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## **Report of the individual review of the annual submission of Estonia submitted in 2011\***

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

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## I. Introduction and summary

### A. Overview

1. This report covers the centralized review of the 2011 annual submission of Estonia, 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 Estonia, 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 Estonia was carbon dioxide (CO<sub>2</sub>), accounting for 84.6 per cent of total GHG emissions<sup>1</sup> expressed in CO<sub>2</sub> eq, followed by methane (CH<sub>4</sub>) (8.4 per cent) and nitrous oxide (N<sub>2</sub>O) (6.1 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) collectively accounted for 0.9 per cent of the overall GHG emissions in the country. The energy sector accounted for 85.4 per cent of total GHG emissions, followed by the agriculture sector (7.8 per cent), the waste sector (4.0 per cent), the industrial processes sector (2.7 per cent) and the solvent and other product use sector (0.1 per cent). Total GHG emissions amounted to 16,657.21 Gg CO<sub>2</sub> eq and decreased by 59.6 per cent between the base year<sup>2</sup> 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<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector.

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<sup>1</sup> In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO<sub>2</sub> eq excluding LULUCF, unless otherwise specified.

<sup>2</sup> “Base year” refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. 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<sup>a</sup>**

	Greenhouse gas	Base year <sup>d</sup>	Gg CO <sub>2</sub> eq							Change
			1990	1995	2000	2005	2007	2008	2009	Base year– 2009 (%)
Annex A sources	CO <sub>2</sub>	36 451.66	36 451.66	17 832.05	15 081.65	16 332.53	18 798.01	17 294.56	14 095.52	–61.3
	CH <sub>4</sub>	2 823.91	2 823.91	1 611.16	1 667.52	1 669.58	1 650.00	1 616.91	1 401.03	–50.4
	N <sub>2</sub> O	1 959.36	1 959.36	916.40	883.01	909.74	1 002.88	1 096.30	1 018.55	–48.0
	HFCs	25.68	NA, NE, NO	25.68	70.13	118.82	140.78	132.08	140.66	447.8
	PFCs	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	NA, NE, NO	0.06	0.04	NA, NE, NO	NA
	SF <sub>6</sub>	3.22	NA, NE, NO	3.22	2.73	1.08	0.97	1.35	1.44	–55.3
KP-LULUCF	Article 3.3 <sup>b</sup>	CO <sub>2</sub>						256.13	235.94	
		CH <sub>4</sub>						NE, NO	NE, NO	
		N <sub>2</sub> O						NE, NO	NE, NO	
	Article 3.4 <sup>c</sup>	CO <sub>2</sub>	NA					NA	NA	NA
		CH <sub>4</sub>	NA					NA	NA	NA
		N <sub>2</sub> O	NA					NA	NA	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, NE = not estimated, NO = not occurring.

<sup>a</sup> “Base year” for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The “base year” for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

<sup>b</sup> 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.

<sup>c</sup> 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<sup>a</sup>

	Sector	Gg CO <sub>2</sub> eq								Change
		Base year <sup>a</sup>	1990	1995	2000	2005	2007	2008	2009	Base year–2009 (%)
Annex A	Energy	36 346.53	36 346.53	17 634.23	14 943.21	16 254.61	18 498.21	16 967.96	14 220.58	–60.9
	Industrial processes	1 076.82	1 047.92	675.54	705.38	807.44	1 050.39	1 051.70	453.49	–57.9
	Solvent and other product use	20.77	20.77	26.02	26.76	26.16	26.45	22.21	17.30	–16.7
	Agriculture	3 026.20	3 026.20	1 421.97	1 237.32	1 216.48	1 284.70	1 385.78	1 302.89	–56.9
	Waste	793.51	793.51	630.74	792.36	727.04	732.94	713.59	662.94	–16.5
	LULUCF	NA	–10 422.03	–9 467.51	3 978.79	–8 669.31	–13 716.06	–349.46	–7 036.74	NA
	<b>Total (with LULUCF)</b>	<b>NA</b>	<b>30 812.90</b>	<b>10 921.00</b>	<b>21 683.82</b>	<b>10 362.42</b>	<b>7 876.65</b>	<b>19 791.77</b>	<b>9 620.46</b>	<b>NA</b>
	<b>Total (without LULUCF)</b>	<b>41 263.83</b>	<b>41 234.93</b>	<b>20 388.51</b>	<b>17 705.04</b>	<b>19 031.74</b>	<b>21 592.70</b>	<b>20 141.23</b>	<b>16 657.21</b>	<b>–59.6</b>
	Other <sup>b</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA
KP-LULUCF	Article 3.3 <sup>c</sup>	Afforestation and reforestation						–167.26	–187.45	
		Deforestation						423.39	423.39	
		<b>Total (3.3)</b>						<b>256.13</b>	<b>235.94</b>	
	Article 3.4 <sup>d</sup>	Forest management						NA	NA	NA
		Cropland management	NA					NA	NA	NA
		Grazing land management	NA					NA	NA	NA
		Revegetation	NA					NA	NA	NA
		<b>Total (3.4)</b>	<b>NA</b>					<b>NA</b>	<b>NA</b>	<b>NA</b>

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

<sup>a</sup> “Base year” for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The “base year” for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

<sup>b</sup> Emissions/removals reported in the sector other (sector 7) are not included in Annex A to the Kyoto Protocol and are therefore not included in the national totals.

<sup>c</sup> 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.

<sup>d</sup> 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<sub>2</sub> eq**

	<i>As reported</i>	<i>Revised estimates</i>	<i>Adjustment<sup>a</sup></i>	<i>Final<sup>b</sup></i>	<i>Accounting quantity<sup>c</sup></i>
<b>Commitment period reserve</b>	84 184 305			83 286 042	
<b>Annex A emissions for current inventory year</b>					
CO <sub>2</sub>	14 274 530	14 095 519		14 095 519	
CH <sub>4</sub>	1 399 869	1 401 034		1 401 034	
N <sub>2</sub> O	1 020 361	1 018 554		1 018 554	
HFCs	140 661			140 661	
PFCs	NA, NE, NO			NA, NE, NO	
SF <sub>6</sub>	1 440			1 440	
<b>Total Annex A sources</b>	<b>16 836 861</b>			<b>16 657 208</b>	
<b>Activities under Article 3, paragraph 3, for current inventory year</b>					
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	-208 473	-187 450		-187 450	
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	NA, NO			NA, NO	
3.3 Deforestation for current year of commitment period as reported	423 389			423 389	
<b>Activities under Article 3, paragraph 4, for current inventory year<sup>d</sup></b>					
3.4 Forest management for current year of commitment period					
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					

*Abbreviations:* NA = not applicable, NE = not estimated, NO = not occurring.

<sup>a</sup> "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustment(s).

<sup>b</sup> "Final" includes revised estimates, if any, and/or adjustments, if any.

<sup>c</sup> "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, if any.

<sup>d</sup> Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such 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). Estonia 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 the minimization of adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 15 April 2011. The annual submission was submitted in accordance with decision 15/CMP.1.

7. Estonia officially submitted revised emission estimates on 17 October 2011 in response to the list of potential problems and further questions raised by the expert review team (ERT) during the review week. Estonia provided revised emission estimates for the energy sector (see paras. 37, 47 and 48 below), the industrial processes sector (see para. 62 below) and the waste sector (see para. 103 below). In addition, on 17 October 2011 Estonia also provided revised emission estimates for the LULUCF sector (see para. 84 below) and for the KP-LULUCF activities (see para. 115 below). The values used in this report are based on the values contained in the submission of 17 October 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.<sup>3</sup>

9. During the review, Estonia 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 most source and sink categories for the period 1990–2009 and is complete in terms of years and geographical coverage. Estonia improved the completeness of the inventory, reporting for the first time CH<sub>4</sub> emissions from industrial wastewater and CO<sub>2</sub> emissions from limestone and dolomite use for the production of ceramics, as recommended in the previous review report, as well as emissions from several categories under the solvent and other product use sector. The ERT commends Estonia for these improvements. However, the ERT noted that the reporting is incomplete for a number of LULUCF categories and pools (see para. 74 below) for which reporting is mandatory and for which methodologies exist in the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter

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<sup>3</sup> 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 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.

referred to as the IPCC good practice guidance for LULUCF). The ERT recommends that, in its next annual submission, Estonia report estimates for the categories not yet estimated in order to further improve the completeness and accuracy of its inventory. Further, the ERT reiterates the encouragement of the previous review report that Estonia report potential emissions of fluorinated gases (F-gases).

**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 continues to perform its required functions. However, although Estonia has implemented changes in the national system to improve the preparation of inventory data for the LULUCF sector and states in the NIR that it plans to implement the recommendations of the previous review report in its next annual submission, the performance of the national system for the LULUCF sector still requires further improvement (see paras. 74–77 below).

12. The Party described the changes to the national system since the previous annual submission. These changes are related to the new agencies responsible for the coordination of the GHG inventory preparation process and for the inventory data for the LULUCF sector and the KP-LULUCF activities, 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. The Ministry of Environment (MoE) has overall responsibility for the national inventory. Other organizations also involved in the preparation of the inventory are the Estonian Environmental Research Centre (EERC), the Estonian Environment Information Centre (EEIC) and the Tallinn University of Technology (TUT). MoE has a coordination function and has to approve the inventory before its official submission to the UNFCCC. EERC compiles the inventory submission and is responsible for quality assurance/quality control (QA/QC) and archiving. These functions were performed by EEIC until the 2010 submission. TUT is responsible for preparing the estimates for the energy and agriculture sectors and EERC is responsible for preparing the estimates for the industrial processes and waste sectors. Starting with the 2011 submission, the Department of the National Forest Inventory (NFI) of EEIC is now responsible for the LULUCF sector and for the reporting of activities under Article 3, paragraph 3, of the Kyoto Protocol.

Inventory preparation

*Key categories*

14. Estonia has reported a key category tier 2 analysis, both level and trend assessment, as part of its 2011 submission for 1990 and 2009 with and without the LULUCF sector. The key category analysis performed by the Party and that performed by the secretariat<sup>4</sup>

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<sup>4</sup> 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.



produced different results because Estonia performed a tier 2 analysis while the secretariat performed a tier 1 analysis. The key category analysis was performed in accordance with the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC good practice guidance for LULUCF.

