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Report of the individual review of the annual submission of Finland submitted in 2011*

* In the symbol for this document, 2011 refers to the year in which the inventory was submitted, and not to the year of publication.

Contents

I. Introduction and summary

A. Overview

1. This report covers the centralized review of the 2011 annual submission of Finland, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 29 August to 3 September 2011 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Bernd Gugele (European Union (EU)) and Mr. Newton Paciornik (Brazil); energy – Mr. Qiang Liu (China), Mr. Ole-Kenneth Nielsen (Denmark) and Ms. Kennie Tsui (New Zealand); industrial processes – Ms. Jolanta Merkeliene (Lithuania); agriculture – Mr. Tom Wirth (United States of America); land use, land-use change and forestry (LULUCF) – Mr. Toru Gomi (Japan) and Mr. Valentin Bellassen (France); and waste – Mr. Pavel Gavrilita (Republic of Moldova). In addition, Mr. Nielsen supported the review of the industrial processes and waste sectors. Mr. Gugele and Mr. Paciornik were the lead reviewers. The review was coordinated by Ms. Barbara Muik and Mr. Roman Payo (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1), a draft version of this report was communicated to the Government of Finland, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Emission profiles and trends

3. In 2009, the main greenhouse gas (GHG) in Finland was carbon dioxide (CO_2), accounting for 83.5 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by nitrous oxide (N_2O) (8.6 per cent) and methane (CH_4) (6.4 per cent). Hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (SF_6) collectively accounted for 1.4 per cent of the overall GHG emissions in the country. The energy sector accounted for 80.1 per cent of total GHG emissions, followed by agriculture (8.6 per cent), industrial processes (7.9 per cent), waste (3.3 per cent) and solvent and other product use (0.1 per cent). Total GHG emissions amounted to 66,344.47 Gg CO_2 eq and decreased by 5.7 per cent between the base year[2] and 2009.

4. Tables 1 and 2 show GHG emissions from Annex A sources, emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO_2, CH_4 and N_2O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector.

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

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for hydrofluorocarbons, perfluorocarbons and SF_6. The base year emissions include emissions from Annex A sources only.

Table 1
Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year to 2009[a]

			Gg CO_2 eq								*Change*
		Greenhouse gas	*Base year*	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009 (%)*
Annex A sources		CO_2	56 596.17	56 596.17	57 838.29	56 741.55	56 389.70	66 135.76	58 255.07	55 417.07	–2.1
		CH_4	6 315.17	6 315.17	6 103.64	5 405.50	4 526.56	4 460.39	4 343.89	4 272.67	–32.3
		N_2O	7 362.74	7 362.74	6 749.62	6 458.37	6 662.27	6 610.54	6 784.96	5 715.24	–22.4
		HFCs	29.33	0.02	29.33	491.76	863.45	903.28	993.19	888.83	2 930.6
		PFCs	0.14	0.07	0.14	22.46	9.88	8.40	11.23	9.32	6 555.3
		SF_6	68.53	94.38	68.53	51.49	34.83	35.97	40.36	41.34	–39.7
KP-LULUCF	Article 3.3[b]	CO_2							3 766.27	3 816.49	
		CH_4							0.00	0.00	
		N_2O							4.65	4.65	
	Article 3.4[c]	CO_2	NA						–38 008.56	–50 305.41	NA
		CH_4	NA						1.28	1.11	NA
		N_2O	NA						34.23	24.91	NA

Abbreviations: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[c] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

Table 2
Greenhouse gas emissions by sector and activity, base year to 2009[a]

			Gg CO_2 eq								*Change*
		Sector	*Base year*	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009 (%)*
Annex A		Energy	54 481.96	54 481.96	56 039.27	54 395.32	53 950.82	63 167.44	55 059.21	53 112.72	–2.5
		Industrial processes	5 078.71	5 075.18	4 648.47	5 529.26	6 241.58	6 723.74	7 077.37	5 251.08	3.5
		Solvent and other product use	178.37	178.37	142.77	124.71	106.39	97.07	86.77	70.51	–60.5
		Agriculture	6 658.45	6 658.45	6 047.99	5 850.67	5 783.21	5 796.54	5 930.15	5 721.35	–14.1
		Waste	3 974.60	3 974.60	3 911.06	3 271.16	2 404.68	2 369.54	2 275.19	2 188.82	–44.9
		LULUCF	–15 038.18	–15 038.18	–13 291.72	–20 936.89	–27 663.46	–23 339.54	–27 010.49	–40 558.42	169.7
		Total (with LULUCF)	**NA**	**55 330.37**	**57 497.84**	**48 234.23**	**40 823.23**	**54 814.80**	**43 418.22**	**25 786.05**	**NA**
		Total (without LULUCF)	**70 372.08**	**70 368.55**	**70 789.55**	**69 171.12**	**68 486.69**	**78 154.34**	**70 428.70**	**66 344.47**	**–5.7**
		Other[b]	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
KP-LULUCF	Article 3.3[c]	Afforestation & reforestation							200.26	202.09	
		Deforestation							3 570.66	3 619.06	
		Total (3.3)							**3 770.92**	**3 821.15**	
	Article 3.4[d]	Forest management							–37 973.05	–50 279.39	NA
		Cropland management	NA						NA	NA	NA
		Grazing land management	NA						NA	NA	NA
		Revegetation	NA						NA	NA	NA
		Total (3.4)	**NA**						**–37 973.05**	**–50 279.39**	NA

Abbreviations: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

[b] Emissions/removals reported under sector 7 "other" are not included in Annex A to the Kyoto Protocol and are therefore not included in national totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation. Only the inventory years of the commitment period must be reported.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation. For cropland management, grazing land management and revegetation, the base year and the inventory years of the commitment period must be reported.

5. Table 3 provides information on the most important emissions and removals and accounting parameters that will be included in the compilation and accounting database.

Table 3
Information to be included in the compilation and accounting database, in t CO_2 eq

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]	*Accounting quantity*[c]
Commitment period reserve	319 515 790			319 515 790	
Annex A emissions for current inventory year					
CO_2	55 408 906	55 417 072		55 417 072	
CH_4	4 272 673			4 272 673	
N_2O	5 715 242			5 715 242	
HFCs	888 831			888 831	
PFCs	9 317			9 317	
SF_6	41 335			41 335	
Total Annex A sources	**66 336 304**			**66 344 470**	
Activities under Article 3, paragraph 3, for current inventory year					
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	202 086			202 086	
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	NA			NA	
3.3 Deforestation for current year of commitment period as reported	3 619 060			3 619 060	
Activities under Article 3, paragraph 4, for current inventory year[d]					
3.4 Forest management for current year of commitment period	–50 279 393			–50 279 393	
3.4 Cropland management for current year of commitment period					
3.4 Cropland management for base year					
3.4 Grazing land management for current year of commitment period					
3.4 Grazing land management for base year					
3.4 Revegetation for current year of commitment period					
3.4 Revegetation for base year					

Abbreviation: NA = not applicable.

[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

[b] "Final" includes revised estimates, if any, and/or adjustments, if any.

[c] "Accounting quantity" is included in this table only for Parties that chose annual accounting for activities under Article 3, paragraph 3, and elected activities under Article 3, paragraph 4, of the Kyoto Protocol, if any.

[d] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more of these activities.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2011 annual inventory submission was submitted on 15 April 2011; it contains a complete set of common reporting format (CRF) tables for the period 1990–2009 and a national inventory report (NIR). Finland also submitted information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and minimization of adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 18 March 2011. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Finland officially submitted revised emission estimates on 8 September 2011 in response to questions raised by the expert review team (ERT) during the course of the review (see para. 59 below). The values used in this report are based on the values contained in the submission of 8 September 2011.

8. Where necessary, the ERT also used the previous years' submissions during the review. In addition, the ERT used the standard independent assessment report (SIAR), parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.[3]

9. During the review, Finland provided the ERT with additional information and documents which are not part of the annual submission but are in many cases referenced in the NIR. The full list of information and documents used during the review is provided in annex I to this report.

Completeness of inventory

10. The inventory covers all source and sink categories for the period 1990−2009 and is complete in terms of years and geographical coverage. Finland has provided CRF tables for all years of the inventory time series. CRF table 7 has been provided for 1990 and 2009.

2. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Overview

11. The ERT concluded that the national system continued to perform its required functions.

12. The Party described the changes to the national system since the previous annual submission. These changes are related to the procedures for the estimation of emissions

[3] The SIAR, parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5(a), 6(c) and 6(k)), under the auspices of the international transaction log (ITL) administrator using procedures agreed in the Registry System Administrators Forum. Part I is a completeness check of the submitted information relating to the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and to national registries. Part II contains a substantive assessment of the submitted information and identifies any potential problem regarding information on the accounting of Kyoto Protocol units and the national registry.

from aviation and access to more detailed data collected by the Energy Market Authority, and are discussed in chapter II.G.3 of this report.

Inventory planning

13. The NIR described the national system and institutional arrangements for the preparation of the inventory. Statistics Finland has overall responsibility for the national inventory. Other institutes are also involved in the preparation of the inventory at the sectoral level: the Finnish Environment Institute (responsible for fluorinated gases and waste); MTT Agrifood Research Finland and the Finnish Forest Research Institute (responsible for agriculture and LULUCF); and VTT Technical Research Centre of Finland (responsible for transport). Finavia (the former Civil Aviation Administration) was responsible for aviation information until last year, but its responsibilities will be transferred to Eurocontrol, as described in chapter II.G.3 of this report. Statistics Finland was appointed as the national authority for Finland's GHG inventory at the beginning of 2005. In addition to the preparation of the inventory, Statistics Finland is also responsible for inventory reporting and its submission under the Convention and the Kyoto Protocol.

Inventory preparation

Key categories

14. Finland has reported a key category tier 2 analysis, both level and trend assessment, as part of its 2011 annual submission. Finland did not report a tier 1 analysis. Finland has performed the key category analysis with and without the LULUCF sector as recommended in the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF).

15. Finland did not include in an annex to the NIR the tables with numerical results as it did in previous annual submissions. The ERT considers that this reduces the transparency of the NIR and recommends that Finland include those tables in its next annual submission. Finland provided the tables to the ERT during the review.

16. The key category analysis performed by the Party and that performed by the secretariat[4] produced different results, because Finland performed a tier 2 analysis while the secretariat provided the results of a tier 1 analysis. Furthermore, the Party and the secretariat used different levels of disaggregation. In particular, in the Party's analysis the energy sector CO_2 emissions are at a higher level of aggregation than that recommended in the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). Finland states in the NIR that the reason for this is that fuel consumption data are less uncertain at this higher level of aggregation. The ERT considers that this choice can lead to the incorrect identification of the key subcategories and encourages Finland to further disaggregate CO_2 emissions from fuel combustion when performing the key category analysis for its next annual submission.

[4] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. 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.

17. Finland reported that the key category analysis is used together with the uncertainty analysis to guide decisions on methodological choice. The list of key categories identified forms the basis of discussions with the sectoral experts on the quality of the estimates and the possible need for improvements; the key categories are subjected to more detailed documentation and quality control compared with other categories.

18. Finland has identified all categories under Article 3, paragraph 3, and the elected category (forest management) under Article 3, paragraph 4, of the Kyoto Protocol as key categories. The result of the analysis is presented both in the KP-LULUCF CRF table NIR.3 and in the NIR. However, the rationale for the identification is presented only in the KP-LULUCF CRF table. The ERT encourages Finland to improve the description of the analysis in the NIR for the sake of transparency.

Uncertainties

19. Finland has reported a tier 1 uncertainty analysis in accordance with the IPCC good practice guidance for both level and trend as well as excluding and including the LULUCF sector. Furthermore, Finland explained in the NIR that a tier 2 methodology and sensitivity analysis is applied to specific key categories selected using the tier 2 key category analysis in order to improve the uncertainty assessment. Finland included this assessment in the NIR for the category N_2O emissions from nitric acid production. While commending Finland for this approach, the ERT encourages the Party to perform periodically a full tier 2 uncertainty assessment. The results of the tier 1 analysis are presented in annex 6 to the NIR and, together with the tier 2 key category analysis, are used to guide improvement plans for the inventory. The uncertainty estimate for total GHG emissions without LULUCF was 12 per cent for 2009, while the estimated uncertainty related to the emission trend was 7 per cent. The uncertainty estimate for the total GHG emissions with LULUCF for the same year was 59 per cent, while the estimated uncertainty related to the emission trend was 39 per cent. The uncertainty estimates have increased compared with those in the previous annual submission, mainly owing to the revision of the uncertainties for the LULUCF sector. Finland did not report uncertainty estimates for KP-LULUCF activities (see para. 86 below).

20. Finland included in the NIR a table showing how the uncertainty results have varied since 1999, as recommended in previous review reports, but did not include any explanation for these variations. In particular, the ERT encourages Finland to include in the NIR a summary of the data improvements and main drivers that explain the changes in uncertainty in relation to the previous annual submission.

Recalculations and time-series consistency

21. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The major changes without the LULUCF sector, and the magnitude of the impact, include: a decrease in estimated total GHG emissions for the base year (0.1 per cent) and an increase for 2008 (0.2 per cent). The changes including the LULUCF sector are significant (increase in estimate of 24.4 per cent for 2008), mainly owing to the use of new area data for all LULUCF categories and a new methodology (see paras. 68 and 69 below). For the other sectors, many recalculations have been conducted, such as the revision of data statistics for the energy sector (see para. 32 below) and corrections in the industrial processes and agriculture sectors, with little overall influence on the estimates. The rationale for these recalculations is provided in the NIR and in CRF table 8(b). In response to the list of potential problems and further questions raised by the ERT during the review, Finland provided revised emission estimates for the industrial processes sector (see para. 59 below).

22. The emission time series is consistent for most categories. The ERT recommends that the improvement of the time-series consistency for SF_6 emissions from electrical equipment be implemented, as planned by Finland for its 2013 annual submission (see para. 60 below).

Verification and quality assurance/quality control approaches

23. Statistics Finland has overall responsibility for the quality assurance and quality control (QA/QC) process. The other institutions involved are represented in the inventory working group, which meets four to seven times a year, and take part, once a year, in the bilateral quality meetings between the inventory unit and the expert organizations, where issues concerning the inventory quality and improvement needs are discussed. The NIR presents an extensive description of the quality objectives, the QA/QC plan and how it is implemented. The category-specific QA/QC details are discussed in the sectoral chapters of the NIR. In response to the previous review report, Finland has included more information on QC checks for the central database of environmental administration (VAHTI) and on the reporting on the audits performed every year. The first internal audit took place for the agriculture sector in November 2009 and another was conducted for the LULUCF sector in October 2010. Finland has also included a section on the treatment of confidentiality issues. The ERT commends Finland for these improvements.

Transparency

24. Finland has been constantly improving the transparency of its annual submission. The NIR includes information on key categories, methods, data sources and uncertainty estimates, as well as a description of the QA/QC procedures and verification activities used in the preparation of the GHG inventory. The sectoral chapters include information on methodological issues, activity data (AD) and emission factors (EFs), together with category-specific uncertainty assessments, QA/QC procedures and verification activities, recalculations and planned improvements. The information provided in the CRF tables and the NIR is consistent. However, Finland has removed some of the information previously presented in the NIR (e.g. tables for key category analysis (see para. 15 above)), which the ERT considers to be inadequate. The ERT encourages Finland to continue to improve the transparency of the information provided in its next annual submission. In particular, the ERT recommends that Finland provide clearer information for the energy sector (see para. 39 below), the industrial processes sector (see paras. 53, 56 and 58 below) and the LULUCF sector (see paras. 69–71, 74 and 75 below), as well as on the activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol (see paras. 92 and 93 below).

Inventory management

25. Finland has a centralized archiving system, located at Statistics Finland, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. The annual inventory process documents, including primary material and internal documents used for the calculations, are also archived at the expert organizations responsible for the sectors.

3. Follow-up to previous reviews

26. Finland has made improvements in its 2011 inventory submission by implementing many of the recommendations formulated during the previous expert reviews. The Party continued to improve the transparency of the NIR and included more information on

internal audits and on implementation of the commitments under Article 3, paragraph 14, of the Kyoto Protocol. The implemented recommendations formulated in the 2010 review report are included in table 10.4-2 of the NIR. The ERT commends Finland for this transparent approach. Finland is still to implement some of the recommendations made in the previous review report, including the provision of separate estimates for above-ground and below-ground biomass in the LULUCF sector (planned for the 2012 annual submission).

