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Report of the individual review of the greenhouse gas inventory of Finland submitted in 2005*

* In the symbol for this document, 2005 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the centralized review of the 2005 greenhouse gas (GHG) inventory submission of Finland, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 3 to 8 October 2005 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Ms. Ruta Bubniene (Lithuania) and Ms. Anke Herold (European Community); Energy – Mr. Leif Hockstad (USA), Mr. Steven Oliver (Australia) and Mr. Michael Strogies (Germany); Industrial Processes – Ms. Ionela Draghici (Romania), Ms. Sonia Petrie (New Zealand), and Mr. Kiyoto Tanabe (Japan); Agriculture – Mr. Erda Lin (China) and Mr. Marcelo Rocha (Brazil); Land Use, Land-use Change and Forestry (LULUCF) – Mr. Jozef Mindas (Slovakia) and Mr. Justin Ford-Robertson (New Zealand); Waste – Mr. Ayite-Lo Ajavon (Togo) and Ms. Anke Herold. Mr. Ayite-Lo Ajavon and Ms. Anke Herold were the lead reviewers. The review was coordinated by Ms. Rocio Lichte (UNFCCC secretariat).

2. In accordance with the "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. In its 2005 submission, Finland provided a complete set of common reporting format (CRF) tables for the years 1990–2003 and a national inventory report (NIR). The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

4. In 2003, the most important GHG in Finland was carbon dioxide (CO_2), contributing 85.5 per cent to total[1] national GHG emissions expressed in CO_2 equivalent, followed by nitrous oxide (N_2O), 7.9 per cent, and methane (CH_4), 5.8 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.8 per cent of the overall GHG emissions in the country. The Energy sector accounted for 85.4 per cent of total national GHG emissions, followed by Agriculture (6.4 per cent), Industrial Processes (4.1 per cent) and Waste (3.2 per cent). Total GHG emissions amounted to 85,559.6 Gg CO_2 equivalent and had increased by 21.5 per cent from 1990 to 2003. From 2002 to 2003 GHG emissions increased by almost 11 per cent, mainly due to the growth of GHG emissions from the Energy sector.

[1] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LULUCF, unless otherwise specified.

D. Key categories

5. Finland has reported a key category tier 2 analysis, both level and trend assessment, as part of its 2005 submission. The key category analysis performed by the Party and the secretariat[2] produced similar results; however, the level of disaggregation of source categories is different due to the use of different tiers. The secretariat identified 18 categories whereas the Party identified 14 key categories (both level and trend). The Party uses a more aggregated categorization in Fuel Combustion and a higher disaggregation level in other sectors. The information reported is very transparent.

E. Main findings

6. In general, both the NIR and the CRF are largely complete and transparent. The inventory includes information on key categories, methods, data sources, emission factors (EFs), uncertainty estimates and quality assurance/quality control (QA/QC) procedures, and contains most of the relevant information needed for replication of the inventory. The methodologies for estimating GHG emissions are consistent with the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance), and there are no major inconsistencies between the CRF and the NIR. The expert review team (ERT) welcomes Finland's efforts to improve the transparency of the inventory information and to improve the descriptions in the NIR, but encourages the Party to provide more detailed explanations where this is recommended in the sectoral sections of this report. An improved estimation of non-energy fuel use, raised by a number of previous reviews, remain unresolved. In its response to this review, Finland stated that a revised estimate for non-energy fuel use would be presented in the 2006 submission. The recalculation of peat production emissions has resulted in a considerable increase in transparency.

F. Cross-cutting topics

1. Completeness

7. Finland has provided inventory data for the years 1990–2003 and included almost all the required tables. Finland has provided emission estimates from LULUCF for the years 1990–2003 using the CRF LULUCF tables, as required by decision 13/CP.9. The geographical coverage is complete and all sectors and relevant categories are covered in the inventory. The CRF tables include estimates of all gases and sources of emissions, with a few exceptions. Fugitive emissions of N_2O from the extraction and handling of peat are not estimated, but Finland indicated that it would include these emissions in its 2006 submission. Information provided on the use of the notation key "not estimated" ("NE") explains that the estimated emissions are close to zero, that no EFs are available or that no IPCC instructions are provided.