15. Estonia has identified all activities under Article 3, paragraph 3, of the Kyoto Protocol as key categories. The results of the key category analysis are presented in KP-LULUCF CRF table NIR-3. However, the rationale for the identification of the activities as key categories is not presented in the comments column of KP-LULUCF CRF table NIR-3 or in the NIR. The ERT recommends that Estonia improve the transparency of its reporting by providing a description of the key category analysis in the NIR and comments in the CRF tables.

16. The previous review report recommended that Estonia use the results of its key category analysis as a driving force for setting priorities for the improvement of the quality of the inventory. In the 2011 NIR, Estonia states that this action has been added to the inventory improvement plan and that it will be carried out when additional financial support is available. However, the ERT reiterates the recommendation from the previous review report because the results of the key category analysis are fundamental for setting the priorities for using available resources.

#### *Uncertainties*

17. Estonia has provided a tier 1 uncertainty analysis in its 2011 annual submission including and excluding LULUCF. However, the results of the analysis are not presented in the main part of the NIR (chapter 1.7); only a reference to the tables contained in annex 7 to the NIR is provided. Further, the ERT notes that the values presented in the last line of both tables in the annex are not correct, leading to a potential misunderstanding of the results. For example: the estimated uncertainties for total GHG emissions without LULUCF in 2009 and the trend are shown in the tables to be 28.3 per cent and 18.7 per cent, respectively, while the correct calculation would be 8.0 per cent and 3.5 per cent, respectively; and the estimated uncertainties for total GHG emissions with LULUCF in 2009 and the trend are shown in the tables to be 44.9 per cent and 24.0 per cent, respectively, while the correct values would be 20.2 per cent and 5.7 per cent, respectively. The ERT recommends that Estonia correct the calculation of the uncertainties in its next annual submission and present the results in the NIR.

18. Estonia did not include explanations for the differences in the uncertainty estimates when the results are compared with previous annual submissions. The ERT reiterates the recommendation of the previous review report that Estonia include explanations for such changes in the uncertainty estimates in its next annual submission. The ERT also reiterates the recommendation that Estonia include uncertainty estimates for the KP-LULUCF activities.

19. The ERT noted that the selected uncertainty values for each category are not always well explained or justified. In response to a recommendation of the previous review report, Estonia stated in the NIR that it is planning to carry out a project in order to improve the uncertainty estimates but that a timeline has not yet been established. The ERT reiterates the recommendation of the previous review report that, in its next annual submission, Estonia improve the justification of the uncertainty values used.

#### *Recalculations and time-series consistency*

20. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The major changes excluding the LULUCF sector, and the magnitude of

the impact, include: a decrease in estimated total GHG emissions in the base year (0.5 per cent) and a decrease in 2008 (1.0 per cent). For the recalculations including the LULUCF sector, the changes are significant (an increase of 87.0 per cent in 2008), mainly owing to changes in land use and land-use change areas and a change in the method used to estimate the carbon stock changes (see para. 79 below). For the other sectors, many recalculations have been conducted, such as: the revision of activity data (AD) and emission factors (EFs) in the energy sector (in particular for the oil shale industry); a revision of N<sub>2</sub>O emissions from agricultural soils; and the inclusion for the first time of N<sub>2</sub>O emissions from domestic and commercial wastewater treatment. The rationale for these recalculations is provided in the NIR and in CRF table 8(b) and the explanations have been enhanced, as recommended in the previous review report. The ERT commends the Party for this improvement.

21. The emission time series is consistent for most categories. The ERT recommends that Estonia improve the time-series consistency of the reference approach in the energy sector (see para. 42 below) and the carbon stocks and organic soil areas in the LULUCF sector (see paras. 81 and 91 below).

#### *Verification and quality assurance/quality control approaches*

22. Estonia has an elaborated QA/QC plan in accordance with the IPCC good practice guidance, including tier 1 and some tier 2 category-specific QC procedures. This plan has been updated as a result of the Twinning Light project “Improving the Quality of Estonia’s National Greenhouse Gas Inventory” developed with Finland in 2009. The Climate Department of EERC is responsible for the implementation of the QA/QC plan. QA procedures are performed by an independent expert from TUT and there are also provisions for a public review of the annual submission. The NIR presents a description of the quality objectives and the QA/QC procedures and responsibilities.

23. In response to a recommendation in the previous review report, Estonia reported that, for the category cement production, it has already implemented a comparison with data from the European Union emissions trading scheme (EU ETS) for verification purposes. The ERT commends the Party for this improvement and encourages Estonia to extend this procedure to other categories. Also, in response to a recommendation in the previous review report in relation to capacity-building, Estonia stated that, in 2010, it nominated an agriculture expert to participate in a review training course, with the aim of future participation in the review process.

24. The ERT noted some inconsistencies between the NIR and the CRF tables and the use of notation keys (see paras. 35, 36 and 44 below) and recommends that Estonia improve its QC and verification procedures to prevent such errors.

#### *Transparency*

25. Estonia has increased the overall transparency of the NIR as part of its inventory improvement plan and in response to previous review reports, for example by increasing the information in relation to QA/QC procedures and including additional explanations regarding methodological choice. The ERT encourages Estonia to continue to improve the transparency of the information provided in its next annual submission. In particular, the ERT recommends that Estonia provide clearer information on the energy sector (see paras. 34, 38, 46, 47–49 and 50–52 below), the industrial processes sector (see para. 62 below), the agriculture sector (see paras. 66, 68 and 69 below), the LULUCF sector (see paras. 75, 77, 83, 85, 89 and 91 below) and the waste sector (see paras. 98, 99, 103 and 104 below), as well as information on the activities under Article 3, paragraph 3, of the Kyoto Protocol (see paras. 107, 109 and 115 below).

### Inventory management

26. Estonia has a centralized archiving system, 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. As part of its newly acquired roles, EERC has responsibility for the centralized archiving system. As described in the NIR, the archiving system is undergoing an improvement programme in response to previous review reports that recommended the improvement of the structure of the archiving system and the provision of more information on the methods used, and as part of the Twinning Light project developed with Finland. The Party stated that the new system has already been used to archive the materials for the 2010 submission as a first trial and further improvements have been implemented for the archiving of the materials related to the 2011 submission.

### **3. Follow-up to previous reviews**

27. Estonia has made improvements in its 2011 inventory submission by implementing many of the recommendations formulated in the previous review report. The Party has also continued to improve the transparency of the NIR. The implemented recommendations formulated in the 2010 review report are listed in table 10.7 of the NIR. The ERT commends Estonia for this transparent approach. The Party has not yet implemented many of the recommendations from the previous review report, including the revision of the EFs used to calculate the emissions from the category consumption of halocarbons and SF<sub>6</sub> (see para. 59 below), the use of country-specific EFs in the LULUCF sector (see paras. 77 and 83 below) and the revision of the waste generation rate, degradable organic carbon (DOC) and methane correction factor (MCF) values (see paras. 97–100 below).

### **4. Areas for further improvement**

#### Identified by the Party

28. The 2011 NIR identifies several areas for improvement. Estonia's improvement plan includes:

- (a) The estimation and implementation of country-specific EFs for the energy sector;
- (b) The improvement of the completeness of the emission estimates for the category consumption of halocarbons and SF<sub>6</sub>, by completing the time series since 1990 for the different subcategories in the 2012 submission;
- (c) The estimation of N<sub>2</sub>O emissions from the use of aerosol cans;
- (d) The improvement of the accuracy of the estimates of CH<sub>4</sub> and N<sub>2</sub>O emissions from manure management, including a data set on country-specific manure management systems that will be developed for the 2012 submission;
- (e) The improvement of the input data for the LULUCF sector, including land areas and carbon stock changes;
- (f) The correction of waste composition data for the period 1950–2000 using country-specific research results and the revision of other parameters for the category solid waste disposal on land;
- (g) The updating of the protein consumption data for the estimation of N<sub>2</sub>O emissions from municipal sewage treatment.

Identified by the expert review team

29. During the review, the ERT identified cross-cutting issues for improvement. These are listed in paragraph 138 below.

30. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

## **B. Energy**

### **1. Sector overview**

31. The energy sector is the main sector in the GHG inventory of Estonia. In 2009, emissions from the energy sector amounted to 14,220.58 Gg CO<sub>2</sub> eq, or 85.4 per cent of total GHG emissions. Since 1990, emissions have decreased by 60.9 per cent. The key drivers for the fall in emissions are the transition from a planned economy to a market economy coupled with the global economic recession in 2009, which resulted in a decline in emissions from the categories energy industries, manufacturing industries and construction, transport, other sectors and fugitive emissions. Within the energy sector, 74.4 per cent of the emissions were from energy industries, followed by 15.2 per cent from transport, 4.3 per cent from manufacturing industries and construction, 3.6 per cent from other sectors and 2.4 per cent from fugitive emissions from oil and natural gas. The category other accounted for 0.2 per cent of total emissions from the energy sector. Fugitive emissions from solid fuels are reported as “NO”.

32. Recalculations have been performed for all years and all categories of the energy sector; for example, the CO<sub>2</sub> EF for oil shale semi-coke was recalculated because updated research information became available. As a result, emissions from the energy sector increased by 0.24 per cent in 1990 and decreased by 1.12 per cent in 2008, respectively. The ERT commends Estonia for its efforts to improve the accuracy of its estimates and to document and justify them in the CRF tables and the NIR.

33. Emissions from the energy sector have been reported for all years of the time series and are complete in terms of geographical coverage, and the time series is consistent. The CRF tables include emission estimates for all categories, gases and fuel uses from the energy sector, as recommended by the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines). The methodologies used in the sector are generally in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance with a few exceptions, such as the methodology used for the reference approach. Emissions from stationary combustion are estimated using the tier 1 methodology for imported fuels. For domestic fuel use, which accounts for most of the emissions, tier 2 and tier 3 methods are used. For road transportation, which accounts for most of the emissions from transport, the CO<sub>2</sub> emissions are estimated using the tier 1 methodology and the CH<sub>4</sub> and N<sub>2</sub>O emissions are estimated using the tier 3 methodology (the COPERT IV model). Such prioritizing is in accordance with the IPCC good practice guidance. The ERT encourages Estonia to continue its work to move to the use of higher-tier methods and country-specific EFs for the key categories.

