996.

4.D Agricultural soils

CO_2 reported as "NE" as these emissions are assumed to be negligible.

LAND-USE CHANGE AND FORESTRY

CO_2 emissions/removals were only reported for category 5.A Changes in forest and other woody biomass stocks (temperate forests). Only CO_2 removals were reported. Tables 5A to 5D of the CRF have not been provided.

5.B Forest and grassland conversion (CO_2) and 5.D CO_2 emissions and removals from soils reported as "NE" in Completeness table (table 9 of the CRF) as these emissions are assumed to be negligible.

WASTE

Key sources

6.A Solid waste disposal on land

- IEF for CH_4 appears to high by roughly 3 orders of magnitude as compared to other countries. The likely cause is a problem with activity data on waste disposal.
- CO_2 emissions: No documentation provided in documentation box. Also listed under both managed and "other: misc." but no further description is given.

Non-key sources

- *6.B Waste-water handling:* CH_4 emissions from waste-water handling are constant for 1990-1993 and then exhibit a large variability for the period 1994-1997. CH_4 emissions per capita from wastewater handling appear low. N_2O emissions per capita from wastewater handling and human sewage (aggregated) appear low (roughly half of most other countries).
- Waste water and human sewage activity data and other related information tables left blank. Emissions listed under "other" but not specified and documentation not provided in CRF.
- *6.C Waste incineration*: N_2O and CO_2 from waste incineration not reported. No documentation provided in documentation box and tables left blank.
- For wastewater handling and waste incineration no activity data were reported, and consequently no IEFs were calculated.

- Missing source categories for the waste sector not identified in the completeness table (table 9).
- Reported 3.8 Gg of N_2O emissions under Sector 7 “Other”in table summary 1.A which was specified as ”polluted surface waters”. Should examine whether this could be better categorized under the waste sector.

NEW ZEALAND

General

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

New Zealand provided inventory data for the years 1990 to 1998 using the CRF, which included all requested tables. The CRF was accompanied by an 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 1998. Indicators were used throughout all tables of the CRF.

Consistency of information between the CRF and the NIR

The data provided using the CRF in electronic format were reproduced in the NIR. There are some differences in relation to activity data and emissions from energy and industrial processes reported in the CRF tables and in the worksheets incorporated in the NIR (see table below for differences in emission estimates for 1998).

Sector	CO_2 (Gg)		CH_4 (Gg)		N_2O (Gg)	
	CRF	*NIR*	*CRF*	*NIR*	*CRF*	*NIR*
Energy, fuel combustion	25,531.08	25,406	10.71	10.86	0.77	0.75
Industrial Processes	2,739.90	2,729	0.11	0.12		

The Party verified these differences and noted that there had been an error within the transport sector of the fuel combustion sector (CO_2). The correct value was reported in the CRF. The difference within the NIR was solved as being a spreadsheet error in the source year data for the compressed natural gas (CNG) data. Energy consumption was actually 510 as opposed to the 760 reported, giving an actual CO_2 emission of 27 Gg.
New Zealand also stated that the methane emissions are calculated from the CO_2 emissions, thus this figure was also changed in the NIR and now matches that reported in the CRF. N_2O may be accounted for by rounding between the spreadsheets in the CRF and the NIR.
Within the industrial processes sector, the figure for cement was incorrect in the NIR due to a later change in the data (the data had been incomplete). The total for industrial processes was 2739.9. Methane figures were different due to rounding in the spreadsheets.

Verification procedures

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

Time series consistency

Emissions data do not indicate any notable annual fluctuations in national totals. However, the activity data and the CO_2 emissions for liquid, solid and gaseous fuels used in category 1.A.1 Energy industries and for gaseous fuels used in category 1.A Fuel combustion varied significantly from year to year.

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 1997. In addition, the NIR contained additional information on changes in activity data and emission factors for each IPCC sector.

The NIR mentioned that in the 2000 inventory submission, data for 1997 for Solvent and other product use were updated. However, in view of the small share of emissions from this sector, no information was provided in the recalculation table.

The effect of the recalculations was an increase of approximately 0.76 per cent in the total CO_2 equivalent emissions without land-use change and forestry for the base year (1990) and a decrease of 0.18 per cent if land-use change and forestry is taken into account. The effect of the recalculations was the most noticeable for the year 1997 and amounted to 0.06 per cent and –1.89 per cent, respectively.

Sector-by-sector findings

ENERGY

Reference approach

General comment

For the reference approach, the quantities of coking coal exported in 1997 and 1998 were higher compared to the sum of the amount produced, amount imported and stock changes (see also comment under comparison with international data) resulting in an apparently negative consumption for primary solid fuels.

New Zealand stated that its estimates in the reference approach are made from two sources in the solid fuel sector: Statistics New Zealand and the coal producers "Crown Minerals". The Party noted that there is a problem in the current methodology used due to the fact that the two information providers have a different breakdown for ranking coal products. This hinders the reporting of coking coal which is currently reported in combination with "other bituminous". The Party noted that this problem is predominantly linked to the fact that there are strict confidentiality agreements within the industry.

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. There is a difference of only -0.02 per cent between the estimates.

Comparison with international data

The reference approach energy data for 1998 correspond very closely to the IEA data (only 0.4 per cent lower). Specific differences include the following:

- Natural gas production in the CRF is 19,363 TJ (11 per cent) higher than the IEA data.
- LPG production in the CRF should probably be shown in Natural gas liquid (NGL) since theoretically LPG should only be a secondary product.
- No stock changes for solid fuels have been provided in the CRF.
- The CRF shows bitumen and refinery feedstocks imports, while IEA data show also imports of lubricants, petroleum coke, white spirit, paraffin waxes and "other oil".
- No data for biomass have been included as memo items in the reference approach.

New Zealand explained that the difference between the CRF and the IEA is linked with the fact that the IEA reports the energy rather than gross energy which is what was reported in the CRF[18].
New Zealand accepted the comment that LPG should be shown in NGL and stated its intention to implement this change in the CRF.
New Zealand informed that no stock changes for solid fuels are accounted for due to the current methodology used in New Zealand for reporting coal production.
The Party also stated that Bitumen and "other petroleum products" have been conglomerated in its reporting.
The Party expressed that the data for biomass which have not been included as memo items have been omitted. This is a reporting error, as this category is reported within the NIR.

In 1990, where the CRF data were 5.6 per cent higher than the IEA, the same differences mentioned above appear. The growth in total apparent consumption in the CRF between 1990 and 1998 was 21.3 per cent and for the IEA data it was 28 per cent.
The Party acknowledged the differences between the CRF and the IEA and stated that these differences are under investigation.

Key sources
Fuel combustion

- 1.A.1.b Energy industries - Petroleum refining: the CO_2 implied emission factor (IEF) from liquid fuels for 1998 has a higher value (74.82 t/TJ) compared to the IEF for other activities of the Energy sector (range: 60.70 – 69.40 t/TJ). This IEF is consistently calculated as higher than 73 t/TJ for the years 1990 to 1998. The largest emission factor mentioned in the NIR is 72.9 t/TJ for "other liquids".
  The Party stated that the way the CRF calculates the emission factors differs from that used to report the emission factors in the NIR. The Party explained that the large differences that occur within the "other liquids" section come from the fact that different proportions of the two fuels included in the "other fuels sector" namely, fuel oil and asphalt, vary in use from year to year. These two fuel types have emission factors of 72.5 and 75.2. The emission factors for the fuels used in New Zealand come from the New Zealand Energy Information Handbook, Baines J.T. , 1993.

- 1.A.2 Manufacturing industries and construction:
  - The CO_2 emissions from gaseous fuels used for this category excluded carbon stored in final products (methanol, synthetic petrol, ammonia and urea). This appears to be the reason for lower values of the CO_2 IEF (range: 31.25 - 39.69 t/TJ for the years 1990 to 1998) which are the lowest among the values from the other Parties and lower compared to the IEF calculated for 1.A.1 energy industries and 1.A.4 other.
  - The CO_2 IEF from solid fuels in 1998 for this category had a lower value (90.43 t/TJ) compared to the IEF for the years 1990 to 1997 and compared to the IEF for other activities of the energy sector (91.2 t/TJ as also mentioned in the NIR).

  The Party stated that those variations come from the fact that the steel emissions are a direct emissions measurement and the electricity emission factor in New Zealand is 92.99. The Party explained that this occurs within the CRF as a variable emission rate,

[18] In its CRF, New Zealand informed that net calorific values were used instead of gross calorific values.

however the issue of there being several different emission factors in place in the data sets from different sectors causes this problem. The Party also explained that these variations are related to the breakdown of the reporting within the CRF of the methodology.

- 1.A.3 Transport: activity data were not reported for any subcategories (reported as "NE"), i.e. civil aviation, road transportation, railways and navigation, although emission estimates were provided for them. However, the aggregate IEF for gasoline and diesel oil for the transport sector of New Zealand was the second lowest IEF of CO_2 and among the lowest IEF of N_2O for both fuel categories compared to the other Parties. The NIR provided emission factors for different fuels used in the Energy sector and a reference to the source of these emission factors. The changes in IEF cannot be assessed, but emissions are slightly increasing.
  New Zealand explained that this lack of reporting is related to the current format in which the Statistic Service Survey is carried out. The current methodology is a top-down approach which aggregates all fuels by industry. This approach will be subsequently amended to account for the individual subcategories. The Party also noted that the accounting for unoxidised carbon – 1 per cent of the emissions results in a lower IEF[19].
  New Zealand stated that nitrous oxide emissions from domestic transport have been assessed in a New Zealand study "Oxides of nitrogen study" (NOx emission levels from the New Zealand Transport Fleet with Special reference to Greenhouse Gas Warming), DSIR Industrial Development, June 2001.

- 1.A.3.a Civil aviation: activity data were not reported and consequently no IEF were calculated. Activity data (aviation fuel) is reported as aggregate data (together with fuel oil and LPG) under "other fuels". However, the NIR provided information on the amount of fuel consumed and the emission factors for 1998.
  The Party explained that this occurred as an error but in fact the fuel is included in the "other fuels " section in 1.A.3. The Party noted the reporting of the aviation fuel types used in New Zealand against the IPCC standards.

Fugitive emissions

- 1.B.1 Fugitive emissions from solid fuels: the aggregate CH_4 IEF for underground mines subcategory mining activities (24.43 kg/t) has the largest value among the reporting Parties. This value was higher compared to the default maximum value suggested by the IPCC. Emissions of CH_4 have increased significantly through the period reported. The NIR provided additional information on emission factors used for bituminous and sub-bituminous coal.
  The Party explained that this high figure for solid fuels for underground mines comes from the combination effect of two source types (bituminous – country-specific emission factor of 35.3 and sub-bituminous value of 12.1). The Party also explained that the ratio of these sources varies from year-to-year explaining the identified variations.

- 1.B.2 Fugitive emissions from oil and natural gas: the majority of CO_2 and CH_4 emissions come from flaring and geothermal activities. Activity data for these categories

[19] This is in line with the IPCC Guidelines and it is therefore expected that all Parties follow this approach.

were not provided in the CRF and consequently no IEF were calculated. However, the NIR provided information on the activity data and emission factors for 1998. Emissions have not been reported from oil and gas extraction, although New Zealand extracts oil and gas according to international statistics (IEA). Emissions of N_2O from flaring have not been estimated.

The comment on the flaring and geothermal activities has been noted by the Party which stated that these specific details will be addressed in future inventories, as well as the estimation of nitrous oxide emissions from flaring.

Non-key sources

1.A.3 Transport - road traffic: the value of IEF of CH_4 (gasoline vehicles) is among the highest compared to the other Parties.

New Zealand stated that the methane emission factor of 60 in gasoline vehicles comes from a Ministry of Transport report "Greenhouse Gas Emissions from New Zealand Transport" Beca Carter Hollings and Ferner Limited, November 1993.