2. Transparency

8. The transparency of the CRF and the NIR has been improved in several areas compared with previous submissions. However, Finland is still encouraged to provide more detailed explanations on the correspondence of the models used to calculate emissions from the Transport sector with IPCC tier

[2] The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Key categories according to the tier 1 trend assessment were also identified for those Parties that provided a full set of CRF tables for the year 1990. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

approaches, the methodology of calculation of solid waste, the EFs for N_2O from nitric acid, and other areas indicated in the relevant sector sections of this report.

3. Recalculations and time-series consistency

9. The ERT noted that recalculations of the time series for the years 1990–2002 had been undertaken to take into account new data sources for peat production area and a revised CO_2 EF for peat production, improvements in the time-series consistency of non-point sources in fuel combustion activities, a number of reallocations of emissions and removals (in particular regarding the LULUCF reporting tables according to the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF), and new data for clinker production, as well as some additional sources such as limestone and dolomite use, soda ash use and hydrogen production. The major changes include: a downward revision of the estimates of CO_2 emissions from peat production by more than 80 per cent for all years of the time series (i.e. for the year 1990 the estimate for CO_2 decreased by 86 per cent compared to the 2004 submission); the reallocation of CO_2 emissions from agricultural soils from the Agriculture sector to the LULUCF sector; and the changes in CO_2 emissions from cement production. Finland provides recalculated estimates in table 8(a)) and explanatory information. The rationales for the recalculations are also provided in a summarized section and in the methodological explanations of the NIR. The effect of the recalculations for the base year (1990) (as reported in the CRF tables) is a decrease by 8.3 per cent in the estimates of CO_2 equivalent emissions excluding LULUCF and a corresponding decrease of 5.8 per cent in 2002. A number of recalculations have been performed in order to take into account the recommendations of previous reviews (e.g. cement production).

10. For peat production the explanations provided in the NIR and CRF were not fully sufficient to enable the ERT to understand the effects of different changes on the revised estimate, but the Party's response to the ERT's questions during the review clarified the recalculations, in particular those due to the revisions of peat extraction areas and EFs compared to the previous submission. The ERT commends Finland for its efforts to improve the estimation methods related to peat extraction.

11. For CO_2 emissions from hydrogen production, limestone production, limestone and dolomite use and soda ash production, Finland points out that the time series are not consistent because more accurate data are only available for the most recent year. Finland is encouraged to provide more information on the time series of activity data (AD) and the EFs used for emissions from these additional sources in its next inventory submission. In its response to the review, Finland indicated that the methods to develop the time series would be described in greater detail in the 2006 submission.

4. Uncertainties

12. Finland performed a tier 1 and a tier 2 uncertainty assessment, and also included the LULUCF sector in the uncertainty estimation. Because of the inclusion of the LULUCF sector, the total uncertainty of the entire inventory increased considerably. The uncertainty results, level of aggregation used, correlations considered and methodological approaches are transparently reported in the NIR and results are also documented in peer-reviewed journals. The uncertainty estimation has been updated to include the revisions of the recent inventory submission. The NIR discusses planned improvements and uncertainty analysis within each category, indicating that the results of the uncertainty analysis are being considered in prioritizing improvements to the inventory.

5. Verification and quality assurance/quality control approaches

13. A quality management system as part of a national inventory system is under development. QA/QC procedures are implemented according to the IPCC good practice guidance. A QA/QC programme has been developed for a limited number of sources. The NIR describes source-specific

QA/QC in the relevant sections. Statistics Finland is the institution responsible for compilation and quality management of the GHG inventory. The Party indicates that a quality manual of the national GHG inventory system is under preparation and would be ready by the end of 2005.

6. Follow-up to previous reviews

14. Compared with previous review findings, the 2005 inventory submission has been improved thanks to a number of activities, such as the implementation of a quality management system including quality objectives, tier 1 QC procedures, quality assurance and verification procedures. The NIR is more complete and transparent and more detailed. Information previously referenced via web links is now included in the main document.

15. Pending issues identified in previous review reports are the reallocation of process emissions from Iron and Steel from the Energy to the Industrial Processes sector, the improvement of the EFs for CH_4 emissions from enteric fermentation of reindeer, and improved data collection for manure management systems.