34. The NIR is not sufficiently transparent in terms of the driving forces behind the trends in emissions and implied emission factors (IEFs) for all subcategories. The ERT recommends that Estonia include more detailed information for all key categories in the NIR of its next annual submission, for example by including graphs or diagrams to demonstrate the different fuel types contributing to a specific subcategory over the time series.

35. The ERT noted that the notation keys have not been used consistently for all categories in the energy sector; for example, for iron and steel (liquid fuels, biomass and other fuels) and agriculture, forestry and fisheries (solid fuels) CO<sub>2</sub> emissions have been reported as not applicable (“NA”), whereas the AD have been reported as not occurring (“NO”). The ERT encourages Estonia to review its use of the notation keys in all CRF tables in its next annual submission in order to ensure that all notation keys are consistently used.

36. The ERT also noted that there are a number of instances in the NIR where incorrect references were used; for example, NIR table 3.29 should refer to the Revised 1996 IPCC Guidelines rather than the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines), and inconsistent EFs were included in comparison with those reported tables in the CRF. The ERT recommends that Estonia improve its internal QA/QC procedures and report thereon in its next annual submission.

37. During the review, the ERT identified a number of cases in the 2011 inventory submission where the EFs have been taken from the 2006 IPCC Guidelines rather than the Revised 1996 IPCC Guidelines or the IPCC good practice guidance, without providing any justification. For some categories, the EFs from the 2006 IPCC Guidelines are considerably lower than those from the Revised 1996 IPCC Guidelines. These include: the CO<sub>2</sub> EF for coke in all categories (29.18 t C/TJ compared to 29.50 t C/TJ); the CH<sub>4</sub> EF for liquefied petroleum gas (1 kg/TJ compared to 5 kg/TJ); the CH<sub>4</sub> EF for coal, coke and oil shale (1 kg/TJ compared to 10 kg/TJ); the CH<sub>4</sub> and N<sub>2</sub>O EFs for waste (2 kg/TJ and 0.6 kg/TJ compared to 30 kg/TJ and 4 kg/TJ); the CH<sub>4</sub> EF for natural gas (1 kg/TJ compared to 5 kg/TJ); and the CH<sub>4</sub> EF for biogas (1 kg/TJ compared to 5 kg/TJ) in manufacturing industries and construction. In response to questions raised by the ERT during the review, Estonia provided some justifications, mainly explaining that the EFs from the 2006 IPCC Guidelines reflect the results of the latest research and thus lead to more accurate emission estimates. The ERT considered that these explanations were not sufficient and/or not sufficiently documented to justify the use of the default EFs from the 2006 IPCC Guidelines. In response to the list of potential problems and further questions raised by the ERT, Estonia reverted to using the EFs from the Revised 1996 IPCC Guidelines and recalculated the emissions for all categories in the energy sector for the whole time series. The ERT recommends that Estonia update the NIR of its next annual submission with the revised EFs, providing explanations for the recalculations.

38. The ERT noted that Estonia replaced the IPCC default EFs with EFs from other countries for some categories in the 2011 annual submission; for example, the CO<sub>2</sub> EF for peat (milled, sod and briquettes) in fuel combustion was adopted from Finland, and the CO<sub>2</sub> EF for gasoline, diesel and gas oil in road transportation was adopted from Lithuania. However, no explanation is provided in the NIR to justify that these EFs better reflect the national circumstances of Estonia. In response to questions raised by the ERT during the review, Estonia provided references from Finnish energy experts from the Estonian-Finnish Twinning Light project that was carried out in 2009, which provide justification for the use of the CO<sub>2</sub> EFs for sod peat and peat briquettes. The ERT recommends that Estonia include these references for the justification of these EFs and provide more detailed documentation in its next annual submission.

39. During the review, Estonia explained that all of the oil products mentioned in paragraph 38 above are not exclusively imported from Lithuania. The ERT recommends that the Party revise its CO<sub>2</sub> EFs for gasoline, diesel and gas oil and develop country-specific values, for example by taking into account the share of oil products from other countries in order to develop country-specific EFs.

40. Estonia adopted the CO<sub>2</sub> EF for natural gas from Finland, using the same carbon EF of 15.01 t C/TJ, but a lower net calorific value (NCV) for natural gas (33.6 GJ/1,000 m<sup>3</sup>)

than Finland (36 GJ/1,000 m<sup>3</sup>). The ERT noted that the resulting IEF (54.76 t/TJ) is lower than the IPCC default value (56.1 t/TJ). The NIR does not provide any explanation as to why the carbon EF of Finland better reflects the national circumstances of Estonia. Also, Finland is not a natural gas producer and imports natural gas from the Russian Federation, as does Estonia. The ERT strongly recommends that Estonia justify or revise the use of EFs that are different from the IPCC default values in its next annual submission. In addition, the ERT recommends that the Party develop country-specific CO<sub>2</sub> EFs for natural gas, for example by obtaining the NCV and composition of natural gas from the national gas companies and report all necessary background information to document these EFs in future annual submissions.

41. The ERT commends Estonia for setting up a project to develop country-specific EFs for fuels which are related to the key categories in the energy sector and to improve the GHG emissions reporting in the inventory. During the review, Estonia provided additional up-to-date information on the progress of this project, including that the decisions for financing will be made by December 2011. The estimated duration of the project is one year and Estonia is planning to implement the results of this project in its 2013 annual submission.

## 2. Reference and sectoral approaches

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

42. The difference in the estimate of CO<sub>2</sub> emissions calculated using the reference and sectoral approaches is 2.00 per cent in 2009. The difference is larger at the beginning of the time series, ranging between 1.77 and 6.58 per cent. The NIR includes brief explanations on the comparison of the two approaches. The difference is mainly attributed to the fact that Estonia has not completed the reference approach in line with the Revised 1996 IPCC Guidelines. In spite of the recommendations in the previous review report, the Party has still not included several fuels in the CRF tables of the 2011 annual submission (e.g. bitumen in the reference approach table 1.A(b) was reported as “NO”, but in table 1.A(d) 1,348.39 TJ of bitumen was reported as feedstock and non-energy use.) Further, in table 1.A(c), the fuel consumption values for gaseous fuels were identical in the two approaches in 2009; however, this should not be the case when the sectoral approach is compared with the reference approach (which includes fuel use for feedstock and non-energy purposes), because natural gas is used as feedstock in Estonia. The ERT recommends that Estonia complete CRF tables 1.A(b), 1.A(c), 1.A(d) in accordance with the Revised 1996 IPCC Guidelines in its next annual submission.

43. Estonia has provided information on the CO<sub>2</sub> comparison between the reference and sectoral approaches and the relevant information on the national energy balance in the 2011 NIR. The ERT recommends that Estonia include a national energy balance sheet in its next annual submission.

44. The information in the NIR on the NCVs and carbon EFs for several fuel types are different from the values reported in CRF table 1.A(b). Also, the NCV for gasoline in CRF table 1.A(b) is 1,000 times smaller than the value reported to the International Energy Agency (IEA). The ERT recommends that Estonia develop appropriate QC procedures in order to avoid these errors and report on their implementation in its next annual submission.

45. The apparent consumption in Estonia's reference approach for 1990–2009, as reported in the CRF tables, corresponds to the data submitted to IEA, with the CRF data being between 4 per cent higher and 7 per cent lower than the IEA data. In 2009, the apparent consumption reported in the CRF tables is 0.1 per cent higher than the IEA data. The growth rate for the total apparent consumption for the period 1990–2009 is also comparable (–59 per cent as reported in the CRF tables and –61 per cent in the IEA data).

*International bunker fuels*

46. Previous review reports have recommended that Estonia improve the explanations of the split between domestic and international aviation and navigation. The 2011 NIR states that the data come from Statistics Estonia, and that the surveys conducted require information to be provided as to whether fuel is used for domestic or international transport, in accordance with the IPCC criteria. However, in the NIR there is no information regarding the source of information for the number of landing/take-off (LTO) cycles. During the review, Estonia provided the time series for the number of LTO cycles divided into domestic and international flights as well as additional information on the methodology used to derive the emission estimates. The ERT recommends that Estonia include this information in its next annual submission.

**3. Key categories**Stationary combustion: solid fuels – CO<sub>2</sub>

47. Oil shale is the main indigenous fuel of Estonia. The NIR provides a full description of oil shale and the methodology used for estimating the CO<sub>2</sub> emissions. Under the thermal processing of the oil shale, shale oil and other products are produced (e.g. oil shale gas). During the review, due to the lack of transparency in the 2011 NIR, the ERT requested that the Party provide a carbon balance for the production of shale oil, taking into account the different products from the thermal processing operations. Estonia provided a CO<sub>2</sub> balance table for 2009 which includes oil shale as the input and shale oil, semi-coke gas, light fuel oil and generator gas as the output. When reviewing the CO<sub>2</sub> balance table with the attached documentation, the ERT identified that the carbon EFs for oil shale, semi-coke gas and both types of generator gases were different from those reported in the 2011 NIR. In addition, Estonia provided a CO<sub>2</sub> balance instead of a carbon balance, which makes the input/output analysis of carbon more difficult because it also reflects carbon oxidation factors. In summary, the ERT identified a lack of transparency of the carbon balance and of the used carbon contents for the production of shale oil, taking into account the different products from the thermal processing operations. This prevented the ERT from assessing whether the emissions were accurately estimated.

48. In response to the list of potential problems and further questions raised by the ERT, Estonia provided an up-to-date carbon balance for all three individual shale oil production plants based on each specific thermal processing operation. Hence, Estonia has revised the carbon EFs for semi-coke gas and both types of generator gases which arise from these operations. This updated information has resulted in revised estimates for all categories under the energy sector and in particular the categories electricity and heat production/solid fuel, chemical industry and other – carbon stored with black ash and semi-coke. The ERT commends the Party for its effort to resolve this issue in such a short period of time and recommends that Estonia include the descriptions and revised carbon EFs spreadsheet in its next annual submission.

49. The ERT further noted that, in its submission of revised estimates, Estonia also updated the NCV of oil shale to a value which is inconsistent with that provided by Statistics Estonia in the energy balance. Estonia explained that Statistics Estonia uses an annual average NCV for enriched oil shale which is obtained from one oil shale mining company. The Party explained that this value is not applicable to the plants that produce shale oil and that the updated NCVs were collected directly from those plants. Further, MoE and the inventory experts have begun discussions with Statistics Estonia to adjust the national statistics data by using plant-specific NCVs for oil shale instead of the average NCV for enriched oil shale. The ERT encourages Estonia to continue this dialogue in order to ensure consistency and to provide explanations in its next annual submission, if the

NCVs reported in the inventory are not consistent with those in the energy balance of Statistics Estonia.

