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

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

Contents

I. Introduction and summary

A. Overview

1. This report covers the centralized review of the 2011 annual submission of Liechtenstein, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 5 to 10 September 2011 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Ms. Anke Herold (Germany) and Mr. Paul Filliger (Switzerland); energy – Ms. Kristien Aernouts (Belgium), Mr. Vishwa Bandhu Pant (India) and Mr. Glen Whitehead (Australia); industrial processes – Ms. Youngsook Lyu (Republic of Korea) and Mr. Menouer Boughedaoui (Algeria); agriculture – Mr. Michael Anderl (Austria) and Mr. Jacques Kouazounde (Benin); land use, land-use change and forestry (LULUCF) – Mr. Nagmeldin Elhassan (Sudan) and Mr. Hector Ginzo (Argentina); and waste – Mr. Davor Vešligaj (Croatia). Ms. Herold and Mr. Elhassan were the lead reviewers. The review was coordinated by Mr. Javier Hanna and Mr. Roman Payo (UNFCCC secretariat).

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

B. Emission profiles and trends

3. In 2009, the main greenhouse gas (GHG) in Liechtenstein was carbon dioxide (CO_2), accounting for 86.6 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (5.9 per cent) and nitrous oxide (N_2O) (5.3 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.2 per cent of the overall GHG emissions in the country. The energy sector accounted for 87.4 per cent of total GHG emissions, followed by the agriculture sector (9.2 per cent), the industrial processes sector (2.2 per cent), the waste sector (0.7 per cent) and the solvent and other product use sector (0.4 per cent). Total GHG emissions amounted to 247.40 Gg CO_2 eq and increased by 7.8 per cent between the base year[2] and 2009. The trends are reasonable.

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

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

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

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

			Gg CO_2 eq								*Change*
		Greenhouse gas	*Base year*[a]	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009 (%)*
Annex A sources		CO_2	203.06	203.06	209.40	227.53	239.92	210.90	229.85	214.15	5.5
		CH_4	13.39	13.39	12.59	12.27	13.98	14.69	14.93	14.67	9.5
		N_2O	13.11	13.11	13.24	12.68	12.78	13.11	13.11	13.05	–0.5
		HFCs	0.0001	0.0001	0.38	2.32	4.38	4.66	5.09	5.34	5 627 130.9
		PFCs	NA, NO	NA, NO	NA, NO	0.003	0.03	0.05	0.06	0.05	NA
		SF_6	NA, NO	NA, NO	NA, NO	0.09	0.27	0.12	0.36	0.14	NA
KP-LULUCF	Article 3.3[b]	CO_2							–2.85	–2.79	
		CH_4							NO	NO	
		N_2O							NO	NO	
	Article 3.4[c]	CO_2	NA						NA	NA	NA
		CH_4	NA						NA	NA	NA
		N_2O	NA						NA	NA	NA

Abbreviations: KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases.

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

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

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

			Gg CO_2 eq								*Change*
		Sector	*Base year*[a]	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Base year–2009 (%)*
Annex A		Energy	203.48	203.48	210.72	229.53	241.99	213.02	232.05	216.32	6.3
		Industrial processes	0.0001	0.0001	0.38	2.41	4.68	4.83	5.51	5.53	5 830 570.5
		Solvent and other product use	2.00	2.00	1.60	1.24	1.02	1.02	1.00	1.00	–49.9
		Agriculture	22.59	22.59	21.44	20.04	21.79	22.88	22.92	22.84	1.1
		Waste	1.50	1.50	1.47	1.66	1.87	1.79	1.91	1.71	13.3
		LULUCF	NA	–8.22	–8.36	–3.25	–6.05	–6.10	–6.12	–6.14	NA
		Total (with LULUCF)	**NA**	**221.35**	**227.26**	**251.64**	**265.30**	**237.44**	**257.28**	**241.26**	**NA**
		Total (without LULUCF)	**229.57**	**229.57**	**235.62**	**254.89**	**271.35**	**243.54**	**263.40**	**247.40**	**7.8**
		Other[b]	NA	NO	NO	NO	NO	NO	NO	NO	NA
KP-LULUCF	Article 3.3[c]	Afforestation and reforestation							–3.21	–3.22	
		Deforestation							0.36	0.43	
		Total (3.3)							**–2.85**	**–2.79**	
	Article 3.4[d]	Forest management							NA	NA	
		Cropland management	NA						NA	NA	NA
		Grazing land management	NA						NA	NA	NA
		Revegetation	NA						NA	NA	NA
		Total (3.4)	**NA**						**NA**	**NA**	**NA**

Abbreviations: LULUCF = land use, land-use change and forestry, KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for all gases.

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

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

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

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

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

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]	*Accounting quantity*[c]
Commitment period reserve	950 061			950 061	
Annex A emissions for current inventory year					
CO_2	214 148			214 148	
CH_4	14 672			14 672	
N_2O	13 049			13 049	
HFCs	5 341			5 341	
PFCs	51			51	
SF_6	142			142	
Total Annex A sources	**247 403**			**247 403**	
Activities under Article 3, paragraph 3, for current inventory year					
3.3 Afforestation and reforestation on non-harvested land for current year of commitment period as reported	–3 222			–3 222	–3 222
3.3 Afforestation and reforestation on harvested land for current year of commitment period as reported	NO			NO	NO
3.3 Deforestation for current year of commitment period as reported	433			433	433
Activities under Article 3, paragraph 4, for current inventory year[d]					
3.4 Forest management for current year of commitment period					
3.4 Cropland management for current year of commitment period					
3.4 Cropland management for base year					
3.4 Grazing land management for current year of commitment period					
3.4 Grazing land management for base year					
3.4 Revegetation for current year of commitment period					
3.4 Revegetation in base year					

Abbreviation: NO = not occurring.