4. Areas for further improvement

Identified by the Party

27. The 2011 NIR identifies several areas for improvement, indicating the expected time frame for their implementation. Finland's improvement plan includes:

(a) Using emission data for aviation from Eurocontrol sources;

(b) Improving the calculation of emissions from leisure boats;

(c) Recalculating SF_6 emissions from electrical equipment, in order to improve time-series consistency;

(d) Updating the distribution of different manure management systems and improving the uncertainty analysis for manure management;

(e) Reviewing the methodology for estimating carbon stock changes in cropland and grassland;

(f) Developing further the methodology to identify transitions between land-use categories with Finnish national forest inventory (NFI) field data, in order to fulfil the demands of reporting under Article 3, paragraph 3, of the Kyoto Protocol;

(g) Improving the method to estimate uncertainties for carbon stock changes in forest land;

(h) Updating the composition data for mixed construction and demolition waste.

Identified by the expert review team

28. During the review, the ERT identified cross-cutting issues for improvement. These are listed in paragraph 114 below. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

B. Energy

1. Sector overview

29. The energy sector is the main sector in the GHG inventory of Finland. In 2009, emissions from the energy sector amounted to 53,112.72 CO_2 eq, or 80.1 per cent of total GHG emissions. Since 1990, emissions have decreased by 2.5 per cent. The key driver for the fall in emissions is the 37.7 per cent decrease in emissions from manufacturing industries and construction, followed by the 8.4 per cent decrease in emissions from the category other. This decrease was attenuated by the rise in emissions from energy industries (32.5 per cent) and transport (1.3 per cent). Within the sector, fuel combustion was by far the largest contributor (99.7 per cent), with 47.9 per cent of the sectoral emissions coming from energy industries, followed by 24.3 per cent from transport, 15.7 per cent from manufacturing industries and construction and 11.8 per cent from the category other. Fugitive emissions from oil and natural gas accounted for 0.3 per cent.

30. Finland has calculated emissions for all categories, gases and fuels used in the energy sector, as recommended in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines). Emissions from the energy sector have been reported for all years of the inventory time series and have been mainly calculated using the ILMARI calculation system developed at Statistics Finland. Only fugitive emissions from solid fuels have been reported as not occurring ("NO"). Emissions from peat production are reported in the LULUCF sector under wetlands, consistent with the IPCC good practice guidance for LULUCF.

31. Finland has provided information on QA/QC procedures performed at the national level, in accordance with the IPCC good practice guidance. One of the QA/QC procedures implemented by Finland is the verification of emission estimates by comparing them with emission estimates reported by facilities under the EU emissions trading scheme (EU-ETS).

32. Finland has provided quantitative information on the energy sector recalculations in table 10.1-1 of the "Recalculations" chapter of the NIR. The recalculations were performed following:

(a) The reallocation of transport biofuels to cover all transport sectors instead of road transportation only, starting from 2008;

(b) The incorporation of new data on various biogenic compounds;

(c) The revision of the time series of diesel fuel consumption to match the energy statistics data;

(d) The revision of the data on fuel consumption in agriculture and space heating for 2008.

33. The recalculations led to an increase in the total estimated emissions of 0.2 per cent for 2008 and were performed in accordance with the IPCC good practice guidance.

2. Reference and sectoral approaches

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

34. Finland has calculated CO_2 emissions from fossil fuel combustion using the reference approach and the sectoral approach for all years in the time series. For 2009, CO_2 emissions estimated using the sectoral approach were 0.03 per cent lower than those estimated using the reference approach. The early years of the time series exhibit the largest differences, especially 1992 and 1993. Finland indicated in its NIR that no obvious reasons for these differences have been found. Previous ERTs have encouraged Finland to continue its efforts to better explain these differences, and the present ERT reiterates that encouragement.

35. In the previous review report it was recommended that Finland include in future annual submissions an annex providing the national energy balances used in the top-down reference calculation, in order to increase the transparency of the comparison between the energy balance and the GHG inventory. In the 2011 annual submission, Finland included the energy balance sheets in annex 4 to the NIR. The energy balance sheets were sourced from the annual energy statistics as the finalization of the energy balance table is usually too late for comparison purposes. The available energy balance sheets provide an additional tool for the verification of the overall results, which in turn improves the internal QA/QC system. The ERT commends Finland for its efforts to compile this information.

International bunker fuels

36. Finland reported emissions from international bunker fuels on the basis of fuel sales using country-specific CO_2 EFs and non-CO_2 EFs from the Revised 1996 IPCC Guidelines. Finland indicated the possibility of a minor double counting of emissions with domestic navigation, where ports are used for both national and international shipping purposes (NIR, page 124). The ERT recommends that Finland address this issue and ensure that emissions are not double counted. Finland has agreed to investigate this issue and will provide more information in its 2013 annual submission.

Feedstocks and non-energy use of fuels

37. Finland reported emissions from feedstocks and non-energy use of fossil fuels under the category other (energy). The Party applied the IPCC default EFs from the Revised 1996 IPCC Guidelines and country-specific EFs. The information presented in the NIR is generally transparent with regard to the methodological approach and the reporting of the emissions. Finland reported lubricant usage as non-energy use of fuels, but did not split it between domestic and international usage, as only information on total sales of lubricants is available in the fuel statistics. The NIR identifies this issue as a planned improvement and the ERT recommends that Finland implement this improvement in its next annual submission.

Country-specific issues

38. Finland reports negative emissions in a category called CO_2 transfer, under other (manufacturing industries and construction). In its NIR, the Party describes that this category includes CO_2 from energy production that is captured in the production of precipitated calcium carbonate (PCC). PCC is widely used in different kinds of paper and paperboard as filling or coating material and CO_2 is considered to be stored long-term, which is the main criterion used for the inclusion of CO_2 capture and storage in the inventory. In response to the recommendation made in the previous review report, Finland has provided further information in annex 3 to its NIR on the methodology used to calculate the CO_2 captured and stored, thereby improving transparency.

39. In the previous review report it was recommended that Finland report CO_2 emissions from fossil fuel combustion separately from those from biomass fuel combustion that are captured in PCC production, and subtract only CO_2 emissions from fossil fuel combustion as CO_2 stored, in order to avoid omitting CO_2 emissions. The ERT noted that Finland has chosen to account for forest management, and consequently all CO_2 emissions from domestic biomass are accounted for in its inventory. During the review, in response to questions raised by the ERT, Finland confirmed that all harvesting of woody biomass is included as carbon stock changes in the LULUCF sector in accordance with the IPCC good practice guidance for LULUCF. Finland also explained that it imports wood (mainly from the Russian Federation, which has also elected forest management), but for energy production the imported amounts are small. The biomass used may contain small amounts of bark from imported wood, but Finland considers this unlikely. The ERT recommends that Finland include this explanation in its next annual submission in order to improve transparency.

3. Key categories

Stationary combustion: all fuels – CO_2

40. Finland calculated CO_2 emissions from fuel combustion using a country-specific method and cross-checked the results with CO_2 emission estimates calculated from the

national energy consumption reported in the national energy balance sheet using a top-down calculation as in the reference approach.

41. The country-specific method used detailed AD on fuel consumption and fuel-specific EFs. Finland has a detailed database of EFs and a calculation system. The Party also uses data collected through the EU-ETS for the calculations to supplement and verify the inventory data. Monitored EU-ETS data for CO_2 emissions are available only for 2005 onwards and the allocation of the EU-ETS data is not always sufficiently detailed for inventory purposes. The Party indicated that, among others, the issue of how to address time-series consistency for the years prior to the implementation of the EU-ETS needs to be resolved before the use of EU ETS data in the inventory can be substantially increased.

Mobile combustion: liquid fuels – CO_2, CH_4 and N_2O[5]

42. In its NIR, page 85, Finland explains that, based on expert judgement, it has revised the allocation of diesel oil, off-road light fuel oil and heating gas oil used in the different subcategories within transport and energy industries. The ERT recommends that Finland provide additional information in its next annual submission, including documentation on how these allocations are derived from expert judgement, in order to improve transparency.