Fugitive emissions: oil – CH<sub>4</sub>

50. Estonia reports CH<sub>4</sub> emissions from transport and storage of oil products using default EFs from the Revised 1996 IPCC Guidelines. However, these EFs refer to crude oil. The ERT encourages Estonia to review the appropriateness of adopting these EFs and document the decision-making process regarding these EFs in its next annual submission.

**4. Non-key categories**

Road transportation: liquid fuels – CH<sub>4</sub> and N<sub>2</sub>O

51. Estonia reports emissions of CH<sub>4</sub> and N<sub>2</sub>O using the IPCC tier 3 COPERT IV model. However, the NIR does not provide any information on how the effects of emission control technology and operation conditions are incorporated into the tier 3 emission calculations. During the review, Estonia provided further documentation on the calculation methodology. The ERT recommends that Estonia include the documentation in its next annual submission in order to improve the transparency of its reporting.

Fugitive emissions: natural gas – CO<sub>2</sub>

52. In the CRF tables, CH<sub>4</sub> emissions from natural gas transmission have been reported but CO<sub>2</sub> emissions from this category have been reported as “NO”. The ERT noted that this is not in line with the IPCC good practice guidance, which provides a tier 1 methodology and a default EF for estimating CO<sub>2</sub> emissions from natural gas transmission and the ERT recommended that Estonia provide an estimate for this category. In response to the list of potential problems and further questions raised by the ERT, the Party stated that there is no transmission of natural gas in Estonia, only distribution and, as there are no compressor stations in Estonia, no fugitive CO<sub>2</sub> emissions occur. The ERT recommends that Estonia correct the reporting in the CRF tables and include this explanation in the NIR of its next annual submission.

**C. Industrial processes and solvent and other product use**

**1. Sector overview**

53. In 2009, emissions from the industrial processes sector amounted to 453.49 Gg CO<sub>2</sub> eq, or 2.7 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 17.30 Gg CO<sub>2</sub> eq, or 0.1 per cent of total GHG emissions. Since the base year, emissions have decreased by 57.9 per cent in the industrial processes sector, and decreased by 16.7 per cent in the solvent and other product use sector. The key drivers for the fall in emissions in the industrial processes sector are the economic conditions and the level of consumer demand in Estonia. Industrial production fell sharply after the country’s declaration of independence in the 1990s; however, from 2002 emissions from industrial processes gradually rose, but fell again in 2009 by more than 50 per cent due to the global economic recession. Within the industrial processes sector, 62.1 per cent of the emissions were from mineral products, followed by 31.3 per cent from consumption of halocarbons and SF<sub>6</sub> and 6.5 per cent from chemical industry.

54. Estonia has made recalculations for the industrial processes sector between the 2010 and 2011 submissions. Estonia recalculated CO<sub>2</sub> emissions from glass production for the years 1990–1996 adding emissions from flat glass production, because only emissions from container glass production had been estimated in the previous annual submission. The ERT noted that these recalculations were performed to take into account improvements in AD.



The impact of the recalculations on the industrial processes sector is an increase in emissions of 0.1 per cent for 1990, and no change for 2008.

55. Estonia has made recalculations for the solvent and other product use sector between the 2010 and 2011 submissions by estimating for the first time CO<sub>2</sub> and N<sub>2</sub>O emissions from this sector. These recalculations have been performed as a result of planned improvements and the impact of these recalculations is an increase in emissions of 22.21 Gg CO<sub>2</sub> eq for 2008.

56. The inventory is generally complete. Emissions from the solvent and other product use sector, in particular CO<sub>2</sub> and N<sub>2</sub>O emissions (except for N<sub>2</sub>O emissions from aerosol cans) were reported for the first time in the 2011 submission. During the review, the ERT noted that Estonia reported CO<sub>2</sub> emissions from soda ash use as “NO”. However, CO<sub>2</sub> emissions from soda ash use in glass production were reported under other (mineral products), but other possible soda ash uses (chemicals, soaps, detergents, flue gas desulphurization) were not taken into account (see para. 61 below). This issue was addressed by Estonia in response to the list of potential problems and further questions raised by the ERT (see para. 62 below).

57. Estonia reports potential emissions of HFCs, PFCs and SF<sub>6</sub> as not estimated (“NE”). The ERT reiterates the encouragement of the previous review report that Estonia provide estimates for the potential emissions of these gases.

58. Estonia has implemented most of the recommendations of the previous review report (e.g. improved transparency of the reporting for the cement production category by justifying the use of high cement kiln dust (CKD) values for the period 1990–2004, corrected data for natural gas consumption as feedstock in ammonia production in CRF table 1.A(d), the provision of CO<sub>2</sub> emission estimates for non-energy use and the disposal of lubricants and paraffin waxes, and corrected notation keys for potential emissions of F-gases under the category consumption of halocarbons and SF<sub>6</sub>), but the Party has not implemented those recommendations relating to consumption of halocarbons and SF<sub>6</sub> (see para. 59 below).

## 2. Key categories

### Consumption of halocarbons and SF<sub>6</sub> – HFCs

59. Emissions from the use of F-gases were calculated using tier 2a and 3 methods from the 2006 IPCC Guidelines and mainly country-specific EFs. Information on the comparison of the EFs used by the Party with the EFs recommended in the 2006 IPCC Guidelines was provided for the stationary refrigeration subcategory. The ERT recommends that Estonia provide, in its next annual submission, justification for the use of the methodology described in the 2006 IPCC Guidelines, and a comparison of the methods and EFs used with those from the IPCC good practice guidance. The ERT reiterates the concern expressed in the previous review report that the EF for the product life factor (PLF), given as 2 per cent for household refrigeration, is high compared with the default PLF provided in the IPCC good practice guidance, which ranges between 0.1 and 0.5 per cent and the country-specific values reported by other countries (which mostly range between 0.01 per cent and 0.5 per cent). The ERT reiterates the recommendation of the previous review report that Estonia review the leakage rate of these refrigerators and further justify its use of the EF or apply a default PLF value or a revised country-specific PLF and recalculate the emissions, as applicable, noting that the review of leakage rates for household refrigerators is mentioned under the planned improvements for the 2012 annual submission. The ERT also reiterates the recommendation that Estonia improve the transparency of its reporting by including in the NIR more information about the development of the PLF for commercial refrigeration and for different types of vehicles that incorporate air-conditioning equipment.

### 3. Non-key categories

#### Cement production – CO<sub>2</sub>

60. Estonia calculates CO<sub>2</sub> emissions from cement production by applying the tier 2 method from the IPCC good practice guidance. Following previous recommendations, in its 2011 submission Estonia has provided a more detailed description of the method used to determine the values for CKD for the years 1990–2004. The ERT commends the Party for this improvement which enhances the transparency of the reporting for this category.

#### Soda ash use – CO<sub>2</sub>

61. Estonia reports CO<sub>2</sub> emissions from soda ash use as “NO”. Although CO<sub>2</sub> emissions from soda ash use in glass production are reported under other (mineral products), other possible soda ash uses (chemicals, soaps, detergents, flue gas desulphurization) are not taken into account. In response to questions raised by the ERT during the review, Estonia stated that there are no published data available on imports/exports and production of soda ash, but that it is currently investigating other uses of soda ash in the country. The ERT notes that the Revised 1996 IPCC Guidelines explicitly state that “Carbon dioxide emissions are associated with the use of soda ash. Some of the major uses include glass manufacture, chemicals, soaps, detergents and flue gas desulphurization. For each of these uses, it is assumed that for each mole of soda ash use, one mole of CO<sub>2</sub> is emitted”.

62. In response to the list of potential problems and further questions raised by the ERT, Estonia informed the ERT about investigations that were carried out to identify further uses of soda ash in Estonia. These investigations identified further soda ash use in processes of electrolyte neutralization and Estonia provided revised emission estimates for CO<sub>2</sub> emissions from soda ash use in the electrolyte neutralization process for the entire time series and the ERT agreed with these estimates. The overall impact of this revision was an increase in emissions of 0.07 Gg CO<sub>2</sub> eq for 2009, equivalent to 0.02 per cent of total emissions from the industrial processes sector. The ERT recommends that Estonia transparently document the methodologies, EFs and AD used for the calculations in the NIR of its next annual submission. The ERT also recommends that Estonia ensure the completeness of this category in future annual submissions by monitoring any potential uses, and report on these activities in its next annual submission. This could be done by applying appropriate QA/QC procedures, for example by comparing the sum of specific soda ash uses included in the inventory with statistical data on production, imports and exports (national or international (e.g. the statistical office of the EU (Eurostat))).

#### Solvent and other product use – CO<sub>2</sub> and N<sub>2</sub>O

63. Estonia estimated CO<sub>2</sub> emissions from paint application, degreasing and dry cleaning, chemical products, manufacture and processing, and CO<sub>2</sub> and N<sub>2</sub>O emissions from the subcategory other for the entire time series for the first time in the 2011 submission and provided information on the data and methodology applied. Under the planned improvements listed in its 2011 submission, Estonia mentioned that it is planning to investigate and estimate N<sub>2</sub>O emissions from aerosol cans, which are still reported as “NE”. The ERT commends Estonia for these improvements and encourages the Party to report emissions of N<sub>2</sub>O from aerosol cans in its next annual submission.

## D. Agriculture

### 1. Sector overview

64. In 2009, emissions from the agriculture sector amounted to 1,302.89 Gg CO<sub>2</sub> eq, or 7.8 per cent of total GHG emissions. Since the base year, emissions have decreased by 56.9 per cent. The key drivers for the fall in emissions are the decrease in the livestock population and the decrease in the amount of synthetic fertilizer and manure applied to agricultural soils. Within the sector, 52.4 per cent of the emissions were from agricultural soils, followed by 33.5 per cent from enteric fermentation, 13.7 per cent from manure management and 0.4 per cent from field burning of agricultural residues.

