COMPLIANCE COMMITTEE

CC/ERT/IRR/2007/26
14 December 2007

Report of the review of the initial report of Luxembourg

Note by the secretariat

The report of the review of the initial report of Luxembourg was published on 14 December 2007. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2), the report is considered received by the secretariat on the same date. This report, FCCC/IRR/2007/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 review of the initial report of Luxembourg

According to decision 13/CMP.1, each Annex I Party with a commitment inscribed in Annex B to the Kyoto Protocol shall submit to the secretariat, prior to 1 January 2007 or one year after the entry into force of the Kyoto Protocol for that Party, whichever is later, a report (the 'initial report') to facilitate the calculation of the Party's assigned amount pursuant to Article 3, paragraphs 7 and 8, of the Kyoto Protocol, and to demonstrate its capacity to account for emissions and the assigned amount. This report reflects the results of the review of the initial report of Luxembourg conducted by an expert review team in accordance with Article 8 of the Kyoto Protocol.

CONTENTS

I. Introduction and summary

A. Introduction

1. This report covers the in-country review of the initial report of Luxembourg, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with the guidelines for review under Article 8 of the Kyoto Protocol (decision 22/CMP.1). The review took place from 11 to 16 June 2006 in Luxembourg city, Luxembourg, and was conducted by the following team of nominated experts from the roster of experts: generalist – Mr. Michael McGettigan (Ireland); energy – Ms. Kristien Aernouts (Belgium); industrial processes – Ms. Karin Kindbom (Sweden); agriculture – Mr. Jorge Alvarez (Peru); land use, land-use change and forestry (LULUCF) – Mr. Richard Volz (Switzerland); waste – Mr. Faouzi Senhaji (Morocco). Mr. Michael McGettigan and Mr. Faouzi Senhaji were the lead reviewers. In addition, the expert review team (ERT) reviewed the national system, the national registry, and the calculations of the Party's assigned amount and commitment period reserve (CPR), and took note of the LULUCF parameters and the elected Article 3, paragraph 4 activities. The review was coordinated by Mr. Sergey Kononov (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, in this final version of the report.

B. Summary

1. Timeliness

3. Decision 13/CMP.1 requests Parties to submit their initial report prior to 1 January 2007 or one year after the entry into force of the Kyoto Protocol for that Party, whichever is later. The initial report was submitted on 29 December 2006, which is in compliance with decision 13/CMP.1. With the initial report, Luxembourg submitted a greenhouse gas (GHG) inventory that had been revised since its original 2006 GHG inventory submission of 6 February 2006. On 27 March 2007, Luxembourg submitted another revision of its 2006 inventory and indicated that this version of 27 March 2007 should be used in conjunction with the initial report. Luxembourg also submitted revised emission estimates on 28 July 2007 in response to questions raised by the ERT during the in-country visit.

2. Completeness

4. Table 1 below provides information on the mandatory elements that have been included in the initial report and reflects the revised emission estimates provided by Luxembourg resulting from the review process. The revised estimates largely reflect major recalculations for methane (CH_4) and nitrous oxide (N_2O) in the agriculture sector, the inclusion of estimates of CH_4 and N_2O associated with wastewater handling in the waste sector (see paragraph 110), the application of improved methodologies for carbon dioxide (CO_2) emissions from a number of important categories in the industrial processes sector (see paragraphs 71, 74, 79, 80), and various minor revisions throughout the energy sector (see paragraphs 53, 55, 57, 58, 60–63). The revisions resulted in an increase in the estimates of base year emissions, from 12,686.69 Gg CO_2 eq. as reported by Luxembourg in its initial report[1] to 13,167.50 Gg CO_2 eq.

[1] Here and elsewhere in this report, data from the inventory submission of 27 March 2007 are used as the data reported by Luxembourg in its initial report, see paragraph 3.

Table 1. Summary of the reporting on mandatory elements in the initial report

Item	Provided	Value/year/comment
Complete GHG inventory from the base year (1990) to the most recent year available (2004)	Yes	Base year: 1990
Base year for HFCs, PFCs and SF_6	Yes	1995
Agreement under Article 4	Yes	72% (decision 2002/358/EC)
LULUCF parameters	Yes	Minimum tree crown cover: 10% Minimum land area: 0.5 ha Minimum tree height: 5 m No activities under Article 3, paragraph 4 of the Kyoto Protocol have been selected.
Election of and accounting period for Article 3, paragraphs 3 and 4, activities	Yes	Commitment period
Calculation of the assigned amount in accordance with Article 3, paragraphs 7 and 8	Yes	45,672,086 tonnes CO_2 eq.
Calculation of the assigned amount in accordance with Article 3, paragraphs 7 and 8, revised estimate		47,402,996 tonnes CO_2 eq.
Calculation of the commitment period reserve	Yes	41,104,877 tonnes CO_2 eq.
Calculation of the commitment period reserve, revised estimate		42,662,696 tonnes CO_2 eq.
Description of national system in accordance with the guidelines for national systems under Article 5, paragraph 1	Partly	Incomplete description is provided
Description of national registry in accordance with the requirements contained in the annex to decision 13/CMP.1, the annex to decision 5/CMP.1 and the technical standards for data exchange between registry systems adopted by the CMP	Partly	Incomplete description is provided

5. The information in the initial report generally covers the elements required by decision 13/CMP.1, section I of decision 15/CMP.1, and relevant decisions of the Conference of the Parties serving as the Meeting of the Parties (CMP). However, the ERT found the descriptions of the national system and the national registry to be incomplete. Luxembourg submitted substantial further information on these two elements during the review process. In particular, during the review process Luxembourg provided all the information on the national registry system required by decision 13/CMP.1, section I of decision 15/CMP.1, and relevant decisions of the CMP.

3. Transparency

6. The initial report is transparent but the descriptions of the national system and the national registry require further elaboration.

4. Emission profile in the base year, trends and emission reduction target

7. In the base year (1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6), the most important GHG in Luxembourg was CO_2, contributing 92.8 per cent to total[2] national GHG emissions expressed in CO_2 eq., followed by CH_4, 3.5 per cent, and N_2O, 3.6 per cent (see figure 1). Hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.13 per cent of overall GHG emissions in the base year and emissions of perfluorocarbons (PFCs) are reported as not occurring ("NO"). The energy sector accounted for 81.5 per cent of total GHG emissions in the base year, followed by industrial processes (12.2 per cent), agriculture (5.7 per cent) and waste (0.4 per cent) (see figure 2). The relatively high share of CO_2 means that the emission profile in Luxembourg is slightly different from that of Annex I Parties in general.

[2] 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.

Figure 1. Shares of gases in total GHG emissions, base year

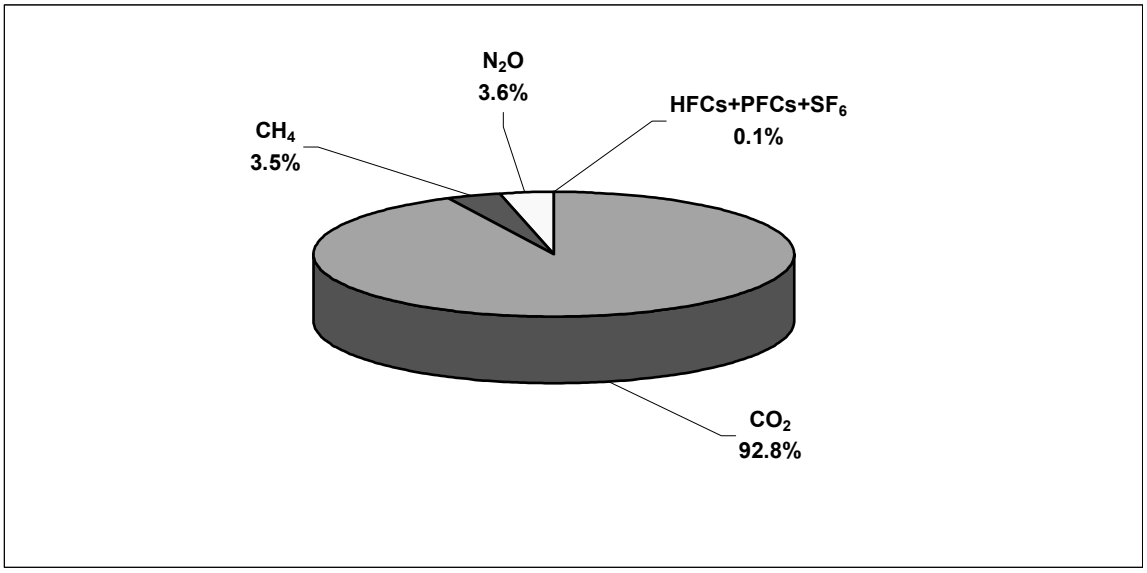
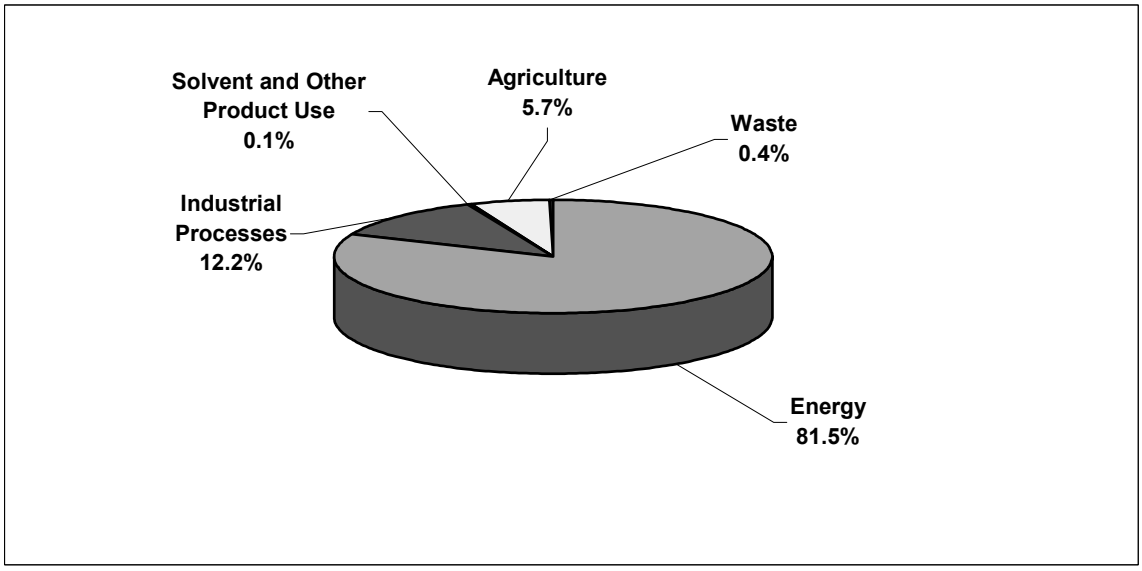


Figure 2. Shares of sectors in total GHG emissions, base year



8. Tables 2 and 3 show the greenhouse gas emissions by gas and by sector, respectively. Total GHG emissions amounted to 13,167.499 Gg CO_2 eq. in the base year and increased by 1.4 per cent between the base year and 2004. The trend is dominated by CO_2 emissions, which decreased by 26.0 per cent between 1990 and 2000 but returned to their 1990 level in 2004. The energy sector shows an overall increase of 10.6 per cent between 1990 and 2004, while the largest sectoral change has been in industrial processes, where emissions decreased by 54.4 per cent, mainly due to changes in the iron and steel industry.

