Advance Version

COMPLIANCE COMMITTEE

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Report of the individual review of the annual submission of Luxembourg submitted in 2010

Note by the secretariat

The report of the individual review of the annual submission of Luxembourg submitted in 2010 was published on 1 April 2011. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2010/LUX, contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.

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Report of the individual review of the annual submission of Luxembourg submitted in 2010*

* In the symbol for this document, 2010 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 2010 annual submission of Luxembourg, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 6 to 11 September 2010 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Riccardo de Lauretis (Italy) and Mr. Teemu Oinonen (Finland); energy – Ms. Ana Carolina Avzaradel (Brazil), Mr. Javier González Vidal (Spain) and Ms. Chia Ha (Canada); industrial processes – Mr. Stanford Mwakasonda (South Africa) and Ms. Detelina Petrova (Bulgaria); agriculture – Ms. Junko Akagi (Japan) and Ms. Janka Szemesova (Slovakia); land use, land-use change and forestry (LULUCF) – Ms. Oksana Butrym (Ukraine), Mr. Aquiles Neuenschwander (Chile) and Mr. Atsushi Sato (Japan); and waste – Mr. Qingxian Gao (China), Mr. Pavel Gavrilita (Republic of Moldova) and Ms. Zivile Paskauskaite (Lithuania). Mr. de Lauretis and Mr. Mwakasonda were the lead reviewers. The review was coordinated by Ms. Barbara Muik and Ms. Astrid Olsson (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 Luxembourg, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Emission profiles and trends

3. In 2008, the main greenhouse gas (GHG) in Luxembourg was carbon dioxide (CO_2), accounting for 91.9 per cent of total GHG emissions[1] expressed in carbon dioxide equivalent (CO_2 eq), followed by nitrous oxide (N_2O) (3.7 per cent) and methane (CH_4) (3.6 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 0.8 per cent of the overall GHG emissions in the country. The energy sector accounted for 88.1 per cent of total GHG emissions, followed by the industrial processes sector (5.9 per cent), the agriculture sector (5.4 per cent), the waste sector (0.6 per cent) and the solvent and other product use sector (0.1 per cent). Total GHG emissions amounted to 12,493.94 Gg CO_2 eq and decreased by 4.8 per cent between the base year[2] and 2008.

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, respectively. In table 1, CO_2, CH_4 and N_2O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector.

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

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

Table 1
Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year to 2008[a]

			Gg CO_2 eq								*Change*
		Greenhouse gas	*Base year*	*1990*	*1995*	*2000*	*2005*	*2006*	*2007*	*2008*	*Base year–2008 (%)*
Annex A sources		CO_2	12 158.49	12 158.49	9 396.25	8 890.69	12 283.04	12 205.59	11 802.36	11 477.92	–5.6
		CH_4	469.17	469.17	476.97	477.73	459.04	454.80	450.83	451.24	–3.8
		N_2O	473.64	473.64	473.66	486.84	447.53	443.18	446.32	464.70	–1.9
		HFCs	14.21	14.21	14.21	43.01	82.54	87.04	87.04	96.06	576.1
		PFCs	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA
		SF_6	2.91	2.91	2.91	3.52	3.78	3.86	3.94	4.02	38.2
KP-LULUCF	Article 3.3[b]	CO_2								64.52	
		CH_4								NO	
		N_2O								NO	
	Article 3.4[c]	CO_2	NA							NA	NA
		CH_4	NA							NA	NA
		N_2O	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, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

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

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

Table 2
Greenhouse gas emissions by sector and activity, base year to 2008

			Gg CO_2 eq								*Change*
		Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2005*	*2006*	*2007*	*2008*	*Base year–2008 (%)*
Annex A		Energy	10 633.71	10 633.71	8 518.39	8 303.45	11 779.95	11 650.52	11 253.84	11 004.27	3.5
		Industrial processes	1 625.48	1 625.48	1 001.61	772.32	744.23	801.32	790.73	735.79	–54.7
		Solvent and other product use	23.90	23.90	19.74	15.81	16.65	16.25	17.48	15.47	–35.3
		Agriculture	745.26	745.26	736.53	723.96	660.46	652.18	656.19	669.08	–10.2
		Waste	90.06	90.06	87.73	86.26	74.65	74.20	72.24	69.33	–23.0
		Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
		LULUCF	NA	347.74	–238.11	–385.41	–385.66	–275.59	–273.18	–272.34	NA
		Total (with LULUCF)	**NA**	**13 466.15**	**10 125.88**	**9 516.40**	**12 890.28**	**12 918.88**	**12 517.31**	**12 221.60**	**NA**
		Total (without LULUCF)	**13 118.41**	**13 118.41**	**10 363.99**	**9 901.80**	**13 275.93**	**13 194.47**	**12 790.48**	**12 493.94**	**–4.8**
KP-LULUCF	Article 3.3[b]	Afforestation & reforestation								–76.51	
		Deforestation								141.03	
		Total (3.3)								**64.52**	
	Article 3.4[c]	Forest management								NA	
		Cropland management	NA							NA	NA
		Grazing land management	NA							NA	NA
		Revegetation	NA							NA	NA
		Total (3.4)	**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, LULUCF = land use, land-use changes and forestry, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The "base year" for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol is 1990.

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

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

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

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

	As reported	*Adjustment*[a]	*Final*[b]	*Accounting quantity*[c]
Commitment period reserve	42 662 696		42 662 696	
Annex A emissions for current inventory year				
CO_2	11 477 922		11 477 922	
CH_4	451 240		451 240	
N_2O	464 702		464 702	
HFCs	96 055		96 055	
PFCs	NA, NO		NA, NO	
SF_6	4 019		4 019	
Total Annex A sources	**12 493 938**		**12 493 938**	
Activities under Article 3, paragraph 3, for current inventory year				
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	NA		–76 513	
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	NA		NO	
3.3 Deforestation for current year of commitment period as reported	NA		141 030	
Activities under Article 3, paragraph 4, for current inventory year[d]				
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 in base year				

Abbreviations: NA = not applicable, NO = not occurring.

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

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

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

[d] 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. Luxembourg submitted its common reporting format (CRF) and standard electronic format (SEF) tables on 15 April 2010 and its national inventory report (NIR) on 27 May 2010. The NIR submitted was incomplete with respect to the information required under Article 7, paragraph 1, of the Kyoto Protocol, and for this reason Luxembourg submitted a revised version on 30 June 2010.

7. The expert review team (ERT) noted that since 2007 Luxembourg has not submitted a complete annual submission by the deadline of 15 April. Although, under decision 15/CMP.1, there is a six-week period before any consequences resulting from a late submission come into effect, the ERT recommends that Luxembourg submit its next inventory submission by 15 April 2011, including both the CRF tables and an NIR. Further, the ERT recommends that Luxembourg review the elements of its national system that would enable the timely submission of its annual inventory.

8. The revised version of the NIR contained most of the information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and minimization of adverse impacts under Article 3, paragraph 14, of the Kyoto Protocol. Luxembourg did not provide some of the required elements in relation to Article 3, paragraph 14 (see para. 94 below), Kyoto Protocol units (see para. 88 below) and KP-LULUCF (see paras. 79 and 80 below).

