UNITED NATIONS

NATIONS UNIES

FRAMEWORK CONVENTION ON CLIMATE CHANGE - Secretariat

CONVENTION - CADRE SUR LES CHANGEMENTS CLIMATIQUES - Secrétariat

FCCC/WEB/IRI(3)/2003/FIN 23 January 2004

FINLAND

REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY SUBMITTED IN THE YEAR 2003[1]

(Centralized review)

I. OVERVIEW

A. Introduction

1. In accordance with decision 19/CP.8 of the Conference of the Parties, the United Nations Framework Convention on Climate Change (UNFCCC) secretariat conducted a centralized review of the 2003 greenhouse gas (GHG) inventory submission of Finland. The review took place from 15 to 19 September 2003 in Bonn, Germany, and was carried out by the following team of nominated experts from the roster of experts: Generalists – Mr. Joe Mangino (United States) and Ms. Inga Konstantinaviciute (Lithuania); Energy – Mr. Leif Hockstad (United States), Mr. Michael Strogies (Germany) and Mr. James Magezi-Akiiki (Uganda); Industrial Processes – Mr. Pierre Boileau (Canada) and Mr. Klaus Radunsky (Austria); Agriculture – Mr. Samuel Adejuwon (Nigeria) and Mr. Bhawan Singh (Trinidad and Tobago); Land-use Change and Forestry – Mr. Jozef Mindas (Slovakia) and Mr. Bubu Jallow (Gambia); Waste – Mr. Eduardo Calvo (Peru) and Ms. Angelina Madete (Tanzania). Mr. Radunsky and Mr. Adejuwon were the lead reviewers of this review. The review was coordinated by Ms. Rocio Lichte (UNFCCC secretariat).

2. In accordance with the UNFCCC "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention", a draft version of this report was communicated to the Government of Finland, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

B. Inventory submission and other sources of information

3. Finland submitted all required common reporting format (CRF) tables for the years 1990–2001 together with the national inventory report (NIR) containing background information on the methodologies and emission factors (EFs) used, including methodological changes to the inventory for each sector of the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC Guidelines). It should be recognized that the NIR follows the latest structure as outlined in the revised UNFCCC reporting guidelines adopted by decision 18/CP.8.[2] In addition, Finland makes reference to a methodological report submitted as part of its 2001 inventory submission, which is the basic document on Finland's calculation methodology and which it considers part of its latest inventory submission. The full list of materials used during the review is provided in annex 1 to this report.

---

[1] In the symbol for this document, 2003 refers to the year in which the inventory was submitted, and not to the year of publication. The number (3) indicates that this is a centralized review report.

[2] The revised UNFCCC reporting guidelines adopted by decision 18/CP.8 will be required for the inventory submissions due in 2004.

C. Emission profiles and trends

4. The NIR includes a discussion dedicated to national emission profiles and trends, which is consistent with the description of the changes in the various sectors (e.g., the effect of hydro-power availability on emissions in the Energy sector throughout the time series).

5. In the year 2001, the most important GHG in Finland was carbon dioxide (CO_2), contributing 83.7 per cent to total[3] national GHG emissions excluding Land-use Change and Forestry (LUCF) expressed in CO_2 equivalent, followed by nitrous oxide (N_2O) – 8.8 per cent, and methane (CH_4) – 6.6 per cent. Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.9 per cent of total GHG emissions in the country. The Energy sector accounted for 82.2 per cent of total GHG emissions, followed by Agriculture (9.2 per cent), Waste (3.9 per cent) and Industrial Processes (3.8 per cent). Total GHG emissions amounted to 80,888 Gg CO_2 equivalent and increased by 4.7 per cent from 1990 to 2001.

D. Key sources

6. Finland completed a tier 2 key source analysis according to the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). The key source analysis performed by Finland and the secretariat[4] produced slightly different results. For example, cement production (CO_2) and mobile combustion–waterborne navigation (CO_2) are not identified as key sources in Finland's analysis, but are key in the secretariat's. Other differences appear to be due to the level of disaggregation at which key sources are identified (they are more disaggregated in Finland's analysis). The NIR states that CO_2 emissions from cement production are among the most important industrial GHG emissions (see section 2.3 of the NIR). Finland may consider using qualitative criteria according to the IPCC good practice guidance as a basis for identifying CO_2 emissions from cement production as key source if they are considered an important source.

7. Generally, appropriate tier methods are used where key sources are involved. In those cases where full tier 2 methods are not used (i.e., where specific plant measurement data are not available), country-specific EFs are employed with national production statistics.