G. Areas for further improvement

1. Identified by the Party

16. The inventory improvement plan included in the NIR identifies the following areas for improvement: updating the time series of point source data, the reallocation of process emissions from Iron and Steel from the Energy to the Industrial Processes sector, further improvement of AD and EF for peat production, improved factors for carbon storage for the estimation of feedstocks and non-energy fuel use, improved non-CO_2 EFs for fuel combustion, the development of ways to verify the estimates of emissions of fluorinated gases (F-gases), the improvement of estimation parameters for Enteric Fermentation, additional data collection of manure management systems, and increased completeness in the LULUCF sector, including area estimates of grasslands before 1995, N_2O emissions from disturbance and soil drainage, and carbon (C) stock change in soil and dead organic matter pools on forest lands.

2. Identified by the ERT

17. Finland has identified the major areas for improvements in its improvement plan or in relevant sections of the NIR. The ERT still believes that more precise descriptions of methodologies and parameters are key for a better understanding of the information provided in a number of source categories, as indicated in the relevant sector sections of this report.

18. Recommended improvements relating to specific source/sink categories are presented in the relevant sector sections of this report.

II. Energy

A. Sector overview

19. The Energy sector is the largest source of GHG emissions in Finland, contributing approximately 85 per cent of the total national GHG emissions in 2003. In 2003, emissions from the sector totalled 73,043 Gg CO_2 equivalent, an increase of 17,339 Gg CO_2 equivalent, or 31 per cent, from the year 1990. The great majority of the emissions in the Energy sector in 2003 are due to fuel combustion (99 per cent); fugitive emissions represent a much smaller portion of the total (1 per cent), with the production of peat as the primary source of fugitive emissions. Transport emissions account for almost 16.0 per cent of total GHG equivalent emissions. The reported fuel consumption and CO_2 emissions from road transport increased by 6 per cent between 1990 and 2003. This contrasts sharply with much larger increases in emissions from road transport in almost all other Parties included in Annex I to the Convention (an

average increase of 25 per cent over the period 1990–2003). The ERT would encourage Finland to explain the reasons for this specific trend in the NIR.

20. The reporting of the Energy sector is generally transparent and complete, with major source categories reported in all years with all respective gases. The time series does exhibit large inter-annual fluctuations. Given the importance of the Energy sector to the inventory, the ERT encourages Finland to further discuss the trends and their drivers within the Energy chapter of the NIR.

21. Finland uses the ILMARI system to calculate emissions through a bottom-up method using the annual fuel consumption of boilers and processes. AD in the form of fuel combustion data are available by boiler/process level and by fuel type through the regional environment centres (VAHTI) and Statistics Finland. Finland has continued to improve its explanation of the ILMARI system compared with previous reports in order to provide improved transparency on this calculation system. The ILMARI system provides bottom–up data for most point sources and aggregate data for transport/off road and other sources for all years of the time series except 1991.

B. Reference and sectoral approaches

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

22. Finland has calculated CO_2 emissions from fossil fuel combustion using the reference and the sectoral approaches for all years in the time series. For the year 2003, there is a difference of –1.96 per cent in the CO_2 emission estimates between the two approaches. As the difference is below 2 per cent, explanations were not required in the CRF tables.

23. The difference in CO_2 emissions between the reference and the sectoral approaches varies across the period 1990–2003, with the largest differences observed in 1991 and 1994. In its responses to a previous year's S&A report, Finland stated that the reference approach for all years would be checked and revised as part of the time-series recalculation during 2004/2005. The ERT encourages Finland to complete its analysis of these variances for its next submission.

24. In the annexes to the NIR, Finland has provided what it terms a "Tier 1 Reference calculation based on the National Energy Balance". The activity figures in annex 4 are based on the national energy balance sheet published in the annual energy statistics, and represent a surrogate comparison of the bottom–up calculations provided in the CRF tables with a top–down calculation from the national energy balance. The ERT encourages Finland to expand upon the explanation of this annex in its future submissions and to eliminate any possible confusion which may arise from comparing this "Energy Balance" calculation with the reference approach provided in the CRF tables.

2. International bunker fuels

25. Data on consumption of bunker fuels are collected and reported separately in the fuel sales statistics, according to the information provided in the CRF, and the estimates from international bunkers are estimated using a model based on figures for fuel sales to ships and aircraft going abroad. The NIR explains that the emissions were estimated using the same methodologies as for the national transport emissions. However, the CH_4 implied emission factors (IEFs) differ from those used for national transport. The ERT would encourage improved explanations of these differences in the Party's next inventory submission. In its response to the review, Finland stated that it would update the NIR description in its 2006 submission.