9. Luxembourg's quantified emission limitation is 92 per cent as included in Annex B to the Kyoto Protocol. As Luxembourg is part of the European Community, whose member States will meet their reduction commitment jointly under Decision 2002/358/EC in accordance with Article 4 of the Kyoto Protocol, Luxembourg's quantified emission limitation is 72 per cent. Luxembourg's assigned amount is calculated on the basis of its Article 4 commitment.

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

GHG emissions	Gg CO_2 equivalent								Change from Kyoto Protocol BY to 2004 (%)
	Base year (Kyoto Protocol)	1990	1995	2000	2001	2002	2003	2004	
CO_2	12 219.20	12 219.20	9 312.46	9 040.46	9 349.65	10 167.00	10 541.53	12 156.87	–0.5
CH_4	460.04	460.04	469.75	486.46	483.47	479.99	473.40	469.29	2.0
N_2O	471.14	471.14	506.59	565.82	551.14	568.14	569.81	644.27	36.7
HFCs	14.21	14.21	14.21	43.01	50.92	58.82	66.73	74.63	425.3
PFCs	–	–	–	–	–	–	–	–	–
SF_6	2.91	2.91	2.91	3.52	3.57	3.62	3.68	3.73	28.2

BY = base year; LULUCF = land use, land-use change and forestry.
Note 1: Luxembourg submitted revised estimates for the base year and 2004 in the course of the initial review. These estimates differ from the GHG inventory submitted in 2006.
Note 2: The base year under the Kyoto Protocol excludes emissions from the LULUCF sector for all gases.

Table 3. Greenhouse gas emissions by sector, 1990–2004

Sectors	Gg CO_2 equivalent								Change from Kyoto Protocol BY to 2004 (%)
	Base year (Kyoto Protocol)	1990	1995	2000	2001	2002	2003	2004	
Energy	10 730.04	10 730.04	8 510.75	8 579.38	8 958.99	9 783.41	10 238.73	11 862.42	10.6
Industrial processes	1 612.68	1 612.68	992.16	761.99	713.53	737.19	686.27	735.85	–54.4
Solvent and other product use	18.31	18.31	16.86	15.17	14.59	14.68	14.72	14.78	–19.3
Agriculture	756.93	756.93	749.87	736.72	709.65	702.53	671.46	691.57	–8.6
LULUCF	NA	–294.93	–294.93	–294.93	–294.93	–294.93	–294.93	–294.93	NA
Waste	49.53	49.53	36.28	46.02	42.00	39.76	43.97	44.17	–10.8
Total (with LULUCF)	NA	12 872.57	10 010.99	9 844.35	10 143.82	10 982.65	11 360.22	13 053.86	NA
Total (without LULUCF)	13 167.50	13 167.50	10 305.92	10 139.28	10 438.75	11 277.58	11 655.15	13 348.79	1.4

BY = base year; LULUCF = land use, land-use change and forestry; NA = not applicable.
Note 1: Luxembourg submitted revised estimates for the base year and 2004 in the course of the initial review. These estimates differ from the GHG inventory submitted in 2006.
Note 2: The base year under the Kyoto Protocol excludes emissions from the LULUCF sector for all gases.

II. Technical assessment of the elements reviewed

A. National system for the estimation of anthropogenic GHG emissions by sources and sinks

10. During the in-country visit, the ERT found, based on the initial report and the information available during the visit, that Luxembourg's national system was not in accordance with the guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol (decision 19/CMP.1). Many of the mandatory requirements stipulated in the guidelines have not been put into effect and there are also many deficiencies with respect to non-mandatory requirements (see table 1). There has been considerable delay in the preparations to establish the national system and it is still unclear when it can be formally implemented. This delay also means that the institutional framework on which the inventories for the years of the commitment period will be prepared may differ appreciably from that underlying the base year inventory. Consequently, at that time Luxembourg could not meet the important objectives of national systems or fully comply with the basic inventory principles set down 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). However, the ERT was informed during the in-country visit that efforts to improve the national system were being made, which subsequently helped Luxembourg to achieve considerable progress after the in-country visit, see paragraph 17.

11. Table 4 shows which of the specific functions of the national system, as stipulated by the guidelines in the annex to decision 19/CMP.1, are included and described in the initial report.

Table 4. Summary of reporting on the specific functions of the national system

Reporting element	Provided	Comments
Inventory planning		
Designated single national entity*	No	See section II.A.1
Defined/allocated specific responsibilities for inventory development process*	No	See section II.A.1
Established process for approving the inventory*	No	See section II.A.1
Quality assurance/quality control (QA/OC) plan*	No	See section II.A.2
Ways to improve inventory quality	No	See section II.B.3
Inventory preparation		
Key category analysis*	Yes	See section II.B.1
Estimates prepared in line with IPCC guidelines and IPCC good practice guidance*	Partly	See section II.B.2
Sufficient activity data and emission factors collected to support methodology*	Partly	See section II.B
Quantitative uncertainty analysis*	No	See section II.B.2
Recalculations*	No	See section II.B.2
General QC (tier 1) procedures implemented*	No	See section II.A.2
Source/sink category-specific QC (tier 2) procedures implemented	No	See section II.A.2
Basic review by experts not involved in inventory	No	See section II.A.2
Extensive review for key categories	No	See section II.A.2
Periodic internal review of inventory preparation	No	See section II.A.2
Inventory management		
Archive inventory information*	Yes	See section II.A.3
Archive at single location	Yes	See section II.A.3
Provide ERT with access to archived information*	Yes	See section II.A.3
Respond to requests for clarifying inventory information during review process*	Yes	See section II.A.1

* Mandatory elements of the national system.

1. Institutional, legal and procedural arrangements

12. During the in-country visit, Luxembourg outlined the current institutional arrangements, as part of the national system, for preparation of the inventory. The Ministry of Environment was the recognized single national entity but was not formally designated under any specific legal basis (see also paragraph 17). The Environment Agency carries out the role of inventory agency for Luxembourg's emissions inventories in general under that legislation establishing it, and it is in this context that it compiles the inventories of GHG emissions. The Administration des Eaux et Forêts (AEF), which has responsibility for the LULUCF inventory, is the only other body involved directly in the preparation of the inventory. The bulk of the activity data (AD) are taken from publications of the Service Central de la Statistique et des Etudes Economiques du Luxembourg (STATEC), supplemented by information supplied by other ministries and administrations and in some cases by plant operators. Luxembourg continues to rely almost entirely on the CORINAIR methodologies for estimating GHG emissions and has made only limited use of the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC guidelines) and the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance).

13. There are clear deficiencies in the existing institutional arrangements and there are no documented procedures covering inventory planning, preparation and management. The process of GHG inventory preparation and submission is cumbersome and inefficient, and the completed inventory receives only minimal checking. The final output is prone to error due to the transfer of common reporting format (CRF) files produced initially by the Environment Agency in the CORINAIR system to the Ministry, where they are regenerated for submission using the CRF Reporter. The in-depth review of the inventory showed that lack of resources, insufficient communication and collaboration among institutions and inadequate definition of their roles and responsibilities are the major causes of Luxembourg's poor progress towards inventory reporting to the standard required by the UNFCCC reporting guidelines. These are the key issues to be addressed in the development of the national system.

14. The application to inventory preparation of the detailed land-cover data which the Party described to the ERT during the in-country review will allow the Party to fully meet the reporting requirements related to Article 3, paragraph 3 of the Kyoto Protocol.

15. In Luxembourg there is no established process for the official consideration and approval of the inventory, including recalculations, prior to its submission and for responding to any issues raised by the inventory review. The current inventory practice does not include any systematic identification of shortcomings in inventory compilation and reporting or a plan to address them. Improvements are sometimes made on an ad hoc basis, the latest of which were for the purpose of preparing the initial report. The ERT recognizes that Luxembourg has not previously been subject to an in-country review, and consequently has not had the opportunity to benefit from the review process to the same extent as most other Annex I Parties. This means that many of the improvements needed now are a matter of urgency.

16. Luxembourg is improving its data management systems and organizational structures under a partnership agreement with the Umweltbundesamt in Austria in order to review and improve Luxembourg's data reporting to the European Environment Agency (EEA). This collaboration extends to issues related to the development of a national inventory system and a quality assurance/quality control (QA/QC) plan for GHG inventories. However, there are no clear terms of reference for this work and no specific deliverables other than an implementation report for reporting in general. The ERT was informed that this report will not define a national system that is appropriate for Luxembourg, nor will it outline a QA/QC plan as an integral part of any such system. The ERT expressed the view that the partnership may not be sufficient to advance the implementation of the overdue national system for Luxembourg. The ERT recommended that the necessary decisions on the basic structure and

functionality of the national system be taken as soon as possible in collaboration with all stakeholders and with Umweltbundesamt, so that Luxembourg can move quickly to the implementation of a system that substantially complies with the guidelines for national systems under Article 5, paragraph 1 of the Kyoto Protocol (decision 19/CMP.1).

17. At the time of the in-country visit, Luxembourg acknowledged the lack of a proper national system and subsequently undertook urgent measures to establish the legal framework necessary for implementation of its national system following the ERT's recommendations. This was achieved by way of a Regulation[3], prepared jointly by the Environment Agency and the Ministry for Environment which was adopted by the Government on 20 July 2007 and which entered into force on 7 August 2007. This Regulation designates the Environment Agency as the single national entity with overall responsibility for the inventory and sets out the roles of the administrations and services that will support the Agency in its task as the national inventory compiler and data coordinator. Provision is made for external experts to produce the inventory for the agriculture, LULUCF and waste-water handling sectors, while the Environment Agency will compile the estimates for all other IPCC sectors in accordance with documented rules and procedures. The ERT is satisfied that the institutional, legal and procedural arrangements provided for under the Regulation, together with Luxembourg's proposed QA/QC management system mentioned in paragraph 19 below, meet the requirements for national systems as set down in the annex to decision 19/CMP.1.

2. Quality assurance/quality control

18. Luxembourg has not elaborated a QA/QC plan in accordance with the IPCC good practice guidance. The current procedures do not incorporate systematic checking in the context of QC or any form of official review, either internally or externally, before inventory submission. Checking is limited to that provided by the CRF Reporter software at the end of the process and to ad hoc correspondence between the individuals in the Environment Agency and the Ministry who compile and report the inventory, respectively.

19. Following the ERT's recommendations regarding QA/QC, Luxembourg submitted a description of the quality management system for the GHG inventory that will underpin the national system referred to in paragraph 17 above. Quality management is process-oriented and targets the overall management and control of the inventory. It addresses such issues as the collection of suitable AD, emission factors (EFs) and estimation methods, the identification of key categories, recalculations, specific QA/QC to achieve defined quality objectives and official review of the inventory. The system documentation incorporates a quality management manual, operating procedures including standard forms and internal documentation on implementation. The ERT concluded that the system as elaborated demonstrates adequate functionality with respect to inventory planning, preparation and management as required by the guidelines in the annex to decision 19/CMP.1.