E. Main findings

8. The NIR generally adheres to the UNFCCC reporting guidelines.[5] It includes information on key sources, methods, data sources, EFs, uncertainty estimates and quality assurance/quality control (QA/QC) procedures, and contains most of the relevant information needed to enable assessment of the inventory. The methodologies for estimating GHG emissions are consistent with the IPCC Guidelines and the IPCC good practice guidance.

9. The data provided in the CRF are largely consistent with the information provided in the NIR.[6]

---

[3] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding Land-use Change and Forestry, unless otherwise specified.

[4] The secretariat had identified, for each individual Party, those source categories which 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. Key sources according to the tier 1 trend assessment were also identified for those Parties providing a full CRF for the year 1990. Where the Party has performed a key source analysis, the key sources presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key source assessment conducted by the secretariat.

[5] In this report, the Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories, are referred to as the UNFCCC reporting guidelines.

[6] Figure 5 of the NIR (which shows non-CO_2 gas trends for 1990–2001) appears to have an error in the legend related to N_2O and CH_4 emissions. This is based on the inconsistency between reported summary trends of table 10 in the CRF, and the values as they are shown in figure 5. It appears that CH_4 and N_2O might have been switched in the legend.

10. For details on methodologies related to the period 1990–1999, the NIR references a report entitled *Greenhouse Gas Emissions and Removals in Finland*. Transparency would be improved if these methodologies were integrated into the latest NIR. Specifically, a means of clarifying where new elements of a methodology have been implemented, EFs have changed, activity data (AD) have changed, recalculations have been performed, or where the methodology has remained unchanged would be helpful (e.g., a table listing each source and whether the methodology is included in the NIR, the previous methodology document, or both). The NIR (section 1.4) provides some of this type of information but it is not always sufficiently transparent to make it possible readily to piece together the new and old aspects (for example, section 1.4 of the NIR 2003 indicates "none" for CRF table 2(II), but methodological changes are noted for the HFC categories in section 10.1 of the section on recalculations and improvements).

F. Cross-cutting topics

Completeness

11. The NIR and the CRF recognize categories that are not estimated, with the statement that future work will look at whether the missing categories are responsible for any emissions and thus would need to be included in the inventory. Notable among the missing sources are fugitive venting emissions (CH_4, CO_2) and fugitive flaring emissions (CH_4, CO_2 and N_2O) from the oil and natural gas category in the Energy sector. This category typically can be a relatively significant CH_4 source where gas is produced in substantial quantities; however, this is not the case in Finland. Other sources stated as not estimated include: CO_2, CH_4, and N_2O from lubricants used in international marine bunkers; CO_2 from the Industrial Processes categories for limestone usage, soda ash production, and asphalt roofing and paving; and CH_4 and N_2O emissions from waste composting. In all these cases, Finland estimates that emissions are nearly zero but that further studies are needed. Overall, the inventory is generally complete and the missing categories do not suggest any major gaps in coverage at this point.

12. CRF table 1.B.2 uses the notation keys "not estimated/zero" ("NE/0") for the oil and gas categories. This combination of two notations is not a standard notation key. The NIR states that emissions for all but CO_2 emissions are "estimated to be negligible". However, there is reference to planned improvements – the calculation of the fugitive emissions from oil and gas distribution. On the basis of the description in the NIR, it would probably be more appropriate to use the "NE" notation key until such improvements confirm that there are no emissions from these sources. The use of a combined notation key ("not estimated/not occurring", "NE/NO") was also noted in the Industrial Processes and LUCF section.[7]

Transparency

13. The NIR reports the use of bottom–up data from the VAHTI database. Section 1.4 of the NIR gives a brief overview of VAHTI. Additional description of what is specifically included in VAHTI, the sources and pollutants, the frequency of updating, data quality procedures and verification activities would increase the transparency of this important source of data for the inventory.

14. To increase transparency, the entire time series of EFs used in the fossil fuel combustion calculations should be provided. It should also be noted why the IPCC 1995 Guidelines are used for some EFs and not the 1996 Guidelines. Detailed methodological discussion is provided in the previous (2001) NIR, covering inventories up to 1999. For further transparency, an updated detailed methodological discussion should be included in each annual NIR (see also paragraphs 3 and 10).

15. Additional documentation on how data are managed (including protocols for verification and quality assurance, and data flow) in the ILMARI system would increase the transparency of this important component of the Finnish inventory.

[7] The revised UNFCCC reporting guidelines adopted by decision 18/CP.8 require that, even if emissions are considered to be negligible, Parties should either report the emission estimate if calculated or use the notation key "NE". The "0" is no longer considered as a notation key.