INDUSTRIAL PROCESSES

Key sources

- *2.C.1 Iron and steel production*: The CO_2 IEF varied from year to year within a range of 1.8064 t/t to 2.0714 t/t for the period 1990 to 1998.
- *2.C.3. Aluminium production*: the CO_2 IEF for 1997 and 1998 was lower compared to the values for the period 1990 to 1996.

For these two cases, the NIR provided a reference for the source of production and emissions data.

New Zealand explained that the variation within the IEF in iron and steel is linked to the variation in the reporting of the coal sources which is linked to the reporting the coking coal in New Zealand. The Party also explained that IEF varied due to the fact that steel emissions are direct measurements.

2.F Consumption of halocarbons and SF_6:[20] Data were not provided in the CRF as only potential emissions for HFCs and PFCs were reported.

New Zealand stated that consumption of SF_6 reported in the CRF are actual emissions.

AGRICULTURE

Key sources

4.A Enteric fermentation - CH_4

- The CH_4 IEF from the reported animal categories were higher compared to the corresponding IPCC default values. Particularly for sheep, New Zealand's CH_4 IEF was the highest value across all Parties. The NIR provided a reference to the source of the emission factors used for different livestock types.

[20] "2.F. Consumption of halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to its expected rapid increase, is likely to be a key source in many countries using the trend assessment.

The Party explained that emission factors for ruminant animals take into account part of the year when the adult will be accompanied by its offspring, which are not captured in the annual statistics.

- 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.
  The Party explained that no New Zealand emission factors are available[21] for the other not reported livestock types and stated that this gap will be rectified in the future. It also noted that selected livestock classes in the national inventory represent most of the emissions.

- IPCC tier 1 method has been used for CH_4 from category 4.A Enteric fermentation.

4.D Agricultural soils - N_2O

- ***IPCC default methods have been used for N_2O from category 4.D Agricultural soils. The Party explained that it used IPCC default methods, but with New Zealand specific emissions factors where these exist.***

4.D.1 Agricultural soils, direct soil emissions - N_2O

- 4.D.1.1 Synthetic fertilizers: an annual increase of 12 per cent in activity data in 1992 was reported.
  New Zealand explained that there has been a gradual increase in synthetic fertilizer use from 1990 to 1998. The Party recognized that there was a slightly larger increase between 1991 and 1992 than the other years in the time series, and note that there may have been a year when farmers had enough surplus income to enable them to buy more fertilizer.

LAND-USE CHANGE AND FORESTRY

Tables 5.A to 5.D of the CRF have not been provided, as a national methodology was used to estimate emissions and sinks from this sector. However, the NIR contained worksheets with data and emission factors used to estimate emissions and removals for this sector. These worksheets were consistent with the IPCC Guidelines.

5.B Forest and grassland conversion: temperate shrublands (reported under "other"): annual fluctuations of -55 to +56 per cent between 1990 and 1998 in CO_2 emissions.
The Party explained that this is a true fluctuation in that it reflects changes from year to year, which can be expected, as this kind of land is not always planted each year. Some years there will be more scrub clearance than others. Emissions are reported from scrubland planting cleared for forest planting. The Party explain that this data varies because it depend on two other variables – the area of land planted and the amount of the land planted.

[21] The IPCC Guidelines provide default emission factors for other types of livestock when national emission factors are not available.

WASTE

Key sources

- *6.A Solid waste disposal on land:* the CH_4 IEF for 1998 from managed waste disposal on land appears low (0.03 t/t MSW). This IEF has gradually decreased to such a low value starting from a value of 0.05 t/t MSW in 1990 due to an increase in the amount of CH_4 recovered.
  The Party stated that New Zealand's per capita methane emissions from solid waste disposal on land seem to be similar to those of other counties with similar national circumstances – e.g. Australia and Norway. There may be no reasons for considering the implied emission factor as "low".

- Activity data and other additional information for solid waste disposal were not provided in the CRF. However, the NIR provided the relevant information used for 1998 emission estimates.

Non-key sources

- *6.B Waste-water handling:* CH_4 emissions per capita from waste-water handling appear high. In addition, activity data and other additional information for this category were not provided in the CRF. However, the NIR provided the relevant information used for 1998 emission estimates.
- *6.C Waste incineration:* N_2O from waste incineration was not estimated and the cell for CO_2 was left blank for the same source. However, information provided in the Completeness table suggests that a very small amount of waste incineration takes place and the associated CO_2 emissions are very small.

NORWAY

General

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

Norway submitted inventory data for the year 1998 using the CRF and included almost all requested tables. The CRF was accompanied by an NIR that included summary information on methodologies used and a description of the self-verification procedures. References to methodologies, activity data, emission factors and measurements were also included.

Consistency of information between the CRF and the NIR

The data that were provided using the CRF in electronic format were reproduced in the NIR. No major differences between the information provided in the CRF and NIR were identified.

Verification procedures

The NIR provided information on internal verification of the greenhouse gas (GHG) inventory data. It contained sections on suitability of methods, emissions data and uncertainty/problems during the verification procedure.

Time series consistency

In-depth analysis was not possible, since only data for 1998 were provided in detail. Emissions data in the trend table do not indicate any notable annual fluctuations in national totals.

- For *4.D Agricultural soils*, CO_2 emissions for the years 1990-1998 have the same value.

Norway stated that in the 2001 submission data for the base year 1990 will also be provided in full detail. Intermediate years will not been reported in the 2001 submission 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. The goals for next year's reporting will be considered on the basis of, inter alia, the results from this assessment.

Comparison with previous submissions

Norway provided recalculated estimates (Tables 8 (a)) and explanatory information for these recalculations (Tables 8 (b)) only for the years 1990 and 1997.
The effect of the recalculations was an increase of approximately 0.24 per cent in the total CO_2 equivalent emissions without land-use change and forestry for the base year (1990). This percentage becomes 0.29 per cent if land-use change and forestry is taken into account. For the year 1997, the effect of the recalculations was –0.56 per cent and –0.79 per cent, respectively.

Sector-by-sector findings

The analysis of trends in implied emission factors (IEF) and activity data was hampered due to lack of data for the years 1990 to 1997. Sectoral background data tables were only provided for 1998.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

There is a difference of 2.3 per cent between the CO_2 emissions calculated using the reference approach and the sectoral approach. An explanation for this difference was provided in the documentation box.

Comparison with international data

The reference approach energy data for 1998 are 11.6 per cent higher than the data reported to the IEA. Apparent consumption of liquid fuels is 16.3 per cent higher in the CRF, consumption of gaseous fuels is 4.7 per cent lower, while consumption of solid fuels is comparable. Specific differences include:

- Production of crude oil and NGLs is 80,927 TJ lower in the CRF (1.2 per cent).
- Exports of liquid fuels are 121,731 TJ lower in the CRF (1.9 per cent). Differences in exports of crude oil, NGL, gasoline and LPG are especially high.
- Production of natural gas is 186,099 TJ higher in the CRF (10.8 per cent).
- Exports of natural gas are 177,244 TJ higher in the CRF (11.4).
- Jet kerosene used in international bunkers is 11,207 TJ in the CRF and 21,893 in the IEA data.

Norway explained that it is currently working on a project funded by Eurostat to explain, and possibly improve, the reporting of energy data used as a basis for CO_2 estimates. Norway has a huge upstream oil and gas sector. This means that small errors in the reference approach can have a large effect on the CO_2 estimated. The classification of fuels as natural gas, crude oil, NGL, gasoline and LPG is problematic, and can explain differences on which comments were made concerning exported volumes. Norway believes that the sum of all exported products is quite correct. Natural gas production reported in the reference approach equals net production plus gas combusted (with the exclusion of flaring). In the project mentioned above, Norway will check the data reported to IEA and compare them with those used in the inventory.
Jet kerosene bunkers reported to IEA include all fuel sold. The data used in the reference approach (and in the sectoral approach inventory) is used for domestic aviation; the bunkers are reported as total sales minus domestic aviation consumption.
The large statistical error in the energy balance indicates the discrepancies between the production and export of energy and the end use. The situation of Norway, with its complex upstream oil and gas sector, implies that the estimates made from the sectoral approach are far more reliable than those from the reference approach. The energy statistics division at Statistics Norway is currently working to improve the data and its reporting to the IEA.

Key sources

Fuel combustion

- Stationary combustion - liquid fuels: the CO_2 IEF varied among the various categories reported (range: 57.32 – 80.13 t/TJ).
  Norway explained that this variation is due to different fuels being listed in different categories. According to the reporting instructions, fuel gas and petrol coke are both to be reported under "liquid fuels", together with heating oil, etc. The category

"Chemicals" with the 57.32 IEF value uses an excess gas which has a lower CO_2 emission factor than, for instance, heating oil.

Fugitive emissions

- No information was provided on methodologies used for estimating CO_2 emissions from 1.B.2 Fugitive Emission for oil and natural gas. (The IPCC Guidelines do not contain calculation methods for this sector.)
  Norway explained that for combustion emissions (for instance, flaring) the CO_2 emission is calculated from a combination of fuel consumption and emission factors. Other CO_2 emissions reported are the result of the assumption of oxidation of NMVOC and CH_4 in the atmosphere. Norway does not report any direct CO_2 emissions from oil and gas activities. In the 2001 submission such emissions will be reported from one field.

- The CH_4 IEF for Transport of crude oil was three times higher compared to the IPCC default emission factor. (Additional information was provided in the documentation box.)
  Norway explained that transportation by tanker (which is the case from many oil fields in Norway) result in large quantities of fugitive emissions compared to transportation by pipeline. This is due to losses during loading of the tankers. The emission factors used are based on high quality studies.

- Fugitive emissions from production of oil and gas have not been reported.
  Norway explained that fugitive emissions from the production of oil and gas are included in 1. B. 2. c. Venting.

- Methane emissions from refineries have not been reported.
  Norway explained that, up to the 2001 report, it has not reported CH_4 emissions from refineries. This is because refinery plants have not reported emissions. In this year's report, refineries have reported CH_4 from refinery processes. These emissions will be included in next year's reporting.

Non-key sources

- Stationary combustion - gaseous fuels: the CH_4 IEF (21.37 t/TJ) was the highest among the reporting Parties.
  Norway explained that the emissions reported under 1.A.1 (gaseous fuels) are from the offshore oil activities. Norway does not use the IPCC default emission factor but uses an emission factor provided by the oil industry itself (OLF).

Bunker fuels

- Emissions (CO_2) from aircraft bunkers differ from those published by IEA.
  According to Norway, its reporting to IEA is not correct (See explanation under "Key sources – fugitive emissions"). The data used in the inventory are considered accurate (based on surveys and sales statistics).

INDUSTRIAL PROCESSES

Key sources

- *2.A.1 Cement production – CO_2:* Activity data were not provided due to confidentiality. However, emissions are consistent with the value for cement production published in UN statistics.
- *2.B.1 Ammonia production:* Activity data were not provided due to confidentiality.
- *2.B.2 Nitric acid production:* Activity data were not provided (no indication why).
- *2.B.4 Carbide production:* Activity data for calcium carbide were not provided (no indication why).

  As for activity data, Norway explained that data from Statistics Norway are used in its estimation of emissions. These data are, however, confidential when the total emissions consist of inputs from three or less factories.
  The Norwegian Pollution Control Authority (SFT) produces activity data for some factories that is available from public sources. These data are, however, not intended for use in connection with the estimation of emissions and, consequently, reporting these data could be misleading.

- *2.C.3 Aluminium production:* In the CRF it was indicated that the CO_2 IEF was based on use of petrol coke, coal electrodes etc. However, the CO_2 IEF was lower (1.79 t/t) than the IPCC default value (3.6 t/t) for petrol coke and prebaked anodes and coal electrodes.
  Norway explained that the figures for the consumption of coke, coal electrodes, etc. was erroneously doubled. That led to a halving of the emission factor in the CRF file, since the CO_2 IEF was calculated by a formula in the file. This is corrected in the 2001 submission.