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

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

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

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

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

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

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

8. During the review, Liechtenstein provided the ERT with additional information, which is not part of the annual submission.

Completeness of inventory

9. The inventory covers all source and sink categories for the period 1990–2009 and is complete in terms of gases, years and geographical coverage. However, CRF table 7 (summary overview of key categories) has not been completed for the years 1990–2003. The ERT recommends that Liechtenstein complete CRF table 7 for 1990 and encourages the Party to complete the reporting of table CRF 7 for 1991–2003 in its next annual submission.

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

Overview

10. The NIR states that there have been no changes in the national system since the previous submission. The ERT concluded that the national system continued to perform its required functions.

Inventory planning

11. The NIR described the institutional system for the preparation of the inventory. The Office of Environmental Protection has overall responsibility for the national inventory.

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

The Office of Economic Affairs, the Office of Agriculture, the Office of Forests, Nature and Land Management and the Office of Land Use Planning directly participate in the compilation of the inventory. Several other administrative and private institutions are also involved in the preparation of the inventory. There is a close co-operation with the Swiss inventory team, especially for the production of the NIR. The inventory group consists of a project manager, a person responsible for quality assurance/quality control (QA/QC) activities and a national inventory compiler, who is represented by the project manager and his assistant. A number of external experts, such as the sectoral specialists, also belong to the inventory group.

12. As noted in the previous review report, due to the specific circumstances of the country, Liechtenstein's inventory uses in many cases the same emission factors (EFs) and methods as Switzerland's inventory. While the use of Swiss country-specific methodologies and EFs is in many cases appropriate for Liechtenstein, the ERT considers it important that Liechtenstein have the national capacity for inventory development. In response to a question raised by the ERT during the review, Liechtenstein mentioned the limited resources of small countries and stated that current capacity is sufficient, emphasizing that a number of external experts are involved in the whole process of the inventory preparation. Nevertheless, to further improve the NIR, Liechtenstein explained that the capacity will be increased in specific areas, as needed (e.g. in the agriculture sector for the 2012 annual submission). The ERT welcomes this improvement and encourages Liechtenstein to further develop its national capacity as mentioned in the Party's response.

13. Although Liechtenstein answered most of the questions of the ERT during the review week, it responded to the questions on the agriculture sector only after that week. The ERT considers it essential that the ERT receive the answers to the questions raised prior to and during the review week from the Party under review within the review week. The ERT recommends that Liechtenstein ensure that sufficient sectoral expertise is available during the review week to react in a timely manner to the questions raised by the ERT as required by the guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol and the annex to decision 19/CMP.1.

Inventory preparation

Key categories

14. Liechtenstein has reported a key category tier 1 analysis, both level and trend assessments, as part of its 2011 submission. The key category analysis performed by Liechtenstein and that performed by the secretariat[4] produced similar results. Liechtenstein has included the LULUCF sector in its key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). Liechtenstein uses the key category analysis to

[4] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

prioritize the improvement of the inventory. No key categories were identified using qualitative criteria.

15. The ERT noted that CRF table 7 is reported for the years 2004–2009 only. The reported results of the key category analysis for 2009 in the NIR and the CRF table 7 are inconsistent, and CRF table 7 contains only the results without LULUCF. In response to a question raised by the ERT during the review, Liechtenstein explained that its QC check did not include table 7 because this table is completed only after the CRF sector tables are available. Therefore, it would be necessary to conduct a second check of the CRF, including table 7. The ERT recommends that Liechtenstein include such a final check into its QA/QC plan and perform routinely such procedure in future annual submissions.

16. Liechtenstein has identified key categories for activities under Article 3, paragraph 3, of the Kyoto Protocol in accordance with the IPCC good practice guidance for LULUCF.

Uncertainties

17. Liechtenstein has reported a tier 1 uncertainty analysis for emissions and removals for the level and trend of emissions in its 2011 submission. The LULUCF sector is included in the analysis. A tier 2 uncertainty analysis was carried out for the 2009 submission. This analysis has not been updated, although the Party had indicated that this would be done in a subsequent year, as stated in the 2009 annual review report. The tier 1 uncertainty for the emission level for 2009 was estimated at 6.8 per cent and the uncertainty for the emission trend (1990–2009) was estimated at 9.5 per cent.

18. Liechtenstein has not reported uncertainty estimates for afforestation, reforestation and deforestation activities. In response to a question raised by the ERT during the review, Liechtenstein stated that it intends to use the uncertainties of the Swiss EFs for afforestation and deforestation. For the activity data (AD), the Party reported that LULUCF experts were in the process of checking how the uncertainties may be specifically estimated for Liechtenstein. The ERT encourages Liechtenstein to continue and complete this work and to report the uncertainty estimates for afforestation, reforestation and deforestation in its next annual submission.

Recalculations and time-series consistency

19. Recalculations have been performed and partly reported. The ERT noted that recalculations of the time series 1990 to 2008 reported by Liechtenstein have been undertaken to take into account: in the energy sector, revised CH_4 and N_2O EFs for road transportation; in the industrial processes and solvent and other product use sectors, a change of population estimates that affects emissions from asphalt roofing, road paving with asphalt and all categories in the solvent and other product use sector (see para. 44 below); in the agriculture sector, a revised nitrogen model for manure management and agricultural soils, and some AD changes in enteric fermentation; and in the waste sector, a revised N_2O EF for wastewater handling. In the LULUCF sector, new land-use data has become available and, therefore, CO_2 emissions have been recalculated for forest land, cropland, grassland, wetlands, settlements and other land.