Recalculations and time-series consistency

16. The 2001 inventory uses the latest ILMARI model for energy sources but, according to the NIR, the previous years are not based on the latest version of ILMARI. Also, the NIR states that the figures for emissions in 1991 are not based on the ILMARI system at all. In response to a question from the expert review team (ERT) regarding the use of ILMARI, Finland responded that the new ILMARI database does not affect emissions previously reported except in terms of reducing the number of erroneous plant-level data, and the reclassification and revised allocation of some emissions in the Energy sector. The ultimate effect on timeline consistency, however, cannot be determined through review until the latest ILMARI system is fully implemented. The NIR does state that future inventories will be recalculated for the entire time series using the latest ILMARI model, which is scheduled to be completed by the end of 2004.

17. The NIR (section 1.8) states that recent studies on EFs, more developed estimation models and updated energy data have caused some inconsistencies in the time series for the Energy sector. It is not entirely clear whether these inconsistencies are related to the implementation of the ILMARI database (see paragraph 16) or if they are due to changes in some fundamental parameters in the methodologies not related to the updating of the database. Some additional documentation regarding this relationship, if any, would help to clarify the reasons for any inconsistencies.

18. A recalculation for waste-water handling is reported in CRF tables 8(a) and 8(b), but no information is provided in the NIR where recalculations are discussed. Table 8(a) for the years 1990 and 1999 shows a great disparity in the effect of recalculation on CH_4 emissions at solid waste landfills: a 1 per cent increase in 1990 and a 98 per cent increase in 1999 since the previous inventory submission. Additional explanation in section 10.1 of the NIR regarding the disparity in the effect of the changes on this source through the time series would help in the assessment of emissions.

19. The overall effect of the recalculations (without LUCF) compared to the previous year's submission is a 0.3 per cent increase in 1990 and a 2.3 per cent increase in 2000. The recalculations are explained in the NIR and are due to a variety of improvements, partly resulting from the adoption of improved methods and the addition of new sources, and partly in response to the comments of earlier UNFCCC reviews. The ERT's overall assessment is that these recalculations reflect an inventory that is continuing to be improved on the basis of review feedback and are evidence of implementation of the IPCC good practice guidance.

Uncertainties

20. Finland has completed both a tier 1 and a tier 2 uncertainty analysis following the IPCC good practice guidance. The total uncertainty of the inventory using tier 2 was estimated at –5 to +6 per cent. The trend uncertainty was +/–5 per cent. The corresponding uncertainties were +/–7 per cent and +/–6 per cent when tier 1 was used. Finland's NIR has a dedicated section for planned improvements as well as a discussion of uncertainty within each category, both of which indicate that the results of the uncertainty analysis are being considered in developing and prioritizing improvements to the inventory.

Verification and quality assurance/quality control approaches

21. No formal QA/QC plan has been implemented and there is no documentation of an external peer review or verification procedures. The NIR does state that the quality management system for the inventory is under development and will be implemented for the inventory year 2002. A general schedule for implementation in each sector is provided. Also, for most categories there is mention of "normal statistical quality checks" that have been implemented, but no list of what specific checks are included.

G. Areas for further improvement

Identified by the Party

22. Finland identifies future areas for improvement, to include: continued updating of the report format to match the latest UNFCCC reporting guidelines; scheduled implementation of a formal QA/QC

plan; various improvements in source categories to reduce uncertainties; and the integration of new ILMARI database calculations.

Identified by the ERT

23. A number of areas for improving the overall transparency of the inventory were identified: additional documentation on the impacts and data flow for updates in the ILMARI system; documentation on the verification procedures for the background VAHTI database; further integration of previous documents on methodologies into the latest NIR; and more consistent use of notation keys in accordance with the UNFCCC reporting guidelines in the CRF.

II. ENERGY

A. Sector overview

24. The Energy sector accounted for 82 per cent of Finland's total emissions in 2001, although there was a decrease in emissions from 2000 to 2001. All emissions from fuel combustion are calculated using Statistics Finland's ILMARI calculation system, which mostly follows the tier 2 method in the IPCC Guidelines. The ILMARI calculation system has been used for calculation of emissions of CO_2, CH_4, N_2O, sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and non-methane volatile organic compounds (NMVOC), as well as particulate matters (PM) emissions of fuel combustion from the year 1992. Emissions for 1990 have now also been calculated by ILMARI. The 1991 emission estimates are produced by top–down estimates based on data for 1990 and 1992. The ERT recommends that Finland provide additional details to increase the transparency of the NIR, such as further discussion of the allocation of emissions to particular source categories and the EFs used throughout the time series, along with further detail on the ILMARI Energy sector-specific emission calculations.