9. Luxembourg officially submitted revised CRF tables on 21 October 2010 in response to questions raised by the ERT in the course of the review. These included revised estimates and information on its activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol (see paras. 79 and 80 below) and on HFC emissions from fire extinguishers and solvent use (see para. 49 below), as requested by the ERT.

10. In addition, the ERT used the standard independent assessment report (SIAR), parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.[3]

11. During the review, Luxembourg 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. Where necessary, the ERT also used the previous years' submissions during the review.

Completeness of inventory

12. The inventory is generally complete in terms of years, geographical coverage, sectors and gases. The CRF tables submitted cover the period 1990–2008. The sectoral

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

background table 2(II).F was not provided. Estimates of potential emissions of HFCs, PFCs and SF_6 were not provided, and actual emissions of PFCs were reported as not occurring ("NO"). The ERT encourages Luxembourg to explore the possibility of estimating potential emissions.

13. Luxembourg submitted its KP-LULUCF CRF tables for 2008. However, the ERT noted that the information in the tables was incomplete, in particular because the Party reported the notation key not applicable ("NA") in all 5(KP) tables and in the accounting table and reported numerical values in table NIR-1 of the CRF. Also, HFC emissions from fire extinguishers and HFC emissions from solvent use were reported as not estimated ("NE"), although estimation methodologies exist in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), as elaborated by the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). During the review, the ERT asked the Party to submit a complete set of KP-LULUCF CRF tables, which Luxembourg did on 21 October 2010. Furthermore, in response to questions raised by the ERT during the review, Luxembourg stated that no HFCs are used in Luxembourg in fire extinguishers or as solvents and changed the notation key in the CRF tables from "NE" to "NO" (see para. 49 below).

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

Overview

14. The Party reported no change in the national system since the previous annual submission. The ERT concluded that the national system continued to perform its required functions.

Inventory planning

15. The NIR described the national system for the preparation of the inventory. The Environment Agency of Luxembourg (Administration de l'Environnement (AEV)) has overall responsibility for the national inventory. Overall management of the inventory is assigned to one staff member of AEV, who is nominated as the inventory focal point. AEV also acts as the national inventory compiler, checking and putting together emission estimates and other information coming from sector experts working in other administrations or services. These other organizations are described in detail in the NIR. Also, the NIR explains each organization's responsibilities with respect to the determination of activity data (AD), emission factors (EFs) and methods. Whereas AEV has the technical knowledge and responsibility for the inventory, the Department of the Environment of the Ministry of Sustainable Development and Infrastructures acts as the national focal point and is responsible for the official annual submission. AEV has the ultimate responsibility for quality assurance and quality control (QA/QC), which is well planned and clearly documented in the NIR.

Inventory preparation

Key categories

16. Luxembourg has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2010 annual submission. During the review, the Party provided the spreadsheets containing the key category analyses to the ERT. The key category

analysis performed by Luxembourg and that performed by the secretariat[4] produced similar results. Luxembourg has included the LULUCF sector in its key category analysis, which was performed in accordance with the IPCC good practice guidance and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF).

Uncertainties

17. Luxembourg has reported a tier 1 uncertainty analysis as part of its 2010 annual submission. The results are reported using table 6.1 of the IPCC good practice guidance, both including and excluding LULUCF. The uncertainty analysis has been prepared in accordance with the IPCC good practice guidance, but only for the key categories and their sum. The ERT noted that, according to paragraph 14 of the annex to decision 19/CMP.1, it is mandatory for Parties included in Annex I to the Convention to quantify the inventory uncertainty for each category, as well as for the inventory in total. The ERT therefore recommends that Luxembourg implement its planned improvements, which include a general revision of the uncertainties, and prepare uncertainty estimates for all categories in the inventory and report thereon in its next annual submission.

Recalculations and time-series consistency

18. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that recalculations reported by the Party of the time series from 1990 to 2007 have been undertaken to take into account changes in AD (the energy, solvent and other product use, LULUCF and waste sectors) and improved EFs (the energy, industrial processes, agriculture and waste sectors) or parameters (the energy sector). The major changes, and the magnitude of the impact, include: an increase in the estimate of emissions from the LULUCF sector for 1990 (66.8 per cent); and an increase in the estimate of emissions from the waste sector for 1990 (42.2 per cent). However, these changes were offset by a decrease in the estimate of emissions from the energy sector (0.1 per cent), so that the estimate of total emissions in 1990 remained unchanged. The estimate of total emissions in 2007 decreased by 1.0 per cent, owing mainly to decreases in the estimates of emissions from the energy (0.8 per cent) and agriculture (7.7 per cent) sectors. The rationale for these recalculations is provided in the NIR and in CRF table 8(b).

19. The ERT noted that the NIR does not discuss time-series consistency in the category-specific sections of the text (under "Uncertainty and time-series consistency"). The ERT recommends that Luxembourg improve transparency by reporting on time-series consistency under the above-stated heading in its next NIR.

Verification and quality assurance/quality control approaches

20. Luxembourg's NIR describes its quality management system, policy and manual in a transparent way. A data validation checklist is described in the NIR, and a data validation checklist for external data suppliers was provided to the ERT during the review. Luxembourg also described, during the review, how internal audits are conducted during the preparation of the CRF tables and the NIR. For each audit, a report is produced, which forms the basis for the inventory improvement plan, meetings of decision-making bodies

[4] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. 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.

and the planning of subsequent audits. Luxembourg reports in the NIR category-specific (tier 2) QC measures for a number of categories in the energy and industrial processes sectors. The ERT encourages the Party to carry out tier 2 QC measures for key categories in the other sectors as well, and to strengthen the implementation of the quality management system in general.

Transparency

21. The Party's NIR follows the structure given in 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" (hereinafter referred to as the UNFCCC reporting guidelines) and the annotated outline, which is a clear improvement on the previous annual submission. However, the NIR does not have any annexes, which should be used to provide additional information. During the review, Luxembourg informed the ERT that the inclusion of annexes is part of the planned inventory improvements, subject to the availability of resources. The ERT encourages Luxembourg to enhance the transparency of its NIR by providing the additional information in the annexes in accordance with the UNFCCC reporting guidelines. The ERT recommends that Luxembourg include information on underlying parameters used for emission calculations for the agriculture sector (see para. 55 below) and explanations for trends in emissions or underlying data, especially for the energy sector (see paras. 40–42 below).

Inventory management

22. Luxembourg 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. Luxembourg archives all inventory information in a single web-based system called CIRCALUX, which is regularly backed up.

3. Follow-up to previous reviews

23. Since the previous review, Luxembourg has improved its inventory management by defining and implementing quality objectives, which has been achieved through the establishment of a decision-making body that adopts the QA/QC and the inventory improvement plans, sets deadlines and prioritizes inventory improvements. In addition, the QA/QC plan was divided into QA/QC and inventory improvement plans, the roles of experts in the quality management system were defined, and checklists were prepared according to the roles and steps in the inventory preparation process. Also, an official approval procedure for the annual submission of the GHG inventory was established.