3. Inventory management

20. Luxembourg has a functional centralized archiving system for the management of inventory data and related material for all emissions into the air, which is held at the Environment Agency. The development of the archive is determined largely by Luxembourg's long-term dependence on the CORINAIR system and its various software products for inventory compilation and reporting. The system does not archive disaggregated EFs, AD or other inputs as distinct elements on a time-series basis. There are no clear links to the sources of AD, such as national energy balances or other national statistics, and the GHG inventory calculations can only be viewed by examination of individual year database compilations using the CollectER II software underpinning the CORINAIR approach. Only one

[3] Reglèment grand-ducal du 1 août 2007 relatif à la mise en place d'un Système d'Inventaire National des émissions de gaz à effet de serre dans le cadre de la Convention cadre de des Nations Unies sur le Changement Climatique. <http://www.leglilux.public.lu/leg/a/archives/2007/1300708/1300708.pdf>.

person currently has full knowledge of the archive system, its content and its functionality. There is no documented procedure covering the overall application of the system or the steps that are involved in annual inventory preparation for Luxembourg. The archived information contains no internal documentation on QA/QC procedures, external and internal reviews, documentation on annual key categories and key category identification, or planned inventory improvements. Nevertheless, there is knowledge of where key documentation is and the ERT recognizes that all items of legislation, referenced documents and various national reports which it requested during the in-country visit were quickly and efficiently supplied by Luxembourg.

21. The ERT recommended that the archive system be developed to include all AD, EFs and emission estimates as separate elements. It should contain the original and recalculated GHG estimates in clearly labelled file versions to preserve the scope and chronology of recalculations. The archive should accommodate the inputs to and outputs from the CORINAIR/CollectER II calculation system and the correspondence and links between this system and the CRF Reporter software, which is needed for the review of GHG inventories. The ERT also recommended that Luxembourg prepare a user manual to describe the content, structure, management and maintenance of the archiving system. The user manual should describe responsibilities, access rights and other relevant information for the inventory core experts who contribute to inventory compilation. This recommendation has been taken into account in the supplementary information related to QA/QC and inventory management (see paragraph 19) which the Party submitted after the in-country visit.

22. The ERT encouraged Luxembourg to reconsider its dependence on the CORINAIR system as the basis for estimating the GHG emissions in some categories, such as agriculture. The ERT suggested that it would be more efficient and more transparent in the context of review if a simple external calculation system were used for this category based on the methods and equations given in the IPCC good practice guidance. Such a system may be linked to the essential statistical data needed as input, which are readily available. During the review, Luxembourg presented new estimates in the agriculture sector which are precisely in line with this suggestion. The ERT welcomes this development as a way of resolving the issues around transparency, completeness and comparability in this sector. The ERT recommends that Luxembourg further develop this simple approach and to apply it where appropriate for the industrial processes and waste sectors, for which some new estimates were also submitted during the review.

B. Greenhouse gas inventory

23. In conjunction with its initial report, Luxembourg has submitted a complete set of CRF tables for the years 1990–2004 and a national inventory report (NIR).

24. During the in-country visit Luxembourg provided the ERT with extensive additional information and reference sources. These documents are not part of the initial report submission and are in many cases not referenced in the NIR. Luxembourg also submitted revised emission estimates on 28 July 2007 in response to questions raised by the ERT during the in-country visit; these revised estimates are reflected in this report. The full list of materials used during the review is provided in annex I to this report.

1. Key categories

25. Luxembourg has not reported a key category analysis in its original 2006 inventory submission. However, the latest GHG inventory (of 27 March 2007), which was made part of the initial report submission, contains the results of national key category analysis. This analysis is also described in the latest version of the NIR.

26. The results of the key category analysis prepared by Luxembourg are consistent with the key category analysis conducted by the secretariat.[4] The analysis by Luxembourg differs from that of the secretariat in two respects: Luxembourg applied a more detailed representation of categories, and its key category analysis excludes the LULUCF sector. The ERT recommends that Luxembourg include the LULUCF sector in its future key category analyses.

2. Cross-cutting issues

27. The inventory of Luxembourg is partially in line with the Revised 1996 IPCC Guidelines, 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). There are deficiencies, to varying degrees, with respect to all the inventory reporting principles, the majority of which are evidently due to the lack of a proper national system.

28. The inventory is sufficiently in compliance with Article 7, paragraph 1 of the Kyoto Protocol and decision 15/CMP.1, and Luxembourg demonstrates the capacity to report information in future years in accordance with Article 7, paragraph 1, provided that the major improvements in the inventory preparation process identified by the ERT are made.

Completeness

29. The 2006 inventory submission gives full coverage for the years 1990–2004 but the reporting of some source categories in all years, for example, in the agriculture and waste sectors, is very incomplete. The ERT believes that only a modest effort is needed to address this deficiency in reporting. During the in-country visit, Luxembourg made a number of presentations to show how estimates can now be provided for the categories that are not included. The results were submitted to the ERT during the review, and resulted in a satisfactory level of completeness for all years.

Transparency

30. The 2006 NIR provides only a basic description of how the Luxembourg inventory is compiled and it lacks much of the detail needed to support a complete technical assessment of the emission estimates reported. In many cases it is difficult to reconcile the AD reported with the statistical information in the sources referenced. For important emission sources, such as CH_4 from solid waste, the method (tier 1 or tier 2) is indicated but there is no further elaboration of the various inputs and parameters underlying the estimation, which makes full technical review impossible.

31. While the CORINAIR approach as used by Luxembourg is in accordance with the UNFCCC reporting guidelines, its use of the Selected Nomenclature for Air Pollution (SNAP) represents a departure from the IPCC reporting categories for GHGs, and the relevant EFs are often applied in a different way. The NIR does not describe the application of CORINAIR in sufficient detail, and this makes review of the inventory difficult. This is a major reason for the lack of transparency in many parts of the GHG inventory of Luxembourg. In addition, the ERT discovered that the NIR of the 2006 submission was largely the work of external experts who had no part in compiling the inventory. The ERT recommends that this practice be discontinued and that sufficient support be provided to ensure that all experts who are engaged in inventory compilation are individually responsible for documenting their work in accordance with the guidance provided for preparing the NIR.

[4] 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* (hereinafter referred to as the IPCC good practice guidance for LULUCF) 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.

Consistency

32. While there is general internal consistency in the estimates as produced by Luxembourg, a full assessment of consistency in the context of the UNFCCC reporting guidelines is hampered by the use of the same estimate of emissions for many categories for all years reported. The work that Luxembourg undertook to revise its estimates for some categories and to improve completeness following the in-country visit has significantly improved the consistency of the inventory.

Comparability

33. The estimates for some categories are not comparable with those of other Annex I Parties due to incomplete coverage of sources, the way in which they are aggregated and the use of methodologies and EFs that are not fully in accordance with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The work that Luxembourg undertook to revise its estimates for some categories and to improve completeness following the in-country visit has significantly improved the comparability of the inventory.

Accuracy

34. The inventory provided by Luxembourg is accurate in that it does not systematically underestimate or overestimate the emissions or removals of greenhouse gases in the country. This assessment takes into account the completeness of coverage of categories and gases, the very high contribution of CO_2 to the total emissions in Luxembourg, and the relatively minor impact of those categories and gases that are known to have the highest uncertainties in GHG emissions inventories.

Recalculations

35. The 2006 submission is the first from Luxembourg to contain a full time-series of CRF tables. No recalculations are reported in this submission and the NIR does not describe any recalculations. The national system currently cannot ensure that recalculations of previously submitted estimates of GHG emissions by sources and removals by sinks are prepared in accordance with the IPCC good practice guidance. For example, when new information on the EF for glass production was obtained (see paragraph 77) no assessment was made of whether data for earlier years should be recalculated to ensure a consistent time-series. The ERT acknowledges the efforts made by Luxembourg to recalculate its inventories during the review and welcomes the provisions related to future recalculations in the proposed national system.

Uncertainties

36. The Party has not provided an uncertainty analysis for each source category or for the inventory in total, although such analysis is required by the IPCC good practice guidance.

37. Luxembourg is aware of the need to report on uncertainty and is addressing this issue. However, this is another aspect of the inventory where the provisions under CORINAIR have taken precedence over the UNFCCC reporting requirements. An evaluation of uncertainty based on CORINAIR qualitative indicators was provided during the in-country visit. The ERT recommends that the Party redirect its efforts in this area towards quantitative uncertainty assessment according to the IPCC good practice guidance. The ERT pointed out that a modest amount of work on this basis would produce an adequate estimate of uncertainty and that the estimate would be low for Luxembourg's GHG inventory, given the very large contribution of CO_2 from combustion to the total GHG emissions in the country. This outcome would put a positive perspective on the published annual estimates.

3. Areas for further improvement identified by the Party

38. The current inventory practice does not include any systematic identification of shortcomings in inventory compilation and reporting or a plan to address them. There are various statements as to planned improvements on most aspects of the inventory in the 2006 NIR, but there is no indication of their order of priority or particular targets for the next or subsequent reporting cycles. Improvements are sometimes made on an ad hoc basis, the latest of which were for the purpose of preparing the initial report.

4. Areas for further improvement identified by the ERT

39. The ERT recognizes that Luxembourg has not previously been subject to an in-country review and consequently has not had the opportunity to benefit from the review process to the same extent as most other Annex I Parties. This means that many of the improvements now identified become a matter of some urgency. Based on the in-country review, the ERT identified the following cross-cutting issues as the priority items for improvement. The Party should:

(a) Implement the national system as soon as possible under the Regulation adopted by the Government on 20 July 2007 and which entered into force on 7 August 2007;

(b) Establish the formal institutional arrangements to implement the national system, ensuring that it facilitates the inclusion of additional inventory experts, such as those who presented supplementary information and proposals for revised estimates during the review;

(c) Implement the QA/QC management system that has been drawn up to underpin the national system;

(d) Assign formal roles and responsibilities to ensure the timely supply of data and plan, prepare and manage the annual inventory;

(e) Further develop and consolidate the methods for the estimation of emissions in agriculture and waste sectors that were adopted during the review as improved alternatives to the CORINAIR approach, and fully document their application in future NIRs;

(f) Assign the responsibility for preparing the inventory submission to the inventory agency;

(g) Prepare quantified estimates of uncertainty;

(h) Ensure that the individual inventory compilers and experts describe the methods and data they have used for their respective components of the inventory as the primary means to improve the NIR;

(i) Reorganize and extend management of the data archiving system to incorporate all essential data related to the GHG time-series in a secure manner that facilitates efficient identification and access to all electronic and hard-copy data elements;

(j) Prepare a user manual to describe the content, structure, management and maintenance of the archiving system.

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

5. Energy

Sector overview

41. The energy sector in Luxembourg is the most important sector in the GHG inventory. In the base year, it was responsible for 81.5 per cent of total national emissions and in 2004 this share increased to 88.9 per cent. Emissions from the energy sector increased by 10.6 per cent between 1990 and 2004. This overall trend conceals differences between the major contributing sectors. The key driver for the rise in emissions is the transport sector, where CO_2 emissions increased by more than 150 per cent over the period 1990–2004, mainly due to so-called fuel tourism (the purchase of automotive fuels by vehicles in transit through Luxembourg). The CO_2 emissions in the iron and steel sector declined over the same period due to a change from the production of basic oxygen furnace steel to electric arc furnace (EAF) steel . Electricity production increased and changed from using excess blast furnace gas to a new natural gas-fired power plant and several new combined heat and power (CHP) installations.