25. As detailed in the NIR and the CRF tables, it appears that the Energy sector is adequately covered for stationary fossil fuel combustion. Source-specific comments are detailed below.

B. Reference and sectoral approaches

Comparison of the reference approach with the sectoral approach and international statistics

26. The CRF tables state that the relatively high difference in liquid fuel CO_2 emissions is due to statistical differences in the national oil balance between the reference approach and the national approach. The ERT recommends that Finland provide further details on these statistical differences.

International bunker fuels

27. Regarding marine bunkers, the CO_2 implied emission factor (IEF) (35.7 kg/TJ) for gas/diesel oil is by far the lowest for 1991, which is not consistent with the values reported in the other years and very low compared to the IPCC default values and those of other reporting Parties. The value of the CH_4 IEF for residual oil increased from about 2 kg/TJ in 1999 to 5.8 kg/TJ in 2000 and 5.02 kg/TJ in 2001. For all years except 1991 the value of the N_2O IEF (30 kg/TJ) for gas/diesel oil is the highest of the reporting Parties (1.7–30 kg/TJ). However, in 1991 the value is 50 per cent lower than in the other years.

28. Regarding the N_2O IEF for use of residual fuel, there is an unexplained break between 1999 and 2000. The value dropped from 31 to 2 kg/TJ. The reported value for 1991 is 100 per cent higher than the value for 1990 or the subsequent years.

29. Regarding aviation bunkers, the CH_4 IEF (88 kg/TJ) and N_2O IEF (32 kg/TJ) values for jet kerosene are among the highest for the years prior to 1999. For the last three years they both decrease drastically (to about 3 kg/TJ).

Feedstocks and non-energy use of fuels

30. Finland currently reports emissions from non-stored carbon under IPCC sector 7 (Other) rather than integrating the storage of feedstocks with the sectoral fuel consumption data in the Energy sector. Finland currently uses the IPCC default method. The ERT recommends that Finland include the feedstock emissions in the appropriate source categories within the Energy and/or Industrial Processes sector, as recommended in the IPCC Guidelines.

31. The NIR states that the uncertainty in non-energy use of fuels was estimated at ±50 per cent in 2001 based on expert knowledge of AD and EF uncertainties, and that improvements are planned for this category to account for emissions more accurately. The ERT recommends that Finland provide further details on improvements: this is necessary since it has noted non-energy use of fuels as a key source.

Country-specific issues

32. Finland uses the ILMARI calculation system, but the system does not calculate emissions for 1991. This leads to time-series inconsistency in the calculation of fuel combustion.

33. The EFs for CH_4, N_2O, CO and NMVOC are stated to be largely based on the compilation of research data in the inventory calculations for the year 1990. The ERT recommends that Finland detail the plans to update the EFs being used by ILMARI based on a more recent inventory year.

34. The ERT recommends that Finland expand its discussion of the emission calculation methodologies, data sources and other details of its use of peat in both the combustion and the fugitive subsectors.

C. Key sources

Stationary combustion: Energy industries, public electricity and heat production

35. The NIR states that the allocation of emissions between IPCC categories 1.A.1 and 1.A.2 in 2001 is different from that for previous years. Emissions from some power plants which were formerly allocated as autoproducers in category 1.A.2 have now been corrected to 1.A.1.b. This change in allocation affects approximately 2.3 Gg of CO_2 in 2001 (1.6 Gg in 2000). The ERT recommends that Finland expands its current explanation in the NIR and provide further details to increase the transparency of this shift in emissions, for instance, to show how this allocation was made and why it was deemed necessary. The sources and reasons for allocating emissions to different sources should be stated.

Stationary combustion: Other

36. To increase transparency, the NIR should provide further details on emission calculation methodologies, data sources and EFs for these subsectors. Specifically, it should be noted what fuel combustion activities were allocated to category 1.A.5 Other. Since biomass and liquid fuels (stated in the NIR uncertainty section as having uncertain AD) within this subsector (listed as category 1.A.5 in table 2 of the NIR) were noted as being key sources, specific details on the emission calculations should be provided.

Stationary combustion: indirect N_2O from fuel combustion

37. In the NIR, Finland details a method for calculating indirect N_2O emissions caused by nitrogen deposition due to nitrogen oxide (NO_X) emissions caused by the combustion of fuels, and apportions these emissions within the Energy sector (adding to direct N_2O emissions in the CRF tables). The method used is similar to that of the IPCC Guidelines for estimating indirect N_2O emissions in the Agriculture sector. For its 2004 submission, Finland plans to either report these emissions in the sector Other or not to report them at all.