24. Luxembourg has also made a number of improvements in the 2010 annual submission which reflect recommendations made in the previous review reports, such as: the update of the net calorific values (NCVs) for jet kerosene and aviation gasoline and of the EFs for gasoline and diesel to country-specific values; the revision of land area data and the estimation of carbon stock changes previous reported as "NE" in the LULUCF sector; and the improvement of the transparency of its NIR by providing additional information on emission trends in the energy sector and background data for the industrial processes sector.

25. The ERT identified a number of recommendations that have not yet been addressed, including: the implementation of the planned improvements for the reference approach (see para. 31 below); the justification of the assumed share between domestic/international use of aviation gasoline (see para. 35 below); and the inclusion of further information on parameters, units and sources in the agriculture chapter of the NIR (see para. 55 below).

4. Areas for further improvement

Identified by the Party

26. The 2010 NIR identifies three areas for improvement with respect to the quality management system: the application of the four-eyes principle in inventory work; the establishment of criteria for the prioritization of the QA/QC plan; and the continuation of QA/QC training for the national inventory compiler and sector experts. With respect to improving other aspects of the inventory, around 40 issues across all sectors are stated in the NIR.

Identified by the expert review team

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

(a) The strengthening of the elements of the national system relating to timeliness of reporting (see para. 7 above);

(b) The improvement of transparency by including annexes to the NIR as recommended in the UNFCCC reporting guidelines (see para. 21 above), and by discussing time-series consistency in the NIR (see para. 19 above).

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

B. Energy

1. Sector overview

29. The energy sector is the main sector in the GHG inventory of Luxembourg. In 2008, emissions from the energy sector amounted to 11,004.27 Gg CO_2 eq, or 88.1 per cent of total GHG emissions. Since 1990, emissions have increased by 3.5 per cent. The key drivers for the rise in emissions are road transportation and, to a much smaller extent, fugitive emissions from fuels and other sectors. Within the sector, 60.5 per cent of the emissions were from road transportation, followed by 14.8 per cent from manufacturing industries and construction, 13.5 per cent from other sectors and 10.5 per cent from energy industries. Fugitive emissions from fuels accounted for 0.4 per cent and other accounted for 0.3 per cent. The observed trends between 1990 and 2008 are emission increases of 146.4 per cent for transport, mainly from road transportation, 8.6 per cent for other sectors and 157.8 per cent for fugitive emissions from fuels, whose growth is closely linked to natural gas use in Luxembourg; and decreases in emissions from energy industries (11.6 per cent) and manufacturing industries and construction (68.5 per cent). For CO_2, CH_4 and N_2O, emissions grew over the period 1990–2008 by 2.8 per cent, 34.7 per cent and 114.5 per cent, respectively.

30. The ERT commends the Party for updating the NCVs for jet kerosene and aviation gasoline to country-specific values and also for the efforts to provide and adopt country-specific EFs for gas/diesel oil and gasoline. The ERT encourages the Party to continue its efforts to obtain country-specific NCVs for key fuels, such as gas/diesel oil and gasoline. Luxembourg's energy balance will be prepared and provided by the national statistical institute (STATEC) from 2010 onwards, being available for the 2011 annual submission. The Party stated that, as part of these revisions, common country-specific NCVs and densities have been fixed for most fuels and have to be applied by all institutions handling the energy data. Hence, the table in the NIR on NCVs and other fuel parameters will be updated in the next annual submission.

2. Reference and sectoral approaches

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

31. CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For 2008, the CO_2 emission estimates for the reference approach are 2.24 per cent lower than those for the sectoral approach. The difference in estimated CO_2 emissions between the reference and the sectoral approach was greater than in 2008 for several years between 1995 and 2007, ranging between 6.81 per cent lower and 1.72 per cent higher. Explanations are provided in the documentation box of the CRF table and also in the NIR. In response to questions raised by the ERT during the review, the Party stated that it is planning to implement the improvements highlighted in table 3-9 of the NIR for its next annual submission. The ERT acknowledges that Luxembourg is in a transition phase regarding the compilation of energy statistics and reiterates the recommendation of the previous review report that the Party implement these measures as soon as possible.

32. According to section 3.2.1.1 of the NIR, whenever AD for a fuel consumption category are in the range of 0–0.5 kt, Luxembourg has reported these data as "NO", owing to lack of precision in the data from the statistical office of the European Union (Eurostat), which does not allow decimal numbers and therefore reports zero values. Hence, estimations are not provided in those cases. This is the case, for example, for building- and plant-site fuel machinery reported under other (stationary (1.A.5.a)), which was reported as "NO" in the CRF table for 2008. Luxembourg informed the ERT that in the revised energy balance (2000–2009) used for the preparation of the inventory for the 2011 annual submission this issue has been solved. However, it remains for the years 1990–1999, for which old energy balances need to be taken into account and the needed detailed data might not be available anymore. The ERT recommends that the Party seek the necessary data in the old energy balances and gather the original fuel consumption data sent to Eurostat, in order to estimate the relevant emissions. If fuel consumption AD cannot be obtained for these categories, but the Party acknowledges that such consumption does occur, the ERT recommends that the Party adopt a conservative approach by considering fuel consumption to be equal to 0.5 ktoe.

33. It is not clear from the NIR whether the fraction of carbon oxidized adopted to calculate emission estimates is the IPCC default value or the Eurostat default value. Furthermore, it is not clear whether the same fraction was applied in the reference and sectoral approaches. In response to questions raised by the ERT during the review, the Party stated that it plans to implement a revision to the reference approach, in order to streamline EFs, NCVs and also oxidation factors. During this revision, the oxidation factors will be adjusted to the IPCC default values for both the reference and the sectoral approach. During the current review, the ERT noted that in some cases in the sectoral approach, when default EFs from the 2006 IPCC Guidelines were applied, no oxidation factor was applied, and hence all carbon was considered to be oxidized into CO_2. The ERT recommends that the Party implement the planned improvements regarding the streamlining of oxidation factors, EFs and NCVs in both the reference and sectoral approaches for its next annual submission.

34. The comparison between the data submitted to the UNFCCC and to the International Energy Agency shows that liquid fossil stock changes have been reported with both positive and negative values, affecting the calculation of apparent consumption. During the review, the Party informed the ERT that this issue will be considered in its next annual submission. The ERT recommends that the Party clarify this matter in its 2011 annual submission.

International bunker fuels

35. In Luxembourg, all jet kerosene is used on international flights, a very specific situation because it is a small country with no domestic flights using jet kerosene. At the moment, the share between domestic and international flights (90:10) of the use of aviation gasoline is based on expert judgement. During the review, the Party claimed that the improvement of this share is not a priority, because it seems to be quite appropriate, according to informal discussion with contacts involved in private leisure aviation and the company selling the fuel at the airport. The ERT reiterates the recommendation of the previous ERT that, in order to improve the transparency of the NIR, Luxembourg include references for the expert judgement and assumptions used in the allocation of fuels in its next annual submission.