65. The Party has made recalculations for the agriculture sector between the 2010 and 2011 submissions. These were performed in response to the 2010 annual review report and due to other issues as identified by the Party. The impact of these recalculations on the agriculture sector is a 4.2 per cent reduction in emissions for 2008. The main recalculations took place in the following categories:

- (a) Agricultural soils (98.7 per cent of the total sectoral emission reduction for 2008) – N<sub>2</sub>O;
- (b) Enteric fermentation – CH<sub>4</sub>;
- (c) Manure management – CH<sub>4</sub> and N<sub>2</sub>O.

66. The inventory is complete in terms of categories and gases with estimates reported for all years of the time series. Improvements were made to the agricultural soils estimate through: the use of the tier 1b method from the IPCC good practice guidance; the estimation of the nitrogen (N) in crop residue; and the revision of the AD on the amount of synthetic N fertilizer and N from livestock manure applied to the soils. The equations from the IPCC good practice guidance used by the Party to calculate the emission estimates for enteric fermentation from dairy cattle have been included and some of the factors used in the calculation of the gross energy (GE) intake of livestock have been corrected. Additionally, the consistent allocation of manure across different manure systems for the estimation of CH<sub>4</sub> and N<sub>2</sub>O emissions has been carried out. The ERT considers that the transparency of the reporting could be enhanced through the improved cross-referencing of data inputs between the CRF tables and the appropriate sections of the NIR.

### 2. Key categories

#### Enteric fermentation – CH<sub>4</sub>

67. Estonia uses the tier 2 approach for the estimation of emissions from cattle and swine and a tier 1 approach for the estimation of emissions from all other animals which is in line with the IPCC good practice guidance. For the species where the tier 1 method is used, Estonia uses the IPCC default EFs, except for fur-bearing animals where the Party has used an EF from Norway, since no IPCC default value is available. As recommended in the 2010 review report, Estonia has updated the tier 2 equations and default parameter values from the IPCC good practice guidance for the estimation of emissions from cattle.

68. The ERT noted that the characterization data for non-dairy cattle provided in the NIR is insufficient as very little information is provided on animal characteristics and production. The ERT recommends that Estonia provide further information on the characterizations applied to non-dairy cattle.

69. The ERT considers that, for swine, the approach used by Estonia is appropriate. However, the ERT recommends that the Party provide further documentation to improve transparency by showing which GE intake and methane conversion rate (Y<sub>m</sub>) values were

used. Developed and developing country values are provided for each of the values in table A-4 of the Revised 1996 IPCC Guidelines, but it is not clear which values have been applied to each of the age/weight classes of swine defined by Estonia. The ERT recommends that Estonia provide additional information, as suggested above, in order to enhance transparency. While the IEF for swine as shown in the CRF tables (0.8 kg/head/year) is the lowest among all reporting Parties, Estonia has provided a reasonable explanation as to why the IEF is lower than the IPCC default value of 1.5 kg/head/year for developed countries and 1.0 kg/head/year for developing countries. Given that the IPCC default EF is based on certain assumptions of population age and size structure so that it can be applied to the entire population across a wide range of countries, it is reasonable that the IEF for Estonia is lower than the IPCC default EF, since Estonia estimated its EFs by age/size class and developed EFs specifically for those age/size classes. The ERT recommends that Estonia enhance the transparency of the NIR by providing the GE and Ym values applied to each of the age/weight classes of swine and justify the use of the lower IEF.

70. In the CRF tables, Estonia reports only calves under the young cattle subcategory, with bovine cattle (aged one to two years) reported in the mature animal subcategory, which is not in accordance with the IPCC good practice guidance. The ERT also noted that the calves were not excluded from the enteric fermentation calculations for the period when they are exclusively milk fed. The ERT reiterates the recommendation of the 2010 review report that Estonia report bovine cattle in the young cattle subcategory, because they are growing animals, and apply a Ym of zero to calves for the period when they are milk fed.

#### Agricultural soils – N<sub>2</sub>O

71. Emissions of N<sub>2</sub>O from agricultural soils represent the largest source of emissions from the agriculture sector, representing almost half of the emissions from this sector. A combination of tier 1 and tier 1b methods were used to estimate the emissions, with the tier 1b method employed for estimating the N content of agricultural residues and the N production from N-fixing crops. A number of improvements have been carried out since the previous annual submission. The AD on the amount of synthetic fertilizer applied to soils from 1990 to 1991 were updated with new data and the quantity of N excretion deposited on soils during grazing was updated as a result of the use of more appropriate N excretion factors. Estonia has also used the IPCC good practice guidance equation for estimating crop residues returned to the soils and has ensured the consistency of the AD across agricultural soils and field burning of agricultural residues. The ERT commends the Party for these improvements.

### **3. Non-key categories**

#### Manure management – CH<sub>4</sub> and N<sub>2</sub>O

72. In the 2011 submission, the allocation of manure for swine and young cattle for the estimation of CH<sub>4</sub> and N<sub>2</sub>O emissions among the different manure management systems is consistent across the entire time series, as recommended in the 2010 review report. The ERT commends Estonia for implementing this improvement.

## **E. Land use, land-use change and forestry**

### **1. Sector overview**

73. In 2009, net removals from the LULUCF sector amounted to 7,036.74 Gg CO<sub>2</sub> eq. Since the base year, net removals have decreased by 32.5 per cent. The key driver for the fall in removals is the decrease in CO<sub>2</sub> removals under forest land remaining forest land. In

2009, within the sector, 6,171.17 Gg CO<sub>2</sub> eq of net removals were from forest land, followed by net removals of 962.78 Gg CO<sub>2</sub> eq from grassland and net removals of 6.90 Gg CO<sub>2</sub> eq from wetlands. Cropland was a net source of emissions and accounted for 104.10 Gg CO<sub>2</sub> eq of net emissions.

74. The ERT notes that the LULUCF sector of the inventory is not complete, with emissions/removals for many subcategories and pools reported as “NE” and with an inconsistent use of notation keys for some years of the time series without clear explanation (e.g. the use of the notation keys “IE” (included elsewhere), “NO” for 1990–1994 and “IE” for 1995–2009 for the carbon stock change in dead organic matter in land converted to grassland). In the 2011 annual submission, Estonia provided for the first time estimates of the carbon stock changes in grassland converted to cropland (organic soils) and land converted to grassland (living biomass and organic soils). The Party has not estimated emissions/removals from forest land converted to wetlands, land converted to settlements, except wetlands converted to settlements, and forest land converted to other land and cropland converted to other land. For the subcategories that are reported, the following pools are not estimated: living biomass for cropland remaining cropland and wetlands remaining wetlands; dead organic matter for cropland remaining cropland and wetlands remaining wetlands; and mineral soils for cropland remaining cropland and grassland converted to cropland, and mineral soils for grassland remaining grassland and all land converted to grassland, except wetlands. The ERT commends the Party for the improvements made to the completeness of its inventory, but reiterates the recommendation of the previous review report that Estonia further improve the completeness of the LULUCF estimates.

75. Estonia uses NFI data to estimate the areas of land categories and land-use changes. The NFI covering the whole country starting from 1999 uses systematic sampling with a 5 km x 5 km quadrangle grid, and is implemented every year, measuring one fifth of the permanent sampling plots. All permanent plots are measured once every five years. Before 1999, stand-wise forest inventories were implemented. Estonia started an additional field study in 2009 within the framework of the NFI to specifically assess land use and land-use changes over the past 20 years and estimate soil types (mineral/organic). However, the ERT notes that the Party did not provide information on the detailed methods used to identify the exact year when the land-use changes occurred on each sampling plot when using the NFI data whereby each permanent plot is measured once every five years, and given that the additional field study only started in 2009.

76. For the LULUCF subcategories reported, Estonia generally applied tier 1 methods for the estimation of the emissions/removals, using country-specific AD and default EFs and parameters from the IPCC good practice guidance for LULUCF. The ERT reiterates the recommendation from the previous review report that Estonia develop country-specific EFs and parameters where possible. The ERT notes that the 2010 review report pointed out that Estonia used the forest area reported to the Food and Agriculture Organization of the United States in the CRF tables, but the data from Statistics Estonia were also provided in the NIR. In its 2011 submission, Estonia re-estimated the area of all land-use categories based on the NFI data and provided explanations for these recalculations in the NIR and in the CRF tables. The ERT commends Estonia for harmonizing the area data of all land-use categories.

77. The ERT considers that the reporting in the LULUCF sector is not transparent but has improved since the 2010 review. Estonia included transparent descriptions of the methods and EFs used to estimate emissions and removals (essentially default values from the IPCC good practice guidance for LULUCF). However, Estonia did not provide information on the methodology used to estimate the carbon stock changes in any land converted to other land in the NIR. The ERT strongly recommends that the Party provide

information on the methodology used to estimate the carbon stock changes in any land converted to other land. The information on the AD, including the data source and estimation method, is sometimes not provided transparently or explained clearly. The ERT reiterates the recommendation from the previous review report that Estonia clearly present the AD used in the NIR.

78. In the 2011 NIR, in response to a recommendation in the previous review report, Estonia provided the rationale for its assumption that all forest land is managed by explaining that the total forest land is or has been covered with forest management plans. The ERT commends Estonia for this improvement in the transparency of its reporting.

79. The Party has made recalculations for the LULUCF sector between the 2010 and 2011 submissions. These were performed mainly due to: changes in the AD used to estimate the land-use areas and land-use change areas by using updated NFI data; and changes in the estimation of the carbon stock changes in forest land from the default method (the gain-loss method) to the stock change method. The impact of these recalculations on the LULUCF sector is a 96.6 per cent reduction in removals for 2008. The main recalculations took place in the following categories: forest land – CO<sub>2</sub>; cropland – CO<sub>2</sub>; and grassland – CO<sub>2</sub>.

## 2. Key categories

### Forest land remaining forest land – CO<sub>2</sub>

80. In its 2011 submission, and for the first time, Estonia has estimated the change in the carbon stock in living biomass by using the stock change method with default parameter values from the IPCC good practice guidance for LULUCF (except for the wood density of pine and birch) and has used the NFI data to estimate the area of forest land. The ERT recommends that Estonia develop country-specific parameter values for future annual submissions.