Mobile combustion

38. The NIR includes only aggregate EFs for road transport using diesel and gasoline but does not describe further details with regard to types of car (e.g., passenger cars with and without catalytic converters). The link to the LIPASTO web page is not satisfactory because there is no information provided on the whole time series: only the results of recent estimates are addressed. This is important because in CRF table Summary 3 it is mentioned that all EFs used are country-specific. The ERT encourages Finland to further improve transparency by providing more detailed information for the Transportation sector in the NIR.

39. The reported changes and breaks within the time series of the derived IEF indicate an inconsistency between the calculations done with and without the LIPASTO model. However, the web page indicates a consistent time series.

40. The Finnish N_2O IEF for road vehicles is fairly high compared to those reported by other countries. It is about 70 per cent above the median value from all reporting countries.

Fugitive emissions: Solid fuels

41. A country-specific methodology and EFs are used for the calculation of CO_2 and CH_4 but not enough detail is given on the methodology to allow for a thorough assessment of the estimates. More information on the methodology should be given in subsequent submissions.

42. The uncertainty in emissions from solid fuels is very high (between 59 and 106 per cent) because of uncertainties in emissions from peat production areas and arable peat lands. Finland indicated in the NIR plans to improve the accuracy of these emission estimates.

D. Non-key sources

Mobile combustion: road vehicles – CH_4

43. More explanations of the significant increase of the CH_4 IEF for gasoline from 1998 to 1999 and of the significant decrease of the CH_4 IEF for diesel for the same period would be welcomed by the ERT. Emissions from the use of natural gas are reported since 1999 with very high IEFs (610 kg/TJ) (the medium value for other reporting countries is 220 kg/TJ).

Fugitive emissions: oil and natural gas

44. AD are reported for the following sub-sources: Oil Transportation; Oil Refining and Storage; Oil Distribution; and Natural Gas Transmission, Distribution and Leakage; however, emissions from these sub-sources were reported as "NE" because Finland considered them as too small. Finland is encouraged to reconsider this issue with a view to reporting these emissions in its next submission.

45. Country-specific methodologies and plant-specific EFs have been used for the calculation of fugitive emissions of CO_2 and CH_4 from oil and natural gas, but not enough detail is given on the methodology to allow for comparison with the IPCC methodology. More information on methodology should be given in subsequent submissions to enable comparison.

46. A general increasing trend was observed in the CH_4 emissions from oil and natural gas but with large inter-annual fluctuations from 1996 to 2001. No information was available to explain these fluctuations. The ERT recommends that Finland provide appropriate explanations.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

47. In Finland emissions from the Industrial Processes sector accounted for 3.8 per cent of total emissions in 2001. The most important process-related emissions are N_2O from nitric acid production (1.6 per cent of total emissions) and CO_2 from cement and lime production (1.3 per cent of total

emissions). HFCs, PFCs and SF_6 – the fluorinated gases (F-gases) – account for 0.9 per cent of total emissions. Coke and ethylene production released small amounts of CH_4 (0.02 per cent of total emissions).

48. From 1990 to 2001, CO_2 and N_2O process-related emissions decreased by 11.4 per cent and 21 per cent, respectively, while CH_4 emissions increased by 65.8 per cent. Emissions of total F-gases increased by more than 600 per cent between 1990 and 2001 (emissions of HFCs increased from 0.02 to 657 Gg CO_2 eq., and PFC emissions from 0.07 to 20 Gg CO_2 eq., while SF_6 emissions decreased by 41.7 per cent).

49. The CRF includes estimates of most gases and sources of emissions from Industrial Processes, as recommended by the IPCC Guidelines. CO_2 emissions from solvent use are not estimated. Not included in the inventory are 2.A.3 Limestone and Dolomite Use, 2.A.4 Soda Ash Production and Use, 2.A.5 Asphalt Roofing and 2.A.6 Road Paving with Asphalt. However, notation keys are used and information is provided in CRF table 9 to the effect that these emissions are estimated to be small and that further studies are needed to consider these sources. In the NIR this is mentioned as a planned improvement.

50. Magnitude and trend checks have been performed for emissions from this sector; however, no verification is performed for sector-specific emissions. No information is provided on the QA/QC systems of data providers (e.g., the national statistics agency or industrial companies). The ERT would welcome such information on QA/QC/verification performed on independent data providers and emission estimates provided by industrial facilities.

51. As outlined in CRF table Summary 3, most Industrial Process sources are estimated using IPCC default methodologies and IPCC default EFs, whereas for key sources, such as N_2O emissions from nitric acid production and consumption of halocarbons and SF_6, country-specific methodologies have been applied. This is consistent with the IPCC good practice guidance.

