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Report of the individual review of the greenhouse gas inventory of Estonia submitted in 2006*

* In the symbol for this document, 2006 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the in-country review of the 2006 greenhouse gas (GHG) inventory submission of Estonia, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 4 to 9 June 2007 in Tallinn, Estonia, and was conducted by the following team of nominated experts from the roster of experts: generalist – Mr. Eilev Gjerald (Norway); energy – Mr. Javier Gonzalez Vidal (Spain); industrial processes – Ms. Natalya Parasyuk (Ukraine); agriculture – Mr. Erda Lin (China); land use, land-use change and forestry (LULUCF) – Mr. Aquiles Neuenschwander (Chile) and Ms. Kyoko Miwa (Japan). Ms. Natalya Parasyuk and Mr. Aquiles Neuenschwander were the lead reviewers. The review was coordinated by Mr. Harald Diaz-Bone (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention", a draft version of this report was communicated to the Government of Estonia, for comment prior to its publication.

B. Inventory submission and other sources of information

3. In its 2006 submission dated 26 April 2006, Estonia submitted a complete set of common reporting format (CRF) tables for the years 1990–2004. On 31 January 2007, the CRF tables for the base year (1990) and the latest inventory year (2004) were resubmitted. A national inventory report (NIR) was submitted on 11 April 2007. Where needed the expert review team (ERT) also used the previous submission (2005), additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

4. In 2004, the most important GHG in Estonia was carbon dioxide (CO_2), contributing 87.6 per cent to total[1] national GHG emissions expressed in CO_2 eq., followed by methane (CH_4), 8.8 per cent, and nitrous oxide (N_2O), 3.5 per cent. Hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) together contributed less than 0.1 per cent of the overall GHG emissions in the country. The energy sector accounted for 89.1 per cent of the total GHG emissions, followed by agriculture (5.6 per cent), industrial processes (2.7 per cent) and waste (2.6 per cent). Total GHG emissions amounted to 21,450.8 Gg CO_2 eq. and had decreased by 49.7 per cent from the base year (1990) to 2004.

5. Tables 1 and 2 show the greenhouse gas emissions by gas and by sector, respectively.

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

Table 1. Greenhouse gas emissions by gas, 1990–2004

GHG emissions	Gg CO_2 equivalent								Change
	Base year Convention[a]	1990	1995	2000	2001	2002	2003	2004[a]	BY–2004 (%)
CO_2 (with LULUCF)	28 307.16	28 307.16	10 239.59	7 660.24	8 628.35	9 234.61	10 946.01	10 802.62	–61.8
CO_2 (without LULUCF)	37 677.86	37 677.86	19 456.06	16 464.87	17 061.78	16 732.83	18 681.86	18 792.51	–50.1
CH_4	3 131.63	3 131.63	2 142.14	2 026.53	1 826.72	1 723.52	1 764.10	1 893.18	–39.5
N_2O	1 820.24	1 820.24	877.27	721.86	697.30	648.48	743.23	755.26	–58.5
HFCs	NA,NO	NA,NO	0.13	4.19	4.89	5.68	6.59	7.21	NA
PFCs	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA
SF_6	NA,NO	NA,NO	0.25	1.43	2.24	3.68	4.75	5.28	NA

Note: BY = Base year; LULUCF = Land use, land-use change and forestry.

[a] Estonia resubmitted its GHG emission inventory for the years 1990–2004 on 25 September 2007. These revised estimates differ from Estonia's GHG inventory submitted in 2006.

Table 2. Greenhouse gas emissions by sector, 1990–2004

Sectors	Gg CO_2 equivalent								Change
	Base year Convention[a]	1990	1995	2000	2001	2002	2003	2004[a]	BY–2004 (%)
Energy	38 069.0	38 069.0	19 684.4	16 692.9	17 295.6	17 075.4	19 035.6	19 119.4	–49.8
Industrial processes	945.6	945.6	568.9	587.6	612.1	423.5	467.6	579.9	–38.7
Solvent and other product use	NA	NA	NA	NA	NA	NA	NA	NA	NA
Agriculture	3 031.3	3 031.3	1 465.7	1 136.2	1 133.1	1 058.9	1 174.8	1 192.0	–60.7
LULUCF	–9 362.9	–9 362.9	–9 214.1	–8 799.5	–8 431.7	–7 488.3	–7 734.4	–7 987.2	–14.7
Waste	576.1	576.1	754.4	797.0	550.5	546.4	521.1	559.3	–2.9
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	33 259.0	33 259.0	13 259.4	10 414.3	11 159.5	11 616.0	13 464.7	13 463.5	–59.5
Total (without LULUCF)	42 621.9	42 621.9	22 473.5	19 213.8	19 591.2	19 104.2	21 199.1	21 450.8	–49.7

Note: BY = Base year; LULUCF = Land use, land-use change and forestry; NA = Not applicable.