81. The carbon stock changes in living biomass fluctuate considerably between 1990 and 2008, from losses of 1,339.21 Gg C in 2001 to gains of 2,579.66 Gg C in 2007. During the review, Estonia explained that the difference in the carbon stock change between two successive years is small compared with the total growing stock, and is lower than the sampling error of the growing stock estimates. In its NIR, the Party also reports that the significant change in the harvest volumes and the extensive impact of wildfires affect the emission estimates. However, the ERT considers that the level of harvest volumes and wildfires cannot explain the large inter-annual fluctuations, and that the method using the NFI data largely contributes to the fluctuations. The ERT strongly recommends that Estonia explore ways to reduce the inter-annual fluctuations due to the estimation method, for example by using the NFI data set for a specific year and that for the five previous years to compare the data of the same sampling plots.

82. In order to calculate the carbon stock change in dead wood, Estonia uses a country-specific value, 0.266, for the biomass expansion factor to convert the merchantable volume to above-ground biomass (BEF<sub>2</sub>); Estonia cites an article in an international journal (*Journal of Forest Science*, 2010, 56(9), pp. 397–405) as a reference for this value. However, by definition, this value should be larger than 1.0, and the rationale for the difference was not clearly provided in the NIR or during the review. The ERT recommends that, in its next annual submission, Estonia provide the rationale for the use of this value or explore the possibility that there might be a different definition in the original reference in accordance with the IPCC good practice guidance for LULUCF. Otherwise, the ERT recommends that the Party use a country-specific BEF<sub>2</sub> which is more accurate than the default IPCC value if appropriate, or the default IPCC value.

83. In the NIR, Estonia did not provide transparent information on the data source used for the estimation of areas of forest land remaining forest land under organic soils. During the review, Estonia explained that the data of NFI, which surveys soil types, were mainly used to estimate the areas for the 2011 NIR, and that supplementary data from the additional field study which started in 2009 were used to estimate the emissions for the years 1990–1998. Forest data provided by Statistics Estonia were used to some extent, but data from the European programme CORINE (Coordination of information on the environment), which had been used in the previous annual submission, are no longer used by the Party. The ERT recommends that Estonia provide information on the data sources used for the estimation of emissions from organic soils in its next annual submission. In addition, Estonia continues to use the default IPCC CO<sub>2</sub> EF (0.16 t C/ha/year) for drained organic soils in managed forests for boreal forests, which may not be suitable for Estonia since the country is situated in a cold temperate wet zone according to the genetic climate zone map in the IPCC good practice guidance for LULUCF (figure 3.13), and the default IPCC CO<sub>2</sub> EF for temperate forests (0.68 t C/ha/year) is larger than that for boreal forests, as indicated in the previous review report. During the review, Estonia indicated that the development of a country-specific EF is still in progress. The ERT reiterates the recommendation of the previous review report that Estonia reassess the appropriateness of the default EF or replace it with country-specific data in its next annual submission.

84. Estonia reports CO<sub>2</sub> emissions from biomass burning under forest land remaining forest land by wildfires in CRF table 5(V) as 2.03 Gg in 2009. However, the Party uses the stock change method to estimate the carbon stock change in living biomass, which usually includes CO<sub>2</sub> emissions from biomass burning. During the review, Estonia recognized that the estimates are double counted, and included revised estimates with its submission of 17 October 2011 so that CO<sub>2</sub> emissions from biomass burning are now included in the carbon stock change in living biomass, and CO<sub>2</sub> emissions from biomass burning under forest land remaining forest land by wildfires in CRF table 5(V) are reported as “IE”. The ERT agrees with the revised estimates and recommends that the Party provide a description of this in the NIR, reflecting the correction, in its next annual submission.

#### Land converted to forest land – CO<sub>2</sub>

85. In its 2011 submission, Estonia has estimated for the first time the area and CO<sub>2</sub> emissions from land converted to forest land as 54.43 kha and 693.86 Gg CO<sub>2</sub>. The ERT commends Estonia for estimating the area and emissions from this category. However, Estonia did not provide information on the methodology used for these calculations in the NIR. The ERT strongly recommends that the Party provide detailed information on the methodology used, including equations and parameters, in accordance with the IPCC good practice guidance for LULUCF in the NIR of its next annual submission.

#### Cropland remaining cropland – CO<sub>2</sub>

86. Estonia did not report the carbon stock change in living biomass from 1990 to 2009 in its 2011 submission, even though the Party reported the carbon stock change in living biomass in orchards in its 2010 submission. Estonia explained that the data on the area of orchards are inappropriate, but that the carbon stock change is estimated to be a very small sink. The ERT recommends that the Party collect more reliable area data on the area of orchards and estimate the carbon stock change in living biomass.

87. Estonia recalculated the area of cropland remaining cropland for the whole time series. For the year 2008, the area is 1,096.40 kha in the 2011 submission, which is substantially larger than that in the 2010 submission (619.9 kha). Estonia explained that the main reason for the increase is the reclassification of abandoned cropland which has not lost the function of arable land from grassland to cropland.

88. The area of organic soils was derived from the NFI data, and CORINE maps were not used in the 2011 submission. During the review, in response to questions raised by the ERT, Estonia explained that the area of organic soils is the same between 1998 and 2008, based on information obtained from an additional field study started in 2009.

#### Grassland remaining grassland – CO<sub>2</sub>

89. Estonia uses 2.5 as the biomass expansion factor for the conversion of merchantable volume to above-ground biomass (BEF<sub>2</sub>) for the carbon stock change in living biomass. In its NIR, a value of 0.25 was reported but, during the review, Estonia explained that 2.5, the default value from the IPCC good practice guidance for LULUCF, is the correct value. There is no methodology provided in the IPCC good practice guidance for LULUCF for the estimation of the carbon stock change in dead wood, and Estonia uses the same methodology for this category as it uses for the category forest land remaining forest land. However, the Party did not provide a detailed explanation of why this methodology is used for grassland remaining grassland. In particular, for the BEF<sub>2</sub> for the carbon stock change in dead wood, Estonia uses a country-specific value of 0.266. This is not only an abnormal value (see para. 82 above), but also different from the value used for living biomass, which could result in an overestimation of the carbon stock change in dead wood. The ERT recommends that Estonia provide a detailed explanation for the use of this methodology in the NIR of its 2012 annual submission.

90. The ERT noted that the area of organic soils in grassland remaining grassland is reported as being constant during the periods 1990–1993 (40.69 kha), 1995–1999 (39.20 kha), 2000–2005 (38.45 kha), and 2006–2008 (38.24 kha), and the ERT noted that this pattern of the time series might derive from the data collection method used. However, the Party did not provide an explanation of the constant area estimates in the NIR. The ERT recommends that Estonia provide an explanation of the trend in the area change, including the method of area estimation and data sources used, and explore a way to improve the time-series consistency of the land areas in the NIR of its 2012 annual submission.

#### Land converted to grassland – CO<sub>2</sub>

91. In its 2011 submission, Estonia has estimated for the first time the area of and CO<sub>2</sub> emissions from land converted to grassland as 6.08 kha and 45.18 Gg CO<sub>2</sub>, respectively. The ERT commends Estonia for estimating the emissions from this category. However, the Party did not provide information on the methodology used for these calculations in the NIR. The Party reported the carbon stock change in dead organic matter as “IE”, “NO” between 1990 and 1994 and “IE” between 1995 and 2009, and reported the carbon stock change in soils as “NO” and “NE” for the whole time series. However, no detailed explanation was provided in the NIR. The ERT strongly recommends that the Party provide, in the NIR of its 2012 annual submission, detailed information on the methodology used, including equations and parameters, in accordance with the IPCC good practice guidance for LULUCF and on the rationale for the use of these notation keys.

#### CO<sub>2</sub> emissions from agricultural lime application

92. Estonia reported that the amount of limestone applied to cropland in 2009 was 0.43 Mg/year but that the amount of dolomite applied to cropland, and limestone and dolomite applied to grassland were reported as “NE”. During the review, in response to questions raised by the ERT, the Party explained that the data correspond to the total limestone and dolomite applied to cropland, although limestone is mainly applied, and that lime is not added to grassland in Estonia. The ERT recommends that the Party provide this detailed information in the NIR and use the correct notation keys in its next annual submission. In addition, the IEF of 120 (Mg CO<sub>2</sub>-C/Mg) in the CRF tables is different from



the IPCC default factor of 0.12 (t C/t CaCO<sub>3</sub> or t CaMg(CO<sub>3</sub>)<sub>2</sub>), which is reported by the Party in the NIR. The ERT notes that it seems that the difference is due to the mistreatment of units. The ERT recommends that the Party check the calculation for this category, provide correct values with a clear explanation in its next annual submission, and enhance the category-specific QC procedures.

## F. Waste

### 1. Sector overview

93. In 2009, emissions from the waste sector amounted to 662.94 Gg CO<sub>2</sub> eq, or 4.0 per cent of total GHG emissions. Since the base year, emissions have decreased by 16.5 per cent. The key drivers for the fall in emissions are the increase in the aerobic treatment of wastewater and the increase in recycling and the reduction of waste deposited on unmanaged solid waste disposal sites (SWDS) due to the implementation of waste management policies and measures. Within the sector, 70.6 per cent of the emissions were from solid waste disposal on land, followed by 17.7 per cent from other, 11.7 per cent from wastewater handling and less than 0.01 per cent from waste incineration.

94. The Party has made recalculations for the waste sector between the 2010 and 2011 submissions for the entire time series as a result of the inclusion, for the first time, of N<sub>2</sub>O emissions from domestic and commercial wastewater treatment. The recalculations resulted in an increase in emissions of 6.78 Gg CO<sub>2</sub> eq (or 0.9 per cent) for the base year and 33.43 Gg CO<sub>2</sub> eq (or 4.9 per cent) for 2008.

95. Estonia has implemented a number of the recommendations from previous review reports. However, there are several outstanding recommendations which are listed in the categories below. Estonia mentions in its NIR that it will address these recommendations in future annual submissions.

### 2. Key categories

#### Solid waste disposal on land – CH<sub>4</sub>

96. The first order decay method (tier 2) of the IPCC good practice guidance was used to estimate CH<sub>4</sub> emissions from solid waste disposal on land. The Party used country-specific AD, DOC data from the Netherlands and default values from the IPCC good practice guidance and the 2006 IPCC Guidelines for other parameters for the model. CH<sub>4</sub> emissions from landfills in 2009 amount to 22.29 Gg, which is 22.0 per cent less than the emissions in the base year (28.57 Gg).