3. Feedstocks and non-energy use of fuels

26. Finland has identified feedstocks and the non-energy use of fuels as a key category. They include naphtha, lubricants, bitumen, natural gas, liquefied petroleum gas (LPG), and "other oils". The

NIR states that not enough data are available to identify the processes and actual source categories, so the calculation method used is the IPCC default method using the IPCC default EFs. The emissions are calculated assuming that all non-stored carbon is combusted. The NIR states that improvements in the carbon storage factors are expected. The ERT strongly encourages Finland to pursue this.

4. Country-specific issues

27. The carbon content EFs used for fuel combustion are a mixture of default and country-specific. Country-specific factors are used for gasoline, diesel oil, black liquor, sulphite liquor, refinery gas, refinery coke, coke oven gas, and incinerated wastes. For UNFCCC-defined key category fuels such as coal, oil (residual) and natural gas, default EFs are used which are referenced as IPCC 1995 (rather than the Revised 1996 IPCC Guidelines). Finland has indicated that results are expected in late 2005 from a new EF study on non-CO_2 EFs of point sources and from an internal review of CO_2 EFs of the most important fuels. The ERT encourages Finland to use these results in its 2006 inventory submission.

28. Finland uses peat for energy purposes, and this is discussed in greater detail under 1.B.1.c Fugitive Emissions from Peat Production.

C. Key categories

1. Stationary combustion – CO_2

29. Emission estimates for CO_2 in certain Energy subcategories under Energy Industries and Manufacturing Industries and Construction (i.e., 1.A.1.b Petroleum Refining, 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries, 1.A.2.a Iron and Steel, 1.A.2.b Non-ferrous Metals, 1.A.2.d Pulp, Paper and Print, 1.A.2.e Food Processing, Beverages and Tobacco) are exactly the same in 1991 and 1992. In its response to the review, Finland explained that for certain categories, 1991 figures were based on 1992 data as a quick and simple solution, attributing most annual variations to changes in sub-category 1.A.1.a Public Electricity and Heat Production. Finland indicated that, in its 2006 submission, estimates for the year 1991 for all sources under 1.A.1 Energy Industries and 1.A.2 Manufacturing Industries and Construction will be derived using interpolation.

2. Energy industries – CO_2

30. Other fuels used to produce electricity appear to be a combination of peat and waste incineration. However, specific details as to whether municipal solid waste (MSW) has been included in the CRF tables under Other Fuels are not given in the CRF documentation boxes or in the NIR (AD per year are not reported in the NIR). While this is a key category, the carbon contents of both peat and MSW and other wastes are default values. The ERT encourages Finland to investigate this further, using country-specific EFs, especially for peat, for this source category and to better document what is included in the "Other Fuels" portion of the CRF tables.

31. In response to questions from the ERT regarding this category, Finland stated that the quality of plant-level reporting of the "other" fuels such as MSW has not always been satisfactory. Finland is preparing a full recalculation of 1.A Fuel Combustion with the aim of improving its reporting of other fuels in this recalculation as far as possible.

3. Transport – CO_2

32. The estimates of transport emissions are based on the results of at least five sub-models from LIPASTO. The ERT believes that the transparency of the Finnish submission would be improved if the correspondence of these models to the different IPCC tier approaches could be explained in the description of methods. In addition, the ERT encourages Finland to discuss any time-series consistency issues in the section on uncertainties and time-series consistency.

33. The ERT noted that an increasing number of countries provide data on fuel consumption and emissions caused by the use of biomass fuels such as biodiesel. In a response to a question from the ERT on the possible use of such fuels in Finland, Finland noted that it has used a small amount of bioethanol since 2002. Finland has included these figures in the total use of gasoline (as fossil origin). Finland indicated that it intends to investigate this issue further. The ERT recommends that Finland explain the allocation of biomass fuels in its next NIR.

4. Fugitive emissions from peat production – CO_2

34. Estimates of fugitive CO_2 emissions from peat production areas have fallen significantly due to a recalculation following the introduction of an improved methodology. The CO_2 EF and peat production area have changed, and the double counting of the emissions with the LULUCF sector has been removed. The ERT welcomes the introduction of the improved methodology and notes that new estimates using preliminary data from new research programmes have been used. The current area is incomplete as it covers only 80–90 per cent of the total area used for peat production. In its response to the review, Finland indicated that the currently missing portion of small producers would be included in the 2006 submission. Finland is encouraged to continue improving the methodology and data sources for peat production.