[a] Estonia resubmitted its GHG emission inventory for the years 1990–2004 on 25 September 2007. These revised estimates differ from Estonia's GHG inventory submitted in 2006.

D. Key categories

6. In 2006 Estonia reported a tier 1 key category analysis, both level and trend assessment, as part of its national inventory report. Estonia did not include the LULUCF sector in its key category analysis. The description of methodology in the NIR is not specifically focused on the key categories. The ERT recommends the Party to improve the description of methodologies in the NIR and to include more of the information given during the review in the NIR.

7. The key category analysis performed by the Party and the secretariat produced similar results.[2] The Party's analysis is more detailed and also includes the following subcategories that are not included in the secretariat's analysis: fugitive emissions from solid fuels /coal mining – CH_4; ammonia production – CO_2; railways – CO_2; pasture, range and paddock manure – N_2O; lime production – CO_2; refrigeration and air conditioning equipment – HFCs; and electrical equipment – SF_6. The ERT noted that the Party does not use the key category analysis as a driver for prioritizing developments in the inventory. The ERT recommends that one institution involved in the inventory preparation be made responsible for the analysis of key categories. The ERT encourages the Party to carry out a tier 2 key category analysis as a basis for further improvement of the inventory.

E. Main findings

8. Estonia has the legal, institutional and procedural arrangements in place for the compilation of GHG inventories. However, the arrangements were formalized only during the review process, and resources for the coordination and compilation of the inventory need to be enhanced. At present, the institutional arrangements are not based on a signed agreement. Furthermore, the ERT recommended the Party to develop and implement a quality assurance (QA) plan and an inventory improvement plan in the NIR, and set up independent peer reviews.

9. The structure of the NIR and the transparency of the methodology descriptions have been improved compared to previous submissions. However, the descriptions in the NIR need to be made even more transparent and the data gaps in the CRF tables (in particular in the LULUCF sector, solvents and other product use, CO_2 captured from ammonia production, and military fuel use) should be filled. The Party should provide information in all the background data tables in the CRF in its next inventory submission.

F. Cross-cutting topics

1. Completeness

10. Estonia's inventory submission is generally complete and covers all years, sectors, sources, sinks and gases. However, the ERT noted that the following sub-categories were reported as not estimated ("NE"): LULUCF (almost all sources); solvents and other product use; CO_2 captured from ammonia production; military fuel use and GHG emissions from international bunkers. The CRF tables are broadly complete, except for the tables on LULUCF and tables 7 and 8b. The ERT recommends the Party to provide estimates for these categories in its next inventory, in order to improve completeness, and to submit all relevant CRF tables.

[2] The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry* for the base year or base year period as well as the latest inventory year. Key categories according to the tier 1 trend assessment were also identified. 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.

2. Transparency

11. The NIR together with the information provided during the review period provides much of the information necessary to assess the inventory. However, additional information is still necessary to improve transparency and this is especially important for the key categories. Improved transparency in the NIR will facilitate future reviews, particularly centralized reviews. The ERT recommends the Party to provide detailed explanations of emission trends and changes in trends in all sectors as well as technical references to country-specific emission factors (EFs) and activity data (AD), particularly in the waste and agricultural sectors. Further options to enhance transparency identified by the ERT are described in detail in the sector sections below.

3. Recalculations and time-series consistency

12. The inventory is generally consistent. The ERT noted, however, that the CO2 EF for oil shale is not consistent over time, and nor are estimates in the LULUCF sector in general. Information on methods used provided in summary table 3 of the CRF is inconsistent with the information on methods and EFs included in table 1.1 of the NIR. For example, the method for CO2 from fuel combustion is indicated as country specific, tier 1 (CS, T1) in summary table 3, but as Intergovernmental Panel on Climate Change (IPCC) default, tier 1 (D, T1) in the NIR. The information on methods and EFs provided disagrees for most sectors. The ERT noted that Estonia has submitted different versions of the NIR and the CRF tables and recommended the Party to ensure consistency between the CRF tables and the NIR in its future submissions.