52. General issues noted by the ERT: Uncertainties for the Industrial Processes and Solvent Use sectors were obtained through expert judgement. Uncertainty estimates are provided for the following sources: 2.A.1 and 2; 2.B.2 and 5; 2.C; and 2.F.1, 2, 4 and 7. The ERT would welcome more information on how uncertainties are estimated for the Industrial Processes sector in the NIR. [8]

B. Key sources

2.F. Ozone depleting substances substitutes

53. Finland plans to reduce uncertainty by improving the survey tool. The changes between 1994 and 1995 of actual HFC-125 and SF_6 emissions show annual increases of 2,460 per cent and 96 per cent, respectively. Finland reports that these changes are due to increased use of HFCs as a substitute for ozone depleting substances (ODS) and the increased use of SF_6 as a cover gas in the manufacture of magnesium.

C. Non-key sources

2.A.3 Lime production – CO_2

54. No information is provided on whether emissions from limestone and dolomite use are estimated separately. The ERT would welcome more detailed explanations in this area.

[8] In its response to the draft of this report, Finland provided the following references: "Uncertainties in the Finnish 2001 Greenhouse Gas Emission Inventory"; Suvi Monni and Sanna Syri, VTT Research Notes 2209, Espoo, 2003 (available at: http://www.vtt.fi/inf/pdf/tiedotteet/2003/T2209.pdf.), and "Finnish 2001 Inventory of HFC, PFC and SF_6 emission"; Teemu Oinonen, 2003 (available at: http://www.ymparisto.fi/palvelut/julkaisu/elektro/symon278/symon278.htm).

2.C.1 Iron and steel production – CO_2

55. CO_2 emissions from 2.C Iron and Steel Production have been included in 1.A.2 Fuel Combustion under Manufacturing Industry. The IPCC good practice guidance recommends reporting emissions from the use of reducing agents in the Industrial Processes sector. The explanation in the NIR (page 24), that emissions were included in the Energy sector because the calculation of emissions is more accurate from the total coke consumption than from partly coke and partly blast furnace gases, is not clear and does not explain why emissions could not be reported under Industrial Processes. The ERT recommends that Finland include a detailed description of the methodology for estimating these process emissions in the NIR. The ERT would also welcome reporting of these emissions under Industrial Processes even if attribution to coke and blast furnace gas cannot be made.

2.C.2 Ferroalloys – CO_2 and CH_4

56. These emissions are reported as "included elsewhere" ("IE") but as regards CH_4 no information is provided on where they are included. According to the CRF, CO_2 emissions from ferroalloys production were allocated to the Energy sector. No information on the estimation methodology is provided. The ERT would welcome more information on the estimation methodology and allocation of the emissions.

2.F Consumption of halocarbons and SF_6

57. In table 2(I)s2 the totals of the columns are greater than the sum of the cells below. The ERT would welcome greater transparency and consistency here.

IV. AGRICULTURE

A. Sector overview

58. Agriculture is the second most significant sector producing GHG emissions, accounting for 9.2 per cent of Finland's total emissions. Total emissions from agriculture exhibit a clearly decreasing trend (approximately 25 per cent since 1990), which is due to a decrease in the number of livestock, reduced use of nitrogen (N) fertilizers and improved manure management.

59. CH_4 emissions from enteric fermentation have been recalculated for the whole time series because a new source, emissions from reindeer, has been added. Also, the time series of N_2O emissions from manure management as well as agricultural soils has been recalculated because of corrections made in the AD.

60. Future improvements will focus on AD collection, the development of country-specific EFs and enhanced QA/QC measures.

B. Key sources

4.A Enteric fermentation – CH_4

61. The methodologies used are tier 2 for cattle and tier 1 for all other animals. However, there are some issues that relate to completeness and transparency that are addressed below.

62. CH_4 emissions from poultry have not been estimated, although AD are provided. Finland informed the ERT that these emissions were not estimated because no IPCC methodology is available. Finland plans to provide additional estimates for categories that are currently not estimated, such as CH_4 emissions from poultry.

63. The ERT noted the high values of the 2001 CH_4 IEF for dairy cattle (114 kg/head/yr) compared to those of other reporting Parties and the IPCC default (100 kg/head/yr). Although Finland has responded to comments on this matter in earlier reviews, the ERT would welcome some quantitative explanation, such as data on milk productivity. In its response to the draft of this report, Finland indicated that it would provide such information in future NIRs.

4.B Manure management – N_2O

64. Finland used the tier 2 method for cattle, a tier 1 method for reindeer, and country-specific methodology for all other animals.