43. Finland calculated fuel consumption and emissions from transport using the LIPASTO system developed by VTT Technical Research Centre of Finland, which contains four sectoral submodels. The NIR provides information on the models, general methodologies, fuel consumption and EFs used. Finland indicated, for example, that it uses EFs for fossil transport fuels based on the product analysis carried out by Neste Oil laboratories. In the previous review report it was recommended that Finland provide additional information on the biofuel EFs that are used in the transport sector for 2002 onwards. In response, Finland reported in the 2011 NIR, section 3.3, that biogenic CO_2 EFs are calculated based on the assumption of the carbon content of each type of biogenic component of each type of oil product and that the same CH_4 and N_2O EFs are used for the fossil and the biogenic share of the same fuel type. The ERT commends Finland for its effort to improve transparency.

4. Non-key categories

Civil aviation: liquid fuels – CO_2, CH_4 and N_2O

44. In its NIR, Finland mentioned that it will start using the data from Eurocontrol starting with the 2012 annual submission to estimate emissions associated with civil aviation, if the work on the Eurocontrol portal advances as planned. The ERT welcomes this plan and encourages Finland to implement this improvement as soon as possible.

Stationary combustion: all fuels – CO_2, CH_4 and N_2O

45. According to its NIR, Finland has identified a methodology for estimating household energy consumption, including space heating, that is more detailed than the one used at the moment. The results will be available for the next annual submission. The ERT encourages Finland to implement this new methodology if it increases the accuracy of the inventory and to provide detailed documentation on the methodology and the recalculations for the sake of transparency.

[5] Not all emissions related to all gases under this category are key categories, particurlarly CO_2 and CH_4. However, since the calculation procedures for and issues related to this category are discussed as a whole, the individual gases are not assesed in separate sections.

Fugitive emissions: natural gas – CH_4

46. Finland reported CH_4 emissions from natural gas transmission and distribution based on measurements conducted by private companies during the period 1996–2009. During the review, Finland confirmed that the CH_4 emission estimates for the years 1990–1995 were calculated using linear interpolation, which is in accordance with the IPCC good practice guidance, and took into account the increased volume of natural gas transmitted and distributed during 1994 and 1995. The ERT encourages Finland to include further documentation in its next annual submission in order to improve the transparency of its reporting.

C. Industrial processes and solvent and other product use

1. Sector overview

47. In 2009, emissions from the industrial processes sector amounted to 5,251.08 Gg CO_2 eq, or 7.9 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 70.51 Gg CO_2 eq, or 0.1 per cent of total GHG emissions. Since the base year, emissions have increased by 3.4 per cent in the industrial processes sector, and decreased by 60.5 per cent in the solvent and other product use sector. The key driver for the rise in emissions in the industrial processes sector is an increase in emissions of halocarbons, which is somewhat counteracted by a decrease in N_2O emissions from nitric acid production. Within the industrial processes sector, 37.1 per cent of the emissions were from metal production, followed by 28.1 per cent from chemical industry, 17.9 per cent from consumption of halocarbons and SF_6 and 16.8 per cent from mineral products.

48. Finland has made recalculations for the industrial processes sector between the 2010 and 2011annual submissions, in order to correct identified errors/omissions. The impact of these recalculations on the industrial processes sector is an increase in the estimate of emissions of 38.13 Gg CO_2 eq (or 0.5 per cent) for 2008. The main recalculations took place for the categories limestone and dolomite use, nitric acid production and consumption of halocarbons and SF_6.

49. Finland has made recalculations for the solvent and other product use sector between the 2010 and 2011 annual submissions, following changes in non-methane volatile organic compound emissions from wood preservation. The impact of these recalculations on the solvent and other product use sector is an increase in the estimate of emissions of 0.89 Gg CO_2 eq (or 1.0 per cent) for 2008.

50. Finland's inventory for the industrial processes and solvent and other product use sectors is complete, including emission estimates for all relevant categories. The reporting is generally transparent regarding the sources of data and factors, and the methods and assumptions used for the entire time series. Finland has provided a full explanation of the uncertainty estimates and QA/QC procedures for all categories of the industrial processes sector, including the verification of emission estimates by comparing them with emission estimates reported under the EU ETS. Other than the improvements to the approach used to estimate SF_6 emissions from electrical equipment, there are no planned improvements.

2. Key categories

Nitric acid production – N_2O

51. The ERT noted that the N_2O implied emission factor (IEF) for nitric acid production for 2009 decreased by 33.8 per cent when compared with that for 2008, owing to the installation of abatement technology. In its 2011 NIR, Finland provided more documentation on the methodology for estimating emissions from nitric acid production

compared with in its 2010 annual submission and provided information on the trend in line with recommendations made in previous review reports. In addition, Finland provided information in the 2011 NIR on the joint implementation project to reduce emissions from nitric acid production and included a description of the plant-specific calculations of EFs. The ERT commends Finland for these improvements.

Other (chemical industry) – CO_2

52. Finland has reported emissions from production of hydrogen under other (chemical industry). Finland uses stoichiometric EFs for the different feedstocks used. In response to a recommendation made in the previous review report, Finland has included in the NIR the EFs for the different feedstocks used for hydrogen production. The ERT commends Finland for this improvement in transparency.

53. Finland applies a correction factor to the stoichiometric factors to account for the incompleteness of the chemical reactions. Finland uses a correction factor of 0.94. This implies that 6 per cent of the carbon in the synthesis gas is carbon monoxide (CO) (most likely) or CH_4. During the review, the ERT enquired about the use of pressure swing adsorption (PSA) units and whether the off-gas from the PSA containing unreacted CH_4 and CO is recycled to the fired reformer as fuel. In response, Finland informed the ERT that there are five hydrogen production plants in Finland and all plants produce hydrogen with steam-reforming and the produced hydrogen is refined in PSA units. Furthermore, Finland explained that when off-gases are used only for preheating of processes, the correction factor has been applied; if off-gases are recycled and combusted no correction factor has been used. Finland also informed the ERT that the combusted off-gas emissions are included in the energy sector and emissions are calculated using the composition of the off-gas to determine the EF. The ERT recommends that Finland include the information provided to the ERT in the next annual submission.

54. The recycling and combustion of off-gases could potentially result in a double counting of emissions since Finland states that the correction factor is not used when off-gases are recycled, which would imply that all carbon is accounted for at this stage and that including emissions from the combustion could lead to an overestimation. During the review, Finland informed the ERT that in its opinion emissions are not double counted and that the off-gas emissions reported in the energy sector are corrected taking the emissions reported under hydrogen production into account. The ERT recommends that Finland ensure that there is no double counting of emissions and improve the description of this in its next annual submission.

Iron and steel production – CO_2

55. Finland states in the NIR that some carbon stored has not been considered in the inventory for iron and steel production. The previous ERT recommended that Finland include in the inventory the very small amounts of carbon stored. Finland has responded to the recommendation stating that the resources needed to perform such a task would outweigh the gain in accuracy. The ERT notes that the approach currently taken by Finland is conservative, ensuring that all carbon is accounted for. From the information provided in the NIR and the responses from Finland during the review, it is evident that the resources needed to implement this would outweigh the gain in accuracy. Furthermore, it could jeopardize resources for other key categories and the change in the estimate of emissions would fall far below the uncertainty of the emission estimate. Therefore, the ERT considers that the approach taken by Finland is appropriate.

3. Non-key categories

Cement production – CO_2

56. For cement production Finland applies a correction factor of 0.92 to account for non-carbonate sources of calcium oxide (CaO) in the raw materials. This factor causes Finland to have one of the lowest IEFs (0.50 t/t for 2009) of all reporting Parties (0.49–0.56 t/t). The source of the IEF is mentioned; however, it is not included in the list of references in the NIR. During the review, Finland informed the ERT that the reference is a personal communication from the only cement producer in Finland, and that the reference had been omitted by mistake. Finland further informed the ERT of the different raw materials containing non-carbonate sources of CaO and that information in environmental permits supported the correction factor used. The ERT recommends that Finland include this information in the NIR of the next annual submission.