13. The ERT noted that recalculations reported by the Party of the time series 1990–2003 had been undertaken for the energy, industrial processes, agriculture and waste sectors. The major changes in emission levels for 2003 include: the agriculture sector – an increase from 732.32 to 1,174.76 Gg CO_2 eq.; the waste sector – a decrease from 732.98 to 521.12 Gg CO_2 eq.; and the energy sector – a decrease from 19,645.31 to 19,035.56 Gg CO_2 eq. The total effect of the recalculations is that the 2003 emissions reduced by 0.9 per cent and the 1990 emissions increased by 2 per cent. The rationale for these recalculations was provided during the review and is in the NIR.

4. Uncertainties

14. Estonia has conducted its first uncertainty analysis, which was made available to the ERT during the review period. Estonia uses IPCC default uncertainties for waste, agriculture and LULUCF, and country-specific uncertainty values for energy and industrial processes. For energy, uncertainty is estimated only for four fuels and not for each individual category. Uncertainty is estimated for three process industries. The ERT was unable to assess the impact on total uncertainty at this level of aggregation. The ERT encouraged the Party to elaborate the uncertainty analysis by using more country-specific uncertainties values and more disaggregated source categories for energy and industrial process, as well as to estimate the overall uncertainty in level and trend and include the information in its next NIR.

15. The uncertainty analysis for waste, LULUCF and agriculture was conducted by the sectoral experts at Tallinn Technical University (TTU) and for energy and industrial processes by Metrosert Ltd, a private company that also compiled the final uncertainty document. The Ministry of Environment (MoE) has now contracted Metrosert Ltd for the development of future uncertainty analysis.

5. Verification and quality assurance/quality control approaches

16. According to information received by the ERT during the review, Estonia has elaborated a quality assurance/quality control (QA/QC) plan. However, the QA plan has not yet been implemented. During the review, and also in the 2007 submission, the Party provided the ERT with the results of a tier 1 QC check that had been performed for all categories. A tier 2 QC check is in development for the key

categories. The ERT recommended the Party to include in its next NIR a list of the QC checks that are carried out by the MoE prior to submission.

17. The Party has not conducted any QA of the inventory by staff not directly involved in the inventory compilation. The ERT recommends the Party to assess the quality of its inventory before the next submission.

18. The ERT recommends Estonia to institutionalize system-level checks, such as cross checking AD available from different sources (the Statistical Office of Estonia (SoE), the European Union (EU) emissions trading scheme (ETS), the EU Large Combustion Plant Directive, the EU IPPC Directive and the European Pollutant Emission Register), to minimize the risks of missing plants/data in future submissions. These QC checks could include having an independent sectoral expert review of AD to explain the reasons for large inter-annual variations for emissions from key sources (on both a level and a trend basis). QA could be improved by including specific questions in the annual energy surveys of the industry in order to elicit additional information. The NIR states that the documentation on QC is under preparation.

6. Follow-up to previous reviews

19. Estonia's GHG Inventory was reviewed in 2005 and since then the GHG Inventory has improved substantially. Today the inventory covers the years 1990–2004 and the Party has submitted CRF tables for all years. The Party has recalculated the complete time series for all sectors as recommended in the previous review. The institutional arrangements for preparing the GHG inventory were established in the autumn of 2006 and the arrangement is described in the national system. The agreement between the MoE and TTU was signed in September 2007 and will last for five years. An agreement with the Estonian Environmental Research Centre (EERC) was signed on 28 May 2007. The SoE is an important data source but it remains unclear how the SoE is integrated into the institutional arrangements for the preparation of GHG emission inventories. The ERT encourages the Party to include the SoE more formally in the institutional arrangements.

G. Areas for further improvement

1. Identified by the Party

20. Estonia does not describe any areas for improvement in the NIR.

2. Identified by the ERT

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

(a) Descriptions of methodologies used, including information on the collection of AD and the choice of method and EFs, should be included in the NIR in order to increase the transparency of the reporting;

(b) The completeness of the inventory should be improved by filling the reporting gaps, specifically by providing complete CRF tables for LULUCF;

(c) The QA/QC plan should be improved and implemented in all sectors;

(d) More disaggregated uncertainty estimates should be provided and more country-specific uncertainty values used.

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

II. Energy

A. Sector overview

23. In 2004, the energy sector accounted for 89.1 per cent of Estonia's total GHG emissions (excluding LULUCF). Between 1990 and 2004, GHG emissions from the energy sector decreased by 49.8 per cent. CO_2 accounted for 95.3 per cent of sectoral emissions in 2004, with CH_4 and N_2O contributing 4.4 and 0.2 per cent, respectively. The largest source was energy industries, followed by transport, fugitive emissions from fuels, energy use in other sectors and manufacturing industries and construction, contributing 79.7, 10.5, 3.9, 3.5 and 2.5 per cent, respectively, to GHG emissions from the energy sector in 2004. The ERT recommends that Estonia provide in its next NIR a more detailed and transparent analysis of sectoral emission trends.