- *2.C.3 Aluminium production – PFCs:* In the NIR it was indicated that CF_4 and C_2F_6 emissions were based on emission measurements carried out at plants in Norway. The ratio between CF_4 and C_2F_6 emissions (26.1) is the highest of all countries (usually 10). In 1998, these emissions were about 58 per cent lower compared to the 1990 levels (see also NIR).
  Norway stated that new measurements have shown that the ratio between CF_4 and C_2F_6 now is about 16 per cent. This ratio will be used in next year's reporting.

- *2.C.4 SF_6 Used in aluminium and magnesium foundries:* The value of the SF_6 IEF (for Magnesium foundries) was 0.46 kg/t. There was no information on SF_6 recovery. (In the IPCC Guidelines, it is assumed that emissions are equal to the consumption of SF_6.)
  Norway explained that the factor of 0.46 kg/t refers to emissions per ton of magnesium produced. The ratio between emissions and input of SF_6 is 1000 (kg/t), which indicates that there is no recovery of SF_6.

Non-key sources

- *2.F Consumption of halocarbons and SF_6*:[22] Ratios of potential and actual emissions of total HFCs (5.2), C_3F_8 (18.1) and total PFCs (18.1) are the highest of all countries. ***Norway believes that the composition of source categories and types of HFC gases varies greatly among countries. Norwegian emissions are characterized by relatively well-kept equipment with low leakage rates. Norway also has a well-established system for the recovery and recycling of cooling agents. The Norwegian tier 2 approach is relatively detailed and should be rather accurate. This model also takes into account the recycling of media, and the amount of recycled media is subtracted from the quality of emissions reported.***

AGRICULTURE

Key sources

4.A Enteric fermentation

- IPCC tier 1 default methods and emission factors were used to estimate CH_4 emissions from enteric fermentation.
- For sheep, the reported activity data were higher than the corresponding value from the FAO (12 per cent difference), while for swine, reported activity data were lower (8 per cent difference).

  Norway explained that the activity data used are considered to be the best available. Some activity data were revised before the 2001 submissions, after a review of all activity data used for reporting emissions from agriculture. Discrepancies between data sources may occur due to different counting periods (the number of sheep is highest in the summer) and lifetimes (short for swine).

- Under this category, CH_4 emissions from humans were also reported. ***Norway explained that CH_4 emissions from humans were erroneously reported (also in the 2001 submission), but will be corrected in the 2002 submission.***

4.D Agricultural soils; 4.D.1 Direct soils emissions and *4.D.3 Indirect emissions*

- IPCC default methods were used. Both IPCC default and country specific emission factors were used.
- For the fraction of synthetic fertiliser N applied to soils that volatizes as NH_3 and NOx (FracGASF) the value reported is relatively low (0.5) compared to the IPCC defaults (1.0) and those reported by most other Parties.

  Norway explained that it has a model to estimate emissions of ammonia. The fraction to volatize is very dependent on the type of fertilizer used. The type used in Norway has a lower factor compared to types used in some other countries (e.g. those using urea).

[22] "2.F. Consumption of halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to its expected rapid increase, is likely to be a key source in many countries using the trend assessment.

Non-key sources

4.B Manure management

- The CH_4 IEF for sheep (0.63 kg CH4/head/year) was approximately 3 times higher than the corresponding default IPCC value for the climate region 'cool' (0.19 kg CH4/head/year) and was the highest among all reporting Parties.
  Norway explained that it uses an MCF value of 5 per cent, following advice from agricultural experts. This is, however, higher than recommended in the IPCC manual. The other parameters used correspond well with suggested values. One explanation for this could be that in Norway, in contrast with most other countries, sheep are kept indoors for part of the year. This practice leads to manure being stored and, consequently, different rates of emissions.

- 4.B Manure management – CH_4 emissions: information on activity data and other parameters for additional livestock types that were not included in the pre-defined list of the CRF table 4.B (a) was provided in a separate data sheet (Appendix to the NIR).
- Data for N_2O from this source category were not reported (table 4.B (b) not provided).

  Norway explained that it meant to report N_2O emissions from this source category under Agricultural soils. The methodology is complex and there may be smaller sub-sources that have not been reported according to the guidelines.

4.D Agricultural soils

- CO_2 emissions from a liming of agricultural soils were included in this category.

LAND-USE CHANGE AND FORESTRY

CO_2 removals were reported only for category 5.A Changes in forest and other woody biomass stocks, namely for 5.A.3 Boreal forests. Emissions and removals from this category were not reported separately in table 5; instead only the net CO_2 removals were reported. As Norway uses a country-specific methodology, sectoral background data tables 5.A to 5.D of the CRF were not provided. However, calculations of uptake by boreal forests were given in a separate data sheet.

WASTE

Key sources

- *6.A Solid waste disposal on land – CH_4:* The CH_4 recovery reported (20,904 Gg) appears high (likely units problem).
  Norway confirmed that this is due to a unit error. The correct number should be 20.904 Gg.

Non-key sources

- *6. B Waste-water handling - CH_4:* CH_4 emissions per capita from waste-water handling (0.09 kg/capita) appear low; however, activity data were not reported in the CRF.
  Norway explained that, in principle, the IPCC default methodology is used. However, only about 2 per cent of the waste water is treated anaerobically, so this is considered to be a very small emission source, and the calculation methods have therefore not been evaluated in detail.

- *6. C Waste incineration:* Emissions from waste incineration were not reported, but emissions were included under 1.A.1.a Energy industries. Table 6.C, though, did not include "included elsewhere" (IE) notation.
  Norway explained this by the fact that energy is utilized when incinerating municipal waste.

SLOVAKIA

General

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

Slovakia submitted its GHG inventory for the year 1998 using the CRF, and included almost all requested tables. However, no information on recalculations and completeness, including relevant tables, was provided. Indicators were used in some sectoral and sectoral background data tables in a limited way. The NIR was not submitted, nor was any textual explanation on the numerical information. Partial numeric information for the years 1995 and 1996 was provided.

Consistency of information between the CRF and the NIR

Not applicable since neither an NIR nor any other additional information were provided.

Verification procedures

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

Time series consistency

Emissions in the trend tables do not indicate major fluctuations with the exception of reported CO_2 removals in LUCF. However, an in-depth analysis is not possible as only 1998 data were provided in detail. The removals in LUCF are reported to be of a magnitude of –2,426 Gg for the entire 1990-1994 period, thereafter they increased steadily to 4,233 Gg in 1996 and remained around the same level in 1997. In 1998 they suddenly dropped to –1,683 Gg. An explanation for this trend was not provided.

Comparison with previous submissions

The submission does not provide any information on recalculations. However, the figures of the national inventory for the year 1997 provided in the 2000 submission differ from those provided in the 1999 submission for the same year.

There are minor changes in almost all sectors for the 1995 and the 1996 estimates reported in previous submissions and those reported in the trend tables for these years in the submission for 2000. Large differences, more than 25 per cent, can be found in CO_2, CH_4 and N_2O emissions of industrial process. CH_4 emissions from manure management and N_2O of agricultural soils also changed significantly. For 1996, the total emission estimates of CO_2 (excluding LUCF) and CH_4 changed within a margin of 5 per cent, and those of N_2O changed by 28 per cent.

The most significant change of the values reported for the year 1996 in the two submissions is related to the estimates of CO_2 removals (-6,041 Gg in previous submission and –4,233 Gg in the 2000 submission). These values suggest that recalculations are needed when different methods, activity data and in some cases emission factors are used for estimating emissions in different submissions.

Sector-by-sector findings

The analysis of trends in implied emission factor (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 1997. Sectoral background data tables were only reported for 1998.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

There is a difference of 2.4 per cent in the CO_2 emissions estimates between the reference approach and the national approach. Although the difference is slightly higher than 2 per cent, no explanation was provided in the documentation box.

Comparison with international data

On an aggregate level, the 1998 reference approach energy data correspond well to the IEA data (1.8 per cent higher). Most of the difference comes from solid fuels, where consumption reported in the CRF is 5.1 per cent higher than the IEA data. Specific differences include:

- Coking coal exports are higher by 9,144 TJ or 16.7 per cent and other bituminous coal exports are higher by 3,053 TJ or 5.7 per cent.
- Lignite production is lower by 1,619 TJ, or 3.3 per cent in the CRF.

Key sources

Fuel combustion

- 1.A.2 Manufacturing industries and construction: no emissions were reported.
- 1.A.3 Transport, at source-category level (a, b, c, d): no IEF were calculated, except for liquid fuels from railways and navigation, as either only activity data or emission estimates were reported, but not both.
- 1.A.1.b Petroleum refining: zero emissions are reported for solid fuels, gaseous fuels, biomass and other fuels.
- 1.A.1.c Manufacture of solid fuels and other energy industries: zero emissions are reported for liquid fuels, solid fuels, biomass and other fuels.
- 1.A.1 Energy industries and 1.A.1.a Public electricity and heat production: the IEF for CO_2 from liquid fuels is smaller by around 50 per cent compared to the IEF used by all other countries, but one. No additional information was provided.
- 1.A.4 Other sectors: a similar problem has been identified with the similar IEF for CO_2 from liquid fuels.

Fugitive emissions

- 1.B.1.a: Fugitive emissions of CH_4 from Coal mining and handling is a key source. The IEF for underground mining is the second smallest (6.70 kg/t) among 11 Parties reporting emissions from this source, but is still within the range of the IPCC defaults.
- 1.B.2 Fugitive emissions of CH_4 from Oil and natural gas are also a key source. In particular, fugitive emissions from oil and gas production and refineries have been estimated, while emissions of CH_4 and other gases from venting and flaring have not been estimated.

Bunker fuels

- Separate estimates of bunker emissions were not provided.

INDUSTRIAL PROCESSES

Key sources

2.A.1 Cement production – CO_2: the IEF is the lowest among all reporting Parties and lower than the IPCC default value.

Non key sources

- *2.B.2 Nitric acid production*: N_2O IEF from this source is lower than the IEF of most other Parties and lower than the IPCC default value.
- *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.B.1 Ammonia production*: no data were reported for this source, although ammonia production data were available in the UN statistics.
- *2.F. Consumption of halocarbons and SF_6*:[23] information was not provided in the sectoral background data table 2(II).F.

Other comments

CRF and international statistics indicate the possible presence of aluminium foundries. However, neither SF_6 emissions nor notation keys were reported.

AGRICULTURE

Key sources

4.A Enteric fermentation – CH_4

- For cattle, sheep and swine, reported activity data were lower than the corresponding values from the FAO (14, 28 and 14 per cent difference, respectively).

4.D.1 Direct soil emissions – N_2O

- For N-fixing crops and Crop residue the unit of the N_2O IEF refers to kg N_2O-N/ kg N rather than to kg N_2O-N/ kg dry biomass.
- For the fraction of N input to soils that is lost through leaching and runoff (FracLEACH) the value reported is relatively low compared to the IPCC defaults and those reported by most other Parties.

Non-key sources

4.D.3 Indirect emissions – N_2O

- N_2O IEF for Atmospheric deposition is lower by approximately a factor of 10 compared to most other counties.

[23] "2.F. Consumption of Halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

LAND-USE CHANGE AND FORESTRY

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

- Data for this category reported in Table 5 differ from data reported in table 5.A.
- Comparison of data reported for Area of forest/biomass stocks with the FAO 2000 total forest cover figures reveals a difference of approximately 13 per cent (1.9 compared to 2.2 Mha in CRF)

5.D. CO_2 Emissions and removals from soils, Cultivation of mineral soils: the soil type was not specified.

WASTE

Key sources

6.A Solid waste disposal on land – CH_4

- All emissions from this sub-category 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 Waste-water handling - CH_4

- CH_4 per capita emissions from waste-water handling appear high (roughly 5-10 times than for most of the countries).
- CH_4 emissions from waste-water handling declined rapidly in 1991-1993. No explanation on this was provided.