Lime production – CO_2

57. It is reported in the NIR that for lime production the EF for one plant is based on the actual content of CaO and magnesium oxide in the lime. For five other plants an IEF has been used for the whole time series. The IEF is based on emission and production data for the period 1998–2002. Comparison with EU-ETS data shows that EU ETS data are higher by about 9 per cent. During the review, the ERT asked Finland to specify the reasons for not using the plant-specific data, where available, and applying interpolation between 2002 and the first year of reporting under the EU-ETS in line with the IPCC good practice guidance. Finland responded that it would consider this but would need to clarify how the EU-ETS AD are related to the AD currently used in the inventory in order to ensure time-series consistency. The ERT recommends that Finland explore the use of plant-specific data for the five plants for which an IEF is currently used, and use interpolation or other ways of ensuring time-series consistency.

Limestone and dolomite use – CO_2

58. For limestone and dolomite use Finland applies correction factors to the IPCC default EFs to account for impurities. The correction factors vary between 0.93 and 0.97 according to the NIR. In response to questions raised during the review, Finland stated that if the plant-specific correction factors were available they were used in the inventory, and in other cases a correction factor of 0.97 was used. Furthermore, Finland informed the ERT that a master thesis from Helsinki University of Technology was used as reference; however, the thesis is written in Finnish. Finland also stated that plant-specific information cannot be included in the NIR for reasons of confidentiality. While the percentages of impurities assumed by Finland seem reasonable in comparison with available international literature, the ERT recommends that Finland include in its next annual submission more information verifying the assumptions it made in establishing the correction factors.

Soda ash use – CO_2

59. Finland excludes a certain amount of the soda ash used from the calculation of CO_2 emissions. In response to questions raised by the ERT during the review, Finland stated that this amount is used in industries where the soda ash is not heated and therefore does not produce CO_2 emissions. Finland mentioned as examples the forage industry, where the soda ash is used as fodder, and the adhesive industry, where the soda ash is used as a filling material. The ERT enquired how the amount of soda ash use in non-emitting sources was calculated to ensure that there was not an underestimation of emissions. In response to the list of potential problems and further questions raised by the ERT, Finland provided revised estimates for this category assuming that all uses of soda ash are emissive. The impact of

the revised estimates is an increase of 8.17 Gg CO_2 eq, or 105.1 per cent, in the emission estimate for this category for 2009. The ERT agrees with these estimates. It notes that the new methodology provides a conservative estimate and might lead to a slight overestimation of emissions. The ERT encourages Finland to revise the methodology in order to eliminate the overestimation if data become available. Finland indicated that an effort to separate soda ash uses into emissive and non-emissive would be too resource-demanding considering the size of the category.

Electrical equipment – SF_6

60. As noted in the previous review report, Finland uses the tier 2 method for the period 1990–2002 and the tier 3c method for the period 2003–2009. It was indicated in the NIR that time-series consistency requires further consideration and that the data for the years prior to 2003 are not detailed enough to use the tier 3c method. In the 2011 NIR, Finland stated that a recalculation of the time series would be considered in parallel with the 2012 annual submission. In response to a question raised during the review, Finland informed the ERT that the improvement had been postponed and would be implemented in the 2013 annual submission. The ERT recommends that Finland, in the next annual submission, include information on the status of the effort to ensure time-series consistency, with a view to implementing it in the 2013 annual submission.

D. Agriculture

1. Sector overview

61. In 2009, emissions from the agriculture sector amounted to 5,721.35 Gg CO_2 eq, or 8.6 per cent of total GHG emissions. Since the base year, emissions have decreased by 14.1 per cent. The key driver for the fall in emissions is a reduction in the number of livestock and the reduced use of nitrogen (N) fertilizers. Within the sector, 60.2 per cent of the emissions were from agricultural soils, followed by 27.6 per cent from enteric fermentation, 12.2 per cent from manure management and 0.01 per cent from field burning of agricultural residues.

62. The Party has made minor recalculations for the agriculture sector between the 2010 and 2011 annual submissions, following the acquisition of new area data for the cultivation of histosols over the entire time series. The impact of these recalculations on the agriculture sector is a 0.1 per cent increase in the estimate of emissions for 2008. It should be noted, however, that for all other years between 1990 and 2008 the difference between the 2010 and 2011 annual submissions is a slight reduction in the estimated emissions (ranging from –0.2 per cent to –1.1 per cent) due to the reduced area of cultivated histosols in comparison with that reported in the previous annual submission. The recalculations were confined to the category agricultural soils (cultivation of histosols).

63. The transparency of the NIR is quite high and additional information on the N mass flow model has been provided in the 2011 annual submission that assisted the ERT in its review. Quantitative uncertainty estimates were provided for each category, the time series is consistent, and category-specific QA/QC and verification procedures have been applied.

2. Key categories

Enteric fermentation – CH_4

64. During the 2010 review, the ERT recommended that Finland estimate CH_4 emissions from enteric fermentation for piglets with the default IPCC EF rather than a lower country-specific value. Following this recommendation, Finland provided revised

estimates for the entire time series 1990–2008 by adding the number of piglets to the number of swine and using the same default EF from the IPCC good practice guidance for both piglets and swine (1.5 kg CH_4/head/year). In the 2011 annual submission, the EF for piglets is the same as for other swine. However, as noted in the NIR, Finland is still evaluating this issue and has indicated that the EF for piglets may possibly be revised in the future. The ERT encourages the Party to implement any improvements that lead to the improved accuracy of the estimates.

Manure management – N_2O

65. For a small part of cattle and swine manure, Finland uses manure management systems that separate the solid and urine portions of manure into two components, with the solid portion going to a solid storage management system and the liquid urine component going to a liquid system, and then estimates the emissions separately. This resulted in a much smaller N_2O IEF for solid storage than the default value. For the solid manure component put into solid storage systems an EF for solid storage (2 per cent) has been used, which is appropriate. The urine component, which is in liquid form, is stored in urine pits/tanks, and an EF for a liquid manure system (0.1 per cent) has been used, as no EF for urine exists in either the Revised 1996 IPCC Guidelines or the IPCC good practice guidance. Finland has assumed that the storage system for separated urine is probably comparable to the slurry system and has therefore applied a similar EF. While this disaggregation of manure and urine appears appropriate to the ERT, Finland is encouraged to improve the documentation in the NIR, in order to improve transparency.

Agricultural soils – N_2O

66. Emissions of N_2O from agricultural soils represent the highest level of emissions from agriculture. Of these emissions, cultivated histosols contribute about half of the total emissions. During the review, the ERT noted that the N_2O IEF for cultivation of histosols is continuously increasing by 0.5 per cent per year. Finland explained that cultivated histosols are divided into grasses and annual crops and the proportion of grasses in the total area has decreased by 0.5 per cent annually and the proportion of annual crops in the total area has increased accordingly. The annual IEF has changed because the EF for grasses is lower than that for annual crops, with the EF for grasses being 4.0 kg N_2O-N/ha/year and the EF for annual crops being 11.7 kg N_2O-N/ha/year, and a proportion of the organic soils used for grass production has been converted to be used for crop production. Finland is encouraged to document this in its next annual submission, in order to improve transparency. Finland has performed recalculations for this category by updating the time series for the area of cultivated histosols. This recalculation, which was performed in line with the IPCC good practice guidance and properly documented in the NIR, has generally resulted in a decrease in estimated emissions over the time series.

E. Land use, land-use change and forestry

1. Sector overview

67. In 2009, net removals from the LULUCF sector amounted to 40,558.42 Gg CO_2 eq. Since the base year, net removals have increased by 169.7 per cent. The key driver for the rise in removals is the increase in carbon stock in living biomass in forest land remaining forest land. In 2009, within the sector, 47,193.55 Gg CO_2 eq net removals were from forest land, followed by 1,709.72 Gg CO_2 eq from other (harvested wood products (HWP)). Cropland, wetlands and grassland were net sources of emissions and accounted for, respectively, 6,550.85 Gg CO_2 eq, 1,295.94 Gg CO_2 eq and 498.06 Gg CO_2 eq. Settlements

and other land are reported as included elsewhere ("IE"), not applicable ("NA"), not estimated and "NO".