24. The coverage of source categories and gases is almost complete for the inventory year 2004, although Estonia has not reported emissions from military fuel use. The ERT recommends that Estonia provide this estimate in its next submission.

25. The SoE collects energy data from surveys from all working units, which is a legal requirement of the Government, and elaborates an energy balance that feeds into the inventory as a major source of AD for the energy sector. Annual energy balances developed by SoE for the entire time series are provided.

26. The 2006 inventory submission of the CRF tables for 1990 and 2004 contains a number of estimates for GHG emissions from the energy sector (in subsectors 1.A.1, 1.A.2 and 1.A.3) that were identified by the Party as incorrect. Estonia corrected these mistakes in its 2007 submission. As a result of this correction, total 2004 GHG emissions from the energy sector were estimated to be 430.44 Gg CO_2 eq. lower in the revised submission than in the original 2006 submission. During the in-country review, the ERT recommended the Party to revise the relevant estimates for the energy sector (in subsectors 1.A.1, 1.A.2 and 1.A.3) in the 2006 submission in order to correct the incorrect estimates. In response, Estonia resubmitted its complete GHG emission inventory on 25 September 2007. For 2004, these revisions reduced the estimate for total GHG emissions from the energy sector by 430.44 Gg CO_2 eq.

B. Reference and sectoral approaches

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

27. CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 2004, CO_2 emission estimates calculated using the reference approach are 5.0 per cent lower than those calculated by the sectoral approach. Further explanations for the difference between the two approaches should be provided in the documentation box of table 1.A(c) of the CRF or in the NIR.

28. The calculations of the reference approach do not take into account the carbon stored in non-energy use of fuels, which should be subtracted. The ERT recommends that the Party recalculate the entire time series and assess the differences in the sectoral approach.

29. The ERT noted that, for all inventory years, the apparent energy consumption reported to the UNFCCC for Estonia is larger by up to 15 per cent than that reported to the IEA. However, for the past four years the difference is only about 3 per cent. Data for Estonia are available to the IEA only from 1992 onwards.

30. Imports of other kerosene, reported in the CRF, are not reported to the IEA. Imports of gas/diesel oil are higher in the IEA dataset for comparable quantities. Bitumen and lubricants, reported to the IEA, are not reported in the CRF. The ERT recommends that the Party study the data collecting system for imports and the procedures for reporting data to different international organizations.

2. International bunker fuels

31. According to the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines)and the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance), GHG emissions from international bunkers should not be included in the national inventory. However, for the base year and other years with no data on the distribution between domestic and international activities in Estonia, emissions from international bunkers were reported as not estimated ("NE"), and all fuel consumption has been allocated to domestic activities, resulting in a possible overestimation of the base year emissions from domestic navigation and aviation. During the in-country review, the ERT recommended the Party to split domestic and international fuel use for aviation and marine activities, using justifiable criteria. In response, the MoE requested additional data on international aviation and navigation from the SoE, and on 25 September 2007 Estonia provided revised estimates for GHG emissions from bunkering for the entire time series. The ERT welcomes this revision, and encourages Estonia to provide more detailed information regarding the new AD sources in its next NIR.

3. Country-specific issues

32. The production of oil shale (60 per cent or more of the total apparent energy consumption for the period 2001–2004) is 5 to 7 per cent higher in the CRF than in the IEA data, due to the use of a different net calorific value. The ERT recommends the Party to provide an explanation of this difference in its next NIR.

C. Key categories

1. Stationary combustion: solid fuels – CO_2

33. A 2004 MoE regulation defines the carbon EF for oil shale used in pulverized combustion technology as 27.85 tC/TJ (the previous value was 29.1 tC/TJ). The Party explained the new regulation and provided the legal and technical documents related with this new EF. The ERT noted that this new country-specific EF has been used for the inventory year 2004 but not for the inventory years 1990–2003. As the new EF is lower than the previous one, this time-series inconsistency results in an overestimation of the 1990–2003 emissions. Following the recommendations of the ERT, Estonia revised the GHG inventories for the entire time series using the new country-specific EF for oil shale pulverized combustion technology (CEF=27.85 tC/TJ) and according to the 2004 MoE regulation.