36. Table 3-11 of the NIR presents "GB 2009" as a source of EFs for international bunkers (aviation), but this reference could not be found by the ERT in the list of references at the end of the document. In response to a question raised by the ERT, the Party explained that this refers to the EMEP/EEA air pollutant emission inventory guidebook 2009, formerly known as the EMEP/CORINAIR emission inventory guidebook. Further explanation regarding the EFs adopted was also provided during the review. For aviation gasoline, default EFs were taken from the 2006 IPCC Guidelines, because they correspond better to Luxembourg's modern fleet of small airplanes burning aviation gasoline, particularly for the EFs for CH_4 and N_2O, because they are technology dependant. The ERT recommends that Luxembourg include this information in its next annual submission.

Feedstocks and non-energy use of fuels

37. According to CRF table 1.A(b), imports of anthracite are included in other bituminous coal. On the other hand, in CRF table 1.A(d) there is no reference to the non-energy use of anthracite. The Party explained that anthracite and other coal products are used by the steel industry as reducing agents (approximately 38 kt in 2008). In the sectoral approach, these emissions are reported under industrial processes (iron and steel). Nevertheless, to international statistics, this consumption is not reported as a non-energy use by the competent reporting authority (i.e. the Ministry of Economics and Foreign Trade). The ERT asked the Party for a further explanation as to why there is such a significant difference between the reference and sectoral approaches, and Luxembourg stated that this explanation will be included in its next annual submission. Furthermore, it will discuss with the competent reporting authority (which from now on will be STATEC) whether it would be possible to declare these consumptions as non-energy use in the future. The ERT recommends that the Party continue discussing this issue with the designated authorities and provide detailed explanations for the differences between the reference and sectoral approaches in the next annual submission.

3. Key categories

Stationary combustion: solid, liquid and gaseous fuels – CO_2

38. The ERT commends Luxembourg's efforts in increasing the transparency of the NIR by including additional data tables and discussions to explain the changes in emission trends within the time series, such as the phasing out of the use of blast furnace gas by power plants to generate electricity and the start-up of a new gas and steam turbine plant. With respect to the use of blast furnace gas, the ERT recommends that Luxembourg reallocate emissions from any iron and steel autoproducers in public electricity and heat production to the iron and steel category in its next annual submission, as recommended in the previous review report, to ensure consistency and comparability.

39. The CO_2 EF for natural gas used by Luxembourg to estimate emissions from combustion sources is based on normal conditions (with temperature set to 0 ˚C). In the NIR, it is not transparent whether that is the standard temperature set by distribution companies in the European Union when measured at metering stations. If metering devices are measuring natural gas volume set to a different standard temperature (greater than 0 ˚C) than the derived CO_2 EF for natural gas needs to be adjusted accordingly, in order to ensure that CO_2 emissions are not overestimated. To increase the transparency and accuracy of the emission estimate, the ERT recommends that the Party provide additional discussion in its next NIR, in particular on the applicability of the CO_2 EF for natural gas taking into account the temperature-dependent volume at metering stations.

40. Luxembourg reports all emissions from manufacturing industries and construction under other (manufacturing industries and construction). The ERT noted large inter-annual fluctuations in the emissions from gaseous fuels between 1990 and 1991, from liquid fuels between 2004 and 2005 and from solid fuels between 2000 and 2001. Explanations of contributing factors are not included in the NIR. To help increase the transparency of the observed trends and to ensure time-series consistency, the ERT recommends that Luxembourg provide, in its next annual submission, a discussion of energy consumption, in order to support the reported emission trends.

Road transportation: liquid fuels – all gases

41. The ERT commends Luxembourg for the use of the COPERT IV model for its previous annual submission and for the efforts that the Party is making in order to better characterize the emissions under this category, owing to the large numbers of commuters and vehicles in transit through the country. These efforts include an extensive study to better estimate emissions from both the fuel tourism and from Luxembourg's fleet. The ERT recommends that Luxembourg provide, in its next annual submission, an explanation for the significant fluctuations in the implied emission factor of N_2O for diesel oil and gasoline across the years of the time series.

Stationary combustion: liquid fuels – all gases

42. The ERT noted a sharp increase in the AD of liquid fuels for agriculture/forestry/fisheries from 2003 to 2004. In response to questions raised by the ERT during the review, the Party stated that one explanation could be that, during this period, diesel oil became tax exempt in order to lift the heavy burden of energy prices from the agriculture sector. The Party indicated that, in the process of the ongoing revision of the energy balance by STATEC, this particular point might be automatically revised. If not, the Party noted that further investigations need to be carried out in order to explain the increase. The ERT recommends that the Party include the explanation in its next annual submission.

4. Non-key categories

Railways: liquid fuels – all gases

43. The ERT identified a sharp increase in both energy consumption (21,640–243,540 GJ) and emissions under this category between 2007 and 2008. In response to a question raised by the ERT during the review, Luxembourg stated that, for its next annual submission, the estimates for this category will be recalculated and the older figures will be revised in cooperation with the national railway company and using information from the revised energy balance. The ERT welcomes these efforts.

Oil and natural gas: oil – CO_2 and CH_4

44. The ERT noted that CO_2 and CH_4 emissions with respect to fugitive emissions from the transport, storage and distribution of refined fuel oils such as diesel fuel were reported using the notation keys "NA" and "NO". The ERT noted that Luxembourg had not estimated emissions from the distribution of oil products as identified in Luxembourg's planned improvement section in the 2009 NIR. The ERT encourages Luxembourg to assess whether these emissions occur and, if appropriate, estimate and report, in its next annual submission, fugitive emissions from the infrastructure supporting the transport, distribution, storage and sale of refined fuel oils, for example by using the EFs of neighbouring countries. Luxembourg informed the ERT that it will analyse the German EFs in more detail, since that is the only country reporting emissions from the distribution of oil products, to see whether these could be applied to Luxembourg. The ERT acknowledges this information and encourages Luxembourg to implement this improvement for the next annual submission, if appropriate.

C. Industrial processes and solvent and other product use

1. Sector overview

45. In 2008, emissions from the industrial processes sector amounted to 735.79 Gg CO_2 eq, or 5.9 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 15.47 Gg CO_2 eq, or 0.1 per cent of total GHG emissions. Since the base year, emissions have decreased by 54.7 per cent in the industrial processes sector and decreased by 35.3 per cent in the solvent and other product use sector. The key driver for the fall in emissions in the industrial processes sector is the change in the production process of steel from blast furnaces to electric arc furnaces between 1994 and 1998. Luxembourg reports that the financial and economic crisis that started in the second half of 2008 is mainly responsible for the 7.0 per cent decrease in emissions between 2007 and 2008. Within the industrial processes sector, 63.4 per cent of the emissions were from mineral products, followed by 23.0 per cent from metal production and 13.6 per cent from consumptions of halocarbons and SF_6.