68. Finland has made recalculations for forest land, cropland, grassland, wetlands, settlements and HWP between the 2010 and 2011 annual submissions. They were made to take account of an updated area estimation for land-use categories using data from the 2011 NFI (NFI11); in order to correct inconsistencies in the reporting of land-use areas under the Convention and under the Kyoto Protocol; following a change of weather data used for the Yasso and Yasso07 model simulations for carbon stock change in forest land; and following the acquisition of a country-specific value for carbon stock change in organic soil in grassland in response to the 2010 annual review report. Other reasons include: changes in biomass expansion factors for forest land; a new extrapolation method for estimating biomass stocks and increment; a change of litter input to the soil model used for soil carbon estimation; a change of allocation of part of the emissions from liming to land converted to cropland; an updated area estimation of organic soil in grassland; a new land area estimation for the peat extraction fields and abandoned non-vegetated areas; new wood products data for HWP; and the correction of identified errors. The impact of these recalculations on the LULUCF sector is a decrease in estimated removals of 8,383.35 Gg CO_2 eq (23.7 per cent) for 2008. All recalculations are well-described in the NIR. The ERT commends Finland for these improvements, including implementing the recommendations made in previous review reports.

69. The area estimates for the land-use categories and the land-use change matrix are based on the NFI. The NFI is a sampling-based forest inventory system covering all land-use classes. The areas for land-use categories were calculated from combined data from the 2010 NFI (NFI10) (measurement years 2005–2008) and NFI11 (measurement year 2009). Land-use changes which occurred in 2004 and during the inventory period 2005–2009 are weighted averages in order to reduce variation between years. In the time series the area estimates for mineral and organic land in each land-use category were calculated backwards starting from 2009. The areas for preceding years were calculated by adding and subtracting the converted areas to and from the land-use category areas. In addition, Finland explained during the review that the land-use changes for each year during the past 20 years were assessed during the field measurements for NFI10 and NFI11, where field crews observed whether any land-use change had occurred between 1990 and the field measurement year on the sample plots, instead of the field assessment of the land-use change in the year of its occurrence. Together with supplementary assessment, including NFI variables, satellite images, aerial photographs and old numerical map data, the land use and land-use change for each year was estimated. To improve transparency, the ERT recommends that Finland provide clearer information on the method used to identify the area for each land-use category and the land-use change area for each year back to 1990, in particular on how the NFIs were used for the area identification from 1990 to 2004, taking into account the requirements of decisions 15/CMP.1 and 16/CMP.1.

2. Key categories

Forest land remaining forest land – CO_2

70. To estimate the change in carbon stock in living tree biomass, Finland has applied the default method (method 1) from the IPCC good practice guidance for LULUCF. Country-specific biomass models for pine, spruce and broadleaved trees have been used; however, a detailed description of the biomass models and their application to each tree species was not provided in the NIR. The ERT recommends that Finland provide in its next annual submission information on the biomass models used for each tree species. The changes in tree biomass and biomass stock for the different tree compartments, used for dead wood, litter and soil carbon computations, are estimated using the same country-

specific tree-level biomass models. Finland has implemented some changes in the extrapolation method used to estimate the biomass stock and increment in biomass between 2007 and 2009 by using annual NFI10 data, which is considered more accurate than the extrapolation based on the difference between NFI10 and the previous NFI. The ERT commends Finland for the improvement. Finland plans to provide separate estimates for above-ground and below-ground biomass in the 2012 annual submission, as recommended in the previous review report. The ERT welcomes this plan and recommends that Finland provide separate estimates in future annual submissions for transparency, taking into account the reporting requirement under the Kyoto Protocol.

71. For mineral soils, Finland uses the Yasso and Yasso07 models to estimate carbon stock, changes in carbon stock and CO_2 emissions from soils. The models provide an aggregated estimate for litter, dead wood and soil organic matter (SOM), but Finland does not report dead organic matter (DOM) and SOM separately, arguing that the division of soil carbon pools between SOM and DOM is artificial. The ERT recognizes the difficulty of providing separate estimates for SOM and DOM. To improve the transparency, the ERT recommends that Finland provide information on how the Yasso model and the Yasso07 model estimate emissions/removals for the aggregate of SOM and DOM.

Cropland remaining cropland – CO_2

72. Cropland remaining cropland was a net source of 4,809.97 Gg CO_2 in 2009 as reported in CRF table 5, including CO_2 emissions from liming, which accounted for 312.04 Gg CO_2. To increase transparency, Finland explained in the NIR that part of the emissions from liming under cropland remaining cropland was allocated to land converted to cropland. However, during the review, Finland explained that that allocation was not implemented as the CRF table allows for the reporting of CO_2 emissions from liming only under the categories cropland, grassland and other. The ERT recognizes the limitation of the CRF table. Finland also explained in the NIR that the emissions reported under cropland include liming on cropland and grassland. During the review, Finland informed the ERT that it would report these emissions under cropland and grassland categories in its next annual submission, and the ERT recommends that Finland reflect this information in the next annual submission.

Land converted to cropland – CO_2

73. Finland has provided detailed information on the land-use conversion on organic soils in the NIR, as recommended in the previous review report. The ERT commends Finland for the improvement. Removals from living biomass in forest land converted to cropland are not included in these figures as this pool is reported under forest land remaining forest land. For the reporting under the Kyoto Protocol, Finland has provided, in table 5(KP-I)A.2, information on the carbon stock changes in biomass for deforestation (the conversion of forest land to cropland). The Party noted in the NIR that the method is under development. The ERT reiterates the recommendation made in the previous review report that Finland improve consistency by reporting the removals of biomass under this land-use category in its next annual submission.

3. Non-key categories

Land converted to forest land – CO_2

74. The gains in living biomass in forest land converted from cropland, wetlands (peat extraction areas) and settlements are based on the mean annual growth estimated as an average of current stocks per area unit divided by the number of years since the conversion. The gains in living biomass are estimated on the basis of the mean stock per area for land

converted from grassland or wetlands to forest land. The losses in living biomass are reported under forest land remaining forest land. Finland did not provide the detailed methodologies, including the equations used for the estimation. During the review, Finland explained that equation 3.2.25 (tier 2 method) from the IPCC good practice guidance for LULUCF was used for the estimation. The ERT recommends that Finland provide in its 2012 NIR the information on methodology, including equations and parameters used.

75. Finland provided consistent area estimates for each subcategory in the NIR and the CRF tables, as recommended in the previous review report. The ERT commends Finland for the improvement. Finland does not separate wetlands converted to forest land in the northern part of the country from those in the southern part. During the review, Finland explained that the EFs used are mean values for Finland based on fertility, and informed the ERT that the information in the NIR would be improved for the next annual submission. The ERT recommends that Finland include the information on EFs and their relationship with the separate reporting on the northern and southern parts of the country in its next annual submission.

F. Waste

1. Sector overview

76. In 2009, emissions from the waste sector amounted to 2,188.82 Gg CO_2 eq, or 3.3 per cent of total GHG emissions. Since the base year, emissions have decreased by 44.9 per cent. The key drivers for the fall in emissions are the implementation of the new Waste Act (1994) and the EU landfill directive (1999/31/EC), which endorsed the minimization of waste generation, the recycling and reuse of waste materials, landfill gas recovery and alternative waste treatment methods for landfills. Similar developments have occurred in the treatment of industrial waste, and municipal and industrial sludge. Within the sector, 84.5 per cent of the emissions were from solid waste disposal on land, followed by 9.8 per cent from wastewater handling and 5.7 per cent from composting.

77. The methods and data used are transparently documented in the NIR. Finland increased transparency by providing data on the amount of landfilled industrial solid waste components and the average degradable organic carbon (DOC) content, following the recommendation of the previous ERT. The NIR states that composition of municipal solid waste will be re-evaluated for the next annual submission, especially for the years 2006–2009, as data on the domestic consumption of paper and board were identified as unreliable.

78. The emissions from solid waste disposal on land have decreased as a result of an increase in waste incineration and composting. In line with the IPCC good practice guidance, Finland reported emissions from waste incineration under the energy sector because all combustion is for energy production. Finland also implemented landfill gas recovery, which had a significant impact on emissions.

2. Key categories

Solid waste disposal on land – CH_4

79. The first-order decay model from the IPCC good practice guidance has been applied. Finland used for its calculation mainly default values from the IPCC good practice guidance and the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (2006 IPCC Guidelines). A combination of country-specific emission parameters and default values are used for DOC, the methane correction factor and methane generation rate.