2. Fugitive emissions: coal mining and handling – CH_4

34. The EFs applied by Estonia for CH_4 from surface and underground mining and handling are very low compared with the IPCC default values for coal. The Party explained that they "do not deal with coal but oil shale. As oil shale is located very close to the surface of the earth, the major part of methane has already been emitted; upon emission calculation the recommendations of local mining specialists have been taken into account (methane emission factor 1.47 kg/t)". During the in-country review, the ERT recommended the Party to provide the technical report that supports the development of the country-specific EFs. Estonia responded that the EFs are obtained directly from the mining company, AS Eesti Põlevkivi (Estonian Oil Shale), and are calculated by the Institute of Ecology (Aunap, 1999).

D. Non-key categories

Road transportation: liquid fuels – N_2O

35. A tier 1 approach has been applied to this non-key category. The ERT noted that no qualitative analysis has been taken into account in the key category analysis, although N_2O from road transportation could become a key category when higher tiers are used. Some of the information required to develop a

higher tier method (attributes of car fleet, mileage) has already been made available by the SoE. The ERT encourages the Party to apply higher tiers for modelling emissions from transport.

III. Industrial processes and solvent and other product use

A. Sector overview

36. In 2004, emissions from industrial processes in Estonia accounted for 2.7 per cent of total national emissions. The largest category in the sector was mineral products (68.3 per cent of emissions from the industrial processes sector) followed by chemical industry (29.6 per cent). The CRF includes estimates of almost all gases and sources of emissions from industrial processes in Estonia, as recommended by the IPCC good practice guidance. However, some categories are not estimated, including iron and steel production, and solvent and other product use. Furthermore, actual emissions of HFCs, PFCs and SF_6 have not been estimated for the period 1990–1994, mainly because of a lack of data. The ERT encourages Estonia to estimate these sources and include the estimates in its next submission.

B. Key categories

1. Cement production – CO_2

37. Estonia has used the IPCC good practice guidance tier 2 method for calculating emissions from this category by multiplying the amount of clinker produced by a country-specific EF. A constant CO_2 implied emission factor (IEF) is used for the period 1990–2004. All relevant data are provided by the single cement plant in Estonia. However, statistical data on clinker production differ from plant to plant for the entire time series. The national experts explained during the in-country review that national statistics contain only data from clinker that has been sold. The ERT agrees with Estonia's approach of using plant-specific AD for clinker production. The ERT recommends the Party to verify and check the AD and provide an explanation for this inconsistency in its next NIR.

2. Lime production – CO_2

38. The IPCC methodology and default EFs for CO_2 from lime production have been used. New plant-specific AD were received during the preparation of the 2006 inventory. However, outdated statistical data were used for the emission calculations. This led to some inconsistencies between the AD in the NIR (plant-specific data) and the AD in the CRF table (statistical data) for lime production. The ERT recommends the Party to verify the AD, check it with the industry and the SoE and recalculate CO_2 emissions from lime production for the entire time series. The ERT also recommends that Estonia continue to work with the industry and use lime production data for calculating CO_2 emissions in this sector, and encourages Estonia to provide more transparent and clear explanations and descriptions of the methods and AD used in the next submission.

3. Ammonia production – CO_2

39. The Party used data on the quantities of ammonia produced as the input data for the calculation of CO_2 emissions from ammonia production. The ERT noted that, according to the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, the most accurate method of estimation is based on the consumption of natural gas as ammonia feedstock. These approaches should in principle result in the same estimates of emissions. However, the ERT's preliminary estimation of CO_2 emissions based on fuel consumed for ammonia production showed a slightly higher result. Moreover, CO_2 emissions from urea (carbamide) use were subtracted from the total emissions and not included in any corresponding categories. The ERT noted that this approach has led to an underestimation of the emissions. The ERT recommends the Party to estimate CO_2 emissions from ammonia production based on the fuel consumed. The fuel data could be obtained from the single producer in Estonia, as well as data on the carbon content

factor and the carbon oxidization factor. In addition, emissions of CO_2 from urea use should be accounted for in the corresponding sectors.

C. Non-key categories

Fluorinated gases

40. In the 2006 inventory, precise data on the emission of PFCs, some HFCs and SF_6 are missing, due to the lack of an adequate data collection system in Estonia. In order to resolve the issue, the MoE recently contracted the EERC to fill the gaps in the time series for the f-gases and set up a system for the provision, analysis and calculation of data in the future. The ERT welcomes the efforts made by Estonia to estimate emissions of f-gases and encourages the Party to include the resulting estimates in its next submission.