46. The inventory for industrial processes and solvent and other product use is generally adequate in the context of transparency, accuracy, discussion of uncertainty, information on recalculations and time-series consistency, QA/QC procedures, planned improvements and recommended sector-specific improvements.

47. The ERT noted that, following recommendations made in the previous review report, Luxembourg had made improvements in the NIR by providing annual AD for clinker, as well as data on the calcium oxide and magnesium oxide content of clinker. Furthermore, Luxembourg provided information on the use of dolomite as a raw material in cement production and modified the methodology used for estimating the EF for cement production. The ERT further noted that Luxembourg had improved the estimation of N_2O emissions from anaesthesia by using country-specific data, as recommended by the previous ERT. The ERT commends Luxembourg for these improvements.

2. Key categories

Glass production – CO_2

48. The ERT noted that the estimation of emissions from glass production is based on the quantity of glass produced and an EF provided by the plant operator. In its response to questions raised by the ERT during the review, Luxembourg explained that the EF takes into consideration recycled glass. The ERT recommends that Luxembourg provide clear

information on how recycled glass is excluded from its estimation of emissions from glass production in its next NIR.

Consumption of halocarbons and SF_6 – HFCs

49. The ERT noted that Luxembourg has continued not to estimate actual HFC emissions from fire extinguishers and from solvent use. In response to questions raised by the ERT during the review, Luxembourg stated that no HFCs are used in the country in fire extinguishers or as solvents and it changed the notation key in the CRF tables from "NE" to "NO". According to the Party, this was confirmed by AEV, which has never permitted the use of HFCs or PFCs in large fire-extinguishing installations and also never issued special authorizations to companies for the use of HFCs and PFCs as solvents. Furthermore, the three main distributors of fire-extinguishing installations in Luxembourg and the non-existence of industrial sectors known to use HFCs as solvents in Luxembourg confirmed that these emission sources do not exist in the country. The ERT considered the response from Luxembourg satisfactory and recommends that the Party include this information in its next NIR.

50. The ERT noted that Luxembourg continues to report estimates of actual HFC emissions based on projections rather than on actual data, on the basis of a report produced in 1999, which includes projections for up to 2010. The ERT further noted that HFC emissions from stationary refrigeration and mobile air-conditioning are estimated on the basis of proxy data. Luxembourg uses data on German per capita emissions to calculate its HFC emission estimates. In its response to questions raised by the ERT during the review, Luxembourg indicated that a re-evaluation of the whole category, using the IPCC good practice guidance, is under way. The ERT reiterates the recommendation of previous ERTs that Luxembourg recalculate its emission estimates for the whole time series, using actual values and not projections or other proxy data.

3. Non-key categories

Soda ash production and use – CO_2

51. Luxembourg includes emissions from soda ash under emissions from glass production. The ERT encourages the Party to report in its next NIR on whether all soda ash used in Luxembourg is imported and consequently no soda ash production occurs in the country. Further, the ERT reiterates the recommendation of the previous ERT that Luxembourg provide information in the NIR demonstrating that soda ash in Luxembourg is only used in glass production.

Solvent and other product use – CO_2

52. Luxembourg calculates its CO_2 emission estimates for this category using AD from Luxembourg and an implied CO_2 EF from Austria. The ERT reiterates the recommendation made in the previous review report that Luxembourg enhance the accuracy of these estimates by using country-specific data.

D. Agriculture

1. Sector overview

53. In 2008, emissions from the agriculture sector amounted to 669.08 Gg CO_2 eq, or 5.4 per cent of total GHG emissions. Since the base year, emissions have decreased by 10.2 per cent. The key drivers for the fall in emissions are reductions in the number of cattle and a decline in synthetic fertilizer application. Within the sector, 45.8 per cent of the emissions were from agricultural soils, followed by 36.5 per cent from enteric fermentation

and 17.7 per cent from manure management. CH_4 accounted for 50.4 per cent of the sectoral emissions, while N_2O accounted for the remaining 49.6 per cent.

54. The inventory for 2008 contains estimates for all gases and for all categories in the agriculture sector.

55. As well as the NIR and the CRF tables, the Party provided, during the review, calculation spreadsheets that include all information on methodologies, parameters and AD used during the preparation of the inventory for the agriculture sector. These spreadsheets significantly increased the transparency of Luxembourg's inventory. The ERT reiterates the recommendation made in the previous review report that the Party include additional information on the parameters, units and sources used, as tables, in its next NIR.

56. The Party provided information on uncertainty in the general section of its NIR (section 1.7) and information on time-series consistency was provided upon the request of the ERT. The ERT noted that Luxembourg implemented a tier 1 uncertainty assessment (error propagation) for the 2010 annual submission and that it plans to implement a tier 2 analysis periodically. The uncertainty for the agriculture sector ranges from 30.1 per cent for CH_4 emissions from enteric fermentation to 173.2 per cent for N_2O emissions from pasture, range and paddock. The ERT welcomes the fact that the Party revised the livestock numbers for some minor species, such as goats and rabbits, for prior to 1997 and included the resulting revised emission estimates in its inventory to improve the time-series consistency. The ERT recommends that the Party include a section on "uncertainties and time-series consistency" in the agriculture chapter of the NIR, following the UNFCCC reporting guidelines, in its next annual submission.

2. Key categories

Direct soil emissions – N_2O

57. The emissions for this category were estimated using the tier 1 methodology and IPCC default EFs. As this category is identified as a key category, the ERT encourages the Party to develop and apply a country-specific EF for this category.

58. The ERT welcomes the fact that Luxembourg has corrected a misallocation of nitrogen-fixing (N-fixing) crops by excluding pasture, range and paddock, and beet from the N-fixing crops category and only including fodder crops, following the recommendations made in previous review reports. The ERT noted that the Party explained what kinds of crops were considered as N-fixing crops in the NIR.

59. In the Excel spreadsheet entitled "(non) N-fixing crop calculation"(filename: "4D Agricultural Soils"), which was provided by the Party during the review, data for other non N-fixing crops (grass and clover seeds) were missing for the years 1990–1999, and the Party explained that these data were not available. Luxembourg informed the ERT that it will extrapolate the mean value for the years 2000 to 2002 to the period 1990–1999. The ERT acknowledges this information and encourages Luxembourg to ensure the time-series consistency of the data in its next annual inventory submission.

Pasture, range and paddock – N_2O

60. The emissions for this category were estimated using the tier 1 methodology and the IPCC default EF. As this category is identified as a key category, the ERT encourages the Party to explore the possibility of the development and application of a country-specific EF for this category.

Indirect emissions – N_2O

61. The emissions for this category were estimated using the tier 1b methodology and the IPCC default EFs. The ERT encourages the Party to develop and apply country-specific EFs.

E. Land use, land-use change and forestry

1. Sector overview

62. In 2008, net removals from the LULUCF sector amounted to 272.34 Gg CO_2 eq. Since the base year, net removals have increased by 178.3 per cent. The key driver for the rise in removals is the increase in removals from forest land remaining forest land. Within the sector, removals of 362.40 Gg were from forest land remaining forest land, followed by emissions of 110.25 Gg from land converted to settlements, removals of 83.33 Gg from land converted to forest land and emissions of 24.78 Gg from land converted to grassland. Land converted to cropland accounted for emissions of 20.15 Gg and land converted to wetlands accounted for emissions of 9.94 Gg. The remaining emissions of 10.89 Gg were from cropland remaining cropland and land converted to other land.