97. Estonia uses the 'forecast' function of the Excel software to calculate the amount of municipal solid waste (MSW) generated in the period 1940–1989 based on data from the period 1990–2009. The ERT notes that the formula automatically recalculates all previous values when a new value for the most recent year is available, without a detailed assessment of the appropriate use of the projection function. In addition, it was noted in previous review reports that the approach used results in a very high waste generation rate of 415 kg/person/year for 1940 while relevant methodological studies recommend a waste generation rate of 200 kg/person/year.<sup>5</sup> The ERT reiterates the recommendation of the previous review report that the Party revise the waste generation rate for the entire time series in order to reflect the actual economic growth and consumption patterns in Estonia since 1940.

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<sup>5</sup> Gulyaev N. 1966. Municipal waste removing in cities. *In: Literature for Construction*. Moscow. p.16, table 6.

98. The ERT noted considerable inter-annual fluctuations in the CH<sub>4</sub> IEFs: the 2009 value (0.090 t/t MSW) is 43.2 per cent higher than the 1990 value (0.063 t/t MSW), but the minimum value occurs in 1996 (0.027 t/t MSW). In response to questions raised by the ERT during the review, the Party explained that these fluctuations are the result of the implementation of CH<sub>4</sub> recovery practices starting in 1995 and the unstable population rate in the country. The ERT recommends that the Party include additional information in the NIR of its next annual submission regarding CH<sub>4</sub> recovery practices and the unstable population rate in the country in order to improve the transparency of its reporting.

99. The DOC value for the period 1940–2000 was derived from an analysis of waste composition from the Netherlands and there is no justification in the NIR to indicate why these data reflect Estonian conditions. The ERT reiterates the recommendations from previous review reports that the Party use the country-specific composition of waste and document any recalculations in its next annual submission. The ERT encourages the Party to compare new values with data from neighbouring Baltic countries.

100. Estonia has used an MCF of 1.0 and an oxidation factor of 0 for the entire period, which implies that all SWDS are categorized as managed. The rationale for this assumption is not provided in the NIR and the ERT considers that it is unlikely that this assumption is correct, at least for the early years of the time series. Moreover, 10 out of 15 SWDS were closed in 2009, probably due to non-conformity with the requirements of managed SWDS. The Party explained that no research or investigations have been carried out by the inventory compilers responsible for the waste sector to categorize and classify SWDS. The ERT reiterates the recommendations from the previous review report that Estonia justify or change the assumption that all SWDS are managed for the entire time series and modify the values for DOC and the MCF accordingly.

#### Wastewater handling – CH<sub>4</sub> and N<sub>2</sub>O

101. Estonia has used the IPCC default method (tier 1) to estimate CH<sub>4</sub> emissions from municipal and commercial wastewater handling. The AD were obtained from the data sets of the EEIC Water Bureau. The Party reports that 99 per cent of domestic wastewater and 99.9 per cent of industrial water in Estonia is treated aerobically. The sludge is treated anaerobically (with biogas utilization) and is either sent to SWDS or composted. Emissions from domestic and industrial sludge which is disposed on landfills are accounted for in the category solid waste disposal on land.

102. N<sub>2</sub>O emissions from domestic and commercial wastewater handling were estimated using the tier 1 method from the 2006 IPCC Guidelines and default EFs and parameters. Recalculations were performed in accordance with the IPCC good practice guidance for the entire time series and resulted in a significant increase in N<sub>2</sub>O emissions from domestic and commercial wastewater of 35.2 Gg CO<sub>2</sub> eq (or 87.5 per cent) in the base year and 33.7 Gg CO<sub>2</sub> eq (or 85.5 per cent) in 2008.

#### Other (waste) – CH<sub>4</sub> and N<sub>2</sub>O

103. For the year 2009, Estonia reported a CH<sub>4</sub> recovery of 4.07 Gg CH<sub>4</sub> in CRF table 6.A. During the review, the ERT identified that 0.12 PJ of biogas was used in the energy sector as fuel, which corresponds to 2.04 Gg CH<sub>4</sub>. In response to questions raised by the ERT during the review, Estonia provided further information to the ERT, which acknowledged that the discrepancy was associated with one landfill site (of the four existing in Estonia) that captured and flared the biogas in 2009. However, Estonia has not provided estimates for the CH<sub>4</sub> and N<sub>2</sub>O emissions from biogas burned in flares. In response to the list of potential problems and further questions raised by the ERT, Estonia submitted estimates for the year 2009 for CH<sub>4</sub> and N<sub>2</sub>O emissions from biogas burned in flares, which resulted in an increase in CH<sub>4</sub> emissions of 0.55 Mg and an increase in N<sub>2</sub>O

emissions of 0.011 Mg. The ERT recommends that Estonia report detailed information on the methods and parameters used to estimate CH<sub>4</sub> and N<sub>2</sub>O emissions from biogas flaring in its next annual submission in order to improve the transparency of its reporting.

104. The ERT noted that there are inter-annual fluctuations in the CH<sub>4</sub> emissions from biological treatment between 1995 and 2003 ranging between -90 and 239 per cent. The Party explained that the inter-annual fluctuations in the CH<sub>4</sub> and N<sub>2</sub>O emissions are due to variations in the composition and amount of organic waste throughout the years. The ERT recommends that the Party include additional information in the NIR of its next annual submission regarding the composition and amount of organic waste in order to improve the transparency of its reporting.

## **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

105. Estonia provided information relating to the KP-LULUCF activities following the structure of the annotated NIR and provided general, land-specific and activity-specific information generally in line with the requirements of paragraphs 5 to 9 of the annex to decision 15/CMP.1.

106. The Party reported activities under Article 3, paragraph 3, of the Kyoto Protocol and did not elect any activities under Article 3, paragraph 4, of the Kyoto Protocol. Estonia has chosen to account for the KP-LULUCF activities at the end of commitment period. The forest definition chosen by the Party is a minimum land area of 0.5 ha, a minimum tree crown cover of 30 per cent and a minimum tree height of 2 m.

107. In the NIR and during the review, Estonia explained that afforestation and reforestation areas have been obtained from data developed by Statistics Estonia using information gathered by environment agencies over time. However, the Party did not provide detailed information on the data, including the data collection method. The area of afforestation and reforestation in 2009 (159.07 kha) is considerably larger than the area of land converted to forest land in 2009 (54.43 kha) estimated by the NFI data, though these two areas are usually similar. Estonia also observed that the area of afforestation and reforestation may be overestimated due to the fact that the data on forests from Statistics Estonia are collected according to the definition of forest under the Estonia Forest Act, which is different from the forest definition selected by Estonia for reporting under the Kyoto Protocol.

108. Deforestation areas have been estimated from a database based on the NFI, with aerial photographs to identify land use and land-use change at the end of 1989. The ERT strongly recommends that Estonia provide detailed information on the data used for the estimation of the afforestation and reforestation areas, and revise it so that is in accordance with its definition of forest, for example by using the NFI data with supporting material including aerial photographs which are currently used for the estimation of the area of land converted to forest land under the Convention and the area of deforestation under the Kyoto Protocol. The ERT also reiterates the strong recommendation from the previous review report that, in its next annual submission, Estonia provide information to demonstrate complete land coverage for afforestation, reforestation and deforestation in accordance with the requirements of paragraph 20 of the annex to decision 16/CMP.1.

109. The areas of afforestation and reforestation are reported separately in the NIR, which is unusual among reporting Parties because it is difficult to identify land that has not been forested for a period of at least 50 years. The ERT encourages Estonia to provide information on the method used to identify land which is under afforestation and under reforestation, or report the areas of afforestation and reforestation together, in line with the IPCC good practice guidance for LULUCF, and to clearly demonstrate that the areas were non-forested land at the end of 1989.

110. The ERT notes that Estonia does not report the carbon stock changes in litter and that the Party assumes that the carbon stocks in mineral soils do not change, regardless of changes in forest management, types and disturbance regimes, which is especially unusual for deforestation. In its NIR, the Party states that it recognizes the importance of carrying out additional studies and that it will explore options to obtain country-specific data regarding litter and soil organic matter for future annual submissions. According to its NIR, Estonia is planning to use data from countries with similar circumstances and conditions to estimate the emissions and removals from the omitted carbon pools and to report those emissions and removals in its 2012 annual submission. The ERT reiterates the strong recommendation of the previous review report that Estonia provide data on these omitted pools, or provide sufficient verifiable information, as required by paragraph 6(e) of the annex to decision 15/CMP.1, which demonstrates that these pools are not a net source, and, as an interim approach, use data from countries with similar circumstances and conditions in its next annual submission.

111. Estonia does not estimate emissions from biomass burning with the explanation that the AD did not allow for the separate allocation of emissions and removals to afforestation, reforestation and deforestation and other forest areas. The ERT considers that this might result in an underestimation of emissions. The ERT strongly recommends that the Party provide emission estimates for biomass burning on areas under afforestation, reforestation and deforestation, or demonstrate that there is no biomass burning on areas under afforestation, reforestation and deforestation.

112. The Party does not provide information on any specific uncertainty analysis or QA/QC procedures applied to the KP-LULUCF activities. The ERT reiterates the recommendation from the previous review report that Estonia implement such measures in its next annual submission.

113. The Party has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions. These have been made due to: changes in the deforestation data which are the result of using NFI data for the first time; and changes to the carbon stock change in living biomass which are the result of using, for the first time, the annual carbon stock change method taking into account the age of the forest stand. The impact of these recalculations on each KP-LULUCF activity for 2008 is as follows:

- (a) A decrease in removals due to afforestation and reforestation by 347.27 Gg CO<sub>2</sub> eq;
- (b) A decrease in emissions due to deforestation by 6,176.12 Gg CO<sub>2</sub> eq.

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

##### *Afforestation and reforestation – CO<sub>2</sub>*

114. In its 2011 submission, Estonia has applied for the first time specific annual growth volumes taking into account the stand age of the forest instead of using constant annual growth volumes. The Party has provided the values used for the biomass expansion factor, density and root-to-shoot ratio to convert to biomass, but has not provided references for these values. The ERT commends Estonia for the use of annual growth volumes, but

recommends that the Party provide references for these values in its next annual submission.