Non-key sources

- *6.A Solid waste disposal on land* – N_2O emissions from this category were reported in the trend tables, but no such information was reported in the sectoral tables for 1998.

SPAIN

General

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

Spain provided partial inventory data for 1990 to 1998 using the CRF. The CRFs provided were incomplete in that only summary, recalculation and trend tables were provided, as well as the table on the reference approach and the sectoral table on HFCs, PFCs and SF_6 (table 2(II) of the CRF). Indicators have not been used and in many cases just 0 was reported.

An NIR has not been submitted, however, accompanying material was provided. This included explanatory information on the status of inventory preparation in Spain and the methodology used (CORINAIR SNAP97 except for HFCs, PFCs, SF_6 and for CO_2, CH_4 and N_2O from non-combustion activities where the 1996 IPCC guidelines were used) provided in four pages. In addition, a 3-page explanation (annex) on the methodological approach and data inputs used to estimate CO_2 from land-use change and forestry (category 5A) was provided.

Consistency of information between the CRF and the NIR

Not applicable in relation to the NIR. Inconsistencies in the information provided in the accompanied materials have not been identified (except that the use of indicators was mentioned in the accompanying materials but indicators could not be found in the CRFs).

Verification procedures

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

Time series consistency

In depth analysis was not possible since sectoral background data tables were not provided for any year (except the reference approach table). Emissions data do not indicate many notable annual fluctuations for national totals. However, where notable annual fluctuations were identified for specific sectors, these are indicated under the sector-by-sector comments below. In addition, for LUCF the same number was reported for all years 1990 to 1998. For agriculture (totals in CO_2 equivalent, CH_4 from enteric fermentation and N_2O from agricultural soils) the same numbers have also been reported for 1996 to 1998.

Comparison with previous submissions

Spain provided recalculated estimates (tables 8 (a)) and explanatory information (tables 8 (b)) for these recalculations for the years 1990-1995. However, the recalculation of CH_4 from oil and natural gas and solid waste disposal, and N_2O from rice cultivation, agricultural soils and waste is not explained in table 8 (b). In addition, for the recalculation of LUCF (5A) it is explained that in the previous submission the reported figure also included an estimate of soil carbon variation, while in the latest submission no soil carbon variation has been taken into account (it is not clear how this contributes to an improved estimate).

The effect of the recalculations for 1990 was an increase of 0.2 per cent in the total CO_2 equivalent emissions without land-use change and forestry. The change in CO_2 emissions was of 0.2 per cent, but for CH_4 and N_2O emissions were –24.41 and 41.21 respectively. The data provided in recalculation tables are in general consistent with the data provided in the 1998 submission. However, it was mentioned that industrial processes were not reported

in a disaggregated way, but for 1990 and 1995 CO_2 and CH_4 emission estimates from mineral products, chemical industry and metal production are available in the 1998 submission.

Sector-by-sector findings

The analysis of trends in implied emission factor (IEF), activity data and emissions at category levels as well as comparisons with other countries was hampered due to the lack of data for the years 1990 to 1998. Sectoral background data tables were not provided in most sectors.

Spain did not provide disaggregated data for most sectors because the corresponding sectoral background data tables were not reported. For this reason, key sources have been identified at the level of category disaggregation as provided in table Summary 1.A of the CRF, instead of at the recommended level of disaggregation by the IPCC good practice guidance. Therefore, the analysis of key sources presented below differs to that of other Parties.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

There is a difference of 2.4 per cent between the CO_2 emissions calculated using the reference approach and the sectoral approach. Although the difference is slightly higher than 2 per cent, an explanation was not provided in the documentation box.

Comparison with international data

Activity data for 1998 were not given in reference approach, so no comparison could be made.

Key sources

Fuel combustion

In accordance with the level of disaggregation mentioned above, the categories Energy Industries, Transport, Manufacturing Industries and Construction and Other sectors (commercial/institutional/residential, etc) constitute key sources for 1998.

Analysis is only possible for the reference approach because the sectoral background data table for the sectoral approach (1.A.(a)) was not reported. The sectoral background data table for CO_2 from fuel combustion using the reference approach (Table 1.A(b)) was provided for 1990-1996. Information for many fuel types was not included in the tables, as well as activity data on production, imports, exports, bunkers, and stock change. Carbon stored was also not reported. Coking coal emissions were reported for 1991 to 1994, but not for 1990, 1995 and 1996. For coke ovens, different carbon emission factors were reported for the various years which in all cases were lower (range from 24.6 to 25.3 tC/ tJ) than the IPCC default (29.5 t C/TJ).

Fugitive emissions

Fugitive emissions from oil and gas were estimated, but the corresponding sectoral background data table (1.B.2) was not provided.

Bunker fuels
Emissions (CO_2) from aircraft bunkers differ from data published by IEA.

INDUSTRIAL PROCESSES

Key sources
For *2.A Mineral products* and *2.B Chemical industry* emissions estimates were reported only at the summary level. No information was reported on activity data or implied emission factors, because the corresponding sectoral background data table was not provided.

For *2.E production of halocarbons and SF_6 - HFCs* the sectoral background data table was also not provided.

Non-key sources
In source category *2.F. Consumption of halocarbons and SF_6*:[24] disaggregated potential emissions were not reported due to confidentiality. Table 2(II) includes many zeros (less than half the unit in accordance with the UNFCCC reporting guidelines). It may be possible, due to the high GWPs of these gases, that when all these small amounts are converted into CO_2 equivalent, the resulting emission estimate could be significant. Large annual variations of emissions of this category, such as up to 72 per cent, are reported.

AGRICULTURE

Analysis of data other than emission estimates was not possible because activity data were not reported for any category in the agriculture sector and consequently, no IEF were calculated (Table 4 and sectoral background data tables 4.A to 4.F were not provided).

Non-key sources
4.C Rice cultivation: Large annual fluctuations in CH_4 emissions are noted, ranging up to 93 per cent in 1996.

LAND-USE CHANGE AND FORESTRY

Table 5 and sectoral background data tables 5.A to 5.D of the CRF were not provided. However, an explanation of the methodological approach and data inputs used to estimate CO_2 from category 5.A Changes in forest and other woody biomass stocks was provided separately.

[24] "2.F. Consumption of Halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

WASTE

Analysis of data other than emission estimates was not possible because activity data were not reported for any category in the waste sector and consequently, no IEF were calculated (Table 6 and sectoral background data tables 6.A to 6.B were not provided).

Key sources

6.A Solid waste disposal on land – CH_4

CH_4 emissions from solid waste disposal increased significantly from 1990-1998.

SWEDEN

General

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

The CRF was provided for 1998 and included almost all requested tables. In addition, the IPCC sectoral tables for 1990-1997 were provided. Indicators have been used only in a limited way in many sectoral background data tables.

An NIR has not been submitted, however, accompanying materials were provided. These included separate comments on sectoral reports (3 pages), methods (5 pages), methods for fuel combustion and industrial CO_2 emissions (4 pages), quality assurance/quality control (QA/QC) (1 page), explanation of the difference between CO_2 emissions estimates using the reference and sectoral approaches (1 page), Excel sheets on emission factors for fuel combustion and worksheets for agriculture and land-use change and forestry sectors.

Consistency of information between the CRF and the NIR

Not applicable since an NIR was not provided.

Verification procedures

The materials accompanying the CRF state that a specific verification procedure has not been established. The inventory is checked by the team responsible for the inventory.

Time series consistency

In-depth analysis was not possible, since only data for 1998 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:

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- CO_2 emissions from *1.A Fuel combustion* seem to be different for 1996 compared to all other years, especially for energy industries, other and international aviation.
  Sweden explained that the CO_2 emissions from 1.A Fuel combustion are different compared to all other years due to an unusually cold winter and a dry summer. Because of the cold winter there was a big demand for energy that year. Sweden is dependent on hydropower and with a dry summer there was a shortage of hydropower. All reserve power stations were used in 1996 because of the cold winter and dry summer.
- CO_2 emissions from *2.A Mineral products* seem to be different for 1995 compared to all other years.
  Sweden explained that the CO_2 emissions from mineral products in 1995 were wrong due to incorrect background data. Sweden indicated that this will be corrected in the 2001 submission.
- CO_2 emissions from 3 Solvents and other product use are substantially different in 1998 compared to all other years.
  Sweden explained that the CO_2 emissions from solvent use are differently reported for 1998 compared to all other years. The CO_2 emissions reported are a conversion of the NMVOC emissions to CO_2 done by the CollectER software. As the cell for reporting emissions from "Chemical products, manufacture and processing" (3C) in the CRF is grey, this estimate was not reported for 1998. For all other years this estimate is included.

- N_2O emissions have only completely been reported for 1990, 1996, 1997 and 1998. For the years 1991-1995 emissions for some source categories such as *4.A Enteric fermentation* and *4.D Agricultural soils* were not reported.
  Sweden explained that the N_2O emissions for the years 1991-1995 have not been recalculated in the submission in 2000 due to a lack of resources. Sweden indicated that this will be corrected in the 2001 submission.

Comparison with previous submissions

No recalculation tables were provided in the CRF. The checklist of the CRF (table 11) states that no recalculations have been made due to a lack of resources. There are minor differences for the base year between the data based on estimates for each GHG as reported in the 1999 and 2000 submissions. This may be influenced by the fact that the 1999 submission was reported as hardcopy only, rounded to full numbers, while the 2000 submission was electronically reported and included the decimal places.

Sector-by-sector findings

The analysis of trends in implied emission factor (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 1997. Sectoral background data tables were only provided for 1998.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

There is a difference of 13.9 per cent between the CO_2 emissions calculated using the reference approach and the sectoral approach. This difference is among the highest for the reporting Parties. An explanation for this difference was provided in a separate sheet, but not in quantitative terms.

Sweden indicated that this has been checked and revised estimates will be provided in the 2001 submission.

Comparison with international data

The reference approach energy data for 1998 are 1.8 per cent higher than the data reported to the IEA. Apparent consumption of liquid fuels is 3.1 per cent higher in the CRF, consumption of solid fuels is 6.4 per cent lower, while consumption of gaseous fuels is comparable. Specific differences include the following:

- Crude oil production is 11,809 TJ (1.4 per cent) lower in the CRF.
- There are 18,687 TJ of bitumen exports shown in the CRF that do not appear in the IEA data.
- No exports of jet kerosene are shown in the CRF – the IEA shows 19,486 TJ.
- The CRF shows a stock draw of crude oil and the IEA shows a stock build.
- The stock change of residual fuel oil is much lower in the CRF data.
- Peat production is 1,744 TJ (12.9 per cent) lower in the CRF.

Sweden explained that the difference in reported data between the CRF and IEA could be explained by the fact that in Sweden the data on petroleum balances is collected in cubic meters (normal). The total import of crude oil in 1998 were 23 447 874 m^3. This figure

was included in the reference approach in the CRF; the import figure is reported in TJ by the conversion factor 36,2585 TJ/m^3.
In the IEA questionnaire the import of crude oil is reported in tons, calculated by using the conversion factor 0,86 tons/m^3 (20 165 thousand tons). This figure is, in turn, converted to TJ by IEA, using the conversion factor 1,021 toe/tons (which is the same as 42,747228 GJ/ton). This gives data stored in the IEA database as 861 998 TJ and 36,7627 GJ/m^3. The difference between the two reporting mechanisms depends on different conversion factors.
For some reason, the import and export of Bitumen is not included in the IEA reporting, the data in the IPCC report are correct.
In the CRF, reported export of Jet kerosene was 655 TJ, and in the IEA report, 669 TJ. As for crude oil, the difference depends on different conversion factors. Sweden states that the IEA figure of 19486 TJ is unknown to them.
Changes in the stocks are made in different ways in the reporting systems, in the IEA report, the stock changes are calculated from the reports of the dealers of petroleum products and large users of petroleum products. In the CRF report the stock changes also includes statistical differences, which could occur from stock changes by smaller users and differences in received and delivered quantities reported by respondents.
Peat production is calculated from the use of peat in the energy sector and in industry. For 1998 there have been some problems with the respondents and the figure has been revised several times. The final revision was made in March 2001 and production is now recorded as 10,330 TJ.