Country-specific parameters that are justified by international and national research were used for the oxidation factor and fraction of DOC dissimilated.

80. The AD used in the calculation are taken from the VAHTI system, which registers waste amounts according to the European Waste Catalogue. The VAHTI system includes information on all landfills in Finland excluding Åland, which is estimated according to population. Data on landfill gas recovery are obtained from the Finnish Biogas Plant Register. CH_4 recovered decreased between 2005 and 2006 by 13.6 per cent, owing to temporary technical problems in one important gas recovery plant. The increase in waste incineration led to lower emissions from landfills in 2008 and 2009.

3. Non-key categories

Wastewater handling – CH_4 and N_2O

81. Finland estimated CH_4 emissions from municipal and industrial wastewater treatment plants, and uncollected domestic wastewater, and N_2O emissions from the nitrogen input of fish farming, as well as from domestic and industrial wastewater in waterways. The estimated emissions from municipal wastewater treatment are based on the biochemical oxygen demand, seven-day test load of the wastewater. The estimated emissions from industrial wastewater treatment are based on the chemical oxygen demand load.

Composting – CH_4 and N_2O

82. Estimates include emissions from municipal solid waste, municipal and industrial sludge and industrial solid waste (construction and demolition waste). Emissions from composting have been calculated using the method given in the 2006 IPCC Guidelines.

G. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

1. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Overview

83. Finland used the annotated NIR and KP-LULUCF CRF tables to provide the information required as outlined in paragraphs 5 to 9 of the annex to decision 15/CMP.1 and consistent with decision 16/CMP.1. Finland provided all the information related to activities under Article 3, paragraph 3, and information on forest management because it elected this activity under Article 3, paragraph 4.

84. From the information provided in the NIR and during the review, the ERT concluded that Finland has accounted for five carbon pools: above-ground biomass, below-ground biomass, litter, dead wood and soil organic carbon. For afforestation and reforestation, the dead wood pool has been excluded from the reporting (see para. 89 below).

85. In the KP-LULUCF CRF tables, Finland reported some changes in carbon pools and GHG categories using notation keys. For example, changes in the carbon pool for below-ground biomass, litter and dead wood are reported as "IE". In the NIR and during the review, Finland provided information on planned and ongoing research to enable it to report carbon stock changes for the below-ground biomass pool separately, and the reason for not separating litter and dead wood in soils. The ERT commends Finland for these efforts to improve the reporting on activities under Article 3, paragraphs 3 and 4, of the

Kyoto Protocol, and concludes that the information provided by Finland is mostly complete and sufficiently transparent to make clear the reporting and the accounting of activities under Article 3, paragraphs 3 and 4.

86. Finland did not report information on uncertainty estimates for activities under Article 3, paragraph 3, of the Kyoto Protocol. The Party also did not report separate information on uncertainty estimates for forest management activity (Article 3, paragraph 4), arguing that the uncertainty estimates developed for forest land remaining forest land under the Convention also apply to forest management. In the NIR and during the review, Finland provided the plan for the further development of uncertainty estimates for activities under Article 3, paragraphs 3 and 4, for its 2012 and 2013 annual submissions. The ERT commends the Party for its plan and recommends that Finland implement the plan for future annual submissions.

87. The Party has made recalculations for the KP-LULUCF activities between the 2010 and 2011 annual submissions, to take account of an updated area estimation for land-use categories using NFI11 data, and following: a change of weather data used for the Yasso and Yasso07 model simulations for carbon stock change; changes of the biomass expansion factors for logging and natural mortality; changes in the estimation method for land converted from organic soil to forest land; the acquisition of a country-specific value for carbon stock change in organic soil in grassland; and a change of allocation of emissions from wildfires between forest management and afforestation/reforestation areas. The impact of these calculations on each KP-LULUCF activity for 2008 is as follows:

(a) Change of afforestation and reforestation from a net sink (1,077.08 Gg CO_2 eq) to a net source (200.26 Gg CO_2 eq);

(b) Increase in emissions from deforestation of 677.53 Gg CO_2 eq (or 23.4 per cent);

(c) Decrease in removals from forest management of 1,917.99 Gg CO_2 eq (or 4.8 per cent).

Activities under Article 3, paragraph 3, of the Kyoto Protocol

Afforestation and reforestation – CO_2

88. The land areas for activities under Article 3, paragraph 3, and the land-use change matrix are estimated using methods similar to those used for the estimations under the Convention. NFI11 data was used for the first time for the land area estimations. A method will be developed to produce annual area data on land-use changes for the commitment period. The NFI will continue to monitor forest and other land uses.

89. Finland reported in the NIR that it excludes carbon stock changes in dead wood from its reporting and uses the notation key "NO" in CRF table 5(KP-1)A.1.1, arguing that the accumulation of dead wood was assumed to be marginal during the period 1990–2009 and significant natural mortality or thinning on afforested/reforested sites is very unlikely because the accumulation of dead wood starts after natural mortality or thinning. The Party also explained that the exclusion of carbon stock changes in dead wood results in a minor underestimation of the dead wood sink. During the review, the Party informed the ERT that it is planning to start estimating and reporting carbon stock changes in the dead wood pool in the future, but that appropriate measurements and models do not exist currently. The ERT commends Finland for its efforts, and recommends that the Party estimate and report carbon stock changes in the dead wood pool in future annual submissions, or provide verifiable information, as required by paragraph 6(e) of the annex to decision 15/CMP.1, which demonstrates that this pool is not a net source in accordance with section 4.2.3.1 of the IPCC good practice guidance for LULUCF.

90. Finland uses the Yasso07 model for carbon stock change estimation for soil, dead wood and soil for the mineral soil area. The average temperature and precipitation for the period 1971–2009 were used as input data for Yasso07 for the first time, in response to the previous year's review report. Furthermore, Finland stated that a study and evaluation of applying annual weather data is in progress. The ERT commends Finland for its efforts, and recommends that the Party continue to explore how to improve the accuracy of the emission and removal estimates in line with the IPCC good practice guidance for LULUCF.

Deforestation – CO_2

91. In its NIR, Finland reported an increase in the annual deforested area from 5.2 kha for 1990 to 23.0 kha for 2003, with some fluctuations from 1990 to 2003. For 2004 to 2009, a constant deforested area of 19.4 kha was reported. In the NIR, in response to the recommendation made in the previous review report, Finland stated that the method for area estimation would be further developed, and that the number of sample plots for the last years of the commitment period would be increased, subject to the availability of resources. The ERT commends Finland for its efforts and the plan to increase the number of sampling plots, and reiterates the recommendation for the Party to report on the annual areas for 2008 onwards in future annual submissions.

92. Finland has reported the carbon stock change in the dead wood pool for deforestation to agriculture on the basis of NFI10 data. However, the Party also reported that the Yasso07 model was applied for calculating carbon stock changes in dead wood, litter and SOM for mineral soil areas. In addition, Finland has reported "IE" for the carbon stock change in DOM for forest land converted to cropland and grassland. The ERT recommends that Finland provide further information, in its next annual submission, on the method for estimating the carbon stock change in the dead wood pool, the application of the Yasso07 model for calculating the estimate, and the inconsistency of the reporting under the Convention and the Kyoto Protocol.

Activities under Article 3, paragraph 4, of the Kyoto Protocol

Forest management – CO_2

93. Finland has estimated the changes in carbon stock in living biomass using a similar approach to that used for the estimation for the forest land category under the Convention. The total biomass increment for forest management and afforestation and reforestation was obtained by multiplying the mean increment per area unit in the forest land category under the Convention by the forest area under the Kyoto Protocol. The biomass increment for forest management was obtained as the difference between the increment in the total forest management and afforestation and reforestation area and the increment in the afforestation area. The drain for the forest management area was obtained by the difference between the drain of all forests reported under the Kyoto Protocol and the drain for the deforestation area. Finland did not provide the reference to the methodology used for the reporting under the Kyoto Protocol. The ERT noted that most of the information on the methodology is provided in the reporting on the LULUCF sector under the Convention. To improve transparency, the ERT recommends that Finland provide the reference to the methodology.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

94. Finland has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note

of the findings included in the SIAR on the SEF tables and the SEF comparison report.[6] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings contained in the SIAR.