20. The impact of the recalculations is very small, and results in increases of estimated total GHG emissions in 1990 (0.01 per cent) and in 2008 (0.01 per cent). The rationale for these recalculations is provided, in part, in the NIR but not provided in CRF table 8(b). The ERT recommends that Liechtenstein provide the reasons for the recalculations in CRF table 8(b), at least for 1990 and the latest reported year. The ERT also recommends that Liechtenstein describe the rationale for all recalculations in the NIR of its future annual submissions.

Verification and quality assurance/quality control approaches

21. Liechtenstein has a QA/QC plan in place in accordance with decision 19/CMP.1 and the IPCC good practice guidance. The QA/QC activities are coordinated by the quality manager of the inventory group. Operational tasks are delegated to the lead NIR author who distributes QA/QC checklists to the project manager, and the sectoral experts and the other NIR authors who then confirm the QA/QC procedures that they have carried out. The checklists, including information on the person who carried out the QA/QC activity and when, are provided in an annex to the NIR.

22. Liechtenstein has provided an inventory development plan (IDP) in an annex to the NIR. The NIR states that the recommendations from the previous annual review report could not be fully included in the 2011 annual submission. The ERT commends Liechtenstein for using the IDP to improve the inventory and for the transparent documentation of the implemented and planned improvements, and encourages the Party to continue including recommendations of the review reports in the IDP.

23. Liechtenstein has not reported on any category-specific tier 2 QC procedures. The ERT encourages Liechtenstein to plan and implement tier 2 QC procedures for key categories.

Transparency

24. The NIR and CRF tables are generally transparent. However, the ERT reiterates the recommendation of the previous review report that Liechtenstein improve the transparency of the information in the agriculture (see paras. 49, 51, 53 and 56–61 below) and LULUCF sectors (see paras. 63, 65, 68 and 70 below). In its 2011 annual submission, Liechtenstein has frequently used EFs and parameters from the Swiss inventory. The ERT encourages Liechtenstein to provide a more detailed justification for its use of the Swiss EFs and parameters in those areas indicated in the sectoral chapters of this report in its next annual submission.

Inventory management

25. The NIR reports that Liechtenstein has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. In response to a recommendation of the previous review report, Liechtenstein extended the description of the archiving system. The backups of the information provided by external companies are archived at a central place in a safe of Liechtenstein's National Bank.

3. Follow-up to previous reviews

26. The ERT noted that Liechtenstein has implemented most of the recommendations in the previous review report; however, the recommendations for the agriculture sector have not been addressed. The NIR includes a table (table 1-1) that refers to the description on how those recommendations have been addressed and the NIR also indicates for which recommendations the implementation is ongoing. The previous recommendations that have been implemented relate to: improving the transparency of the NIR of the annual submission; implementing QA/QC procedures; updating data as well as providing new data and revision of EFs; and extending the description of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The ERT commends

Liechtenstein for these improvements. The ERT recommends that Liechtenstein continue improving its annual submission by:

(a) Increasing the use of country-specific methods, including the provision in the NIR of more precise descriptions of the methodologies that differ from those of the IPCC good practice guidance, the IPCC good practice guidance for LULUCF or the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines);

(b) Enhancing the consistency of the information provided in the NIR and the CRF tables on the key category analysis (CRF table 7) and the rationale for the recalculations (CRF table 8(b));

(c) Improving the transparency of the information reported in the NIR, in particular in the agriculture and LULUCF sectors.

4. Areas for further improvement

Identified by the Party

27. The NIR submitted in 2011 includes an IDP that identifies several areas for improvement. The plan contains more than 30 items, and many items are listed in the agriculture, the LULUCF and the waste sectors. In response to a question raised by the ERT during the review, Liechtenstein explained that it is making substantial efforts to improve the transparency and accuracy of the information in the agriculture sector and that it will report on these improvements in its 2012 annual submission. The ERT commends Liechtenstein for presenting the IDP, which the ERT assessed as being complete, and encourages the Party to continue with its implementation.

Identified by the expert review team

28. During the review, the ERT identified cross-cutting issues for improvement. These are listed in paragraph 116 below.

29. The recommended improvements relating to specific categories are presented in the relevant sectoral chapters of this report.

B. Energy

1. Overview

30. The energy sector is the main sector in the GHG inventory of Liechtenstein. In 2009, emissions from the energy sector amounted to 216.32 Gg CO_2 eq, or 87.4 per cent of total GHG emissions. Since 1990, emissions have increased by 6.3 per cent. The key drivers for the rise in emissions are attributed to increases in emissions from other sectors (namely the commercial/institutional, residential and agriculture categories) and road transportation. For 2009, within the energy sector, 46.3 per cent of the emissions were from other sectors, followed by 39.2 per cent from transport, 11.0 per cent from manufacturing industries and construction, 1.7 per cent from other and 1.4 per cent from energy industries. The remaining 0.5 per cent was from fugitive emissions from fuels.

31. The ERT concluded that emissions from the energy sector have been estimated in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, and that the inventory is complete in terms of geographical coverage, categories, gases and years. The energy section of the NIR is transparent. The CRF tables are also complete.

32. Liechtenstein has made recalculations for the energy sector for 2008, following changes in the EFs for CH_4 and N_2O for road and off-road transportation, which affect the following categories: road transportation, agriculture/forestry/fisheries and mobile – off-road vehicles and other machinery (other). The updated EFs for 2008 are lower than the EFs used for 2008 in the Party's previous annual submission. The update is due to the fact that Liechtenstein has revised its EFs in line with the EFs from the Swiss inventory. The impact of these recalculations on the energy sector is a decrease of 0.03 per cent in total GHG emissions for 2008 (no impact for 1990).

33. AD for estimates in the energy sector were taken from Liechtenstein's energy statistics after correcting some inconsistencies for gas-oil, natural gas and gasoline/diesel. The AD and the consistency corrections are transparently reported in the NIR for the entire time series.