Key sources

Fuel combustion

- 1.A.1. Energy Industries - CO_2: The IEF for gaseous fuels is considerable higher than the average of all other reporting Parties. This is due to the high emission factor in the public electricity and heat production subcategory, which is also higher than in most other Parties. Some cells have been left blank; they should probably be filled in with 'NO'.
- 1.A.2. Manufacturing industries and construction - CO_2. The IEF for gaseous fuel is the highest of all reporting Parties.
- 1.A.4.b. Residential - CO_2: The IEF for gaseous fuel is considerably higher than the average of all other reporting Parties.
- 1.A.4.c. Agriculture/Forestry/Fisheries-CO_2: The IEF for liquid fuels is considerably higher than the average of all other reporting Parties.
  Sweden explained that the IEF for CO_2 for gaseous fuels for the subcategories 1.A.1 "Energy Industries", 1.A.2 "Manufacturing industries and construction" and 1.A.4.b "Residential" are not correct because of wrong allocation of fuels to IPCC fuel categories. For example, all "gaseous" fuels (coke oven gas) are reported in the fuel category "Gaseous fuels" which is not correct. The same is valid for CO_2 IEF for the sub-category 1.A.4.c. "Agriculture/Forestry/Fisheries" where all "liquid" fuels have been allocated to the fuel category "Liquid fuels" which is not correct. Sweden indicated that this will be corrected in the 2001 submission.
- 1.A.3. Transport: In 1.A.3.a civil aviation, the IEF for jet kerosene is considerably higher than the average of all other reporting Parties. In 1.A.3.b Road transportation the IEF for diesel oil is considerable higher than the average of all other reporting Parties.
  Sweden explained that the IEF for CO_2 in subcategories 1.A.3.a "Civil Aviation" (jet kerosene) and 1.A.3.b "Road Transportation" (diesel oil) is incorrect due to incorrect reporting. Sweden indicated that this will be corrected in the 2001 submission.

In addition, Sweden indicated that the empty cells in the background tables for energy should be filled in with "NO".

Other comments

The top part of Table 1.A (d) on feedstock is empty. Documentation box on the bottom notes that non-energy use is included in 2.G. Other industrial processes.

Sweden stated that this will be corrected in the 2001 submission.

Fugitive emissions

1.B. Fugitive emissions from fuels have not been reported. In the overview table (table 7) it is mentioned that 'Presently no data are available'. According to international statistics, Sweden has coal production and refines crude oil. It is not possible to establish whether CH_4 fugitive emissions are a key source or not because they were not estimated.

Sweden states that in the 2001 submission emissions from "Solid fuel transformation" will be included.

Bunker fuels

The IEF for gas/diesel oil, residual fuel oil and jet kerosene differ substantially from the average of all other reporting Parties.

Sweden explained that as for the IEF in the subcategory 1.A.3 this is due to incorrect reporting and stated that this will be corrected in the 2001 submission.

INDUSTRIAL PROCESSES

Key sources

2.A.1 Cement production

- The CO_2 IEF is lower (0.44 t/t) than for most other Parties and lower than the IPCC default value (0.499 t/t).

  Sweden explained that the emissions from cement production are based on lime use instead of clinker production and changes in the stock of limestone might be an explanation for the low IEF. Sweden indicated that this will have to be checked for future submissions.

2.B.2 Nitric acid production - N_2O

- Activity data and emissions were reported but no IEF was calculated (formulas in CRF were deleted).

  Sweden explained that this was due to an error which will be corrected in the 2001 submission.

2.G Other industrial processes

- Includes mineral wool, toxic waste and non-energy purpose, but no activity data or other information was provided.

  Sweden stated that this will be corrected in the 2001 submission.

2.F.(a). Consumption of halocarbons and SF_6

- Only potential emissions are given for both types of emissions. The potential emissions may be considerably larger than the actual ones. This may affect the identification of other key sources. Accompanying information states that Sweden has initiated a project to calculate actual emissions for its next submission.

- The trend tables only cover 1998 for HFCs, PFCs and SF_6 and 1995 for SF_6.
  Sweden explained that only potential emissions are given for both types of emissions because of a lack of data. A study on the use of halocarbons and SF_6 has been conducted and the emissions will be reported in the 2001 submission. In addition, Sweden explained that the trend tables are incomplete due to a lack of data.

Non-key sources

2.C.1 Metal production

- CO_2 activity data for steel is provided but no corresponding CO_2 emissions are reported.
  Sweden indicated that this error in reporting will be corrected in the 2001 submission.
- CF_4 emissions from aluminium are reported. However, no SF_6 emissions from aluminium foundries were reported, and no notation keys were used.
  Sweden explained that no SF_6 emissions from aluminum foundries are reported because SF_6 is not used in aluminum foundries. Notation keys should have been used.

2.A.2 Lime production and *2.A.4 Other mineral products*

- Activity data were not provided (and therefore no IEFs were calculated) for lime production or "other" mineral products (glass production, production of explosives).
  Sweden indicated that this will be corrected in the 2001 submission.

AGRICULTURE

Key sources

4.A. Enteric fermentation - CH_4

- CH_4 IEF for dairy cattle is at the top range of all reporting Parties (154 kg CH_4/head/yr), and is also significantly higher than the IPCC default (100 kg CH_4/head/yr).
  Sweden explained that they used national emission factors. These are now under review to explain the difference or adjust the estimates.

4.B. Manure management - N_2O

- N-excretion rates for swine (8.7 kgN/head/yr) and sheep (5.8 kgN/head/yr) are relatively low compared to the IPCC default (20 kgN/head/yr).
  Sweden explained that the figures are weighted averages of subcategories (sheep and lambs etc.). The mix of animals (for instance a large proportion of pigs for meat production, which produce 9.5 kg N/year) may lower the average N-production.
- No data on pasture range and paddock are reported in table 4.B (b), but reported in table 4.D. [25]
  Sweden explained that they do not consider animal production of nitrogen from grazing animals as a manure management system.

4.D. Agricultural soils: 4.D.1 Direct soil emissions, 4.D.2 Animal production, and 4.D.3 Indirect emissions - N_2O

- IPCC default methods and emission factors used to estimate N_2O from this category.

[25] According to the IPCC Guidelines, N_2O emissions from daily spread and pasture range and paddock are to be reported under "agricultural soils". However, the IPCC estimation method for pasture range and paddock is the same as for other systems of manure management. The CRF takes into account these reporting requirements by not including N_2O emissions from daily spread and pasture range and paddock in the total for 4.B Manure management in table 4 of the CRF.

- *4.D.1.1 Synthetic fertilizers and 4.D.1.2 Animal wastes applied to soils:* N_2O IEFs are higher by a factor of 1000 compared to most other Parties.
- *4.D.2 Animal production*: N_2O IEF is higher by a factor of 1000 compared to most other Parties.
- *4.D.3 Indirect emissions, Atmospheric deposition and Nitrogen leaching and run-off*: N_2O IEFs are higher by a factor of 1000 compared to most other reporting Parties.
  Sweden explained that in table 4.D activity data for the referred categories were erroneously given in tons instead of kilograms as requested, but do not affect the estimated emissions. Sweden stated that this will be corrected in the 2001 submission.

LAND-USE CHANGE AND FORESTRY

CO_2 emissions/removals are reported only for category 5.A Changes in forest and other woody biomass stocks (temperate and boreal forests). Emission and removals from this category are not reported separately in table 5; instead only the net CO_2 removals are reported. Sectoral background data table 5.A was provided for reporting data of this source/sink category.

- Comparison of data reported for "area of forest/biomass stocks" with FAO 2000 total forest cover figures reveals a difference of approximately 19 per cent (27.1 Mha compared to 22.6 Mha in CRF)
- Carbon emission factor for 'Total biomass removed in commercial harvest' (0.05 t C/ t dm) is lower by a factor of 10 compared to other reporting Parties.
  Sweden explained that the amount of "Total biomass removed in Commercial Harvest" is wrongly reported and should be 29,720 kt and the "Carbon emission factor" should be 0,45 t C/t dm.

Other categories of the LUCF sector are reported as NE (Completeness table). For 5.B it was reported that this category is not relevant for Swedish conditions and that there are no statistics on this type of land conversion. In the case of 5.C and 5.D it was reported that very small areas of pastures and cultivated land have been abandoned since 1980 in Sweden (a rough estimate is provided: 20 kha since 1990).

WASTE

Key sources

6.A Solid waste disposal on land – CH_4

- Activity data and other additional information (Table 6.A) were not provided, consequently no IEF were calculated.
  Sweden explained that this is due to a lack of data and that it will be corrected in the 2001 submission.
- The accompanying information notes that waste has not been re-estimated since for the year 1995. The same value has been reported for the years 1995 through 1998.
  Sweden explained that this is due to a lack of data and that recalculated estimates will be provided in the 2001 submission.

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 explained that waste incineration is included in the energy sector and emissions from waste-water handling are considered to be negligible.

SWITZERLAND

General

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

The CRF was provided for 1998 and included all requested tables. Indicators have not been used in any of the tables. Instead information on any not occurring or not estimated source categories was provided in the documentation box of the corresponding sectoral background data tables. An NIR was not submitted.

Consistency of information between the CRF and the NIR

Not applicable since neither an NIR nor any other additional information were provided.

Verification procedures

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

Time series consistency

Emissions data in the trend tables do not indicate any notable annual fluctuations in national totals. However, an in-depth analysis of the trends was not possible, since only data for 1998 were provided in detail. Emissions trends for HFCs, PFCs and SF_6 were not provided, as values for 1990 to 1996 were not yet available.

Specific fluctuations in specific categories were noticed:

- CO_2 emissions from 1.A.1 Energy industries show a 35 per cent increase from 1990 to 1991, and then a 25 per cent decrease in 1993.
- CO_2 removals increase by 26 per cent in 1994 compared to the previous year.

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 1997.
The effect of the recalculations was a decrease of approximately 1.3 per cent in the total CO_2 equivalent emissions without land-use change and forestry for the base year (1990), and a 1.2 per cent decrease if land-use change and forestry is taken into account.

Sector-by-sector findings

The analysis of trends in implied emission factor (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 1997. Sectoral background data tables were only provided for 1998.

ENERGY

Reference approach

Comparison of the reference approach with the national approach

- There is a difference of 0.33 per cent in the CO_2 emissions estimates between the reference approach and the national approach. Although the difference is less than 2 per cent, an explanation was provided in the documentation box.

Comparison with international data

The reference approach energy data for 1998 are 25 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. These seem to be partially reported under secondary fuels in products such as gasoline, gas/diesel oil and residual fuel oil. Total liquid fuel imports are 32,557 TJ (5.5 per cent) lower in the CRF.
- Imports of natural gas (98,850 TJ in the IEA data) are not shown in the CRF.

Key sources

Fuel combustion

- 1.A.2.f Manufacturing industries and construction – other: Other fuels were reported (for cement, lime and glass production), but the fuel mix used was not specified.

Other comments

- The IEF for biomass combustion in other sectors (CH_4) is low compared to values reported from other countries.
- 1.A.1 Energy industries: Data for solid fuels were not reported.
- 1.B.1 Fugitive emissions from solid fuels have not been reported, but from international production statistics these are expected to be of minor importance in Switzerland.
- 1.B.2.d Venting and Flaring – Oil: The CH_4 IEF seems very low compared to the IPCC default (227 compared to 1000-3000 kg/PJ).

INDUSTRIAL PROCESSES

Key sources

- *2.A.1 Cement production:* The CO_2 IEF was higher than for most countries and higher than the IPCC default value.