4.D.1 and 4.D.3 Agricultural soils: direct and indirect N_2O emissions

65. N_2O emissions from nitrogen-fixing crops grew from 0.01 to 0.04 Gg between 1990 and 1991, which corresponds to an increase of more than 200 per cent. Finland informed the ERT that this increase was due to an increase in crop yield of peas which increased from 9.1 Gg in 1990 to 28.3 Gg in 1991.

66. The value for $Frac_{GASF}$ (0.006) is the lowest among reporting Parties and much lower than the IPCC default (0.1). Values for some other fractions also differ significantly from those reported by other Parties and the IPCC defaults. Finland is encouraged to provide information on this non-default parameter with scientific/technical studies and justify that the underlying assumptions or measurements are representative of Finnish conditions. Finland indicated that it would provide such additional information in future NIRs.

4.D Agricultural soils – CO_2

67. Finland has chosen to report CO_2 emissions from agricultural soils as agricultural emissions and not as LUCF emissions. Emissions decreased by 39 per cent between 1990 and 2001. Finland explained this decrease as being due to a decrease in the area of organic soils as well as in the amount of lime added to the soil during that period. Finland is encouraged to explain the reason for not considering this source in its key source analysis, given that it has been identified as key source in previous inventories.

C. Non-key sources

4.B Manure management – CH_4

68. The ERT noted a large annual increase (17 per cent) in CH_4 emissions between 1994 and 1995. Finland explained that this increase resulted from the increase in the number of pigs, an increase in milk production, an increase in the proportion of slurry handled and a decrease in the proportion of solid storage of manure.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

69. Net CO_2 removals from LUCF ranged from –9,713 to –38,207 Gg CO_2 during the period 1990–2001, which represent 12.4–50.7 per cent of Finland's total GHG emissions. A slight decreasing trend is observable with high annual variations. These are explained by fluctuations in the rate of harvesting that are due to commercial felling demands and the global wood market situation.

70. Finland has provided emissions and removals data for categories 5.A Changes in Forest and Other Woody Biomass Stocks for all years throughout the period 1990–2001. Other categories (5.B, 5.C) are reported as included into category 5.A. Emissions of non-CO_2 gases are not reported.

71. Although CO_2 emissions from soil are accounted for under the Agriculture sector, inventory data for this source are reported in table 5.D of the CRF for the following subcategories: Cultivation of Mineral Soils, Cultivation of Organic Soil, and Liming of Agricultural Soils.

72. Estimates for the error in the increment of the tree stem volume are available, but these data are not provided in the NIR. Error estimates for other variables are under development. The new carbon allocation model with error estimates is expected to be ready by 2005.

73. Finland reports that the new carbon allocation model will be used in the near future, as will a new method of estimating changes in the carbon content of forest soils which is under development at the Finnish Forest Research Institute.

B. Sink and source categories

5.A Changes in forest and other woody biomass stocks – CO_2

74. Finland has used a country-specific methodology which gives more accurate figures than the IPCC methodology, but no detailed description of the model is provided. AD are based on data sources from the Finnish Forest Research Institute.

75. The country-specific methodology used covers the categories 5.A, 5.B and 5.C, and aggregate results are reported under category 5.A.

5.D CO_2 emissions and removals from soils

76. CO_2 emissions from organic soils and liming have been estimated as well as the changes in carbon stocks in mineral soils due to land-use change. The emissions are accounted for under category 4.D as Finland considers them to be caused by agricultural activities.

77. Emissions and/or removals from forest soils are currently not reported. Changes in the carbon content of forest soils are slow. Several studies have been reviewed but a suitable method covering both mineral and peat land forest soils has not been identified by Finland.

VI. WASTE

A. Sector overview

78. The Waste sector contributed about 4 per cent of Finland's total emissions in 2001 and 1990, the major emission source being CH_4 from solid waste disposal sites (SWDS) (92 per cent of total waste emissions in CO_2 equivalent). Decreases in CH_4 emissions from solid waste and from waste-water handling, and of N_2O from waste-water handling, have produced a decreasing trend. The decreasing CH_4 emissions from solid waste are explained mainly by the implementation of a new law endorsing waste minimization, recycling and resource recovery in Finland.

79. The inventory is mostly complete in terms of gases, sources and years covered. There are plans to include emissions from compost in future inventories. The NIR has information on different waste streams that have been reported under the category Other in the CRF. The ERT recommends Finland to improve transparency and to present the information by waste stream according to the IPCC good practice guidance. Emissions from waste incineration are considered in the section on Energy and are therefore not estimated here. Finland has included NMVOC emissions based on expert estimation.