34. The ERT noted that Liechtenstein's NIR states that most of the EFs were taken from Switzerland's inventory after checking their applicability to Liechtenstein, and that they are reported as country-specific EFs.

2. Reference and sectoral approaches

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

35. Liechtenstein has reported CO_2 emissions from fuel combustion using both the reference and the sectoral approaches for every year in the entire time series (1990–2009). The NIR includes information on the differences in estimates for energy consumption and CO_2 emissions between the two approaches for each year. The differences between the reference and sectoral approaches in the CO_2 emission estimates are very small for the complete time series (0.03 per cent in 2009). For energy consumption, the ERT noted that the differences between the two approaches as reported in the NIR differ from what is reported in the CRF tables and, therefore, recommends that Liechtenstein improve the consistency between the NIR and the CRF tables in its next annual submission. The International Energy Agency (IEA) does not collect energy data for Liechtenstein, as Liechtenstein is not member of the IEA. For this reason, a comparison of the Party's reference approach with international statistics is not possible.

International bunker fuels

36. The ERT noted that the only bunker emissions occurring in the country stem from the nation's single helicopter base (Balzers). Only a few flights are domestic; most of them are international business flights to Switzerland and Austria. Marine bunker emissions do not occur in the country. Emission estimates in this category are calculated using the tier 1 method. The information on the share of fuel consumption from international flights is provided by the two companies operating in the country. This information allows Liechtenstein to separate domestic from international bunker fuel use. The share of fuel consumption for international bunkers in 2009 was 85.0 per cent of the total fuel consumption in aviation activities.

Feedstock and non-energy use of fuels

37. The ERT noted that Liechtenstein continues to report feedstock and non-energy use of fuels as not occurring ("NO") in the CRF tables 1.A(d) for the complete time series, as had been noted in previous review reports. The ERT, therefore, reiterates the recommendation made in previous review reports that Liechtenstein include the use of lubricants and bitumen in this assessment with a view to ensuring the transparency and completeness of its inventory.

3. Key categories

Stationary combustion: liquid and gaseous fuels – CO_2

38. The ERT noted that all emissions from liquid and gaseous fuels from the category food processing, beverages and tobacco are reported under the category other (manufacturing industries and construction) in the CRF tables, which is not in line with the Revised 1996 IPCC Guidelines. The ERT recommends that Liechtenstein report these emissions in the appropriate category in its next annual submission.

Road transportation: liquid fuels – CO_2

39. The ERT noted that Liechtenstein uses the CO_2 EFs for gasoline and diesel oil from Switzerland's inventory for the entire period 1990–2009, and that these EFs are constant over the whole time period (73.90 t CO_2/TJ for gasoline and 73.60 t CO_2/TJ for diesel oil). The ERT noted that Liechtenstein has not any refineries and that all gasoline and diesel are imported from Switzerland. The ERT recommends that Liechtenstein justify in more detail why the EFs are constant in the period 1990–2009.

4. Non-key categories

Other: liquid fuels – CO_2, CH_4 and N_2O

40. In its 2011 submission, Liechtenstein has reported CO_2, CH_4 and N_2O emissions from off-road and other mobile equipment used by construction and industry in the category mobile (other). In response to a question raised by the ERT during the review, Liechtenstein explained that it plans to reallocate these emissions under manufacturing industries and construction in its next annual submission, as recommended by the ERT during the review.

Oil and natural gas: gaseous fuels – CH_4

41. The current estimation of CH_4 fugitive emissions from the category oil and natural gas is limited to the distribution of natural gas and is based on the data on the quantity of the natural gas from Switzerland. CH_4 fugitive emissions are estimated with a tier 3 method adapted from the Swiss inventory. The ERT recommends that Liechtenstein use country-specific data obtained from Liechtenstein's natural gas utility in its future annual submissions. The ERT noted that Liechtenstein, in CRF table 1.B.2, has reported other leakage of natural gas as "NO" for both industrial plants and power stations and the residential and commercial categories. However, Liechtenstein has reported consumption of gaseous fuels for public electricity and heat production and the commercial/institutional and residential categories in sheets one and four of CRF table 1.A.(a). Therefore, the ERT strongly recommends that Liechtenstein estimate fugitive emissions for these categories in its next annual submission or, if they are estimated and included elsewhere, explain it and use the correct notation key ("IE").

42. The ERT also noted that Liechtenstein has reported fugitive emissions of natural gas transmission as "NO" in CRF table 1.B.2. The ERT strongly recommends that Liechtenstein justify in its next NIR that these emissions do not occur or, if they are included elsewhere, that the Party use the correct notation key ("IE"). If these emissions are not estimated, the ERT strongly recommends that Liechtenstein estimate these emissions in its next annual submission.

C. Industrial processes and solvent and other product use

1. Sector overview

43. In 2009, emissions from the industrial processes sector amounted to 5.53 Gg CO_2 eq, or 2.2 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 1.00 Gg CO_2 eq, or 0.4 per cent of total GHG emissions. Since 1990, emissions have increased by 5,830,570.5 per cent in the industrial processes sector, and decreased by 49.9 per cent in the solvent and other product use sector. The key driver for the rise in emissions in the industrial processes sector is the increasing use of refrigeration and air-conditioning equipment and corresponding HFC emissions. Within the industrial processes sector, emissions were mainly from the subcategory refrigeration and air-conditioning equipment.