IV. Agriculture

A. Sector overview

41. In 2004, total GHG emissions from agriculture were 1,192 Gg CO_2-eq, accounting for about 5.6 per cent of total Estonian emissions. N_2O from agricultural soils accounted for the largest share of sectoral emissions (52.2 per cent), followed by CH_4 emission from enteric fermentation (37.0 per cent), and CH_4 and N_2O from manure management (6.3 per cent and 4.5 per cent, respectively) in 2004. Uncertainty analysis was presented to the ERT during the review week. The ERT encourages the party to include it in its next NIR.

42. Livestock numbers by subcategories and by counties for 1990–2004 were not reported. The ERT recommends Estonia to provide detailed information on livestock numbers by subcategories and by counties for the entire time series.

B. Key categories

1. Enteric fermentation – CH_4

43. Estonia used a tier 2 method (IPCC 1996) and country specific EFs to estimate CH_4 mission from enteric fermentation of cattle and swine. Tier 1 and IPCC default EFs were used for the emissions of other livestock. In the 2007 NIR, equations 4.7 and 4.9, the data for DEji (Digestible energy expressed as a percentage of gross energy for j category of cattle in i county) is not reported. The ERT recommends Estonia to provide these data in its next NIR or CRF.

2. Manure management – CH_4

44. Estonia used a tier 2 method (IPCC 1996) and country specific EFs to estimate CH_4 emission from manure management of cattle and swine. Tier 1 and IPCC default EFs were used for emissions of other livestock. In the 2007 NIR, equations 4.15 and 4.16, the data of Boji (Maximum CH_4 producing capacity for manure produced by j category of cattle in i county) and DEji (Digestible energy of the feed for j category of cattle in i county) are not reported. The ERT recommends Estonia to provide these data in its next NIR or CRF.

3. Agricultural soils – N_2O

45. Estonia used tier 1 (IPCC 1996) and IPCC default EFs to estimate N_2O emissions from agricultural soils. The 2007 NIR provides a recalculated estimate for direct N_2O emissions from synthetic fertilizer nitrogen applied to soil. The calculation of N_2O emissions from synthetic fertilizer applied to agricultural soils was found to be incorrect and the ERT recommended Estonia to provide full background information and to revise the estimate for N_2O emissions for the entire time series, In response to this recommendation, Estonia provided revised estimates for this category. For the year

2004, these revisions reduced the estimate for N_2O emissions from agricultural soils by 10.0 per cent (from 0.49 to 0.44 Gg kg N_2O-N/kg N).

V. Land use, land-use change and forestry

A. Sector overview

46. In 1990, the LULUCF sector was a net sink of 9,362.9 Gg CO_2 eq. and in 2004 the net sink was 7,987.25 Gg CO_2 eq., a decrease of 14.3 per cent in the period. All removals were attributed to biomass growth in stocked forest lands, while emissions were derived from wood harvest, fuel wood collection and wildfires.

47. In the 2006 submission, only CRF tables 5, 5.A and 5 (V) contained estimations of emissions and removals. All the other tables were reported as not observed ("NO") and non existing ("NE"). The Party informed the ERT that emissions and removals from the land-use categories cropland, grassland, wetlands, settlements, and other lands were not estimated because not all the data required in the IPCC good practice guidance for tier 1 LULUCF calculations were available.

48. The ERT noted that official data on land use and land-use change categories showed inconsistencies according to the data source, which are mainly the SoE, the National Forest Inventory and the Ministry of Agriculture. The ERT recommends the Party to develop institutional agreements between the Ministries of Agriculture and Environment in order to standardize the definitions and official data on the areas of land use and land-use change, and to develop a matrix of land-use change among the different land use categories, with the objective of preparing GHG inventories in line with the IPCC good practice guidance for LULUCF.

49. QA/QC procedures for the LULUCF sector were not reported in the 2006 Estonian submission. In the 2007 revised NIR (Annex 2, table C), a QC procedure for forest land remaining forest land and for wild fires was performed.

50. No uncertainty assessment was reported in the April 2007 NIR. During the review, Estonia presented an initial uncertainty assessment on forest land remaining forest land and biomass burning from wild fires. No LULUCF key category analyses were reported in the 2006 and April 2007 submissions. During the review, Estonia informed the ERT that QA/QC procedures, uncertainty assessment and key category analyses will be considered for the LULUCF sector in future submissions.

B. Key categories

Forest land – CO_2

51. Forest land remaining forest land was identified as a key category by the secretariat. In 2004, carbon stock changes in living biomass equalled 17 per cent of total GHG emissions, not including LULUCF.