Non-key sources

- *2.A.2 Lime production:* the CO_2 IEF was far lower than most countries and lower than the IPCC default value.
- *2.B.1 Ammonia production*: reported as only NH_3 emissions. No activity data, IEF or other information provided.
- *2.F Consumption of halocarbons and SF_6*:[26] The ratios of potential and actual emissions of consumption of HFC-32 (19.8) and C_5F_{12} (16.0) are the highest across all Parties. It was stated that this was "Preliminary data; detailed information 2001/2002".

[26] "2.F Consumption of Halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

- 2.*E Production of Halocarbons and SF_6*: No estimates have been reported for this source category. However, Summary 3 indicates the methods and emission factors used for estimating PFC and SF_6 emissions.

AGRICULTURE

Key sources

- *4.A Enteric Fermentation - CH_4*
  CH_4 IEF for Swine is the lowest among all reporting countries.

- *4.B Manure management - N_2O*
  Information on methods and emission factors used was not provided (Summary 3). Population data for sheep reported in table 4.B(b) differs from data reported in tables 4.A and 4.B(a).

- *4.D Agricultural Soils: 4.D.1 Direct soil emissions, and 4.D.3 Indirect emissions - N_2O*
  Information on methods and emission factors used was not provided (Summary 3).

Non-key sources

- *4.B Manure management – CH_4*
  CH_4 IEF for sheep is low compared to other countries and to the IPCC default.

LAND-USE CHANGE AND FORESTRY

CO_2 emissions/removals were reported only for category 5.A Changes in forest and other woody biomass stocks (5.A.2 temperate forests). Sectoral background data table 5.A was provided for reporting data of this source/sink category. Information on any other source/sink category of the land-use change and forestry sector was not provided.

- Table 5: Emissions and removals were not reported separately. Instead, only the net CO_2 removals were reported.
- Table 5.A: Values reported for 'average annual growth rate' are higher than those for the area of forest/biomass stocks. They are also higher by a factor of 1000 compared to other reporting Parties.
- Carbon emission factors for 'Total biomass removed in commercial harvest', 'Traditional fuelwood consumed' and 'Total other wood use' are higher than for other reporting Parties.

WASTE

Key sources

- *6.A Solid waste disposal on land – CH_4*
  No activity data and other related information were provided in Table 6.A; consequently, no IEFs were calculated.

- *6.C Waste Incineration – CO_2*
  Activity data for biogenic and non-biogenic and biogenic wastes were reported all together; consequently, no IEF for the various waste types were calculated.

Non-key sources

- *6.B Waste-water handling*: No activity data and other related information were provided in Table 6.B; consequently, no IEF were calculated.

UNITED KINGDOM

General

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

The CRF was provided for 1990 to 1998 and included all requested tables. Indicators were used appropriately. An NIR for 2000 was submitted on 17 April 2001 but was received too late to be included in the synthesis and assessment report. However, some comments explaining changes from previous submissions and departures from the IPCC Guidelines were provided with the CRF.

Consistency of information between the CRF and the NIR

No major differences between the information provided in the CRF and NIR were identified. However, for some sources and sink categories in land-use change and forestry, CO_2 emissions and removal estimates were differently allocated in table 5 provided in the CRF compared to the corresponding table provided in the NIR. This had, however, no implications on the total net CO_2 emissions/ removals from this sector.

Verification procedures

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

Time series consistency

Emissions data do not indicate any notable annual fluctuation for national totals. However, where notable annual fluctuations were identified for specific categories, these are indicated under the sector-by-sector comments below.

Comparison with previous submissions

The United Kingdom provided recalculated estimates (tables 8 (a)) and explanatory information for these recalculations (tables 8 (b)) for the years 1990 to 1997. However, for CH_4 from oil and natural gas, which was revised 8 per cent upwards for 1990 in the 2000 submission, no explanation could be found.

The United Kingdom explained that the increase in CH_4 emissions from oil and natural gas in 1990 is due to the addition of leakage from pressure mains. The explanation is stated on Table 8 (b) for 1.B.2.ii but has been incorrectly referenced as a CO_2 rather than a CH_4 emission.

The effect of the recalculations (as reported in the CRF tables) was an increase of 0.06 per cent in the total CO_2 equivalent emissions without land-use change and forestry for the base year, and 0.03 per cent if land-use change and forestry is taken into account.

Sector-by-sector findings

ENERGY

Reference approach

Comparison of the reference approach with the national approach

- There is a difference of 4.67 per cent in the CO_2 emissions estimates between the reference approach and the national approach, which is explained in the relevant documentation box.

Comparison with international data

The energy data used for the reference approach for 1998 are 2.0 per cent lower than the data reported to the IEA. Apparent consumption of liquid fuels is 3.3 per cent lower in the CRF, consumption of solid fuels is 4.2 per cent lower, while consumption of gaseous fuels is comparable. Specific differences include:

- Slightly lower crude oil and solid fuels production in the CRF.
- International bunkers of jet kerosene are 336,139 TJ in the CRF and 243,547 TJ in the IEA.
- International bunkers of gas/diesel oil are 48,689 TJ in the CRF and 60,493 TJ in the IEA.

In 1990, the same differences appear, but the CRF was 0.8 per cent lower than the IEA. The growth in total apparent consumption in the CRF between 1990 and 1998 was 3.0 per cent and for the IEA data it was 4.2 per cent.

The Party explained that data used in the reference approach and the main inventories are taken from the Digest of United Kingdom Energy Statistics 1999, published in August 1999. Some of the discrepancies may arise from different estimates used for marine and aviation bunkers (see below) and these account for 80,788 TJ (=CRF Bunkers-IEA Bunkers). The CRF apparent liquid fuel consumption is 3,139,610 TJ and so the bunkers discrepancy accounts for 2.5 per cent (i.e. 80,788/(3,139,610+80,788)), and partly explains the liquid fuel discrepancy.

Key sources

Fuel combustion

- Energy industries - gaseous fuels: The CO_2 implied emission factor (IEF) drops 7 per cent between 1992 and 1993. Between 1990 and 1998, this IEF drops 13.4 per cent (CO_2 emissions were 6 times higher in 1998 compared to 1990). Over the same period, the CO_2 IEF for liquid fuels drops
  2.0 per cent and the IEF for solid fuels by 3.7 per cent.
  The United Kingdom explained that variation in gaseous IEF is due to the rapid increase in mains gas used in power generation compared with the relatively constant consumption of unrefined natural gas 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 change in IEF for liquid fuels is due to the massive reduction (9-fold decline) in fuel oil consumption in power stations. As a result the IEF is affected since the carbon content of other fuels (e.g. petrocoke, OPG) is lower.
  The change in IEF for solid fuels is due to a variation in the reported calorific value of coal.

- Manufacturing industries and construction - solid fuels: CO_2 IEF for 1998 is the highest among all reporting countries.
  According to the Party, 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) sheet 4). IEF for coal is 93 t CO_2/net TJ and for coke & patent fuel 103 t CO_2/net TJ.

- Other sectors, agriculture, forestry, fisheries - solid fuels: CO_2 IEF for 1998 is the lowest among all reporting countries.
  The United Kingdom explained that the IEF quoted in other sectors is an aggregate of coal, anthracite and patent fuel. These have the IEF factors of 85, 92 and 97 t CO_2/net TJ respectively.

- N_2O from road transport: The IEF in 1990 (gasoline vehicles) is low compared to values from other Parties expected to have a comparable technology. IEF for 1998 equals other values calculated (IEF more than 5 times higher in 1998 compared to 1990).
  The United Kingdom clarified that the change in IEF for road transport reflects the penetration of catalytic converters. In 1990 the usage was lower than other European countries and subsequently penetration has been rapid.

Fugitive emissions

- 1.B.2 Fugitive oil and gas: emissions from flaring have not been reported separately; documentation box states that these are included in fugitive emissions from production.
- 1.B.2 Fugitive oil and gas: CO_2 and CH_4 emissions have been reduced in spite of increased production.
  The Party explained that Table 1.B.2 reports an estimate for flaring on oil and gas installations. It is not really meaningful to separate this into oil and gas fields as many fields produce both. The flaring estimate is reported under 1.B.2ciii Flaring combined and is not included in 1.B.2.a.ii Production.
  Venting emissions are included in 1.B.2.a.ii Production. Again it is not possible to split them into oil and gas fields and it is not possible to disaggregate them from other fugitives for the whole time series. The United Kingdom informed that in the 2001 submission venting data have been separated out and reported in 2.B.2.c Venting for 1995-99. The United Kingdom Offshore Operators Association (UKOOA) advises that newer installations and working practices are more efficient on fuel consumption and produce lower emissions. The industry maintains a database of statutory and non-statutory reported emissions and this confirms a decrease in atmospheric emissions of CO_2 and CH_4 despite increased production.

Bunker fuels

- Emissions from bunkers (aviation and marine) differ from data published by the IEA.
- Bunkers, aviation (jet kerosene) and marine (gas/diesel oil): Activity data (in TJ) differs from data published by IEA (28 per cent and 24 per cent difference, respectively) (see comments above).
  The United Kingdom explained that the differences between data reported to the IEA and UNFCCC are likely to result from differences in treatment of bunker and military fuels. The United Kingdom informed that it will investigate this and reconcile the data for the 2002 NIR.

Non-key sources

- Civil aviation (jet kerosene) and domestic navigation (gas/diesel oil): Activity data (in TJ) differs from data published by IEA (350 per cent and 16 per cent difference, respectively).
  The United Kingdom explained that the differences between data reported to the IEA and UNFCCC are likely to result from differences in treatment of bunker and military fuels. The Party informed that it will investigate this and reconcile the data for the 2002 NIR.

- IEF for CH_4 from biomass burning is among the highest values compared to other Parties.
  The United Kingdom explained that biomass refers to wood, straw, and poultry litter used for energy production. Emission factors are derived from CORINAIR, IPCC and USEPA. The high aggregate figure derives from emissions from electricity generation using biogas. This assumes an emission factor for a reciprocating gas engine of 0.69 t/TJ net taken from USEPA AP-42.

- IEF for oil loading is low compared to the value of Norway. It states that this is offshore loading only. It is unclear where onshore loading has been reported.
  The United Kingdom explained that CH_4 emissions reported are for offshore and onshore loading. However the activity data pertain to offshore loading only. The United Kingdom informed that this has been corrected in the 2001 submission where both activity and emission for onshore loading and offshore loading have been reported separately. The effective emission factors used are 0.043 t CH_4/kt for offshore and 0.013 t CH_4/kt for onshore. The estimates are based on UKOOA data.

INDUSTRIAL PROCESSES

Key sources

2.B.3 Adipic acid production - N_2O: IEF changed notably from year to year.
The Party explained that DuPont provide data on emissions from 1995. The plant was operated by ICI until 1994. The data from 1990-1994 include emissions from a small nitric acid plant integrated into the process. Data supplied from 1995 exclude the nitric acid plant and show more consistent emission factors. The 1998 emission factor is low because a newly commissioned nitrous oxide abatement plant was operating part of the year. The United Kingdom informed that in the 2001 submission the amounts of N_2O abated are separately stated.

2.A.1 Cement production - CO_2

- IPCC tier 1 method and default emission factors used (for entire category 2.A mineral products)
- Ratio of clinker (reported in CRF) to cement (UN data) is lower than for other Parties (CRF clinker production data aprox. 20 per cent lower than UN cement production data).
  The United Kingdom explained that the clinker data are supplied by the DETR and are published in Monthly Statistics of Building Materials & Components. In 1998 United Kingdom production was 12.37 Mt clinker and 12.41 Mt of cement. The difference in other years is wider but not as high as 20 per cent.

2.C.1 Iron & steel industry - CO_2

- Change of 153 per cent in emissions from 1993 to 1994.
- Steel production data is different from UN data.
- The IEF is low in comparison to other Parties and default IEF for the "iron & steel" category.
- Reporting of "other" (blast furnace gas flaring), particularly the reporting of negative emissions is not adequately explained.