63. Luxembourg has improved the LULUCF inventory by including revised data on land area and new estimates for some of the categories and subcategories and by changing the notation keys used for several categories, following recommendations made in the previous review report. Luxembourg provided estimates of carbon stock changes in living biomass, dead organic matter and soils for wetlands, settlements and other land for the first time. Recalculations were undertaken following the revision of AD and methodologies and owing to the availability of new country-specific parameters. The ERT commends Luxembourg for improving the completeness of the reporting on the LULUCF sector.

64. The information reported on the LULUCF sector is generally transparent. Data sources and methodologies for most calculations are clearly referenced in the NIR. However, some information is missing from the NIR, including: the methods for estimating carbon stock changes in the litter carbon pool for forest land remaining forest land; the source of data on the deadwood pool for forest land, which is used in the calculation of forest land converted to other land uses; and information on the approach applied to calculate estimates for the whole time series using the available data for certain years. This information was provided by the Party in response to a question raised by the ERT during the review. The ERT commends Luxembourg for its efforts and recommends that the Party improve the completeness of its annual submission by including all relevant information in its next annual submission.

65. Luxembourg uses approach 3 from the IPCC good practice guidance for LULUCF to determine areas of land use and land-use change, using data for the multiple land use/land cover from the OBS (Occupation Biophysiques du Sol) maps published in 1989, 1999 and 2007. This land information has subcategories, up to six detailed classes and is aggregated to the appropriate broad land-use categories. The time series was derived by interpolation and extrapolation. However, the areas of land-use change between cropland and grassland are obtained by a special method using administrative data from the Ministry of Agriculture.

66. Luxembourg conducted basic QA/QC procedures, but has not conducted an uncertainty analysis of the LULUCF sector under the Convention or under the Kyoto Protocol. The ERT recommends that Luxembourg implement category-specific QC procedures and perform an uncertainty analysis for its next annual submission.

2. Key categories

Forest land remaining forest land – CO_2

67. During the review, Luxembourg explained that AD on area used for calculating the increment of growing stock biomass on forest land remaining forest land were derived from the current National Forest Inventory of Luxembourg. The ERT noted a difference in the data on forest area between the OBS maps and the National Forest Inventory of Luxembourg and recommends that Luxembourg explain how this difference affects the result of carbon stock changes for forest land remaining forest land in its next annual submission.

68. Luxembourg applies the IPCC tier 2 default method (gain–loss method) for the estimation of carbon stock changes in the living biomass pool. Almost all parameters are provided and explained in the NIR. However, information on the AD for carbon loss is not transparent. During the review, Luxembourg explained that these AD were obtained on the basis of expert judgement. The ERT recommends that the Party report, in its next NIR, on the type of data used for the AD for carbon loss for forest land remaining forest land and how the data have been obtained.

69. Luxembourg uses a broad definition of forest land for its reporting on LULUCF that includes some non-forest area such as shrubs, forest roads, quarries and clearcutting. In this system, the areas converted from forest stand to non-forest area are not classified as land use change from forest land. During the review, the Party informed the ERT that it will reassess the area which was forest stand in 2000 but is non-forest area in 2010 when the new National Forest Inventory of Luxembourg is finished. The ERT encourages Luxembourg to implement this planned improvement.

3. Non-key categories

Emissions from disturbance associated with land-use conversion to cropland – N_2O

70. The Party explained in the NIR that a carbon–nitrogen ratio of 10:12 is used for the calculation of N_2O emissions from disturbance associated with land-use conversion to cropland. The ERT noted that this value (0.83) is much lower than the typical range for the carbon–nitrogen ratio for forest land and grassland converted to cropland (8–12) given in the IPCC good practice guidance for LULUCF. The ERT recommends that, in its next annual submission, Luxembourg reassess the reported ratio, and either report on the reasons for the deviation from the typical ratio, or apply an appropriate ratio and recalculate the emission estimates for this category accordingly.

F. Waste

1. Sector overview

71. In 2008, emissions from the waste sector amounted to 69.33 Gg CO_2 eq, or 0.6 per cent of total GHG emissions. Since the base year, emissions have decreased by 23.0 per cent. The key driver for the fall in emissions is the decrease in CH_4 emissions from solid waste disposal on land, which is because of: a decrease in the quantity of waste being landfilled, notably as a result of the development of recycling schemes and the expansion of both the number and variety of waste categories collected by recycling centres; the aerobic pre-treatment before landfilling; and the installation of CH_4 recovery systems at waste collection sites. Within the sector, 55.7 per cent of the emissions were from solid waste disposal on land, followed by 23.6 per cent from composting and 20.7 per cent from wastewater handling.

72. QA/QC procedures are reported for wastewater handling only. The ERT noted that, during the previous in-country review in 2008, extensive QA/QC checks were found detailed in the spreadsheets for the whole waste sector. As adequate procedures are obviously established, the ERT recommends that Luxembourg include a description of the QA/QC procedures for all waste categories in its next annual submission.

73. Likewise, uncertainties are reported for wastewater handling only. For other waste categories, uncertainties are referred to in the general uncertainty chapter of the NIR. The present ERT reiterates the recommendation of the previous review report that Luxembourg include a discussion on uncertainty for each category in the waste sector in its next annual submission.

2. Key categories

Solid waste disposal on land – CH_4

74. Luxembourg applies the IPCC tier 2 first order decay method and IPCC default parameters to estimate CH_4 emissions from solid waste disposal on land. Following recommendations made in previous review reports, the calculation was revised to cover the years since 1950. In 2009, the Party re-estimated waste composition and CH_4 generation in two studies and it included these new parameters for the first time in its 2010 annual submission. The impact of the recalculations on the estimate of total emissions from the waste sector was an increase of 42.2 per cent, or 26.7 Gg CO_2 eq, for the base year and an increase of 31.0 per cent, or 17.1 Gg CO_2 eq, for 2007. The ERT welcomes the implemented improvements.

75. Luxembourg reports the recovery of CH_4 emissions from solid waste disposal on land for 2001 onwards. During the review, the Party explained that CH_4 recovery started in 2000 but the corresponding data are not available. The ERT encourages the Party to report this activity for all the years in which it occurred, by collecting the necessary data or, if these are not available, by applying appropriate extrapolation methods following the IPCC good practice guidance.

3. Non-key categories

Wastewater handling – CH_4 and N_2O

76. N_2O emissions from human sewage are reported by Luxembourg as "NA". However, N_2O emissions from domestic and commercial wastewater (excluding human sewage) are estimated by Luxembourg for different population categories and different types of wastewater treatment plant, in accordance with the 2006 IPCC Guidelines. In response to questions raised by the ERT during the review, the Party explained that the notation key "NA" is only applicable to emissions from sludge. The ERT considers that emissions from human sewage are occurring and are most probably included in the estimates of emissions from wastewater. It reiterates the recommendation of the previous review reports that Luxembourg verify its use of the notation key "NA" for reporting N_2O emissions from human sewage and consider the emissions from human sewage should be reported as included elsewhere ("IE").