42. The reporting in the energy sector is complete for CO_2, but for CH_4 and N_2O the emissions for some categories and years are reported as not estimated ("NE"). During the in-country visit it became clear that in some cases (when "NE" appears only in a few years) this was probably the result of the truncation of data to two decimal digits during internal data transfers from one format to another. The ERT recommended that Luxembourg check whether and where in the data processing steps these data were lost, and ensure that this problem is solved for future inventory submissions. In some other cases, CH_4 and N_2O emissions are not estimated for all years and the ERT recommended that Luxembourg complete its inventory for such categories/gases. These issues were taken into account in revised estimates submitted by Luxembourg during the review process. Specific examples are provided for the respective categories in the sectoral sections of this report below.

43. Luxembourg uses appropriate tiers in estimating the emissions in the energy sector. A tier 2 approach for CH_4 and N_2O is used, by taking different technologies into account in the choice of EFs. Most EFs are taken from CORINAIR but country-specific EFs for CO_2 are used for some fuels, such as blast furnace gas. The ERT recommended that the selection of EFs should be described better in the NIR, that comparisons with IPCC default values should be made and that the possibility of using more country-specific EFs should be investigated further. In response to this recommendation, Luxembourg revised its EFs by using IPCC default values (not taking into account the oxidation factors for CO_2) instead of CORINAIR EFs and submitted revised estimates during the review process. As part of the improvements planned for Luxembourg's future submissions, the use of country-specific EFs will be considered where possible.

44. The ERT recommends that Luxembourg increase the transparency of the data and methods used in the energy sector by giving more explanation in the NIR, and by making the CRF tables and the NIR fully consistent. Greater transparency is required in relation to the allocation of fuel use in category 1.A.2 (manufacturing industries and construction) and any other treatment of STATEC data to make them more suitable for using with the technology-dependent EFs for CH_4 and N_2O. To make the NIR more transparent, explanations should be included on what data are used and how they were used in all categories. Because of the importance of energy data as basic AD in the energy sector, more cooperation between the energy administration and the inventory agency may be helpful in making the energy consumption data more suitable for inventory purposes.

45. No actual QA/QC procedures are in place for this sector, but some ad hoc checks of total AD against STATEC data were re-run and demonstrated during the in-country visit. However, the possible problem of truncation (see paragraph 42 above) showed that the current checks are not able to prevent problems. The ERT suggests that interim steps in handling and transforming data from one format to another be limited as far as possible, and that intermediate checks be introduced to prevent errors in the final inventory results.

Reference and sectoral approaches

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

46. The CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. There are differences of –0.79 per cent and –6.31 per cent in the CO_2 emission estimates between the two approaches, 1990 and 2004, respectively. The difference varies from year to year and often exceeds 2 per cent (e.g., –9.50 per cent in 1999). The difference between the reference approach and the sectoral approach becomes much larger for the individual fuel types. For example, in 1990 apparent consumption of liquid fuels in the reference approach was 15.3 per cent higher than the sectoral use of liquid fuels. For solid fuels, apparent consumption was 56.7 per cent higher than the consumption in the sectoral approach, while the CO_2 emissions were 10.3 per cent higher. No explanations are provided in the documentation box of CRF table 1.A(c) or in the NIR to clarify the reasons for such differences. During the in-country visit, however, the reasons were explained. The main reason for solid fuels is the fact that coke for the blast furnaces in the period 1990–1997 is not included in the sectoral approach (only blast furnace gas is included). For liquid fuels, the input of the residual fuel as a reducing agent in the blast furnace is also not included, but emissions are accounted for under industrial processes. In the later years, there is also a small difference for gaseous fuels, because the emissions from natural gas use in the EAFs are allocated under industrial processes and not the energy sector in the current approach. The ERT recommends that Luxembourg include these explanations in the appropriate documentation boxes and the NIR. In response, Luxembourg stated that it would carry out a thorough analysis of the basic data for both approaches in its future submissions.

International bunker fuels

47. CO_2 emissions from bunker fuels are reported under memo items as required, but no estimates are reported for CH_4 or N_2O for both aviation kerosene and aviation gasoline. Luxembourg has no marine bunkers. For aviation bunkers, all aviation kerosene is assumed to be used for international air traffic, which is a reasonable approach. In the present CRF tables, no aviation gasoline is reported. During the in-country visit, a methodology was presented whereby a small part of aviation gasoline is allocated to international aviation based on expert judgement (namely, 10 per cent of the aviation gasoline allocated under bunker fuels). Luxembourg should apply this methodology to calculate CH_4 and N_2O emissions as well and include these estimates in the inventory. Luxembourg added CH_4 and N_2O from kerosene use in its revised estimates submitted during the review process, but emissions from aviation gasoline were not included.

Feedstocks and non-energy use of fuels

48. Luxembourg has no feedstocks and only a small non-energy use of fuels. In CRF table 1.A(d), lubricants and bitumen are reported for all years and white spirit for some years. However, the associated emissions (only from lubricants and white spirit, as all carbon in bitumen is considered to be stored) are not allocated anywhere. Luxembourg should quantify and allocate the related emissions, and explain the procedure and data used in the NIR.

Key categories

Electricity and heat production: gaseous fuels – CO_2

49. For the estimation of AD for CHP plants, the NIR indicates that an internal study was used. The method used in the study is not explained in the NIR. During the in-country visit, however, the study was made available. The method is an estimate based on production and consumption data for a few "example" plants, resulting in an average value for the amount of fuel used per megawatt (MW) installed for three types of plant (natural gas and diesel motors, and gas turbines). These averages are used to calculate the annual consumption of fuel, based on the power generation capacity (in MW installed) from

annual statistics provided by STATEC. The data in the CRF tables for 2002 and 2003 should be updated with the data from this study. The ERT believes that Luxembourg could improve these estimates by using actual data on energy use and production, which may be available from the energy administration. Overall, however, the method used for estimating these emissions does not influence the total use of gaseous fuels and can only affect the allocation of fuels (and emissions) between sectors.

50. A new gas turbine CHP plant started operation in 2002. The resulting emissions are allocated under the category manufacturing industries and construction (1.A.2), and not together with the other (smaller) CHPs which are allocated under the category public electricity and heat production (1.A.1(a)). The ERT suggests that transparency might be improved by allocating the new plant also under 1.A.1(a). In response, Luxembourg reallocated the data for this plant from manufacturing industries and construction – other (1.A.2(f)) to 1.A.1(a), as part of the revised estimates submitted during the review process. Luxembourg should confirm in its next submission that all CHPs allocated to 1.A.1(a) produce heat and power for public use only.

Manufacturing industries and construction: liquid/solid/gaseous fuels – CO_2

51. The NIR and CRF tables are not clear as to whether all industries are included in the category manufacturing industries and construction (1.A.2). For chemicals, pulp, paper and print, food processing, beverages and tobacco, the notation key "NE" is used. However, in reality these emissions are included in the subcategory manufacturing industries and construction – other (1.A.2(f)), and they should therefore be reported as included elsewhere ("IE"). During the in-country visit, it became clear that when the energy data from STATEC are rearranged to correspond better to the 1.A.2 subcategories, the final difference in fuel consumption (between the totals from the bottom-up approach used for the subcategories for which the energy use is known, and the overall national totals from STATEC) is allocated under 1.A.2(f). This also explains the large fluctuations in fuel use and emissions in this subcategory. Luxembourg should provide a more detailed explanation of this approach and its consequences in its NIR or CRF tables. In the revised submission presented during the review process, Luxembourg added the notation key "not occurring" ("NO") for subcategories chemicals (1.A.2(c)); pulp, paper and print (1.A.2(d)); and food processing, beverages and tobacco (1.A.2(e)). However, it should check whether it would be better to use the notation key "IE". Luxembourg has also reallocated the natural gas consumption by EAFs from industrial processes to 1.A.2(f). It would be better to include these under iron and steel (1.A.2(a)).

52. Luxembourg has and uses good AD for the iron and steel industry. The methodology, however, should be improved by using tier 2 methods. During the in-country visit, the use of tier 2 methods was discussed and the methodology was improved by Luxembourg in the revised estimates submitted following the in-country visit.

Road transport: liquid fuels – general

53. The use of liquefied petroleum gas (LPG) is indicated as "NE" in the CRF tables. However, what is reported under residual fuel oil is in fact LPG. This mistake was made when the data were transferred from the Environment Agency to the Ministry of Environment, which shows how multiple transfers can affect the quality of data. The ERT recommended that this error be corrected and unnecessary data transfers eliminated from the process of inventory preparation. Luxembourg made the corrections to the data for LPG (resulting in CO_2 emissions of 1.29 Gg from LPG for 1990) in its revised estimates submitted during the review process.

Road transport: liquid fuels – N_2O and CH_4

54. For road transport, N_2O and CH_4 emissions are reported in the CRF but not by fuel type. Luxembourg indicated that this is probably due to a problem with CRF Reporter. To enhance transparency, this problem should be solved and estimates should be reported for the individual fuels. In

response to this remark, Luxembourg included the emissions per fuel type in the CRF tables in its revised estimates submitted during the review process.

55. The COPERT III model has been used to estimate fuel consumption and GHG emissions for the national vehicle fleet of Luxembourg. This estimate shows that in 2004 only about one-quarter of fuels sold was actually used by the national vehicle fleet. The CO_2 emissions are upscaled by extrapolation using the national statistics on fuels sold, which means that the structure of the whole vehicle fleet purchasing fuel in Luxembourg was assumed to be the same of that of the national vehicle fleet. During the in-country visit, it was made clear that N_2O emissions have also been upscaled for gasoline and diesel oil, and CH_4 only for gasoline, also using a simple linear extrapolation. As the N_2O and CH_4 EFs are technology-dependent, this method assumes that the vehicle fleet of Luxembourg is representative of the total vehicle fleet that purchases fuel in Luxembourg. Given the large amount of fuel tourism and the fact that N_2O emissions from road transport is a key category, Luxembourg was encouraged to analyse whether this is actually a plausible assumption and to investigate whether other options are possible. Luxembourg was recommended also to upscale CH_4 emissions for diesel oil using the same method as for N_2O and include them in the inventory. In response to this remark, Luxembourg included CH_4 emissions from diesel oil (0.15 Gg CH_4 for 1990) as part of the revised estimates submitted following the in-country visit.

Other sectors: general

56. The population of Luxembourg grew by about 20 per cent between 1990 and 2004. There has also been an increase in the number of commuters coming to work in Luxembourg city. These changes are apparently not reflected in total energy use and emissions in Luxembourg because CO_2 emissions increased only by 5.4 per cent, and fuel use by about 8 per cent, over this period. During the in-country visit, the ERT did not receive a clear explanation of the much lower increase in fuel use and emissions, although references were made to an increase in energy efficiency, better insulation, and more efficient heating devices. The ERT recommends that Luxembourg analyse the CO_2 trends in more detail and explain them in its next NIR. Luxembourg proposes to improve the estimates for category 1.A.4 (other sectors) and to provide a split between the commercial/institutional sector and the residential sector in future submissions. The ERT welcomes the proposal as a means to facilitate trend analysis for these sub-categories.

Non-key categories

Electricity and heat production: liquid/solid/gaseous – CH_4 and N_2O

57. These CH_4 and N_2O emissions are reported as "NE" in the CRF tables for all years for liquid and gaseous fuels, and as "NE" for solid fuels from 1990 to 1997 ("NO" is reported for the period 1998–2004), although relevant emissions factors are reported in the NIR. The ERT encouraged Luxembourg to include these emissions in its CRF tables. In response, Luxembourg added estimates for CH_4 and N_2O for the appropriate years in the revised estimates submitted during the review process. For 1990, this revision resulted in the addition of 0.04 Gg CH_4 and 0.01 Gg N_2O.