52. In its April 2006 submission, Estonia adopted new country-specific EFs for calculating carbon stocks in forests, as reported in the April 2007 NIR, Table 5.2.1. The ERT noted that the new wood density values for conifer species (0.44 tonne d.m./m^3) are about 10 per cent higher than previous values and also higher than the default values in the IPCC good practice guidance for LULUCF (except for Pine (0.46 tonne d.m./m^3)), and that for broadleaf species the new value (0.50 tonne d.m./m^3) is about 20 per cent higher than previous and IPCC default values. New biomass expansion factors (BEFs) include living biomass above and below ground. The new BEF for broad leaf species is 1.678, which is 6.7 per cent above previously reported values. In the case of conifers, for Spruce the current BEF value is 1.859, which is 22.5 per cent above the previous value. The ERT recommends Estonia to compare the current wood density and BEF country-specific factors reported with those in the IPCC good practice guidance for LULUCF, as well as those reported by other Parties for boreal forests.

VI. Waste

A. Sector overview

53. Since 2005, Estonia has recalculated CH_4 emissions from solid waste disposal on land, and CH_4 from industrial wastewater and domestic and commercial wastewater for the entire time series. CH_4 emissions from wastewater handling in 1990 and 2004 were again recalculated during 2006. In 2006, N_2O emissions from human sewage were newly estimated and reported for the entire time series under wastewater handling, which improved completeness. After the in-country visit, Estonia revised the estimates for CH_4 emissions from solid waste disposal on land, CH_4 emissions from sewage sludge under solid waste disposal on land and N_2O emissions from human sewage, taking the recommendations of the ERT into consideration, which improved the accuracy of the emission estimates from the waste sector.

54. As a result of these revisions, the estimate for GHG emissions from the waste sector in 2004 is 559.35 Gg CO_2 eq., an increase of 4 per cent (21.66 Gg CO_2 eq.) on the estimates before the review. The waste sector contributed 2.6 per cent to the total GHG emissions of Estonia in 2004.

55. The secretariat's key category analysis identified CH_4 from solid waste disposal as a key category by level and trend for both 1990 and 2004. Estonia identified N_2O from human sewage under wastewater handling as a key category by trend.

56. The recalculated CH_4 emission from solid waste disposal on land in 2004 is 520.05 Gg CO_2 eq., an increase of 27.9 per cent on the base year (406.70 Gg CO_2 eq.) and of about 9.3 per cent from 2003 (475.95 Gg CO_2 eq.).

57. N_2O from wastewater handling is not estimated due to the lack of AD. Emissions from waste incineration are not estimated because waste incineration is not conducted in Estonia.

58. With regard to the uncertainties in the waste sector, Estonia recognised the potential uncertainties in the category of solid waste disposal due to the lack of separate data on large landfills and small dump sites.

59. The ERT noted that the calculation procedures and their consistency over the entire time series were not transparent because the equations used for emission estimates for the entire time series were not shown in the calculation spreadsheets. It further noted that information regarding AD from expert judgement, and communication between data compilers, experts and inventory compilers, are not well documented. The ERT encourages Estonia to elaborate its method of documenting and archiving its inventories.

B. Key categories

1. Solid waste disposal on land – CH_4

60. Estonia used the tier 1 mass-balance approach to estimate CH_4 emissions from solid waste disposal, using country-specific AD for waste generation. Since this is a key category, Estonia recalculated CH_4 emissions using the simple first order decay (FOD) method, as recommended by the ERT during the in-country review.

61. Estonia gathered recent data on waste management from a few landfill sites in the capital area and extrapolated these data to the entire time series, including for the period 1990–1992. The ERT noted that the application of recent data on waste management from urban municipal landfill sites to the whole population of Estonia and throughout the entire time series might result in an overestimation of degradable organic materials in municipal solid waste (MSW) in earlier periods. In its revision of emissions from this category, using the FOD method, Estonia considered the urban population only (instead of the total national population) with revised degradable organic carbon (DOC) values to take

into account a more accurate amount of DOC in the landfill sites. As a result of this revision, the revised estimate for CH_4 emissions from MSW in 2004 is 520.05 Gg CO_2 eq., 4.6 per cent higher than the original estimate, and in 1990 is 21.2 per cent (about 109.1 Gg CO_2 eq.) lower than the original estimates. The ERT welcomes this improved accuracy of the emission estimates from this category.

62. In the course of these revisions, Estonia noted that CH_4 emissions from sewage sludge brought to the landfills were not included in its original estimates for 1990–1992. Estonia calculated these using the tier 1 mass-balance method, because it is difficult to make reasonable historical estimates on sewage sludge generation using the FOD method. IPCC default parameters and DOC values from the Finnish inventory were used in this estimation.