77. Luxembourg reports CH_4 and N_2O emissions from sludge in industrial, domestic and commercial wastewater as "NE". In response to questions raised by the ERT during the review, the Party explained that industrial sewage sludge treatment is carried out under aerobic conditions, thus CH_4 emissions should be reported as "NA" and not "NE". Concerning domestic and commercial sludge, Luxembourg further explained that the sludge is used in agriculture or incinerated; thus the emissions are covered under other sectors and the appropriate notation key would be "NA" instead of "NE". The ERT

considers that the notation key "IE" might be more appropriate and recommends that the Party include these explanations and change the notation keys used in its next annual submission.

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

78. Luxembourg reported emissions and removals from activities under Article 3, paragraph 3, of the Kyoto Protocol for 2008. This is in accordance with the "Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol", as Luxembourg did not elect any activities under Article 3, paragraph 4, of the Kyoto Protocol. Both afforestation and reforestation, and deforestation activities were identified as non-key categories in the key category analysis conducted by the Party for 2008.

79. The original 2010 annual submission of the KP-LULUCF CRF tables for Luxembourg included data in table NIR-1 but only the notation key "NA" in all KP-LULUCF tables and the accounting table. This incomplete reporting resulted in a significant lack of information and inconsistency between the reporting under the Convention and the Kyoto Protocol. During the review, the Party officially resubmitted its KP-LULUCF tables on 21 October 2010 in response to the questions raised by the ERT. The ERT recommends that Luxembourg report the KP-LULUCF CRF tables correctly in its next annual submission.

80. Luxembourg reported the required information set out in paragraphs 5–7 of the annex to decision 15/CMP.1. However, the Party did not report all of the required information in accordance with paragraph 8 of the annex to decision 15/CMP.1. In response to questions raised by the ERT during the review, the Party provided the missing information. The ERT recommends that Luxembourg include all required reporting elements, as set out in paragraphs 5–8 of the annex to decision 15/CMP.1, in its next annual submission.

81. The system Luxembourg has used for detecting land subject to afforestation, reforestation and deforestation since 1990 is based on approach 3 from the IPCC good practice guidance for LULUCF, using data for multiple land use/land cover from the OBS maps published in 1989, 1999 and 2007. The ERT considers that units of land under Article 3, paragraph 3, of the Kyoto Protocol are identifiable and that the spatial assessment unit used for the determination of areas of land units subject to activities under Article 3, paragraph 3, is properly taken into account under the system used by Luxembourg. However, the NIR provided insufficient information on how the Party had constructed area data for afforestation, reforestation and deforestation for 2008 and how it will calculate complete data for the whole time series up to 2012. During the review, Luxembourg informed the ERT that it is planning to include new OBS data at the end of the first commitment period to cover all necessary data for the entire commitment period. Luxembourg also explained that the extrapolation method was used for estimating areas subject to afforestation, reforestation and deforestation in 2008. The ERT recommends that the Party include this information in its next NIR.

82. The methods used to estimate emissions and removals from afforestation, reforestation and deforestation activities under the Kyoto Protocol are the same as those used for the corresponding categories under the Convention. Most of the information on

calculations and data is covered in chapter 7 (LULUCF) and chapter 11 (KP-LULUCF) of the NIR, except some elements, which are listed in paragraph 64 above.

83. In general, the ERT considers that Luxembourg has all the necessary data and methods in place to estimate carbon stock changes in each pool under afforestation, reforestation and deforestation activities. However, the ERT noted that QA/QC procedures have not been fully implemented, including reporting complete KP-LULUCF information and the procedure to ensure that the KP-LULUCF CRF tables are compiled properly, although this information was provided during the review. The ERT recommends that Luxembourg resolve this weakness of its national system regarding KP-LULUCF for its next annual submission.

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

Afforestation and reforestation – CO_2

84. Luxembourg reports carbon stock changes in above-ground biomass, below-ground biomass and mineral soils, which also includes litter, under afforestation and reforestation activities. Carbon stock change in the deadwood pool is reported as "NO" applying the conservative approach, with an explanation that this pool is "not a net source". The ERT considers that the explanation is appropriate.

Deforestation – CO_2 and N_2O

85. Luxembourg reports carbon stock changes in all carbon pools under deforestation and the associated CO_2 emissions, but reports N_2O emissions from deforestation as "NO". The ERT noted that N_2O emissions from disturbance associated with forest land conversion to cropland are reported under the Convention. As this activity obviously occurs in Luxembourg, the ERT recommends that the Party calculate and include estimates of emissions for this category in its next annual submission.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

86. Luxembourg 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 and recommendations included in the SIAR on the SEF tables and the SEF comparison report.[5] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

87. 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.

[5] 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.

88. Luxembourg did not report all information required by chapter I.E of the annex to decision 15/CMP.1 in its NIR. Luxembourg made this information available to the SIAR assessor via a consultation form in response to the draft SIAR assessment, part I. The ERT reiterates the SIAR assessor's recommendation that Luxembourg include the following information in its next annual submission:

(a) Information on discrepancies, in accordance with paragraph 12 of the annex to decision 15/CMP.1;

(b) Information on notifications received by the registry, in accordance with paragraphs 13–15 of the annex to decision 15/CMP.1;

(c) Information on any invalid units that exist in the registry, in accordance with paragraph 16 of the annex to decision 15/CMP.1;

(d) Information on changes made to correct discrepancies or to prevent them from reoccurring or a specific statement that no changes were made, in accordance with paragraph 17 of the annex to decision 15/CMP.1.

National registry

89. 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 also took note of 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.

90. However, the SIAR identified that the national registry has not completely fulfilled all requirements regarding the public availability of information in accordance with chapter II.E of the annex to decision 13/CMP.1. Moreover, Luxembourg should clarify the information reported on its public website pursuant to paragraph 46(a–d) of the annex to decision 13/CMP.1 concerning projects related to Article 6 of the Convention. If the Party does not participate in joint implementation projects, the Party should state this both in its annual submission and on its public website. The ERT recommends that Luxembourg address these problems and report the results in its next annual submission.

Calculation of the commitment period reserve

91. Luxembourg has reported its commitment period reserve in its 2010 annual submission. Luxembourg reported that its commitment period reserve has not changed since the initial report review (42,662,696 t CO_2 eq), as it is based on the assigned amount and not on the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

92. Luxembourg reported that there is no change in its national system since the previous annual submission. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

93. Luxembourg reported that there are no changes in its national registry since the previous annual submission except for the upgrade of the registry software, which provided a structural solution for the shortcomings of the public reports module, and the change of

name of the registry administrator. The software passed all the mandatory test procedures. The public reports can now be consulted directly at the national registry web address as well as the list of legal entities. The ERT concluded that Luxembourg'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 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

94. Luxembourg has included information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol, as requested in chapter I.H of the annex to decision 15/CMP.1, in its 2010 annual submission. However, the ERT noted that the original information reported was not complete and transparent, as the Party had not provided information on the prioritization of actions in implementing its commitments under Article 3, paragraph 14. During the review, Luxembourg provided the ERT with the missing information.