95. Information on the accounting of Kyoto units has been prepared and reported in accordance with chapter I.E of the annex to decision 15/CMP.1, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements referred to in paragraph 88(a–j) of the annex to decision 22/CMP.1. The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

96. Finland provided access to information from its national registry that substantiated or clarified the information reported in its annual submission.

National registry

97. The ERT took note of the SIAR and its finding that the reported information on the national registry is complete and has been submitted in accordance with the annex to decision 15/CMP.1. The ERT further noted from the SIAR and its findings that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with decisions 16/CP.10 and 12/CMP.1. The national registry also has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate.

Calculation of the commitment period reserve

98. Finland has reported its commitment period reserve in its 2011 annual submission. The Party reported that its commitment period reserve has not changed since the initial report review (319,515,790 t CO_2 eq), as it is based on the assigned amount and not the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

99. Finland provided information on changes to its national system in its annual submission. The reported changes were:

(a) The contract with Finavia for estimation of the emissions from aviation was not renewed, as the intention is that Eurocontrol would take over this task. Finavia has agreed to provide Statistics Finland with the necessary data and support for the inventory calculations until the agreement with Eurocontrol is implemented;

(b) The agreement between Statistics Finland and the Energy Market Authority has been updated, giving Statistics Finland access to the more detailed data collected by the Energy Market Authority.

100. The ERT concluded that, taking into account the confirmed changes in the national system, Finland's national system continues to be in accordance with the requirements of national systems set out in decision 19/CMP.1.

[6] The SEF comparison report is prepared by the ITL administrator and provides information on the outcome of the comparison of data contained in the Party's SEF tables with corresponding records contained in the ITL.

4. Changes to the national registry

101. Finland provided information on changes to its national registry in its annual submission. The Party reported that access to the Finnish registry through the optional username and password authentication is no longer possible and that the recovery location for taking over the live registry is now operational. The ERT concluded that, taking into account the confirmed changes in the national registry, Finland's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with the relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP).

5. Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

102. Finland reported information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, in its 2011 annual submission, but it did not identify the changes in its reporting compared with that in its previous annual submission in accordance with decision 15/CMP.1. However, the ERT identified that Finland has indeed improved the completeness and transparency of the information, as recommended by the previous ERT.

103. In addition to the information provided in its previous annual submission, Finland states that all major policies, such as the national Long-term Climate and Energy Strategy adopted in 2008, and activities undergo an environmental impact assessment, including impacts on other countries. Finland mentions in particular policy programmes related to the production of renewable energy as having a positive impact on developing countries and describes the procedures in place to ensure that the increase in the use of biofuels will not jeopardize social and ecological sustainability. Finland also reports on its support to developing countries by helping them to build their capacity and develop their economic infrastructure, thus helping them to diversify their economies and energy production. The ERT concluded that, taking into account the changes in the reporting, the information provided is complete and transparent.

III. Conclusions and recommendations

104. Finland made its annual submission on 15 April 2011. The annual submission contains the GHG inventory (comprising CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol (information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, Kyoto Protocol units, changes to the national system and the national registry, and minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1.

105. The ERT concludes that the inventory submission of Finland has been prepared and reported in accordance with 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. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1990–2009 and an NIR; these are complete in terms of geographical coverage, years and sectors, as well as complete in terms of categories and gases.

106. The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1.

107. The Party's inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT commends Finland for the improved transparency in the NIR since the last annual submission and encourages it to continue to improve it in the next annual submission.

108. The Party has made recalculations for the inventory between the 2010 and 2011 annual submissions, following changes in AD and EFs, in order to rectify identified errors, and in response to the 2010 annual review report. The impact of these recalculations on the national totals without the LULUCF sector is an increase of 0.2 per cent for 2008, while the impact including the LULUCF sector is an increase of 24.4 per cent for 2008. The main recalculations concerned the following:

(a) New area data for all categories and a new methodology in the LULUCF sector;

(b) Revised data statistics for the energy sector (agriculture and space heating);

(c) Corrections in the industrial processes sector;

(d) New area data for the cultivation of histosols in the agriculture sector.

109. Finland provided information related to activities under Article 3, paragraph 3, and to elected activities under Article 3, paragraph 4 (forest management), as set out in paragraphs 5 to 9 of the annex to decision 15/CMP.1 and consistent with decision 16/CMP.1. However, the ERT identified areas for improvement in relation to the emission and removal estimation, uncertainty estimation and transparency of the report (see paras. 86–93 above).

110. Finland has reported information on its accounting of Kyoto Protocol units in accordance with chapter I.E of the annex to decision 15/CMP.1, and used the required reporting format tables as required by decision 14/CMP.1.

111. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1.

112. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the CMP.

113. Finland has reported information under chapter I.H of the annex to decision 15/CMP.1, "Minimization of adverse impacts in accordance with Article 3, paragraph 14", as part of its 2011 annual submission. The ERT identified that this information is reported in accordance with paragraphs 23 and 25 of the annex to decision 15/CMP.1 and is complete and transparent and was submitted on time.

114. The ERT identifies the following cross-cutting issues for improvement:

(a) The further improvement of transparency in the energy sector (see para. 39 above) and the industrial processes sector (see paras. 53, 56 and 58 above), by including in the NIR the information provided to the ERT during the review;

(b) The further improvement of transparency in the LULUCF sector (see paras. 69–71, 74 and 75 above) and on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol (see paras. 92 and 83 above);

(c) The development of uncertainty estimates for activities under Article 3, paragraphs 3 and 4 (see para. 86).

115. In the course of the review, the ERT formulated a number of recommendations relating to the transparency and methodological improvement of the information presented in the Party's annual submission. The key recommendations are that Finland:

(a) Improve the estimates for the lime production category through the use of plant-specific data (see para. 57 above);

(b) Improve the time-series consistency of the estimates of SF_6 emissions from electrical equipment (see para. 60 above);

(c) Provide separate estimates for above-ground and below-ground biomass in the LULUCF sector (see para. 70 above);

(d) Estimate carbon stock changes in the dead wood pool for afforestation and reforestation under Article 3, paragraph 3, of the Kyoto Protocol in future annual submissions, or provide verifiable information demonstrating that this pool is not a net source (see para. 89 above).

IV. Questions of implementation

116. No questions of implementation were identified by the ERT during the review.

Annex I

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

"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/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"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>.

"Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng /08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

Status report for Finland 2011. Available at <http://unfccc.int/resource/docs/2011/asr/fin.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2011. Available at <http://unfccc.int/resource/webdocs/sai/2011.pdf>.

FCCC/ARR/2010/FIN. Report of the individual review of the annual submission of Finland submitted in 2010. Available at <http://unfccc.int/resource/docs/2010/arr/fin2.pdf>.

UNFCCC. *Standard independent assessment report*, parts I and II. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

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 methodologies and assumptions used. The following documents[1] were also provided by Finland:

E. Tomppo. 2005. *The finnish national forest inventory* in A. Kangas and M. Maltamo (eds.): *Forest Inventory – Methodology and Applications*. Netherlands: Springer.

J. Repola. 2008. *Biomass equations for birch in Finland*. Silva Fennica 42(4): 605–624.

J. Repola. 2009. *Biomass equations for Scots pine and Norway spruce in Finland*. Silva Fennica 43(4): 625–647.

J. Repola, R. Ojansuu, M. Kukkola. 2007. *Biomass functions for Scots pine, Norway spruce and birch in Finland*. Helsinki: Finnish Forest Research Institute. Available at <http://www.metla.fi/julkaisut/workingpapers/2007/mwp053.htm>.

[1] Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
DOC	degradable organic carbon
DOM	dead organic matter
EF	emission factor
ERT	expert review team
EU	European Union
EU-ETS	European Union emissions trading scheme
Gg	gigagram
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IPCC	Intergovernmental Panel on Climate Change
KP-LULUCF	Land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
kg	kilogram (1 kg = 1,000 grams)
LULUCF	land use, land-use change and forestry
NA	not applicable
N_2O	nitrous oxide
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
SOM	soil organic matter
UNFCCC	United Nations Framework Convention on Climate Change