Electricity and heat production: other – CO_2 and N_2O

58. The waste incinerator in Luxembourg produces electricity and should therefore be allocated under category 1.A.1(a) (public electricity and heat production) and not under the waste sector as in the 2006 inventory submission. The ERT noted that the same value for CO_2 emissions is reported for all years; it is based on expert judgement. During the in-country visit, Luxembourg made available exact data on the amount of waste incinerated and on waste composition for several years. With these data, better estimates of CO_2 emissions from waste incineration are possible. The ERT therefore recommended that Luxembourg calculate the emissions of the non-biogenic part for CO_2 and N_2O based on these data and include them in the inventory under other fuels in category 1.A.1(a) and describe the

methodology used in its next NIR. In response to this recommendation, Luxembourg recalculated the emissions from waste incineration and included these[5] under other fuels in 1.A.1(a) instead of category 6.C (waste incineration) in the revised estimates submitted during the review process (see paragraphs 111 and 112).

Manufacturing industries and construction – CH_4 and N_2O

59. Emissions of CH_4 and N_2O are reported as "NE" in 2002 and 2003 for liquid, solid and gaseous fuels, although AD are reported. The N_2O emissions from solid and gaseous fuels are indicated as "NE" for the years 1995–1998 and for 2000–2004. This creates inconsistencies in the time-series. In the revised estimates submitted during the review process, Luxembourg included estimates for these (minor) emissions.

Civil aviation: liquid – CO_2, CH_4 and N_2O

60. AD are reported as "NE" for all years. During the in-country visit, Luxembourg presented a methodology whereby aviation gasoline may be reported and divided between international flights and domestic flights based on expert judgement. For its next inventory submission, Luxembourg was encouraged to include emissions of CO_2, CH_4 and N_2O and to explain the method used in the NIR. In response, Luxembourg added the AD and emission estimates (0.24 Gg CO_2 for 1990) in the revised inventory submitted during the review process.

Railways: liquid fuels – N_2O and CH_4

61. These N_2O emissions are reported as "NE" for the years 1995–2001 and CH_4 emissions are reported as "NE" for all years. Since AD are available for all years, these emissions should be estimated and included in the inventory. Luxembourg provided estimates of N_2O and CH_4 for this category in the revised inventories submitted following the in-country visit.

Navigation: liquid fuels – N_2O

62. The N_2O emissions are reported as "NO" or "NE". The AD are the same for all years and are based on expert judgement. Luxembourg was encouraged to investigate whether a different method might be used to estimate these AD and emissions. Luxembourg provided estimates of N_2O for this category in the revised inventories submitted following the in-country visit.

Other sectors: all fuels – N_2O

63. The N_2O emissions from other sectors are reported as "NE" for all years for gaseous and solid fuels. For liquid fuels, N_2O is reported as "NE" in 2000, 2003 and 2004. Possibly, this is due to the truncation problem (the loss of data during data transfers). The ERT recommended that these emissions be estimated and included in the inventory. Luxembourg provided estimates of N_2O for this category (0.01 Gg N_2O for 1990) in the revised inventories submitted following the in-country visit.

Memo items: biomass

64. Biomass use is reported only for other sectors (category 1.A.4). The AD come from STATEC and are more or less stable for all years. Other sources, however, indicate that the use of wood stoves and biogas from composting have been increasing over the last few years. If additional data reflecting this trend become available from other sources in Luxembourg, estimates for future years may be improved and used in the inventory. For example, the administration of water and forests has data on the wood harvested in public forests and makes estimates of harvesting in private forests. The forestry information system could be analysed to help improve the data used for biomass combustion.

[5] 33.29 Gg CO_2, 0.04 Gg CH_4 and 0.01 Gg N_2O for 1990.

6. Industrial processes

Sector overview

65. In the base year 1990 (1995 for the fluorinated gases (F-gases)), the industrial processes sector accounted for 12.2 per cent and the solvent and other product use sector for 0.1 per cent of total national emissions in Luxembourg. Emissions from industrial processes decreased by 54.4 per cent between 1990 and 2004, mainly due to a complete transition from basic oxygen furnaces (BOFs) to EAFs in steel production. As a result, in 2004 the share of industrial processes in total GHG emissions was only 5.5 per cent. The GHG emissions from solvent and other product use decreased by 19.3 per cent between 1990 and 2004. Their share in total GHG emissions remained the same in 2004 as it was in 1990 (0.1 per cent).

66. The 2006 submission is complete for CO_2 but no estimates for N_2O or CH_4 are provided for the industrial processes sector. For the F-gases, actual emissions of HFCs and SF_6 are reported, but no estimates for PFCs or of potential emissions are provided, and relevant background data are not reported. The ERT recommends that Luxembourg improve the completeness of its reporting by providing estimates for N_2O and CH_4 emissions where appropriate. A complete time-series of data on the use of N_2O for anaesthesia were provided and included in the revised estimates submitted after the in-country visit.

67. To increase transparency, the ERT recommends that Luxembourg provide in the NIR more explanations on data sources, EFs, methodologies, AD and the emission trends observed. Transparency in the CRFs would be improved by providing completed background tables for the F-gases. The information in the NIR is not always consistent with that in the CRF, and Luxembourg should address this issue in its next inventory submission.

68. No recalculations have been made in the 2006 submission. Several recalculations were, however, made as a result of the discussions during the in-country visit, and submitted as revised estimates to the ERT for consideration. The recalculations are further discussed for the individual categories below. New information on emissions or EFs had originally not been treated according to good practice for recalculations and time-series consistency. For example, when new information on the EF for glass production was obtained (see paragraph 77) no assessment was made of whether data for earlier years should be recalculated to ensure a consistent time-series. Furthermore, based on the point estimates for 1995 and 2000 for emissions of F-gases, a constant value equal to the value for 1995 is reported until 1999, and there is then a sudden change to the point estimate for the year 2000. Good practice would have been to interpolate emission values for the intermediate years. In the revised estimates provided by Luxembourg in response to the recommendations during the in-country visit, these deviations from good practice had been attended to (see paragraphs 78, 79 and 82).

69. No formal QA/QC procedures exist for the sector and no uncertainty estimates are reported. In Luxembourg's response to the discussions during the in-country visit, some quantitative uncertainty estimates were provided with the revised estimates. Planned improvements are mentioned in the NIR in general terms, such as revising AD and EFs, but are generally not further specified.

Key categories

Cement production – CO_2

70. Emissions have been estimated using the CORINAIR "simple" methodology, which corresponds to the IPCC tier 1 method. As this is a key category, a tier 2 methodology should be used according to the IPCC good practice guidance. A constant plant-specific EF, which is somewhat higher than the IPCC default, has been used but is not transparently explained in the NIR. During the in-country visit new calculations for 1990 and 2004 based on a tier 2 method were presented to the ERT.

71. The ERT welcomed the effort made by Luxembourg to apply the appropriate tier for this key category and recommended that the entire time-series be recalculated according to the tier 2 method as presented, since all the required plant-specific information is available. In the revised estimates which Luxembourg subsequently submitted the tier 2 method is used to estimate CO_2 emissions for the full time-series, based on five-yearly plant-specific data on lime (CaO) content and annual clinker production. The revision increased estimated CO_2 emissions in 1990 by 6.5 Gg, from 550.6 to 557.1 Gg CO_2. The revised estimation method should be transparently described in Luxembourg's next NIR.

Iron and steel production – CO_2

72. In the period 1990–2004, a complete transition from BOF steel production to EAF took place in Luxembourg. Emissions from all processes covered in iron and steel production have been estimated using the CORINAIR "simple" methodology (a tier 1 method). Since this is a key category, a tier 2 methodology should be used according to the IPCC good practice guidance. During the in-country visit new calculations based on a tier 2 method were presented to the ERT. The method was applied for 1990 for blast furnaces and BOF steel production, and for 2004 for EAF steel production.

73. According to information provided during the in-country visit, detailed data concerning blast furnaces and BOF steel production are available for 1990, taking into account all carbon-containing materials in a carbon balance, as required for the tier 2 methodology. EFs can be derived from the 1990 data and used for subsequent years. Blast furnace gas is allocated to the energy sector.

74. The ERT recommended that Luxembourg revise the relevant time-series (1990–1997) for basic oxygen steel production in line with the new calculations. In the revised estimates provided to the ERT during the in-country visit, the tier 2 method has been applied. The EFs are derived from the detailed calculations for 1990 and used for subsequent years. Emissions are calculated and reported separately for sinter production, blast furnaces and basic oxygen furnaces. The new method improves transparency and is according to good practice. The new calculations increase estimated CO_2 emissions by 23.1 Gg in 1990, from 961.8 to 984.9 Gg.

75. In the emission estimates for EAF steel production, plant-specific data on the use of anthracite, carbon and electrodes as well as natural gas acting as a reducing agent were included. New calculations for 2004, which were presented during the in-country visit, exclude the use of natural gas, which instead is allocated to the energy sector. This is in line with the IPCC good practice guidance.

76. The ERT recommended that the Party recalculate, for its next submission, the relevant time-series (1993–2004) for EAFs according to that tier 2 method, and to investigate whether additional detailed information on carbon contents in input materials taken from the European Union emissions trading scheme (EU ETS), permit schemes or a detailed mass balance approach can be applied retrospectively to ensure consistency in the time-series. In the revised estimates provided to the ERT a tier 2 method based on a detailed carbon balance available for 2004 has already been applied. Information on the carbon content in input material (scrap, electrodes, anthracite and carbon) and carbon remaining in steel products was used in the calculation. Based on the 2004 calculations, an EF for EAF steel production is derived and used for earlier years. According to the revised calculations the emissions from EAF steel production would decrease from 240.3 to 152.4 Gg CO_2 in 2004, partly because with this method the natural gas used is allocated to the energy sector. The revised methodologies for estimating emissions from BOF and EAF steel production are in line with the IPCC good practice guidance and should be transparently reported in Luxembourg's next NIR.

Non-key categories

Other mineral products: glass production – CO_2

77. The AD used for calculating CO_2 emissions from float glass production are reported to be the same in all years, corresponding to the plant capacity according to the operating permit rather than to actual production data. Furthermore, the EF is given as constant for the period 1990–1999, with a subsequent considerable change upwards in 2000. The new, higher EF (0.142 t CO_2/t glass) has been used for subsequent years. The information provided to the ERT during the in-country visit showed that there is no justification for this sudden change in the EF.

78. New calculations for 1990 and 2004 were presented during the in-country visit, based on the actual production data and a constant plant-specific EF identical to the one used for the years 2000–2004 (0.142 t CO_2/t glass). These preliminary calculations are in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance and their results are consistent with other available estimates based on information on raw material input from the EU ETS, with a resulting EF of 0.14 t CO_2/t glass, which confirms that the use of the higher EF is appropriate.

79. The ERT recommended that Luxembourg recalculate the whole time-series for this category according to the calculations presented for 1990 and 2004. In the revised estimates provided to the ERT the full time-series was recalculated according to the recommendations, including the use of actual annual production data and a constant EF of 0.142 t CO_2/t glass. The revised estimates have improved the accuracy of the inventory and time-series consistency by using actual production data and revising the EF for earlier years. The revised estimates increase estimated emissions of CO_2 by 13.6 Gg, from 40.0 to 53.6 Gg CO_2 in 1990.