35. Finland does not report AD for peat production as the unit of the data available in Finland is "area", whereas the CRF requires that AD be reported as "amount of fuel produced". The ERT recommends that, to improve transparency, the AD "area" be reported in the documentation box of CRF table 1.B.1, with the notation key "not applicable" ("NA") reported under AD in the CRF table.

D. Non-key categories

1. Manufacturing industries and construction – CO_2

36. The CRF tables indicate that emissions from coke and residual fuel oil used in the blast furnaces in the iron and steel industry have been included in fuel combustion under 1.A.2 Manufacturing Industries instead of 2.C.1 Iron and Steel Production. Additionally, blast furnace gas has been assigned a carbon content EF of "0" according to the NIR, to avoid double counting the carbon in the coke and fuel oil which are converted to blast furnace gas in these plants. This methodology is confusing and does not conform to the Revised 1996 IPCC Guidelines. Emissions from Iron and Steel should be allocated to the appropriate sector depending on whether they are combustion- or process-related (using the appropriate IPCC method for the Industrial Processes sector), and the appropriate EFs should be used.

2. Other

37. The NIR does not present fuel consumption for 1.A.5 Other (not specified elsewhere) (although it does for other categories), thus making it difficult to cross-reference with the CRF tables. As Finland has chosen to make the 1.A.5 Other source category a repository for such sources as military, non-specified use, and statistical corrections (without distinguishing between stationary and mobile sources), the ERT recommends that further details be provided (especially in the case of the "statistical corrections") in the NIR.

3. Fugitive emissions from oil and gas

38. The descriptions of the methodology and data sources used for estimating emissions from natural gas distribution lack transparency. Measurement data are not referenced. The estimates of emissions from 1991 to 1994 are stated to be based partly on industry measurements and partly on rough estimates. The ERT encourages Finland to provide a greater level of detail in the NIR for Natural Gas Distribution.

III. Industrial Processes and Solvent and Other Product Use

A. Sector overview

39. In 2003 the Industrial Processes and Solvent and Other Product Use sectors together contributed 4.1 per cent to total national GHG emissions. N_2O contributed 41.2 per cent (mainly from nitric acid production) and CO_2 contributed 38.1 per cent (mainly from cement production and lime production) to total sectoral emissions. Actual emissions of F-gases contributed 20.3 per cent (mainly HFCs from refrigeration and air conditioning equipment). From 1990 to 2003 emissions from these sectors increased by 12.2 per cent. The most significant change in emissions for this period was the increase in emissions of F-gases (a more than sevenfold increase). N_2O emissions decreased by 13.4 per cent over the same period. CH_4 emissions increased by 61.9 per cent, but their contribution to total emissions is very small. CO_2 emissions from the Industrial Processes sector in 2003 were almost the same as those in 1990 (only a 1 per cent decrease).

40. The inventory of emissions from industrial processes is well advanced and documented. Some of the categories could not be reviewed for reasons of confidentiality, but they contribute only a small proportion (2 per cent) to the sector's emissions. All gases and most of the sources, as recommended by the Revised 1996 IPCC Guidelines, are covered in the inventory. No emission estimates have been provided for 2.A.5 Asphalt Roofing and 2.A.6 Road Paving with Asphalt, except for non-methane volatile organic compounds (NMVOCs), as the Revised IPCC 1996 Guidelines or the IPCC good practice guidance do not provide default methodologies or EFs for direct GHGs from these sources. The inventory has been improved compared to the previous submission with estimates now being reported for 2.A.3 Limestone and Dolomite Use and 2.A.4 Soda Ash Use.

B. Key categories

1. Nitric acid production – N_2O

41. Emissions are calculated by multiplying the AD by an EF. AD are obtained directly from the production plants. The EF is plant-specific and based on measurements carried out at these plants in 1999. The ERT noted that this is not fully consistent with the IPCC good practice guidance, which states that industry-supplied emission estimates with appropriate QA/QC, audits and review should be reported where this is a key category. Finland explained during the review that it intended to obtain and use emissions measured at plants in its future inventories. The ERT encourages Finland to make this improvement in its next inventory submission. Also, the ERT recommends that Finland explain its next NIR that no abatement technologies are used for nitric acid production (as was explained during the review).