The United Kingdom explained that the emission of CO_2 reported in this category is based on a 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 steel production data are from Iron and Steel Industry Annual Statistics for the United Kingdom.

2.E Production of halocarbons and SF_6 – HFCs

- All HFC emissions from this category have been reported under "By-product emissions - other" which include both by-product and fugitive emissions. Emissions were not reported by gas species, but were all reported under HFC-23 using an average GWP.
- Only limited information was available on IEF and the decline of IEF over time.

The United Kingdom explained that it does not report emissions dissagregated by gas because of the commercial sensitivity of the information provided by some industry sectors. Further information on the IEF will be provided in the NIR 2002.

Non-key sources

2.A.2 Lime production - CO_2: IEF is lower than default/other Parties. However, CRF indicates data is for "limestone consumed".
The United Kingdom explained that emissions are estimated from the limestone consumed in calcinations, as these data are available from an Office of National Statistics survey.

2.B.1 Ammonia production: Production data is significantly different compared to UN data and the IEF of CO_2 is significantly different compared to default/other Parties. There are noticeable changes in the IEFs in 1997 and 1998 with respect to earlier years.
The United Kingdom explained that some ammonia plant in the United Kingdom are integrated with other plant i.e. acetic acid, methanol. For example one plant does not emit any CO_2 since it runs on hydrogen supplied as a by-product from acetic acid manufacture. In another plant the CO produced is used to produce methanol. Hence emissions reported are the actual CO_2 emissions arising from the plant supplied to us by the plant operators. The activity data reported are the consumption of natural gas input to the ammonia process and the IEF reflects the carbon content of this natural gas that is eventually emitted to atmosphere.

2.B.2 Nitric acid - N_2O: Change of 31 per cent in emissions from 1994 to 1995.
The Party clarified that an abatement system for NOx was fitted to one of the plants in 1995 and also had the effect of reducing N_2O emissions. Emissions have also fallen due to plant closures.

HFCs, PFCs and SF6

- For reasons of confidentiality, the United Kingdom reported aggregate emissions for all HFCs, for all PFCs and for SF_6 and aggregated per source category 2.C Metal production, 2.E. Production of halocarbons and SF_6, 2.F Consumption of Halocarbons and SF_6,[27] instead of gas by gas and by subcategory except 2.F (a), which is further divided into sub-sectors. Sectoral background data tables are filled in the same manner.

AGRICULTURE

Key sources

4.A Enteric fermentation - CH

- CH_4 IEF for sheep is among the lowest compared to other Parties and is significantly lower than the IPCC default.
  The United Kingdom assumes an emission factor for lambs that is 40 per cent of that for adult sheep; so taking account of the proportion of lambs in the United Kingdom total will give a lowered IEF.

- CH_4 IEF for dairy cattle: 6 per cent increase from 1990 to 1998.
  The United Kingdom assumes a 1 per cent per year increase in the live weight of cattle, on the advice of MAFF statisticians, which results in increases in intake and yield and thus the IEF.

- CH_4 IEF for non-dairy cattle: 3 per cent decrease from 1997 to 1998.
  The United Kingdom explained that its own calculations find the IEF to be 42.82 and 42.88 for 1997 and 1998, respectively and not a 3 per cent decrease. There may be a transposition error that will be rectified in the next submission.

- CH_4 IEF for sheep: Fluctuations of -6 per cent to 8 per cent from 1994 to 1995.
  According to the Party there may have been a transposition error, as the figure 4.37 does not appear in the originator's spreadsheet. The United Kingdom stated that the 2001 submission calculates an IEF of 4.67.

- Emissions from poultry reported as zero.
  The Party explained that it uses the default IPCC emission factor of zero.

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

- N_2O IEF for cultivation of histosols seems too high by a factor of 100 compared to other reporting Parties.

[27] 2.F. Consumption of halocarbons and SF_6" was not identified as a key source in the level assessment. This source, due to the expected rapid increase, is likely to be a key source in many countries using the trend assessment.

The United Kingdom informed that this was a mistake that has been rectified in the revised CRF submitted for 1990 to 1999. The United Kingdom underestimated the area of histosols by a factor of 100, leading to the consequential overestimation of the IEF.

Non-key sources

- *4.B Manure management - CH_4*: CH_4 IEF for sheep is low compared to other reporting Parties and is also lower than the IPCC default.
  The United Kingdom assumes an emission factor for lambs, which is 40 per cent of that for adult sheep; so taking account of the proportion of lambs in the United Kingdom total will give a lowered IEF.

- *4.B Manure management - N_2O*: N excretion rate for swine seems low compared to the IPCC default.
  The United Kingdom explained that it uses United Kingdom -specific experimentally derived emission factors, in this case the work of Ken Smith at ADAS[28]. The United Kingdom will provide a general comment in the next National Inventory Report suggesting what criteria the United Kingdom uses when selecting emission factors that deviate from the IPCC defaults.

- *4.F Field burning of agricultural residues*: Emissions were reported from 1990 to 1993. Since then they have been reported as "not occurring".
  The United Kingdom clarified that burning crops as a means of residue disposal was banned in the United Kingdom in 1993 under the Crop residues (Burning) Regulations. A few crops such as linseed and oats are exempt from the regulation and under certain limited conditions can be burnt, taking into account the controls laid out in the Clean Air Act. The estimated amounts burnt are small and previous estimates suggest that their contribution would be approximately 0.01 per cent of the United Kingdom total of both CH_4 and N_2O. The latest information we have on crop residue disposal (J. Garstang, personal communication, 2000) relates to 1998 where 63 per cent was baled and removed from farms, 90 per cent of which was used for livestock bedding, with various other minor uses such as mushroom compost and power generation. The remaining 37 per cent are estimated to be incorporated into the soil with the amount burnt being too small to be considered in this analysis.

LAND-USE CHANGE AND FORESTRY

Tables 5.A to 5.D of the CRF have not been filled in as the IPCC default methods have not been used, except for liming of agricultural soils (5.D.3). However, explanatory comments on the methods and underlying data were provided in documentation boxes of tables 5.A and 5.D.

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

- CO_2 removals increase by 12 per cent in 1998 relative to 1990 (in temperate forests (5.A.2) the increase of the removals is 22 per cent).

[28] A copy of this paper was provided to the secretariat during the individual review of its GHG national inventory.

- CO_2 removals from harvested wood (5.A.5 Other): increase of 27 per cent in 1995 relative to 1994.

5.D CO_2 emissions and removals from soil:
- CO_2 emissions from cultivation of mineral soils (5.D.1): decrease of 17 per cent in 1998 compared to 1990.
- CO_2 emissions from Liming of agricultural soils (5.D3.): decrease of 28 per cent in 1998 compared to 1990 (annual changes fluctuate around -38 to +24 per cent).
- CO_2 removals from set aside (5.D.5 Other): large annual fluctuations, ranging from -90 to +300 per cent.

5.E Other: Under this category CO_2 emissions have been reported for "Peat extraction", "lowland drainage" and "upland drainage". CO_2 removals have been reported for "changes in crop biomass".
- CO_2 emissions from peat and lowland drainage decreased by 11 and 18 per cent respectively in 1998 relative to 1990.

The United Kingdom explained that for all the above categories in land-use change and forestry, changes in emissions are a result of increases or decreases in activity data.

WASTE

Key sources

6.A Solid waste disposal on land - CH_4
- IEF appears high compared to other reporting Parties.
  The United Kingdom explained that emissions are estimated using country-specific data and assumptions. It is not clear why other countries' IEFs are lower.

- MSW activity data appears to be low by a factor of 100 compared to other countries. Units need to be checked.
  The United Kingdom explained that reported MSW activity units are incorrect- Mt have been confused with Gg, hence the reported activity is 1000 times too low. The reported emissions are correct.

Non-key sources

6.B Waste-water handling
- CH_4 emissions from industrial waste-water have not been estimated (reported as NE).
  The United Kingdom explained that reported emission is based on a study on waste-water discharged to the public system. This will include domestic, commercial and industrial waste. It is likely that there is some treatment by private industrial operators so this would not be included in the estimate.

- N_2O from human sewage: protein consumption factor appears to have been reported low as an order of magnitude. N_2O emissions per capita from human waste appear to be low by an order of magnitude compared to many other Parties.
  The United Kingdom explained that there is an error in the units of the protein consumption data used to make these estimates. The data was believed to be on a per week basis rather than a per day basis; hence the estimate is too low by a factor of

seven. The United Kingdom informed that emission has been corrected in the 2001 submission.

UNITED STATES OF AMERICA

General

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

The CRF was provided for 1990 to 1998 and included all requested tables. Indicators were used appropriately. An 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 the CRF and the 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 explained that the United States report fossil fuel combustion emissions from United States territories and military fuel use under the category "Other"(1.A.5) and that the values reported in the CRF are consistent with the NIR. However, the NIR does not include separate estimates of domestic (versus international bunker) military fuel use emissions. Military emissions in the NIR are included with emissions of stationary and mobile source categories.

Verification procedures

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

Time series consistency

Emissions data do not indicate any notable annual fluctuations in national totals. Some large annual fluctuations or significant changes in trends are noted below:

- Other fuel combustion – CO_2 (1.A.5): the variability in year-to-year emissions is larger (as high as 9 per cent) than for other fuel combustion categories. These emissions include fuel consumption by the military and in the United States territories. The information provided in the NIR did not seem to provide clarification as to the reason for the level of fluctuations.

  The United States explained that the variability in CO_2 emissions reported under fuel combustion category "Other"(1.A.5) is primarily the result of fluctuations in marine bunker fuel data. The uncertainty in this data set is discussed in the Energy chapter of the NIR under Uncertainty, "International bunker fuels".

- Chemical industry - CO_2 (2.B): 17 per cent increase from 1995 to 1996 due to consumption data. The information provided in the NIR explained the collection method and source of such data.

  The USA further explained that CO_2 emissions from the chemical industry are solely produced from carbon dioxide consumption (i.e., use of CO_2 as a chemical feedstock such as in carbonated beverages). Fossil fuel feedstock emissions are currently accounted for in the Energy sector. The variation in the activity data is not significant given its uncertainty and this source category represents only 0.02 percent of United States GHG emissions.

- 1.A.4 Fuel combustion-other sectors (residential/commercial/institutional) - CH_4: larger variability than other years (18 per cent decline from 1996 to1997). Seems largely due to calculations of emissions from wood combustion in residential/commercial/institutional use. The inventory reports these emissions as one of the largest areas of uncertainty in CH_4 estimates from stationary sources.
- 4.C Rice cultivation - CH_4: 15 per cent increase in emissions in 1993-1994. Seems consistent with the variability in harvested areas year-to-year and the levels of uncertainty in calculations.
- 4.F Field burning of agricultural residues - CH_4 and N_2O: increases of 32 per cent and 37 per cent in 1993-1994, respectively - seems consistent with the variability in crop production reported.
- HFC-23: From 1996-1997 there was an increase of only 0.5 per cent – seems consistent with the reduction in emissions from production of HCFC-22 from 1996 to 1997 and continuing increase since 1995 of HFC-23 as an ODS substitute. However, detailed information on production of HCFC-22 and applied factors not provided due to confidentiality.

Comparison with previous submissions
Recalculation tables were not provided in the CRF (reported as "NA") but summary information as to major revisions in methodologies and data was provided in the NIR. However, in some instances where the summary did not provide explanations, data had to be checked against data in the previous inventory report.

Sector-by-sector findings

ENERGY

Reference approach
General comments
Because of differences in the fuel categories between the IPCC reference approach and the US energy balance, a modified reference approach and a comparison with the sectoral (national) approach were provided in a separate spreadsheet for the years 1995 to 1998.