Food and drink – CO_2

80. Estimates of CO_2 are reported from this category. According to the Revised 1996 IPCC Guidelines, CO_2 emissions from this source should not be accounted for if they are of biogenic origin. During the in-country visit it was confirmed by means of other documentation that the CO_2 is indeed of biogenic origin. In accordance with the ERT's recommendation and notification on this being a potential problem, Luxembourg removed the estimated CO_2 emissions for the entire time-series from the inventory in the revised submission. This decreases estimated emissions in 1990 by 3.4 Gg CO_2.

Consumption of halocarbons and SF_6 – HFCs and SF_6

81. The reported emissions of HFCs and SF_6 are based on estimated data for 1995 and 2000. The emissions in 1990–1999 are assumed to be the same as in 1995 and those in 2000–2004 to be the same as in 2000. Since HFCs in many applications were a substitute for chlorofluorocarbons (CFCs), and generally only entered into widespread use a few years after 1990, the estimates of HFC emissions for 1990 are probably overestimated by this assumption. However, the base year for F-gases is 1995, and preliminary data from a new draft study on F-gases in Luxembourg confirm that the level of emissions reported for 1995 is reasonable.

82. In response to recommendations by the ERT during the in-country visit, Luxembourg applied interpolation of HFC and SF_6 emissions in the revised estimates it provided so that the same value does not apply for several consecutive years. In addition, the previously aggregated emission estimates reported as an unspecified mix of HFCs have been disaggregated and emissions are reported for individual HFC species in the revised estimates.

83. The ERT recommends that Luxembourg use information from the new draft F-gas study and recalculate the emissions for the whole time-series for its next submission. The ERT further recommends that AD and EFs be reported in the relevant background tables of the CRF.

7. Agriculture

Sector overview

84. The GHG inventory reported in 2006 contains emission estimates for three categories: enteric fermentation, manure management and agricultural soils. Several categories have not been reported (e.g., N_2O emissions from manure management, direct N_2O from animal manures, direct N_2O from crops and pastures and indirect N_2O from nitrogen deposition and leaching) and not all the CRF tables have been completed (e.g., table 4.F). The inventory is thus far from complete. Following the recommendation of the ERT and its recognition of this serious problem of completeness, during the in-country visit Luxembourg initiated a comprehensive revision of the emission estimates for the agriculture sector intended to cover all sources.

85. The revision by Luxembourg produced recalculated estimates for the whole time-series, which were included as part of the revised inventories submitted to the ERT during the review process. They were prepared in a manner that makes full use of the available national statistics for agriculture and country-specific EFs where such factors could be developed. In all other cases the IPCC default data on EFs and other parameters needed for the calculations have been strictly applied. The ERT welcomed this major revision of the inventory and believes that it improves the quality of the estimates considerably. It brings a satisfactory level of transparency, consistency and comparability to the emissions time-series. The ERT now recommends that the new approach be consolidated and further developed to deliver consistent results in future submissions. Given the extent of the changes for the agriculture sector, the following assessment refers mainly to the revised estimates.

86. In 1990, emissions from the agriculture sector amounted to 756.9 Gg CO_2 eq. or 5.75 per cent of total national emissions. The principal categories were CH_4 emissions from enteric fermentation (category 4.A) and N_2O emissions from agricultural soils (category 4.D), contributing 35.8 and 47.5 per cent, respectively, of total sectoral emissions. Emissions from agriculture decreased by 65.4 Gg CO_2 eq., or by 8.6 per cent, from 756.9 Gg CO_2 eq. in 1990 to 691.6 Gg CO_2 eq. in 2004 due to a reduction in the cattle population and in the use of synthetic fertilizers.

87. Luxembourg had identified two key categories in the agriculture sector in the incomplete inventory of the 2006 submission. These are CH_4 from enteric fermentation and direct N_2O emissions from agricultural soils. In the revised submission received during the review direct N_2O emissions from agricultural soils is the only key category in 1990, accounting for 2.73 per cent of total national emissions.

88. The NIR of the 2006 submission does not include any uncertainty analysis or description of QA/QC procedures for the agriculture sector.

Key categories

Direct emissions from agricultural soils – N_2O

89. In its 2006 submission, Luxembourg had calculated direct N_2O emissions from agricultural soils only for the category synthetic fertilizers (category 4.D.1), using the CORINAIR method, which means that the reporting for this category is substantially incomplete. The ERT suggested that sufficient AD are available to estimate all relevant emissions from agricultural soils in Luxembourg and that the 1996 Revised IPCC Guidelines and the IPCC good practice guidance provide a simple approach, together with extensive default data on EFs and other parameters, for calculating these emissions. The ERT recommended that Luxembourg prepare the estimates on this basis and submit the revised estimates for the full time-series from 1990 to 2004. The submission of revised data received during the review reflects full implementation of this recommendation with strict application of the IPCC methodologies

and default data. As a result of the revision, direct N_2O emissions from agricultural soils in 1990 increased from 0.47 to 0.52 Gg.

90. All relevant categories within 4.D are covered by the new estimates and CRF table 4.D has been fully completed to show emissions and the corresponding nitrogen (N) inputs. Luxembourg includes sewage sludge spreading as a specific item under other direct emissions (4.D.1.6). The emissions in category 4.D contributed 89.8 per cent of N_2O emissions in the agriculture sector and 76.4 per cent of total national N_2O emissions in 1990. The principal emission subcategories are synthetic fertilizers (4.D.1.1) and nitrogen leaching and run-off (4.D.3.2), which accounted for 28.6 and 32.8 per cent, respectively, of the emissions in category 4.D in 1990.

Non-key categories

Enteric fermentation – CH_4

91. Enteric fermentation is the main source of CH_4 emissions in Luxembourg, contributing 58.9 per cent to total national CH_4 emissions in 1990. Cattle accounted for 98.4 per cent of CH_4 emissions from enteric fermentation and Luxembourg uses the option B characterization for cattle to report these emissions and other background data in the CRF tables. The main subcategories are mature dairy cattle, with 48.1 per cent of the emissions from enteric fermentation in 1990, and young cattle with 38.7 per cent.

92. Luxembourg uses the tier 2 method to estimate emissions of CH_4 from enteric fermentation in the three basic animal classes (mature dairy, mature non-dairy and young cattle) adopted to characterize the cattle population using STATEC population data. The estimation of gross energy intake to derive EF follows the IPCC good practice guidance closely and the national data for relevant parameters are taken from official publications of STATEC and the Service d'Economie Rurale (SER).

93. The implied emission factor (IEF) for mature dairy cattle reported by Luxembourg in its 2006 submission is 121.8 kg/head for all years in the period 1990–2004, and the ERT questioned this as being too high for the base year. The new analysis for dairy cattle, reflected in the revised estimates provided during the review process, produces CH_4 EFs ranging from 105.4 kg/head in 1990 to 125.4 kg/head in 2004, which are among the highest reported by Annex I Parties. These values are valid and are driven by high milk yield, which increased from 4,787 kg/head/yr in 1990 to 6,734 kg/head/yr in 2004. Overall, as a result of the revision, CH_4 emissions from enteric fermentation in 1990 increased from 9.37 to 12.90 Gg. The high milk yields are confirmed by the SER and reflect the move towards high yield and lower population resulting from reform of the EU common agricultural policy (CAP). The dairy cattle population decreased by one-third in Luxembourg between 1990 and 2004.

94. The EF for mature female non-dairy cattle is 54.73 kg/head for all years 1990–2004 while that for mature male non-dairy cattle is 53.22 kg/head over the same period. Luxembourg uses the subcategories of calves and growing heifers to represent the young cattle class. The derived EF for calves increases slightly from 31.3 kg/head in 1990 to 31.45 kg/head in 2004, and that for growing heifers varies from 43.85 kg/head to 43.91 kg/head over the period. The ERT is satisfied that Luxembourg's EFs for non-dairy cattle are appropriate for use in estimating CH_4 from enteric fermentation and they are broadly in line with those of other Annex I Parties.

Manure management – CH_4

95. Luxembourg uses detailed national information on animal waste management systems (AWMS) together with default data in table B1 of the Revised 1996 IPCC Guidelines to develop EF to calculate CH_4 emissions from manure management. The animal characterization is the same as that used under enteric fermentation (4.A). The estimates are in accordance with good practice. This is a very minor

source of emissions in Luxembourg, accounting for only 0.65 per cent of total national emissions in 1990.

Manure management – N_2O

96. Luxembourg uses national information on nitrogen excretion and AWMS along with IPCC default EFs to calculate CH_4 emissions from manure management. The adopted values of nitrogen excretion are appropriate and the estimates are in accordance with the IPCC good practice guidance. This is a very minor source of emissions in Luxembourg, accounting for only 0.31 per cent of total national emissions in 1990.

8. Land use, land-use change and forestry

Sector overview

97. Luxembourg provides data in the CRF tables only under other (5.G). A "carbon intake by temperate forests" of 294.93 Gg CO_2 and an "N_2O emission of broadleaf and coniferous forests" of 0.07 Gg are reported. The amount of the sink equals 2.2 per cent of total national GHG emissions in CO_2 eq. in 1990. Luxembourg has stated that the values reported are only a rough estimate calculated in 1996. The value is applied as a constant for all years from 1990 to 2004. According to Luxembourg, this estimate was put under the category other (5.G) to reflect the rough character of the estimate. The ERT recommends Luxembourg to put the data, even when they are only a rough estimate, in the appropriate category (such as forest land) and to fill in the relevant background tables and use the documentation boxes to provide complementary explanations. In all the sectoral background tables from 5.A to 5.F and 5(I) to 5(V), the notation keys are used. No data on land use, land-use change and stock change on the different land-use categories and activities are reported. The LULUCF sector is not included in the key category analysis of the inventory. The ERT encourages Luxembourg in future to include the sector in the key category analysis according to the IPCC good practice guidance for LULUCF. The key category analysis by the secretariat identifies other (5.G) as a key category.

98. The ERT noted that Luxembourg has comprehensive information to report on land use and land-use change. Detailed land-use maps from 1989 and 1999 were presented to the ERT during the in-country visit. The ERT was also informed that Luxembourg has started a project in cooperation with the European Space Agency within the framework of the Global Monitoring for Environment and Security (GMES) using satellite techniques for land-use information. The ERT believes that the available data allow Luxembourg to improve its reporting on the LULUCF sector considerably, and recommends that Luxembourg apply approach 2 or 3 of chapter 2 of the IPCC good practice guidance for LULUCF to provide a land-use change matrix for all land-use categories. The ERT encourages Luxembourg also to make agreements with different institutions which can provide information for carbon stock changes or for emissions from certain activities for the reporting of LULUCF.

Key categories

Forest land remaining forest land – CO_2

99. The ERT is of the opinion that the value reported under other (5.G) should be reclassified and reported under forest land remaining forest land (5.A.1). Forest land remaining forest land is therefore treated as a key category in this review and not as category other (5.G), which would be a key category according to both the CRF tables of Luxembourg and the key category analysis of the secretariat. A short document on the calculation of the rough estimate of the carbon (C) stock change was provided during the review. From this documentation an IEF of 2.41 Mg C/ha for gains in the C stock in living biomass could be derived. This value is similar to the IEFs of neighbouring countries.