2. Refrigeration and air conditioning equipment – HFCs, PFCs

42. HFC and PFC emissions have increased significantly since 1990 as ozone depleting substances have been phased out. The unusual changes in recent years (a decrease of 29 per cent from 2001 to 2002 and an increase of 40.7 per cent from 2002 to 2003) are not documented in the NIR. During the review, Finland acknowledged that these inter-annual changes are not easy to explain, but indicated that they result from the use of the model which calculates emissions based on the new capacity installation data. The ERT recommends that Finland further investigate the reasons for these inter-annual fluctuations and explain them in its next NIR.

43. The method has not been used consistently for the entire time series. Finland explains in the NIR that the different methods used were compared for two overlapping years and that the results were found to be very similar in 2001. Finland concluded that the inconsistency in the time series should not be a significant issue. To increase the transparency of the reporting, the ERT encourages Finland to provide the results of the comparison in its next NIR.

C. Non-key categories

1. Cement production – CO_2

44. The CO_2 IEF for Finland is calculated to be 0.53 tonnes CO_2 /tonne clinker. The ERT noted that this is higher than the IPCC default value and seems to be higher than those of many other Parties. To improve transparency the ERT encourages Finland to document the plant-specific cement kiln dust (CKD) correction factor applied in calculating the CO_2 emissions using the tier 2 method. In its response to the review, Finland explained that plant specific CKD correction factors cannot be reported due to confidentiality reasons, but that a country-specific factor has been calculated which will be included in the 2006 submission.

2. Lime production

45. EF data were unavailable for the years 1990–1997 and 2003. For these years the mean EF for the years 1998–2002 has been used. The ERT encourages Finland to obtain and use an actual EF for the latest year of the inventory in future submissions.

3. Iron and steel production

46. CO_2 emissions from Iron and Steel Production are allocated to the Energy sector. In response to the previous (2004) review report, Finland expressed its intention to revise the methodology, but this has not yet been carried out. The ERT encourages Finland to split emissions arising from this category between Energy and Industrial Processes in its 2006 submission, as planned.

IV. Agriculture

A. Sector overview

47. In 2003 the Agriculture sector was responsible for 35.4 per cent of total national CH_4 emissions; 55.2 per cent of total N_2O emissions; and 6.4 per cent of the total national GHG emissions. Total emissions from the sector in 2003 amounted to 5,469.9 Gg of CO_2 equivalent. Over the period 1990–2003, emissions from the sector decreased by 21.8 per cent. According to the NIR, the causes for these reductions are changes in the economic structure. Fluctuations in the trend occur mainly because of changes in animal numbers, the amounts of synthetic fertilizers applied and crop yields. Emissions from Agricultural Soils represent 59.4 per cent of the emissions from the sector, followed by Enteric Fermentation, with 28.1 per cent, and Manure Management, with 12.5 per cent.

48. In general the submission is complete, transparent and consistent. Emissions from Field Burning of Agricultural Residues are not reported due to the small contribution they make and the non-availability of data. Minor improvements can be made, for example, by using the correct notation keys in some tables, and by providing more details about the calculation of country-specific EFs and choice of parameters. The documentation has improved regarding EFs for reindeer and sheep and the reporting of uncertainty estimates. In the Agricultural Soils category, the emissions estimates have been completed for the estimation of direct emissions from crop residues.

B. Key categories

1. Enteric fermentation – CH_4

49. Finland uses a tier 2 method for cattle and tier 1 for other animal categories, in line with the IPCC good practice guidance. AD are from national sources but sufficient details on the data collection

are not provided. Finland is encouraged to provide complete references (in English) to the data sources,[3] including documentation of metadata on data collection if possible. In its response to the review, Finland indicated that the data collection methodology would be described more detailed in future NIRs and that also the documentation of the EFs has been developed further for the 2006 submission.

2. Manure management – N_2O

50. For non-dairy cattle, swine and poultry the country-specific nitrogen (N) excretion rates are lower than the IPCC default values. Finland should improve explanations of the country-specific N excretion rates, as already suggested in previous reviews. The fraction of manure managed in each manure management system is the same from 1998 to 2003, and it is recommended that Finland update these fractions. In its response to the review, Finland stated that N excretion rates and distribution of manure management systems have been updated for the 2006 inventory submission.