115. Estonia does not estimate the carbon stock change in dead wood, explaining that the accumulation of dead wood is assumed to be marginal. The ERT recommends that the Party provide further information, as required by paragraph 6(e) of the annex to decision 15/CMP.1, to demonstrate that these pools are not a net source, in accordance with section 4.2.3.1 of the IPCC good practice guidance for LULUCF. In table 5(KP-I)A.1.1 of its original 2011 submission, Estonia reported a positive value for the carbon stock change in organic soils (2.87 Gg C in 2009), which would indicate that this pool was a sink. During the review, in response to questions raised by the ERT, Estonia explained that the value was reported with the opposite sign due to a confusion regarding the interpretation of the notes in the CRF Reporter software. In its submission of 17 October 2011, the Party submitted new CRF tables, where the values of the carbon stock change in organic soils were corrected. The ERT recommends that the Party provide the description of the correction in its next annual submission.

#### *Deforestation – CO<sub>2</sub>*

116. In its 2011 submission, Estonia has provided for the first time an explanation of how harvesting or forest disturbance that is followed by the re-establishment of forest is distinguished from deforestation, as recommended by the previous review report. The Party explains that at NFI sample plots with clear cutting, the surveyor assesses whether the cutting was undertaken for regeneration purposes or for land-use change by checking for clear signs of land-use change. In addition, the Land Cadastre and the Land Registry, which record human-induced land-use changes that require permits from local authorities and/or MoE, are also checked to ensure the correct identification of land-use change. The ERT commends Estonia for its provision of this information.

## **2. Information on Kyoto Protocol units**

### Standard electronic format and reports from the national registry

117. Estonia 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.<sup>6</sup> 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.

118. Information on the accounting of Kyoto Protocol 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 set out 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.

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<sup>6</sup> 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.

### National registry

119. 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 finding 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. The Party is encouraged to select, implement and report, in its next annual submission, changes made to its registry database, infrastructure and/or procedures to support a user authentication mechanism as suggested by the ITL Administrator's Change Advisory Board.

### Calculation of the commitment period reserve

120. Estonia has reported its commitment period reserve in its 2011 annual submission. The Party reported its commitment period reserve to be 84,184,305 t CO<sub>2</sub> eq based on the national emissions in its most recently reviewed inventory (16,836.86 Gg CO<sub>2</sub> eq). In response to the list of potential problems and further questions raised by the ERT, Estonia resubmitted a complete set of CRF tables and a new value for the commitment period reserve (83,286,050 t CO<sub>2</sub> eq) based on the national emissions in its most recently reviewed inventory (16,657.21 Gg CO<sub>2</sub> eq). The ERT does not agree with this figure, but calculated the commitment period reserve using the most recently reviewed inventory contained in the CRF tables submitted by the Party on 17 October 2011 to be 83,286,042 t CO<sub>2</sub> eq.

## **3. Changes to the national system**

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

(a) A new Climate and Radiation Department has been established under MoE, and the Climate and Ozone Bureau of EEIC has been closed and the staff have been relocated to the new department in MoE. The Climate and Radiation Department is now responsible for organizing and coordinating the GHG emission reporting activities under the UNFCCC, the Kyoto Protocol and EU legislation (including the GHG inventory);

(b) From the 2011 submission onwards, EERC is responsible for coordinating the preparation of the GHG inventory, where previously this had been the responsibility of the Climate and Ozone Bureau;

(c) Starting from the 2011 submission, NFI is responsible for the inventory data for the LULUCF sector and the KP-LULUCF activities. Previously, TUT was responsible for preparing the estimates.

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

## **4. Changes to the national registry**

123. Estonia provided information on changes to its national registry in its annual submission. The reported changes were:

(a) The contact details of the registry administrator have been changed because the registry of Estonia has been moved under the administrative field of EEIC to the jurisdiction of MoE;

(b) The publicly available information web page was updated in 2011. The new web page address is <<http://khgregister.envir.ee>>.

124. The ERT concluded that, taking into account the confirmed changes to the national registry, Estonia'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**

125. Estonia did not provide information on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol in its 2011 annual submission. However, the ERT identified that Estonia has slightly modified the information provided. In addition to the information provided in its previous submission, Estonia highlighted that it has approved a National Renewable Energy Action Plan up to 2020 and that one of the objectives of the plan is to increase the share of renewable energy to at least 25 per cent of all domestic energy consumption.

126. In addition, Estonia reported under cooperation projects with developing countries that it supported in 2009 the project "Forestry co-operation between Estonian Ministry of the Environment and Adjara Autonomous Republic Forestry Administration" and also reported its contribution in 2009 and 2010 to the activities of international environmental organizations in support of environmentally sound development in developing countries. The ERT concluded that, taking into account the confirmed changes in the reporting, the information provided is complete and transparent. The ERT recommends that the Party, in its next annual submission, report any change(s) in its information provided under Article 3, paragraph 14, in accordance with chapter I.H of the annex to decision 15/CMP.1.

### **III. Conclusions and recommendations**

127. Estonia 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 the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is in line with decision 15/CMP.1.

128. The ERT concludes that the inventory submission of Estonia 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 generally complete in terms of categories and gases. Some of the categories in the LULUCF sector were reported as "NE" (see para. 74 above).

129. 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.

130. 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 Estonia for the improved transparency of the NIR since the previous annual submission.

131. The Party has made recalculations for the inventory between the 2010 and 2011 submissions. The recalculations were made in response to the 2010 annual review report, due to changes in AD and EFs, and in order to rectify identified errors. The impact of these recalculations on the national totals without the LULUCF sector is a decrease in emissions of 1.0 per cent for 2008, while the impact including the LULUCF sector is an increase in emissions of 87.0 per cent for 2008. The main recalculations took place in the following sectors/categories:

- (a) The revision of land use and land-use change areas and the replacement of the estimation method for carbon stock changes (see para. 79 above);
- (b) The revision of the AD and EFs in the energy sector, in particular for the oil shale industry (see para. 32 above);
- (c) The revision of the N<sub>2</sub>O emissions from agricultural soils (see para. 65 above);
- (d) The inclusion of N<sub>2</sub>O emissions from domestic and commercial wastewater treatment for the first time (see para. 94 above).

132. Estonia provided information related to activities under Article 3, paragraph 3, of the Kyoto Protocol as set out in paragraphs 5 to 9 of the annex to decision 15/CMP.1; the information provided is generally consistent with decision 16/CMP.1. However, the ERT identified areas of improvement in relation to the estimation of emissions and removals, the uncertainty estimates and the transparency of the reporting (see paras. 107–116 above).

133. The Party has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions following changes in methodologies, AD and EFs. The impact of these recalculations on each KP-LULUCF activity for 2008 is a decrease in net emissions by 5,828,85 Gg CO<sub>2</sub> eq (or 96.1 per cent) (see para. 113 above).

134. Estonia 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 has used the required reporting format tables as required by decision 14/CMP.1.

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

136. 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 CMP decisions.

137. Estonia 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 has been 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.

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

- (a) Enhance the completeness of the inventory for the LULUCF sector and the KP-LULUCF activities (see paras. 74, 111 and 115 above);
- (b) Implement the use of the key category analysis as a driving force for setting priorities for the improvement of the quality of the inventory (see para. 16 above);
- (c) Correct the uncertainty analysis calculation (see para. 17 above);



(d) Improve the transparency of the NIR for all sectors and in particular for the LULUCF sector (see para. 25 above);

(e) Improve the QC procedures to minimize inconsistencies between the CRF tables and the NIR and in the use of notation keys and ensure the full implementation of the QA/QC plan (see paras. 35, 36, 44 and 92 above);

(f) Provide an uncertainty analysis for the activities under Article 3, paragraph 3, of the Kyoto Protocol;

(g) Implement and report QA/QC procedures for the activities under Article 3, paragraph 3, of the Kyoto Protocol.

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

(a) Include in the NIR a national energy balance for the most recent year;

(b) Improve the calculation of the reference approach in accordance with the Revised 1996 IPCC Guidelines;

(c) Revise the EFs in the category consumption of halocarbons and SF<sub>6</sub> – HFCs, in particular for the leakage rate of refrigerators (see para. 59 above);

(d) Collect data on all soda ash use in the country and calculate the CO<sub>2</sub> emissions from the total soda ash use (see para. 61 above);

(e) Revise the allocation of cattle to subcategories and ensure the correct use of EFs (see para. 70 above);

(f) Develop country-specific EFs and parameters for the LULUCF subcategories (see paras. 76, 80 and 83 above);

(g) Collect more reliable area data on orchards and estimate the carbon stock change in living biomass in the cropland remaining cropland subcategory (see para. 86 above);

(h) Revise the waste generation rate, DOC and MCF values for the entire time series (see paras. 97–100 above).

#### **IV. Questions of implementation**

140. 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 Estonia 2011. Available at <http://unfccc.int/resource/docs/2011/asr/est.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/EST. Report of the individual review of the annual submission of Estonia submitted in 2010. Available at <http://unfccc.int/resource/docs/2011/arr/est.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](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. Anne Mändmets (Ministry of the Environment), including additional material on the methodologies and assumptions used.

## Annex II

### Acronyms and abbreviations

AD	activity data
BEF <sub>2</sub>	biomass expansion factor to convert the merchantable volume to above-ground biomass
CH <sub>4</sub>	methane
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> eq	carbon dioxide equivalent
CKD	cement kiln dust
CRF	common reporting format
DOC	degradable organic carbon
EF	emission factor
ERT	expert review team
EU ETS	European Union emission trading scheme
F-gas	fluorinated gas
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs and SF <sub>6</sub> without GHG emissions and removals from LULUCF
GE	gross energy
GJ	gigajoule (1 GJ = 10 <sup>9</sup> joule)
HFCs	hydrofluorocarbons
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
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
m <sup>3</sup>	cubic metre
Mg	megagram (1 Mg = 1 tonne)
MCF	methane correction factor
MoE	Ministry of Environment
NA	not applicable
NCV	net calorific value
NE	not estimated
NFI	National Forest Inventory
NO	not occurring
N <sub>2</sub> O	nitrous oxide
NIR	national inventory report
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10 <sup>15</sup> joule)
PLF	product life factor
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF <sub>6</sub>	sulphur hexafluoride
SIAR	standard independent assessment report
SWDS	solid waste disposal sites
UNFCCC	United Nations Framework Convention on Climate Change
Ym	methane conversion rate