44. The NIR includes information on the recalculations made for the industrial processes sector between the 2010 and 2011 submissions, but it only reports on the recalculations made to the CO and non-methane volatile organic compound emissions from asphalt roofing and road paving with asphalt for the period 2001–2008 following changes in the specific emissions per inhabitant in the Swiss inventory, which are used as a proxy data in Liechtenstein's inventory. However, CRF table 8(a) shows that Liechtenstein has also made recalculations for HFC emissions from consumption of halocarbons and SF_6, which are also made following changes in the specific emissions per inhabitant as reported in the Swiss inventory for the same period. The ERT recommends that Liechtenstein report on all recalculations in its next annual submission, in particular including the rationale and background information for all recalculations in the NIR. The ERT reiterates the recommendation of the previous review report that Liechtenstein complete CRF table 8(b) with explanatory information on the recalculations and that the Party improve the consistency of the information provided in the CRF tables and the NIR in relation to recalculations in its next annual submission. The impact of these recalculations on the industrial processes is a decrease of 0.00002 per cent (0.00006 Gg CO_2 eq) in total GHG emissions for 2008.

45. Liechtenstein has also made recalculations for the CO_2 and N_2O emissions from the solvent and other product use sector for years 2001 to 2008 between the 2010 and 2011 submissions. The impact of these recalculations is a decrease of 0.03 per cent (of 0.07 Gg CO_2 eq) in total GHG emissions for 2008.

2. Key categories

Consumption of halocarbons and SF_6 – HFCs

46. HFC emissions for refrigeration and air-conditioning equipment under this category show a continuously increasing trend from 1990 to 2009. However, this increasing trend for HFC emissions is interrupted in the period 2004–2006, in which emissions are almost constant. The methodology used is based on the specific emissions per inhabitant in Switzerland, used as a proxy, times the number of inhabitants in Liechtenstein. The ERT encourages Liechtenstein to report on the reasons why HFC emissions in the period 2004–2006 changed the previous trend in its next annual submission. Recalculations were conducted for HFC emissions for the refrigeration and air-conditioning equipment category (see para. 44 above).

3. Non-key categories

Consumption of halocarbons and SF_6 – PFCs

47. PFC emission estimates from this category were reported for the first time in last year's submission for the years 1998–2009. The methodology used is based on the

emissions reported by Switzerland and the assumption of proportionality considering specific indicators such as the number of households, the number of employees and the number of cars. The ERT commends Liechtenstein for improving the completeness of its inventory and encourages the Party to describe in more detail how actual and potential emissions are estimated with this methodology in its next annual submission.

D. Agriculture

1. Sector overview

48. In 2009, emissions from the agriculture sector amounted to 22.84 Gg CO_2 eq, or 9.2 per cent of total GHG emissions. Since 1990, emissions have increased by 1.1 per cent. Within the sector, 45.6 per cent of the emissions were from enteric fermentation, followed by 39.3 per cent from agricultural soils and 15.1 per cent from manure management.

49. Liechtenstein has made recalculations for the agriculture sector between the 2010 and 2011 submissions for the entire time series, following changes in data for energy intake of poultry and non-dairy cattle, as well as the adaptation to the new Swiss ammonia model AGRAMMON resulting in new values for animal nitrogen (N) excretion and ammonia EFs. The impact of these recalculations is an increase in total GHG emissions of 0.1 per cent for 2008 and of 0.01 per cent for 1990 (the impact on the emissions from the agriculture sector is an increase of 1.0 per cent for 2008 and of 0.3 per cent for 1990). The main recalculations took place in manure management and agricultural soils. According to the NIR, the revised data better reflect changes and tendencies in Liechtenstein's agriculture. The ERT recommends that Liechtenstein justify the applicability of refined Swiss methodologies to Liechtenstein conditions.

50. The agriculture sector inventory is complete in terms of geographical coverage, years, categories and gases covered. As field burning of agricultural residues, prescribed burning of savannas and rice cultivation do not occur in the country, Liechtenstein reported these categories as "NO".

51. Although Liechtenstein has slightly improved the documentation in its NIR, the ERT considered that the transparency is not complete. Relevant data, such as fractions of animal manure excreted in different manure management systems and most of the parameters to be documented within the estimation of soil emissions, are inadequately described in the NIR. Liechtenstein has reported all parameters in the additional information table of CRF table 4.A as "IE", "NE" or "NA", and, in CRF table 4.B(a), the allocation of all animal waste management systems (AWMS) as 100.0 per cent and all the methane conversion factors (MCFs) as "NA". In the additional information table of CRF table 4.D, Liechtenstein has reported the values of five parameters as zero. The ERT recommends that Liechtenstein report the correct values in the CRF tables and explain how the Party has obtained the values in its next NIR.

52. Liechtenstein has used Swiss methods and EFs to estimate energy intake for enteric fermentation, N excretion values and AWMS distribution for manure management, and N input per ha, volatilization losses and N in crop residues for agricultural soils. Liechtenstein has justified this use by the very close similarity and relationship between Liechtenstein and Switzerland's agricultural practices. Due to the customs and monetary union, Swiss environmental provisions and climate protection regulations impact greatly on the environmental and fiscal strategies of Liechtenstein. In response to a question raised by the ERT during the review, Liechtenstein explained that its agricultural structure and geo-climatic conditions are very similar to those in Switzerland and that Liechtenstein has only limited resources for the determination of country-specific EFs.

53. Due to the specific national circumstances in Liechtenstein, the ERT welcomes the methodological support by experts of the Swiss Federal Office for Environment. As indicated in the NIR, once a year at the beginning of the inventory process, Liechtenstein reviews the applicability of Swiss methods and EFs to its GHG inventory. If Swiss EFs are assessed to be more accurate than the default EFs, they are adopted by Liechtenstein's GHG inventory. The ERT appreciates this review, but recommends that Liechtenstein document the results of this review in the NIR of its next annual submission.