100. The Administration on Waters and Forests is responsible by law for collecting data on forests and forest management. The ERT was informed that the information system maintained by the

Administration of Waters and Forests records, among other parameters, detailed data on stock and harvesting in public forests, which cover 47 per cent of the forested area. The information on private forests is estimated by officials. The harvesting data are reported in the *Statistical Yearbook of Luxembourg* (published by STATEC). Detailed statistics on forest fires are also available in Luxembourg. In 1999–2000 the first National Forest Inventory was carried out. It will be repeated in 2009–2010 and will increase data availability and data quality. There have been legal controls on deforestation since 1905. The law has been tightened in several successive steps, and since 1982 any afforestation or deforestation has needed a ministerial permit. Information on these activities can therefore be found in the relevant legal proceedings.

101. The ERT concluded that Luxembourg has a good information basis to report on carbon stock change of forests and on conversions from and to forest. It encourages Luxembourg to use the available data and to calculate consistent emission/removal estimates for this category for the whole time-series. The ERT also recommends that Luxembourg use the relevant methodological guidance provided in chapter 5 of the IPCC good practice guidance for LULUCF.

9. Waste

Sector overview

102. Luxembourg's 2006 inventory submission reports estimates of CH_4 from solid waste disposal on land and CO_2 emissions from waste incineration. During the review, recalculated inventories for all years were submitted, which included emissions of CH_4 and N_2O from wastewater handling. The notation key "IE" has been used for all emissions from waste incineration, the relevant emissions being reallocated to the energy sector because they are associated with energy recovery. In the revised estimates, the waste sector contributed 0.38 per cent (49.5 Gg CO_2 eq.) to total national GHG emissions in 1990, a much smaller proportion than for most Annex I Parties. CH_4 emissions from the waste sector contributed 9.3 per cent to total national CH_4 emissions. In 2004, the corresponding contributions were 0.33 and 6.4 per cent, respectively. Most of the sectoral GHG emissions stemmed from solid waste disposal on land (86.2 per cent in 1990 and 54.2 per cent in 2004). There are no key categories in the waste sector.

103. Sectoral GHG emissions decreased by 10.8 per cent between 1990 and 2004. This change is due to an increase in the amount of waste recycled and waste incinerated, with a simultaneous decline in the amount of waste landfilled at solid waste disposal sites – by 22.6 per cent between 1990 and 2004.

104. All the sectoral CRF tables have been provided. However, in some cases the notation keys have been used incorrectly. The ERT recommends that Luxembourg revise the use of the notation keys and provide in the NIR more detailed information on the methodologies, AD and EFs used in the waste sector. Luxembourg should also make better use of the documentation boxes in the CRF tables and comment more extensively in the NIR on the results of the emission estimates.

105. No QA/QC procedures are reported and no assessment of uncertainties has been attempted. The ERT recommends that Luxembourg assess the uncertainties, elaborate on them in the NIR and use them in data processing (e.g., in interpolation).

Non-key categories

Solid waste disposal on land – CH_4

106. In the base year, CH_4 emissions from solid waste disposal on land accounted for 9.3 per cent of total national CH_4 emissions and for all sectoral CH_4 emissions reported by Luxembourg. The IPCC tier 2 method has been used to estimate these emissions. The composition of municipal solid waste and the parameters used in the first order decay (FOD) model are not provided. The ERT recommends that

Luxembourg fill in this gap in its future submissions, and provide a flow diagram with a mass balance and the solid waste composition.

107. The CH_4 emission estimates from solid waste disposal on land (6.A) for the whole time-series 1990–2004 are based on AD for the period 1975–2004. In the emission estimates made, Luxembourg assumes that all national landfill sites have been fully managed since 1975. Accordingly, Luxembourg uses the value of 1.0 for the methane correction factor (MCF) in the FOD model. However, for the period 1975–1990, no information on actual waste management practices is provided in the NIR and the ERT did not receive such information during the in-country visit. If any of the sites for waste disposal were unmanaged at any time during the period 1975–1990, a lower value of the MCF, reflecting the applicable proportions of managed to unmanaged waste, should be used in the FOD model to be in line with the IPCC good practice guidance.

108. During the in-country visit, the ERT requested Luxembourg to provide evidence of the landfill management practices during the indicated period (1975–1990) and to recalculate the CH_4 emissions using an appropriate value of the MCF if not all landfilled waste was fully managed during that period. In its response, Luxembourg provided some justification for its approach by stating that solid waste disposal practice after 1975 at the landfills concerned would come within the definition of managed sites, as given by the IPCC guidelines with waste incineration taking over from the poorly managed sites. The ERT accepts this explanation.

109. The SIDA[6] waste disposal site was closed in January 1994. Its CH_4 emissions are not taken into account in the 2006 inventory submission, although such emissions do still occur at sites that have been closed. The ERT recommended that Luxembourg include this source category in the inventory and calculate the corresponding emissions for the whole time-series. This was done in the revised estimates submitted during the review process. Overall, as a result of the revision, CH_4 emissions from solid waste disposal on land in 1990 increased from 1.55 to 2.03 Gg.

Wastewater handling – CH_4 and N_2O

110. Emissions from wastewater treatment plants are not estimated in the 2006 submission. During the in-country visit, the Party presented an overview of this source category and new estimates of CH_4 and N_2O emissions. The estimates for N_2O are based on 70 per cent denitrification rates for biological wastewater treatment plants with denitrification and 35 per cent in plants without denitrification, and assume that 1 per cent of the denitrified N is emitted as N_2O. The ERT recommended that Luxembourg include these estimates in the inventory and they were provided in the revised estimates submitted during the review process. This is a very minor source of emissions (6.9 Gg CO_2 eq. in 1990 and 7.3 Gg CO_2 eq. in 2004) but the estimates improve completeness.

Waste incineration – CO_2 and N_2O

111. The CO_2 emissions from waste incineration were reported as a constant value (10.0 Gg) in the 2006 submission based on expert judgement of the non-biogenic fraction of the waste incinerated, and N_2O emissions are not reported. The information provided to the ERT during the in-country visit showed that Luxembourg has sufficient data to derive improved estimates for CO_2 emissions from waste incineration that take account of the actual amount of non-biogenic waste incinerated and to include estimates of N_2O emissions. The ERT recommended that Luxembourg use the Revised 1996 IPCC Guidelines and the IPCC good practice guidance to estimate these emissions accurately and that it include them in the whole time-series from 1990 to 2004. The ERT also noted that CO_2 emissions from waste incineration should be reported under the energy sector because waste incineration is used for energy production.

[6] SIDA: Syndicat de communes pour la collecte, l'évacuation et l'élimination des ordures provenant des communes de la région de Wiltz et du nord du pays

112. In response to the ERT's recommendations, a new time-series of emission estimates was developed for CO_2, CH_4 and N_2O from waste incineration and they were reported in the CRF category other fuels (1.A.1(a)). Total emissions from the category increased from 36.2 Gg CO_2 eq. in 1990 to 69.5 Gg CO_2 eq. in 2004. The IPCC tier 2 method is used for CO_2 taking full account of waste composition and the fossil carbon fractions in waste components.

C. Calculation of the assigned amount

113. The assigned amount pursuant to Article 3, paragraphs 7 and 8, is calculated in accordance with the annex to decision 13/CMP.1 using the inventory data referenced in the initial report.

114. Luxembourg's base year is 1990 for CO_2, CH_4 and N_2O and the Party has chosen 1995 as the base year for HFCs, PFCs and SF_6. Luxembourg's quantified emission reduction is 92 per cent as included in Annex B to the Kyoto Protocol. As Luxembourg is part of the European Community, whose member States will meet their reduction commitment jointly in accordance with Article 4 of the Kyoto Protocol, Luxembourg's quantified emission reduction is 72 per cent. Luxembourg's assigned amount is calculated on the basis of its Article 4 commitment.

115. Land-use change and forestry did not constitute a net source of GHG emissions in 1990. Therefore, according to decision 13/CMP.1 the Party's aggregate anthropogenic carbon dioxide eq. emissions by sources minus removals by sinks in 1990 from land-use change (deforestation) are not relevant to the calculation of the assigned amount.

116. Based on Luxembourg's base year emissions – 12,686.690 Gg CO_2 eq. – and its quantified emission reduction (72 per cent), the Party calculated and presented in the initial report its assigned amount as 45,672,086 tonnes CO_2 eq.. However, in its response to inventory issues identified during the review the Party submitted revised estimates of its base year inventory, which resulted in a recalculation of the assigned amount. Based on the revised total emissions of 13,167.499 Gg CO_2 eq. in the base year, the Party calculates its assigned amount to be 47,402,996 tonnes CO_2 eq. The ERT agrees with this figure.

D. Calculation of the commitment period reserve

117. The calculation of the required level of the commitment period reserve is in accordance with paragraph 6 of the annex to decision 11/CMP.1.

118. Based on its original calculated assigned amount – 45,672,086 tonnes CO_2 eq. – Luxembourg calculated and presented in the initial report its commitment period reserve as 41,104,877 tonnes CO_2 eq. In response to inventory issues identified during the review Luxembourg submitted revised estimates of its base year inventory, which resulted in a recalculation of the commitment period reserve. Based on the revised total emissions of 13,167.499 Gg CO_2 eq., the Party calculates its commitment period reserve to be 42,662,696 tonnes CO_2 eq. The ERT agrees with this figure.

E. National registry

119. In its initial report, Luxembourg provided very limited information on the national registry system required by the reporting guidelines under Article 7, paragraphs 1 and 2, of the Kyoto Protocol (decision 15/CMP.1). The information provided is transparent and broadly follows these reporting requirements. The ERT recommends that Luxembourg provide complete and detailed information on the registry in its next inventory report under the Kyoto Protocol.

120. During the in-country visit, the ERT was provided with additional and updated information on the national registry of Luxembourg, which is managed in close cooperation with the national registry of Belgium. In particular, the ERT was informed that adequate measures are taken to safeguard, maintain and recover data in the event of disaster and that adequate security measures are in place. The ERT was

also informed that with the software in use at that time the national registry conformed to the technical standards for data exchange between national registry systems and the EU Community independent transaction log (CITL) registry system.

121. At the time of the in-country visit, Luxembourg had an operating registry within the EU ETS. This registry had been fully operational since May 2006. It is located in Belgium and uses the same hardware and software as the Belgian registry, in accordance with an agreement between Luxembourg and Belgium. The registry software was developed and supplied, for both Luxembourg and Belgium, by Seringas, a French company. Information on the EU ETS registry is publicly available through the Internet at URL <http://www.environnement.public.lu/air_bruit/dossiers/registre_national_quotas_GES/index.html.>.

122. During the in-country visit, the ERT was informed that Luxembourg was in the process of changing the registry software, as part of its transition from the EU ETS registry to the Kyoto Protocol registry. The transition from the Seringas software to the Community registry software (CRS) was under way and the new software was expected to be available in August/September 2007. The initialization process was expected to be completed by October and the registry to be fully operational by 1 December 2007.

123. Table 5 summarizes the information on the mandatory reporting elements on the national registry system, as stipulated by decisions 13/CMP.1 and 15/CMP.1.