95. Luxembourg reported that it is working to minimize not only the adverse impacts of climate change but also any adverse impacts due to the reduction of GHGs, by striving to implement all its commitments under the Kyoto Protocol. In the Party's development of a long-term sustainable development policy, adverse impacts are avoided through two main actions:

(a) As set out in the European Union emissions trading scheme, emission allowances are granted for free to companies with certain characteristics. This is done in order to avoid the risk of carbon leakage and to reduce the risk of an increase in GHG emissions in other countries that do not have comparable environmental standards;

(b) Joint implementation and clean development mechanism projects can only be eligible in Luxembourg if they respect specific social and environmental criteria, and the priority is given to technology transfer projects.

96. In implementing its commitments under Article 3, paragraph 14, of the Kyoto Protocol, Luxembourg gave priority to:

(a) Substantially reforming its energy markets to reduce market imperfections and in order to comply with European legislation;

(b) Putting in place several fiscal incentives with the aim of reducing the use of fossil fuels in the transport sector;

(c) Putting in place several subsidies in the residential, commercial and institutional sectors, with the aim of reducing the use of fossil fuels and improving the use of renewable energy sources and promoting energy efficiency.

97. The ERT recommends that Luxembourg include information on the prioritization of actions in implementing its commitments under Article 3, paragraph 14, of the Kyoto Protocol in its next annual submission.

III. Conclusions and recommendations

98. Luxembourg made its annual submissions as follows: the CRF and SEF tables were submitted on 15 April 2010 and the NIR was submitted on 27 May 2010. Luxembourg resubmitted its NIR on 30 June 2010 and its CRF tables on 21 October 2010. The annual submission contains the GHG inventory (comprising the CRF tables and an NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol

(information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, Kyoto Protocol units, changes to the national system and the national registry, and minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol). This is generally in line with decision 15/CMP.1. However, the ERT noted that the NIR was not submitted by 15 April.

99. The ERT concludes that the inventory submission of Luxembourg has been prepared and the information reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1990–2008 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, with the exception of CRF table 2(II).F, which was not provided. Some of the categories, particularly in the industrial processes sector (potential HFC and SF_6 emissions), were reported as "NE".

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

101. Luxembourg's inventory is in line with the UNFCCC reporting guidelines, and generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, except in specific sectoral areas where recommendations for improvement have been made by the ERT. The ERT commends the Party for improving the accuracy of its inventory by applying country-specific parameters for mobile combustion and solvent use, and encourages Luxembourg to continue its efforts to obtain country-specific parameters, such as NCVs for key fuels and EFs for emissions from soils.

102. The ERT concludes that Luxembourg's submission on KP-LULUCF is generally in accordance with the requirements of paragraphs 5–9 of the annex to decision 15/CMP.1. In general, the ERT considers that Luxembourg has all the necessary data and methods in place to estimate carbon stock changes in each pool under afforestation, reforestation and deforestation activities. However, the Party did not provide correctly completed KP-LULUCF CRF tables or information in accordance with paragraph 8 of the annex to decision 15/CMP.1 until they were requested during the review.

103. Luxembourg has reported information on its accounting of Kyoto Protocol units in accordance with chapter I.E of the annex to decision 15/CMP.1, and used the reporting tables as required by decision 14/CMP.1. However, the ERT noted that Luxembourg did not report all information required by chapter I.E of the annex to decision 15/CMP.1 in its NIR, but instead made this information available to the SIAR assessor.

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

105. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the CMP. However, the SIAR identified that the national registry has not completely fulfilled all requirements regarding the public availability of information in accordance with chapter II.E of the annex to decision 13/CMP.1.

106. Luxembourg has reported the information requested in 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 2010 annual submission. The information was provided on 30 June 2010. The ERT noted that the reported information was not complete and transparent in terms of the prioritization of actions in implementing its commitments under

Article 3, paragraph 14. During the review, Luxembourg provided the ERT with the missing information.

107. In the course of the review, the ERT formulated a number of recommendations relating to the completeness, transparency and timeliness of the annual submission (including the information required under Article 7, paragraph 1). The key recommendations are that Luxembourg:

(a) Review the elements of its national inventory system that would enable the timely submission of its annual submission, and submit its next annual submission by 15 April 2011;

(b) Include all annexes to the NIR, in accordance with the UNFCCC reporting guidelines;

(c) Prepare uncertainty estimates for all categories in the inventory;

(d) Report on time-series consistency in its next NIR;

(e) Implement the planned revision of the reference approach and the streamlining of the reference and sectoral approaches, and further elaborate its explanations on the differences between the reference and sectoral approaches;

(f) Recalculate its HFC emission estimates for the whole time series, on the basis of actual data and not projections or other proxy data;

(g) Include estimates of N_2O emissions from deforestation, consistent with the reporting under the Convention;

(h) Report all information on Kyoto Protocol units as required by chapter I.E of the annex to decision 15/CMP.1 in its NIR;

(i) Consider all mandatory information items on activities under Article 3, paragraph 3, of the Kyoto Protocol and implement the necessary QA/QC procedures as part of its national system in order to ensure the completeness of its next KP-LULUCF submission;

(j) Ensure that its national registry fulfils all requirements regarding the public availability of information;

(k) Provide complete information on the implementation of its commitments under Article 3, paragraph 14, of the Kyoto Protocol by reporting on the prioritization of its actions.

IV. Questions of implementation

108. 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 Luxembourg 2010. Available at <http://unfccc.int/resource/docs/2010/asr/lux.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2010. Available at <http://unfccc.int/resource/webdocs/sai/2010.pdf>.

FCCC/ARR/2009/LUX. Report of the individual review of the annual submission of Luxembourg submitted in 2009. Available at <http://unfccc.int/resource/docs/2010/arr/lux.pdf>.

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

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Marc Schuman (Division Air/Bruit, Administration de l'Environnement), including additional material on the methodologies and assumptions used. The following documents[1] were also provided by Luxembourg:

Tier 1 key category analysis of Luxembourg, 2010, v12, contained in an electronic file.

Tier 1 uncertainty analysis of Luxembourg, 2010, v.3, contained in an electronic file.

Checklist for external data providers, contained in an electronic file.

[1] Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CORINAIR	core inventory of air emissions
CRF	common reporting format
EF	emission factor
ERT	expert review team
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
GJ	gigajoule (1 GJ = 10^9 joule)
HFCs	hydrofluorocarbons
IE	included elsewhere
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
LULUCF	land use, land-use change and forestry
N	nitrogen
NA	not applicable
NE	not estimated
NO	not occurring
N_2O	nitrous oxide
NCV	net calorific value
NIR	national inventory report
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
UNFCCC	United Nations Framework Convention on Climate Change