54. The ERT commends Liechtenstein for the improvements made in the agriculture inventory, but recommends that the Party correct all inconsistencies identified by the ERT during the review (see paras. 57, 58 and 61 below) in its next annual submission, as the Party indicated in its responses to questions raised by the ERT during the review. The ERT strongly recommends that Liechtenstein enhance its specific agriculture sector QA/QC practices.

2. Key categories

Enteric fermentation – CH_4

55. Liechtenstein used a tier 2 methodology and EFs based on equation 4.14 of the IPCC good practice guidance to estimate emissions from enteric fermentation for all animal species. For dairy cows, country-specific gross energy intake data depending on the average milk yield were used, while for all other animals the Swiss values were applied. For the methane conversion rate (Ym), a mix of IPCC default parameters and Swiss country-specific values have been used.

56. Unlike the Swiss inventory, in Liechtenstein's GHG inventory breeding cattle are not included in the young cattle category but are reported under other livestock. The ERT reiterates the recommendation from the previous review report that Liechtenstein report breeding cattle in the appropriate cattle category and correct the documentation in the NIR of its next annual submission. In response to a question raised by the ERT during the review, Liechtenstein indicated that it will address this issue in its 2012 submission.

57. The ERT noted that the number of fattening calves used in the estimation of CH_4 emissions from enteric fermentation (NIR table 6-6) is significantly lower than the number of fattening calves used in the estimation of N_2O emissions from manure management (NIR, table 6-12). In addition, the data on cattle numbers reported to the Food and Agriculture Organization of the United Nations (FAO) are 18.0 per cent higher and the data from the official agricultural statistics of Liechtenstein are 0.9 per cent lower than the number of animals used in the Party's inventory for 2009. Liechtenstein explained to the ERT that the number for calves used to estimate N_2O emissions from manure management (NIR, table 6-12) was incorrect and that the livestock figures will be revised in its 2012 annual submission. The ERT strongly recommends that Liechtenstein provide consistent cattle numbers and explain any differences with the FAO statistics in its next annual submission.

Manure management – CH_4

58. Liechtenstein has applied the Swiss distribution AWMS in its inventory, but the Party has not justified that the AWMS distribution of Switzerland represents the situation in Liechtenstein. No information on the percentage of manure excreted in different AWMS is presented in the NIR. In the additional information table 4.B(a) of the CRF an allocation of 100.0 per cent is reported for each AWMS. MCF values are presented in the NIR, but they are not reported in the additional information table of CRF table 4.B(a). The ERT strongly recommends that Liechtenstein provide additional information on the applicability of Swiss AWMS data to Liechtenstein's inventory, and that Liechtenstein report all data required in

the NIR and CRF table 4.B(a) in its next annual submission. In response to a question raised by the ERT during the review, Liechtenstein responded that, in its next annual submission, improved AWMS data derived from the AGRAMMON model will be taken for the estimates for manure management. The ERT welcomes this development, but recommends that Liechtenstein provide sufficient background information on the AGRAMMON model, especially on the applicability and the adoption of the model results to Liechtenstein conditions.

Direct soil emissions – N_2O

59. Liechtenstein has estimated direct N_2O emissions from soils using the IPCC tier 1b methodology and IPCC default EFs. For the calculation of volatilization losses, Swiss country-specific parameters have been used. Liechtenstein has explained the applicability of the Swiss parameters by the fact that the two countries have the same soil types and comparable agricultural management. The amount of synthetic fertilizer was calculated on the basis of average N input per hectare and extrapolation with the area fertilized. In contrast to the IPCC methodology, Liechtenstein included sewage sludge spreading and compost application in the amount of synthetic fertilizers, which is less transparent than separate estimates. The ERT strongly recommends that Liechtenstein report separately the AD of synthetic fertilizer use, compost and sewage sludge application and improve the transparency of the information on how these data are obtained in the NIR of its next annual submission. The ERT also recommends that the Party reallocate AD and emissions from compost and sewage sludge application to the category other direct emissions in agriculture soils in CRF table 4.D.

Indirect emissions – N_2O

60. For the estimation of N_2O emissions from atmospheric deposition, Liechtenstein has used country-specific fractions of N losses obtained from the Swiss emission model AGRAMMON. Although the NIR provides an overview of volatilization losses, Liechtenstein has reported a zero value for the fractions of N from synthetic fertilizer and N from livestock that volatilize as ammonia and N oxides ($Frac_{GASF}$ and $Frac_{GASM}$, respectively). The ERT strongly recommends that Liechtenstein increase the transparency of its calculations by reporting the correct numbers in CRF table 4.D in its next annual submission.

3. Non-key categories

Manure management – N_2O

61. In the reporting on manure management in CRF table 4.B(b), the total quantity of N excreted, calculated as a product of the livestock population number and the N excretion factors, is 49.1 kt lower than the sum of N allocated to different types of AWMS for 2009. Since the correction of this inconsistency had already been recommended in the previous annual review report, the ERT reiterates that recommendation. In response to a question raised by the ERT during the review, Liechtenstein explained that this inconsistency will be corrected in its next annual submission. To prevent inconsistent data sets in its inventory submission, the ERT recommends that Liechtenstein enhance its specific QA/QC practices for the agriculture sector.

E. Land use, land-use change and forestry

1. Sector overview

62. In 2009, net removals from the LULUCF sector amounted to 6.14 Gg CO_2 eq. Since 1990, net removals have decreased by 25.2 per cent. The period 1997–2002 shows the lowest removals in the whole time series, as a result of the higher rate of conversion from forest land to grassland during this period, as explained in the NIR. Within the sector, removals are reported only from forest land (18.39 Gg CO_2 eq in 2009), while emissions are reported from cropland (4.51 Gg CO_2 eq), grassland (3.33 Gg CO_2 eq), settlements (3.28 Gg CO_2 eq), other land (0.95 Gg CO_2 eq) and wetlands (0.17 Gg CO_2 eq).