3. Direct and indirect emissions from soil– N_2O

51. Finland uses an IPCC tier 1a methodology for this key category. Finland uses IPCC default EFs except for values for $Frac_{GASF}$, $Frac_{GASM}$ and $Frac_{LEACH}$, which are well documented national values, whereas the revised amount of applied nitrogen for ammonia (NH_3) and N in N-fixing crop is based on national literature. Finland has used a mass-flow approach for its 2005 submission.[4] Finland should provide more explanations about this approach. The results of an ongoing project in Finland are expected to further improve the $Frac_{GASF}$ value and Finland should report the results when project results are available.

V. Land Use, Land-use Change and Forestry

A. Sector overview

52. Finland has implemented methodological improvements and changes since its 2004 inventory submission due to the implementation of the IPCC good practice guidance for LULUCF. This has enabled Finland to complete the LULUCF reporting tables as required by decision 13/CP.9. The ERT noted that the whole LULUCF reporting category is under ongoing development and will be more complete in Finland's forthcoming submissions.

53. Finland has reported a fluctuating sink with a net removal of 22,749 Gg CO_2 equivalent in the year 1990 and its lowest point of removals, of 8,896 Gg CO_2 equivalent, in 1998. There has been an increase in removals since 1998, reaching 17,782 Gg CO_2 equivalent in 2003. The time series indicates a 22 per cent reduction in net removals from 1990 to 2003. Removals by the LULUCF sector represent 21 per cent of the total emissions reported in 2003 (85,559.6 Gg CO_2 equivalent), and 32 per cent in 1990.

54. The submission does not include estimates for Wetlands (in category 5.D), Settlements (in category 5.E) and Other Land (in category 5.F). The ERT notes that not all subcategories under these three categories are mandatory to report. Complete reporting of area of all land-use categories and changes over time would be preferable.

55. The key category analysis of the LULUCF sector identified the following as key categories by both level and trend in 2003: CO_2 emissions from C stock change in living biomass, CO_2 emissions from C stock change in soils (both mineral and organic) in Cropland Remaining Cropland, and CO_2 emissions from C stock change in mineral soils in Grassland remaining Grassland.

[3] I.e. the Matilda database; the *Yearbook of Farm Statistics*; the Finnish Trotting and Breeding Association; and the Finnish Fur Breeders Association.

[4] The approach used by Finland is aimed at avoiding double counting by subtracting the fraction lost as NH_3 and nitrogen oxide (NO_x) ($Frac_{GASF}$=0.01 (or 0.06)/IPCC's 0.1; $Frac_{GASM}$ =0.31/IPCC's 0.20) as well as fraction leached ($Frac_{LEACH}$=0.15/IPCC's 0.30). For $Frac_{NCRO}$ =0.04 instead of 0.015 has been used.

56. Finland indicated during the review that it will have new tree biomass models available for the 2007 submission for estimating carbon stock changes in living biomass from Forest Land Remaining Forest Land, the dominant key category of the LULUCF sector, whose associated uncertainty is currently estimated at ± 35 per cent. Finland also indicated that it will add soil and dead organic matter pools on forest land in its 2006 submission.

B. Sink and source categories

1. Forest land – CO_2

57. The transparency of the NIR regarding this category (i.e. the corresponding category according to the Revised 1996 IPCC Guidelines) has been improved, as recommended by the previous (2004) ERT. The ERT recommends that emissions and removals from forest land be reported separately for Forest Land Remaining Forest Land and Land Converted to Forest Land. Finland indicated that such separation would be undertaken in the 2007 submission.

2. Cropland – CO_2

58. There are no estimates for soil and biomass under permanent horticultural crops which was explained by Finland with the small area under permanent horticulture. The ERT encourages Finland to explain the use of the notation key "NE" in CRF table 9.

3. Drainage of soils and soil disturbance in cropland – N_2O

59. N_2O emissions from disturbance associated with the conversion of land to cropland (5 (III)) and N_2O emissions from drainage of soils (5(II)) have not been estimated due to inadequate data and methods. ERT encourages Finland to provide N_2O emission estimates from disturbance associated with land-use conversion to cropland ((5(III)). It would also welcome estimates for N_2O emissions from drainage of soils (5(II)), however noting that this source is not mandatory to be reported. In its response to the review, Finland explained that development to produce AD to estimate N_2O emissions from disturbance associated with the conversion of land to cropland is ongoing and that first results would be available for the 2007 submission.