63. The ERT noted that, although completeness in this sector was improved, the use of a mass-balance approach that adds the emissions from sewage sludge brought to landfills is not recommended, because CH_4 emissions from landfill sites is a key category, and emissions from other DOC in the landfill sites are estimated using the FOD decay method. Noting the difficulties of estimating historical data on sewage sludge under the national circumstances of Estonia, the ERT recommends the Party to further elaborate historical AD and DOC values of its sludge (from industrial wastewater and domestic and commercial wastewater) brought to landfills, and to use these parameters for the estimation of CH_4 emissions from landfill sites, based on the FOD method, in its future submissions

64. The ERT also recommends Estonia to improve transparency in the NIR and reconsider the presentation of data and methods used, for example by using fractions of all waste types in the landfill sites including inert material such as plastics, with the sum of these fractions adding up to 100 per cent of the amount of waste produced in Estonia.

65. Estonia does not estimate CH_4 emissions from industrial waste under solid waste disposal, for which Estonia is collecting the data to include in its next inventory. Estonia is recommended to maintain its efforts to estimate emissions from industrial waste for the sake of completeness.

2. Wastewater handling: human sewage – N_2O

66. Estonia estimated N_2O emissions from human sewage using per capita protein supply as the input parameter. The ERT recommended the Party to use per capita protein consumption instead. In response, Estonia recalculated N_2O emissions from this category with data on per capita protein consumption from the Food and Agriculture Organization of the United nations (FAO) database.

C. Non-key categories

Wastewater handling – CH_4

67. The estimate for CH_4 emission from wastewater handling in 2004 was revised to 4.7 Gg CO_2 eq., which is 46.5 per cent lower than the originally reported estimates (8.7 Gg CO_2 eq.). The revised estimates show a decrease in CH_4 emissions of 4.6 Gg CO_2 eq. since 2003 (9.3 Gg CO_2 eq.).

68. The overall trend of emissions from both industrial and domestic and commercial wastewater fluctuates. CH_4 emissions from industrial wastewater decreased by 80.4 per cent between 1992 and 1993, and CH_4 emissions from domestic and commercial wastewater decreased by 72.1 per cent between 1993 and 1994. Estonia explained that these decreases in emissions resulted from a change in the wastewater treatment method. During the review the ERT requested Estonia to provide background information, including the capacity of treatment facilities.

VII. Conclusions and recommendations

69. Estonia's greenhouse gas inventory is largely complete, except for the LULUCF sector, and has been compiled in accordance with the Revised 1996 IPCC Guidelines and the IPCC good practice

guidance. It has a data collection system, building mainly on national statistics, and plant-specific data for the energy and industrial processes sectors. Country-specific AD and EFs are used for the most important key categories. In spite of this, the 2006 submission showed a number of deficiencies, many of which were corrected in the resubmission of the 2006 GHG inventory from 25 September 2007. Most significantly, the descriptions in the NIR need to be made more transparent and the data gaps in the CRF tables, in particular in the LULUCF sector, need to be filled in future submissions.

70. In the course of the review, the ERT formulated a number of recommendations relating to the completeness and transparency of the information presented in the initial report. Recommendations were also made relating to the choice of methods, AD and EFs in the GHG inventory. Many of the recommendations were implemented during the review process. The remaining key recommendations[3] are that Estonia:

(a) Improve the NIR's description of methodologies and include all the elements stipulated by the IPCC good practice guidance and the UNFCCC reporting guidelines, especially for country-specific methods;

(b) Include a description of the QA/QC plan and information on the QA/QC measures implemented in all sectors in the NIR, and a list of the QC checks that are carried out by the ministry prior to submission;

(c) Provide detailed explanations and analysis of the emission trends by sector and by gas in its next NIR;

(d) Put in place the following elements in order to enhance the institutional arrangements: a signed agreement on institutional arrangements, a QA plan and an archive at a single location;

(e) Complete the relevant parts of the CRF tables for all years with emission estimates, in particular for LULUCF (almost all sources), solvents and other product use, CO_2 captured from ammonia production, and military fuel use; and provide information in all background data tables in the CRF in its next inventory submission.

71. Future reviews should focus on whether:

(a) The structure of the NIR and the transparency of the methodology descriptions have been improved; this issue has been raised in several previous reviews;

(b) The QA plan has been developed, and how it is implemented, especially at the sectoral level;

(c) Emission estimates have been provided for all years in the CRF tables, in particular in the LULUCF sector.

[3] For a complete list of recommendations, the relevant sector sections of this report should be consulted.

Annex

Documents and information used during the review

A. Reference documents

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

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B. Additional information provided by the Party

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