80. References and documentation on methodologies and country-specific EFs, as well as additional information in the CRF tables, are provided, enhancing transparency. The population data given in tables 6.A and 6.B of the CRF are not consistent. Estimates are self-assessed in table 7 as being of medium quality only for CH_4 from SWDS and of low quality for waste-water handling emissions. Uncertainty estimates are provided for each emission source, even combining different gases. Recalculations are reported for emissions from waste-water handling in the CRF, and have also been addressed in section 10.4.1 of the NIR, but have not been addressed in section 8.3.5 of the NIR. The ERT proposes that Finland improve the consistency of the NIR by revising section 8.3.5.

B. Key sources

6.A Solid waste disposal on land – CH_4

81. Finland has developed a tier 2 methodology since 2001 which has led to a recalculation of the entire time series since 1990, resulting in big increases in the figures for emissions from 1992 onwards

(near 100 per cent). The IPCC good practice guidance was adapted using several waste streams independently. This is also reflected in the extensive use of the category Other for this source. Finland has adapted good practice guidance equation 5.1 for the methane correction factor (MCF), considering only one value. It is argued that this is valid for closed landfills. The ERT invites Finland to provide more information in its future NIRs. The application of the degradable organic carbon (DOC) value is unclear. The ERT encourages the provision of AD and examples of calculations for the different waste streams. The NIR states the use of MCF values between 0.98 and 1, while in the CRF a single value of 0.994 is reported. Further clarification would be welcomed as to whether other values than 0.994 have been used in the calculations.

82. Uncertainties remain very high as a result of the use of rough estimates and lack of data. Finland acknowledges the need for better AD and more information on waste composition.

C. Non-key sources

6.B Waste-water handling – CH_4 and N_2O

83. Uncollected waste water has been added, based on population estimates, leading to a recalculation of the figures for this category.

84. CH_4 emissions from waste water have been calculated using an MCF and degradable organic carbon (DOC) value based on expert estimates, which are not documented as required by the IPCC good practice guidance. The MCF is low because of the volumes recovered. The degradable organic component (DC) was based on biochemical oxygen demand for seven days, not the internationally used standard of five days. The ERT recommends Finland to provide in its next NIR a more extensive explanation on the origin of the MCF value.

85. N_2O emissions are calculated based on nitrogen input in waterways and include nitrogen from fish farming. These emissions along with those from industrial waste water have decreased over time. No AD, EFs or methodologies are presented in the NIR.

6.B Emissions from human sewage – N_2O

86. Data for protein consumption (e.g., 36.2 and 37.7 kg protein/person/yr for 1990 and 2001, respectively) are included in the CRF and are assumed to vary during the period 1990–2001. The ERT encourages Finland to provide background material in the NIR explaining the variation. Considering the growth of population between 1990 and 2001, the decrease in associated emissions also needs to be explained in the NIR.

ANNEX 1: MATERIALS USED DURING THE REVIEW

A. Support materials used during the review

2003 submission including CRF for years 1990–2001 and an NIR, including the NIR submitted in 2001.
2002 submission including CRF for years 1990–2000.
UNFCCC secretariat (2003). "Report of the individual review of the greenhouse gas inventory of Finland submitted in the year 2002 (Centralized review)." FCCC/WEB/IRI(3)/2002/FIN (available at http://unfccc.int/program/mis/ghg/countrep/fincentrev02.pdf).
UNFCCC secretariat. "2003 Status report for Finland" (available at http://unfccc.int/program/mis/ghg/statrep03/fin03.pdf).
UNFCCC secretariat. "Synthesis and assessment report of the greenhouse gas inventories submitted in 2003. Part I." FCCC/WEB/SAI/2003 (available at http://unfccc.int/program/mis/ghg/s_a2003.html) and Part II – the section on Finland) (unpublished).
Finland's comments on the Draft synthesis and assessment report of the greenhouse gas inventories submitted in 2003 (unpublished).
UNFCCC secretariat. Review findings for Finland (unpublished).
UNFCCC secretariat. "Handbook for review of national GHG inventories." Draft 2003 (unpublished).
UNFCCC secretariat. "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories." FCCC/CP/1999/7 (available at http://www.unfccc.int/resource/docs/cop5/07.pdf).
UNFCCC secretariat. "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention." FCCC/CP/2002/8 (available at http://unfccc.int/resource/docs/cop8/08.pdf).
UNFCCC secretariat. Database search tool – *Locator* (unpublished).
IPCC. *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000* (available at http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm).
IPCC/OECD/IEA. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volumes 1–3, 1997* (available at http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm).

B. Additional materials

Responses to questions during the review were received from Mr. Niemi (Ministry of Environment) including additional material on the methodology and assumptions used.

- - - - -