4. Biomass burning – CO_2, CH_4

60. Total on-site carbon in biomass is estimated by applying the appropriate factors (e.g. expansion factors, carbon content etc.) to harvested stem volume and reported as a decrease in carbon stocks, thus as an emission. CO_2 is also reported under Biomass Burning. This CO_2 could be double counted as all the carbon in this biomass is assumed to instantly oxidize to CO_2 at harvest. In its response to the review, Finland acknowledged that CO_2 emissions from slash burning have been double counted as these emissions are also covered in living biomass under category 5.A Forest land, and explained this has been corrected in the 2006 submission. The ERT encourages Finland to provide the necessary explanations regarding the estimates of CO_2 as well as those of CH_4 reported under Biomass Burning in its next NIR.

VI. Waste

A. Sector overview

61. In the year 2003, the Waste sector contributed approximately 3.2 per cent of Finland's total GHG emissions. CH_4 from landfills is the most important GHG emitted in the sector, contributing 91.5 per cent to total sectoral emissions. From 1990 to 2003 emissions in the sector decreased by 31.3 per cent, mainly because of the implementation of waste management regulations and methane recovery.

62. Finland reports declining amounts of solid waste disposal on landfills because its waste management policy promotes alternative waste treatment methods such as composting. However, Finland does not estimate emissions from composting and therefore underestimates current CH_4 and N_2O emissions. The actual amounts of CH_4 and N_2O emissions from composting may still be small, but the ERT strongly recommends that Finland include these emission sources in the inventory as their relevance may grow in the future. EFs for CH_4 and N_2O could be obtained either from country-specific data or from other countries which estimate this source (e.g. Austria, Italy, Belgium, the Netherlands), as the Revised 1996 IPCC Guidelines and the IPCC good practice guidance do not provide a methodology or default EFs for composting. Finland informed the ERT that estimates of CH_4 and N_2O emissions from composting would be included in its 2006 submission.

63. Transparency and quality management in the Waste sector have been improved compared to previous submissions.

B. Key categories

1. Solid waste disposal – CH_4

64. Finland has used a first-order decay (FOD) method with a slightly modified equation 5.1 which complies with the IPCC good practice guidance. The average common methane correction factor assumed in the calculation is < 1 before 2002; thus some small unmanaged landfilling is assumed up to 2002, which seems to be rather late compared to other European countries. The country-specific average degradable organic carbon (DOC) is based on waste composition data from 1990. The data for 1990 are not properly referenced, and information should be provided as to how the data were derived (e.g. data collection method and completeness). Since 1990 waste management practices have changed considerably, for example, additional recycling and/or different biomass waste treatment are taking place which have significantly altered waste composition compared to 1990. Finland is urged to update its waste composition data for recent years and to collect data on waste composition periodically.

2. Waste-water handling – N_2O

65. N_2O emissions are reported for fish farming and domestic and industrial waste water. Finland provided clear documentation on the country-specific and default methodologies used to estimate N_2O emissions.

C. Non-key categories

1. Waste-water handling – CH_4

66. A country-specific methodology in line with the Revised 1996 IPCC Guidelines based on biochemical oxygen demand (BOD) and chemical oxygen demand (COD) has been used to estimate CH_4 emissions from municipal (domestic), industrial waste-water handling plants and uncollected domestic waste waters.

2. Waste incineration – CO_2, N_2O and CH_4

67. In the NIR Finland assumes that waste incineration without energy recovery is nearly negligible. This assumption should be better documented.

Annex

Documents and information used during the review

A. Reference documents

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories, 2000. Available at: <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

IPCC. Good practice guidance for land use, land-use change and forestry, 2003. Available at: <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.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>.

UNFCCC. 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/SBSTA/2004/8. Available at: <http://unfccc.int/resource/docs/2004/sbsta/08.pdf>.

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UNFCCC secretariat. Synthesis and assessment report on the greenhouse gas inventories submitted in 2005. FCCC/WEB/SAI/2005. Available at
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B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Riitta Pipatti (Statistics Finland) including additional material on the methodology and assumptions used.

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