63. In its NIR, Liechtenstein has reported recalculations of the time series from 2003 to 2008 because of the new area data available, based on a 2008 area survey. Due to the consideration of this new area data, the classification of some areas has changed from "unproductive forest" to "copse" (subdivision of grassland), leading to a small decrease in area of forest land and a corresponding increase of the grassland area compared with that reported in the previous annual submission. The extrapolations used in the previous submissions for the years after 2002 have been replaced by the actual area statistics of 2008, which has resulted in significant changes in the estimation of land-use changes to wetlands from the year 2003 onwards (Liechtenstein stated that this recalculation is not significant for the years until 2002). However, the reporting of the recalculation in the NIR is not transparent and Liechtenstein has not included sufficient information on the impacts of these recalculations. Therefore, the ERT recommends that Liechtenstein provide further information of its recalculation on the LULUCF sector in its next annual submission. These recalculations resulted in a decrease of net removals of 0.1 per cent for 2008 for the LULUCF sector (the decrease was of 0.04 per cent for 1990).

64. In its NIR, Liechtenstein has provided detailed information on land use and land-use changes. The information includes the national definition of land uses and their mapping onto the IPCC categories. Land-use statistics including absolute and relative area change for the period 1990–2009 have been provided showing the overall trends of land-use changes. A matrix (table 7-7) for land-use change for the period 2008–2009 has also been provided. However, this land-use matrix is not consistent with the IPCC good practice guidance for LULUCF, because it does not transparently show the land-use categories and the areas of these categories at the different time periods (2008–2009) as indicated in the matrices in chapter 2 of the IPCC good practice guidance for LULUCF. The ERT commends Liechtenstein for improving the transparency of its reporting of land-use areas by providing detailed information, including the latest land-use statistics for 2008. The ERT encourages Liechtenstein to use the approaches for consistent land representation and the land-use matrices of the IPCC good practice guidance for LULUCF in its work on consistent land representation in its next annual submission.

65. In previous review reports, it was noted that the use of a 12-year interval for calculating annual carbon stock changes in soils due to land-use conversion is not consistent with the IPCC good practice guidance for LULUCF. In its 2011 submission, Liechtenstein has continued to apply the 12-year interval. In response to a question raised by the ERT during the review, Liechtenstein reported that the inventory period of land-use changes is predetermined by the inter-survey period of the Swiss land-use statistics, which is, on average, 12 years. The ERT is of the view that 12 years may not be sufficient for soil carbon to reach stability. The ERT strongly reiterates the recommendation of previous review reports that Liechtenstein use the 20-year default IPCC value for reporting land-use conversion or provide sufficient justification for the use of a 12-year conversion in its next annual submission.

66. Previous review reports had identified deficiencies in the completeness of reporting of biomass burning, drainage of soil, N fertilization and liming. In response to this, Liechtenstein has provided the following information in its NIR: for biomass burning, there is information on fires available, but the area affected is insignificant (about one hectare); drainage of soil is not common; fertilization is prohibited by law; and liming does not occur. The ERT welcomes the clarifications provided by Liechtenstein and recommends that the Party estimate the emissions from biomass burning or, if it is not applicable for some years, explain why and use the correct notation key ("NO") for biomass burning in its next annual submission.

2. Key categories

Forest land remaining forest land – CO_2

67. Liechtenstein has used Swiss national inventory data (data for growing stock, gross growth, cut (harvesting) and mortality was derived from the first and the second Swiss national forest inventory) and parameters (e.g. biomass expansion factor) to estimate carbon stock changes in this category. In the NIR, Liechtenstein explained the similarities between the Swiss conditions and those of Liechtenstein and its forest resources. The methods and parameters used are in line with IPCC good practice guidance for LULUCF.

68. Liechtenstein has reported the area of organic soils as "NE" for all years of the inventory time series. Further, the carbon stock changes from organic soils are reported as "included elsewhere" ("IE") under mineral soils for all years of the inventory time series. Despite these issues having been raised in previous review reports, they have not been addressed by Liechtenstein in this submission and no explanation has been provided in the NIR or in response to questions during the review. The ERT recommends that Liechtenstein address this issue in its next annual submission.

Cropland remaining cropland – CO_2

69. Methods and parameters used are obtained from Swiss national inventory data (e.g. mean soil organic carbon stocks for cropland). The national AD and the methodology applied (tier 2) are in line with the IPCC good practice guidance for LULUCF.

70. Liechtenstein reports the area of organic soils as "IE" for all years of the inventory time series. Further, the carbon stock changes from organic soils are reported as "IE" for all years of the inventory time series. In its NIR, Liechtenstein has indicated that the use of this notation key is due to lack of data. The ERT recommends that Liechtenstein improve completeness of its reporting of this key category by replacing the notation keys by the appropriate values in its next annual submission.

Land converted to grassland – CO_2

71. Liechtenstein has used national AD and parameters from the Swiss national inventory data (e.g. carbon stocks in living biomass of permanent grassland) to estimate carbon stock changes in this key category. The method (tier 2) and parameters used are in line with the IPCC good practice guidance for LULUCF.

72. Liechtenstein has reported the area of organic soils as "IE" and "NE" and the carbon stock changes from organic soils are reported as "IE" for all years of the inventory time series. The ERT encourages Liechtenstein to address this completeness issue in its next annual submission or to provide background information and additional explanations that the reported emissions and removals appropriately address emissions from both mineral and organic soils.

3. Non-key categories

Grassland remaining grassland – CO_2

73. Liechtenstein has used national AD, parameters from the Swiss national inventory (e.g. carbon stocks in living biomass and carbon stocks in mineral and organic soils) and a tier 2 method to estimate carbon stock changes in this category. The approach used is in line with the IPCC good practice guidance for LULUCF.