Comparison of the reference approach with the national approach
The energy consumption and CO_2 emissions, as reported in the CRF, from the reference approach are 2.13 per cent and 15.48 per cent lower than the national approach. However, in annex O of the NIR, energy consumption is 2.0 per cent lower in the reference approach and CO_2 emissions from the reference approach are 0.8 per cent higher than the national approach. In annex O reasons given for differences include product definitions, data inconsistencies (more accurate consumption data), and carbon coefficients (default vs. category-specific). Detailed explanations of the results are provided in annex O of the NIR. The reasons for the differences in the information presented in the NIR and the CRF need to be looked at more closely.
The Party explained that the differences between the reference approach data provided in the NIR and that provided directly in the CRF are a result of an incomplete mapping of United States-specific fuel categories and carbon content factors into the CRF. The United States currently employed a more detailed reference approach including fuel types and carbon factors not included in the CRF. The Party noted that for the purpose of reviewing

the inventory the separate tables that were provided in the CRF and in Annex O of the NIR should be used.

Key sources

Fuel combustion

Energy data have been given on a gross calorific value basis. This means that the implied emission factors (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 were given on a net calorific value basis.

- CO_2 IEFs for liquid fuels throughout all categories in fuel combustion have decreased from 1990 to 1998.
  The United States explained that CO_2 IEFs for liquid fuels have varied over time primarily due to the use of various additives in the mix of motor gasoline, which differ regionally and temporally in the United States.
- IEF values for N_2O from gasoline vehicles are changing at a slower rate compared to values from other countries (and as would be expected from changes in technology). The values have been declining for the last few years.
  The United States explained that N_2O IEFs for gasoline vehicles are primarily a function of the emissions control technologies utilized within the U.S. vehicle fleet. Due to improvements in control technologies, in conjunction with turnover of the U.S. vehicle fleet, IEFs have decreased over time. Significant reductions in the IEFs of other countries should only be expected if there are significant changes in control technologies.

Fugitive emissions

- 1.B.2 Oil and natural gas: CH_4 emissions from venting and flaring have been included in the fugitive emissions. N_2O emissions from flaring have not been estimated. Fugitive CO_2 have not been estimated for either oil or gas production.
- 1.B.1.a Coal mining and handling – CH_4: IEF for underground mines-mining activities is the lowest compared to other countries (5.3 kg/t) and post mining activities one of the highest (1.6 kg/t); surface mines-post mining activities has the highest IEF (0.1 kg/t).
  The USA explained that the IEF for underground mining calculated in the CRF as 5.3 kg/t corresponds to a net emission factor (i.e., it is back calculated by dividing the net CH_4 emissions by total production) rather than a gross emission factor. The more appropriate value is 7.45 kg/t, based on dividing total CH_4 liberated by underground mining activities by total production. This is in the lower range but consistent with values from other countries. The estimate for underground mines uses a tier 3 approach, for which quarterly measurement data and annual degasification system data from underground mines is used.
  The Party further noted that coal mining emission factors are highly dependent on the specific geological characteristics of each coal basin, and should be expected to vary significantly from region to region, and country to country. The emission factors used by the United States are tier 2 factors based on measurements of in-situ gas content for major coal basins. Based on the tables included in section I of the synthesis & assessment report, the IEFs appear to be within the range of many other countries.
- CH_4 IEF for mining activity and post-mining activities have decreased from 1990 to 1998 for both underground and surface mines.

The USA explained that the emission factors for mining activities decreased from 1990-1998 because of an increase in CH_4 recovery, and a shift in production from underground mining to surface mining. While total coal production increased slightly, underground production decreased. Thus, the IEF shows a decrease because surface mining releases significantly less CH_4/ton of coal.

Bunker fuels

- The CO_2 IEF for gas/diesel oil under marine bunkers (124.02 t/TJ) is high compared to values by other countries. The IPCC value is 75-77.6 t/TJ (ocean-going ships).
- The reported CO_2 emissions from marine bunkers are very different to the values published by IEA.
  The Party explained that the activity data/consumption for gas/diesel oil reported under marine bunkers is incorrect. The value should have been 165,847 TJ instead of 91,788 TJ. The CO_2 IEF would then correctly be 76.4 t/TJ rather than 124.02 t/TJ. The activity data did not include military bunker fuel consumption, while the emissions data did.

Other comments

- Consumption data for fuel consumption from industry is collected by fuel type, not by end-use sector. Therefore, total fuel consumption by manufacturing industries and construction is listed under "other" (1.A.2.f) rather than in each individual industry category.
- Fuel consumed in and emissions from petroleum refining (1.A.1.b) and manufacture of solid fuels and other energy industries (1.A.1.c) are included under "other" manufacturing industries and construction (1.A.2.f).

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.

2.B.3 Adipic acid production

- The N_2O IEF for 1997 (0.06 t/t) and 1998 (0.03 t/t) was lower compared to other years (0.08 t/t). This seems to be explained by the implementation of abatement technology in the production process as explained in the NIR.

Non-key sources

2.B.1 Ammonia production, 2.C.2 Ferroalloys production, and 2.C.3 Aluminium production

- CO_2 emissions from these categories are accounted for under non-energy uses of fossil fuels in the energy sector (table 1.A(d)). Information was provided in the industrial processes tables for illustrative purposes.

2.F. Consumption of halocarbons and SF_6:[29]

[29] 2.F. Consumption of halocarbons and SF_6 was not identified as a key source in the level assessment. This source, due to its expected rapid increase, is likely to be a key source in many countries using the trend assessment.

- Confidentiality requirements prevent listing HFC-152a and HFC-227ea consumption; PFC and PFPE consumption for solvent end-uses; the breakdown of potential halocarbon emissions (i.e., production, imports, exports, destroyed); the amount of gas used in the semiconductor industry; and, the sulphur hexafluoride used in electrical equipment. The HFC-152a, HFC-227ea, and PFC/PFPE emissions have been aggregated and listed in terms of HFC-23 equivalents under "other".

2.E.1 By-product emissions:

- Limited information available as to the annual variations of HFC-23 emissions from HCFC-22 over the 1990-1998 period. Activity data were not provided due to confidentiality. See also comment above on 2.F. Consumption of halocarbons and SF_6.

AGRICULTURE

Key sources

4.A Enteric fermentation

- The CH_4 IEF for dairy cattle (156.9 kg/head/year) seems very high compared to other countries and to the IPCC default.
  The United States explained that the methodology used for enteric fermentation has undergone improvements since the submission of the inventory considered in this report. The most important of these improvements being an enhanced population characterization method (i.e., IPCC tier 2) that was adopted for cattle. As a result, the IEF for dairy cattle in the U.S. has dropped from 156.9 kg/head/year to 94.7 kg/head/year. This new value is now closer to IPCC default values and values observed in other countries.

- The CH_4 IEF for diary cattle increased by 6.5 per cent from 1990 to 1998.

4.B Manure management

- The CH_4 IEF for dairy cattle (101.46 kg/head/year) and swine (39.89 kg/head/year) seem high compared to other countries and to the IPCC defaults.
  The United States explained that the methodology used for manure management has undergone significant improvements since the submission of the inventory considered in this report. The most significant of these being the revision of swine population characterization estimates to account for immature swine and the revisions of waste characteristics and typical animal mass data for beef cattle, dairy cattle, swine, and poultry. As a result, the IEFs for dairy cattle and swine are now more consistent with IPCC default values and values observed in other countries. The IEF for dairy cattle has dropped from 101.46 kg/head/yr to 45.53 kg/head/yr, and for swine from 39.89 kg/head/yr to 12.07 kg/head/yr.

- The CH_4 IEF for non-diary cattle and swine increased by 10 and 57 per cent, respectively, from 1990 to 1998.

4.D.1 Direct emissions from agricultural soils

- N_2O emissions were calculated using IPCC default methods.

Non-key sources

4.B Manure management

- The N_2O IEF for anaerobic lagoons (0.785 kg N_2O-N/kg N) seems higher by a factor of 100 compared to other countries and IPCC defaults.
  The United States explained that the methodology used for manure management has undergone significant improvements since the submission of the inventory considered in this report. The most significant of these being the revision of swine population characterization estimates to account for immature swine and the revisions of waste characteristics and typical animal mass data for beef cattle, dairy cattle, swine, and poultry. Also, the process for compiling the IEFs for the CRF tables has been improved. As a result of these various improvements, the N_2O IEF for anaerobic lagoons has dropped from 0.785 kg N_2O-N/kg N to 0.006 kg N_2O-N/kg N. This value is now more consistent with IPCC default values and values observed in other countries.
- N excretion rates for dairy cattle (420.5 kgN/head/year) and swine (112.8 kgN/head/year) are four to five times higher than IPCC defaults and those of other countries. For non-dairy cattle this parameter is also the highest across Parties (105.0 kg N/head/year).
  The Party explained that the methodology used for manure management in the United States has undergone significant improvements since the submission of the inventory considered in this report, including the process for compiling the aggregated nitrogen excretion rates for the CRF tables. As a result, the nitrogen excretion rates for dairy cattle have dropped from 420.5 kg N/head/yr to 84.1 kg N/head/yr, and for swine from 112.8 kg N/head/yr to 7.1 kg N/head/yr. These values are closer to IPCC default values and values observed in other countries.

4.C Rice production

- Trends in activity data (harvested area) indicate a decrease of 10 per cent in 1993 and then an increase of 17 per cent in 1994.

4.F Field burning of agricultural residues

- Crop production data for Maize fluctuate from -33 per cent up to +59 per cent between 1990 and 1996. Other crop types also show large annual variations in production data.

LAND-USE CHANGE AND FORESTRY

Tables 5.A to 5.D of the CRF have not been provided, as the IPCC default methods have not been used to calculate emissions and removals. Instead, a carbon stock approach based on forest inventory data is used to estimate net flux. Explanatory comments on the national method were provided in the documentation boxes (table 5.A-5.D). The NIR provides a thorough description.

5.A Changes in forest and other woody biomass stocks

- Net CO_2 emissions/removals decreased by 25 per cent in 1993.

WASTE

Key sources

6.A Solid waste disposal on land

- Activity data for managed solid waste disposal appear high by a factor of 1000 (Tg instead of Gg reported) causing errors in IEF calculations.
  The United States noted that the activity data in the CRF was reported in Tg instead of Gg. The correct value is 340,090 Gg.
- CH_4 IEF from managed waste disposal on land (30.19 t/t) was the second highest amongst reporting Parties.
  The Party explained that the emission factors for U.S. landfills are based on measurements at approximately 100 landfills and that in the United States, most waste is disposed in large landfills that tend to generate more CH_4/ton of waste.
- CH_4 managed waste disposal on land IEF decreased from 1990 to 1998, and seems to be in line with increasing CH_4 recovery.

Non-key sources

6.B Waste-water handling

- Emissions from industrial waste water were not calculated due to lack of adequate data.

6.C Waste incineration

- CO_2 emissions increased by 9 per cent from 1996 to 1997 (larger than other years).
  The Party explained that CO_2 emissions from this source category result only from the combustion of plastics in the municipal solid waste stream. The growth in emissions from 1996 to 1997 was due to a large increase in the generation of plastics in the waste.
- CO_2 IEF for 1997 significantly different (>27 per cent higher) to all other years. No clear explanation in the inventory report.
  The Party explained that the difference in IEFs was due to the reporting of inconsistent activity data in the CRF. In 1997, the activity data was reported in terms of the carbon content of the plastics combustion, while in 1996 it was reported as the total mass of plastics. The Party provided corrected data, including IEFs with its comments.
- N_2O IEF were significantly different for 1998 as compared to earlier years.
  The Party explained that N_2O IEFs were calculated in the CRF using the same data as for CO_2 emissions and therefore the same inconsistent data was provided. The Party provided corrected data, including IEFs with its comments.

General comment:

The Party noted that in relation to the overall emissions data presented in the CRF submission of the United States for 2000, the total has not changed as a result of the explanations or corrections it has provided above.