Table 5. Summary of information on the national registry system

Reporting element	Provided in the initial report	Comments
Registry administrator		
Name and contact information	No	Provided during the in-country visit
Cooperation with other Parties in a consolidated system		
Names of other Parties with which Luxembourg cooperates, or clarification that no such cooperation exists	Yes	Registry operated jointly with that of Belgium
Database structure and capacity of the national registry		
Description of the database structure	No	Provided during the in-country visit
Description of the capacity of the national registry	No	Provided during the in-country visit
Conformity with data exchange standards (DES)		
Description of how the national registry conforms to the technical DES between registry systems	No	Covered in the independent assessment report (IAR)
Procedures for minimizing and handling of discrepancies		
Description of the procedures employed in the national registry to minimize discrepancies in the transaction of Kyoto Protocol units	No	Provided during the in-country visit
Description of the steps taken to terminate transactions where a discrepancy is notified and to correct problems in the event of a failure to terminate the transaction	No	Provided during the in-country visit
Prevention of unauthorized manipulations and operator error		
An overview of security measures employed in the national registry to prevent unauthorized manipulations and to prevent operator error	No	Provided during the in-country visit
An overview of how these measures are kept up to date	No	
User interface of the national registry		
A list of the information publicly accessible by means of the user interface to the national registry	No	Provided during the in-country visit
The Internet address of the interface to Luxembourg's national registry	Yes	

Reporting element	Provided in the initial report	Comments
Integrity of data storage and recovery		
A description of measures taken to safeguard, maintain and recover data in order to ensure the integrity of data storage and the recovery of registry services in the event of a disaster	No	Provided during the in-country visit
Test results		
The results of any test procedures that might be available or developed with the aim of testing the performance, procedures and security measures of the national registry undertaken pursuant to the provisions of decision 19/CP.7 relating to the technical standards for data exchange between registry systems.	No	Covered in the independent assessment report (IAR)

Note: Pursuant to decision 16/CP.10, once registry systems become operational, the administrator of the international transaction log (ITL) is requested to facilitate an interactive exercise, including with experts from Parties to the Kyoto Protocol not included in Annex I to the Convention, demonstrating the functioning of the ITL with other registry systems. The results of this exercise will be included in an independent assessment report (IAR). They will be also included in its annual report to the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol.

124. The ERT was also informed on the procedures and security measures in place to minimize discrepancies, terminate transactions and correct problems, and minimize operator error. These procedures and security measures are explicitly defined in the terms of reference of the registry-hosting company. In particular, they include internal checks and reconciliation procedures.

125. The ERT acknowledged the efforts made by Luxembourg to put in place adequate procedures and security measures. The registry system is provided with a secure sockets layer/virtual private network (SSL/VPN) secure login, dedicated servers, full redundancy, firewalls and virus check. It has also a redundant power supply, an emergency power supply for long outages and a redundant fire detection system. The ERT gained the overall impression that Luxembourg attaches adequate importance, and allocates adequate resources, including human resources, to the development, operation and maintenance of the registry.

126. During the in-country visit, the ERT recommended that the Party expedite, as far as practicable, the implementation schedule for the registry, including the switch to the new Community registry software, in order to comply with the relevant requirements of the Kyoto Protocol.

127. The ERT noted the results of the technical assessment of the national registry, including the results of standardised testing, as contained in the independent assessment report (IAR) forwarded to the ERT on 10 December 2007 by the UNFCCC secretariat as the administrator of the international transaction log (ITL) pursuant to decision 16/CP.10 as well as of the additional information forwarded to the ERT by Luxembourg on 28 July 2007. The ERT reiterated the overall findings of the IAR, i.e. that the registry fulfils all the obligations regarding conformity with the data exchange standards (DES). These obligations include having adequate transaction procedures, adequate security measures to prevent and resolve unauthorised manipulations and adequate measures for data storage and registry recovery. The ERT therefore concluded that the registry is fully compliant with the registry requirements defined in decisions 13/CMP.1 and 5/CMP.1, noting that registries do not have obligations regarding operational performance or public availability of information prior to the operational phase.

F. Land use, land-use change and forestry parameters and election of activities

128. Table 6 shows Luxembourg's choice of parameters for forest definition and accounting method for Article 3, paragraph 3, activities in accordance with decision 16/CMP.1. These values selected are within the agreed ranges for these parameters as specified in decision 16/CMP.1. The values selected are also consistent with what Luxembourg has reported to the Food and Agriculture Organization of the

United Nations (FAO). Luxembourg has not selected any activities under Article 3, paragraph 4 of the Kyoto Protocol.

Table 6. Selection of LULUCF parameters

Parameters for forest definition		
Minimum tree crown cover	10 %	
Minimum land area	0.5 ha	
Minimum tree height	5 m at maturity	
Elections for Article 3, paragraphs 3 and 4, activities		
Article 3, paragraph 3 activities	**Election**	**Accounting period**
Afforestation and reforestation	Mandatory	Commitment period
Deforestation	Mandatory	Commitment period
Article 3, paragraph 4, activities		
Forest land management	Not elected	Not applicable
Cropland management	Not elected	Not applicable
Grazing land management	Not elected	Not applicable
Revegetation	Not elected	Not applicable

III. Conclusions and recommendations

A. Conclusions

129. The ERT concludes that the information provided by Luxembourg in its initial report is complete and is submitted in accordance with the provisions of paragraphs 5, 6, 7 and 8 of the annex to decision 13/CMP.1, section I of the annex to decision 15/CMP.1 and other relevant decisions of the CMP; that the assigned amount pursuant to Article 3, paragraphs 7 and 8, is calculated in accordance with the annex to decision 13/CMP.1, and is consistent with the revised inventory estimates as submitted and reviewed; and that the calculation of the required level of the commitment period reserve is in accordance with paragraph 6 of the annex to decision 11/CMP.1, and the LULUCF definitions are within the agreed range.

130. During the review Luxembourg made major improvements to its GHG inventory by performing a substantial amount of recalculations using methods that the ERT finds to be in accordance with the revised 1996 IPPC guidelines and the IPCC good practice guidance. These recalculations improve the transparency, completeness, consistency and accuracy of the inventory. By submitting the revised inventories and by supplying the additional information requested by the ERT, Luxembourg has demonstrated sufficient capacity to comply with the UNFCCC reporting guidelines and to report the supplementary information required by Article 7 of the Kyoto Protocol.

131. Luxembourg's assigned amount takes into account the revised and reviewed base year estimates and has been calculated correctly in accordance with the annex to decision 13/CMP.1. Similarly, the commitment period reserve is based on the revised estimates and has been calculated correctly in accordance with the annex to decision 11/CMP.1. The values of the parameters selected for the definition of forest (Table 6) for use in the accounting of activities under Article 3, paragraph 3 are within the respective ranges specified for these parameters in the annex to decision 16/CMP.1.

132. Using the revised total emissions of 13,167.499 Gg CO_2 eq. in the base year and its quantified emission reduction of 72 per cent, Luxembourg calculates its assigned amount to be 47,402,996 tonnes

CO_2 eq. and its commitment period reserve as 42,662,696 tonnes CO_2 eq.. The ERT agrees with these values.

133. Luxembourg's national system as reviewed during the in-country visit did not comply with the requirements for national systems under Article 5 of the Kyoto Protocol, as contained in the annex to decision 19/CMP.1. Those mandatory provisions of national systems which were not in place included the allocation of specific responsibilities for inventory development and data collection, a QA/QC plan, a process for official consideration and approval of the inventory, procedures to ensure adequate implementation of the IPCC guidelines and the IPCC good practice guidance, quantitative estimates of uncertainty and properly archived documentation, including documentation on planned improvements.

134. During the in-country visit, the ERT recommended that decisions on the basic structure and functionality of the national system be taken as soon as possible in collaboration with all stakeholders so that Luxembourg can move quickly to the implementation of a system that complies with the guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol (decision 19/CMP.1). Luxembourg acknowledged the lack of a proper national system and undertook urgent measures to establish the legal framework necessary for implementation of its national system following this recommendation. A regulation adopted by the Government on 20 July 2007 which entered into force on 7 August 2007 designates the Environment Agency as the single national entity with overall responsibility for the inventory and sets out the roles of the administrations and services that will support the Environment Agency in its task as the compiler and data coordinator of the national inventory. The institutional, legal and procedural arrangements provided for under the regulation, together with Luxembourg's proposed QA/QC management system, meet the requirements for national systems as set down in the annex to decision 19/CMP.1.

135. The description of the national registry provided in the initial report was not sufficient to enable the ERT to assess how far the registry adheres to the requirements contained in the annex to decision 13/CMP.1 and the annex to decision 15/CMP.1. However, on the basis of additional information provided on the registry during the in-country visit and the findings of the IAR, the ERT is satisfied that Luxembourg's national registry meets all these requirements and that the registry fully conforms to the technical standards for data exchange between registry systems adopted by the CMP.

B. Recommendations

136. In the course of the review, the ERT formulated a number of recommendations relating to the completeness and transparency of Luxembourg's information presented in the initial report. The key recommendations[7] are that Luxembourg should:

(a) Implement the national system and the associated QA/QC plan as soon as possible;

(b) Implement the new inventory management procedures as soon as possible in order to streamline inventory preparation and reporting, so that institutional efficiency is increased and potential reporting errors are minimized;

(c) Further develop the methods for estimating emissions in the agriculture and waste sectors that were adopted during the review as improved alternatives to the CORINAIR approach and fully document their application in future NIRs;

(d) Complete any outstanding work on recalculations for several parts of the inventory, and submit the results and supporting documentation with a view to achieving complete, transparent and comparable inventories for all years;

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

(e) Develop an improvement programme to address all the important inventory issues identified in this review and implement the programme on a systematic phased basis;

(f) Use the next and subsequent NIRs to describe the recalculations and improvements that have been carried out;

(g) Include quantified estimates of uncertainty in line with the IPCC good practice guidance as a component of its future annual inventory submissions;

(h) Facilitate and respond to the various stages of the review process in the coming years.

C. Questions of implementation

137. No questions of implementation were identified by the ERT during the review of the initial report.

Annex I

Documents and information used during the review

A. Reference documents

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B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Eric de Brabanter (Ministry of Environment) including additional material on the methodologies and assumptions used. The following additional information was provided by Luxembourg during the review:[1]

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[1] This list does not include the presentations made by Luxembourg's experts during the in-country visit.

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
BOF	basic oxygen furnace
CH_4	methane
CHP	combined heat and power
CO_2	carbon dioxide
CO_2 eq.	carbon dioxide equivalent
CHP	combined heat and power
CMP	Conference of the Parties serving as the Meeting of the Parties
CRF	common reporting format
CRS	Community registry software
EAF	electric arc furnace
EC	European Community
EF	emission factor
ERT	expert review team
ETS	emissions trading scheme
EU	European Union
F-gas	fluorinated gas
FOD	first order decay
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)
GWP	global warming potential
HFCs	hydrofluorocarbons
IAR	independent assessment report
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1 thousand grams)
kgoe	kilograms of oil equivalent
LULUCF	land use, land-use change and forestry
m^3	cubic metre
MCF	methane correction factor
Mg	megagram (1 Mg = 1 tonne)
Mt	million tonnes
Mtoe	millions of tonnes of oil equivalent
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10^{15} joule)
QA/QC	quality assurance/quality control
SER	Service d'Economie Rurale
SF_6	sulphur hexafluoride
SO_2	sulphur dioxide
STATEC	Service Central de la Statistique et des Etudes Economiques du Luxembourg
Tg	teragram (1 Tg = 1 million tonnes)
TJ	terajoule (1 TJ = 10^{12} joule
UNFCCC	United Nations Framework Convention on Climate Change

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