74. Liechtenstein has reported both the area of organic soils and the carbon stock changes from organic soils as "IE" for all years of the inventory time series. The ERT encourages Liechtenstein to provide, in its next annual submission, background information and additional explanations that the reported emissions and removals appropriately address emissions from both mineral and organic soils.

F. Waste

1. Sector overview

75. In 2009, emissions from the waste sector amounted to 1.71 Gg CO_2 eq or 0.7 per cent of total GHG emissions. Since 1990, emissions have increased by 13.3 per cent. The key drivers for the rise in emissions are: an increase in population, leading to higher emissions from wastewater treatment; and an increase in composting activities, which did more than balance the decrease in emissions from the category solid waste disposal on land. Within the sector, 57.2 per cent of the emissions were from wastewater handling, followed by 41.0 per cent from other (composting), 0.9 per cent from solid waste disposal on land and 0.8 per cent from waste incineration.

76. Liechtenstein has made a recalculation for N_2O emissions from wastewater handling (N_2O emissions from human sewage) between the 2010 and 2011 submissions following a recommendation of the previous review report to revise the value for protein consumption per capita for the entire time series (see para. 80 below). The recalculation is explained transparently in the NIR. The impact of this recalculation on the waste sector is a decrease in total GHG emissions of 0.02 per cent for both 2008 and 1990.

77. According to the key category analysis performed by Liechtenstein there are no key categories in the waste sector.

2. Non-key categories

Solid waste disposal on land – CH_4

78. CH_4 emissions from solid waste disposal on land amounted to 0.02 Gg CO_2 eq. As there are no managed landfills in Liechtenstein, the Party has reported emissions from managed waste disposal on land as "NO" for the entire time series. Since 1974, all unmanaged solid waste disposal sites in Liechtenstein have been closed and all municipal solid waste is exported to Switzerland for incineration. Liechtenstein uses the tier 2 method (IPCC first-order decay method) to estimate CH_4 emissions from solid waste disposal in unmanaged landfills.

Wastewater handling – CH_4 and N_2O

79. The NIR reported that Liechtenstein estimates the categories industrial wastewater and domestic and commercial wastewater together because industrial wastewater is generally only pretreated on site (e.g. correction of pH, solid matter, sedimentation and/or oil removal) and subsequently treated together with domestic wastewater. The aggregated

emissions are reported under domestic and commercial wastewater (sludge), while "IE" and "NO" are used for industrial wastewater.

80. In its 2011 submission, Liechtenstein has used a constant value of 33.86 kg/person/year for protein consumption for the entire time series for its estimates of N_2O emissions from human sewage. This value is taken from Switzerland's inventory, one of the options recommended by the previous review report. In response to a question raised by the ERT during the review, Liechtenstein explained that it plans to use country-specific annual data for protein consumption in future submissions. The ERT encourages Liechtenstein to implement this improvement, which is also in line with the recommendation of the previous review report.

81. In response to questions raised by the ERT during the review, Liechtenstein indicated that it plans to revise the CH_4 EF for the leakage of biogas from recovery from 0.2 per cent by volume to 0.75 per cent by volume for its next annual submission, resulting in higher emissions. The revised assumption is based on recent measurements in Swiss wastewater treatment plants. The ERT encourages Liechtenstein to implement this revision in its next annual submission and to transparently document the change in the EF in the NIR and in the CRF tables.

Waste incineration – CO_2, CH_4 and N_2O

82. Liechtenstein states in the NIR that it plans to verify the EFs used for the reporting of emissions from illegal burning of wastes from gardening, households and construction sites. The ERT recommends that, in its next annual submission, Liechtenstein transparently document and report any recalculations in the NIR and in the CRF tables and justify how the revised EFs improve the emission estimates. The ERT noted that Liechtenstein has reported estimates of CO_2 emission from biogenic waste incineration in CRF table 6.C for the entire time series, but has reported the AD as "IE" (the Party has also reported CH_4 and N_2O emissions as "IE"). The ERT recommends that Liechtenstein increase the consistency of the CRF table 6.C and improve the transparency of the information on the allocation of emissions from incineration of biogenic waste in its next annual submission.

Other (waste) – CH_4 and N_2O

83. Liechtenstein has reported CH_4 and N_2O emissions from open-air composting of biodegradable waste under this category. Emission estimations are based on the Swiss country-specific method and EFs. The ERT noted that the EFs are also similar to the EFs used in the German inventory based on research on centralized compost plants. The ERT commends the Party for improving the completeness on its inventory for categories and gases for which there are no IPCC methodologies.

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

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

Overview

84. In its 2011 submission, Liechtenstein has provided the required supplementary information on KP-LULUCF in the NIR and the KP-LULUCF CRF tables. Liechtenstein has not elected any activity under Article 3, paragraph 4, of the Kyoto Protocol. Liechtenstein chose annual accounting for its activities under Article 3, paragraph 3, of the Kyoto Protocol. The information provided on the activities under Article 3, paragraph 3, of the Kyoto Protocol is generally in line with the reporting requirements included in

paragraphs 5 to 9 of the annex to decision 15/CMP.1. However, the information provided in the KP-LULUCF section of the NIR is brief and in many cases only a reference is made to another section in the NIR where issues that are not necessary clearly described are referred to. The ERT recommends that Liechtenstein improve the transparency of its reporting of the KP-LULUCF supplementary information under Article 7, paragraph 1, of the Kyoto Protocol and strictly follow the guidance for reporting this information provided in the annex to decision 15/CMP.1.

85. Liechtenstein has identified the geographical location of the boundaries of the areas that encompass units of land subject to activities under Article 3, paragraph 3, of the Kyoto Protocol as the entire territory of the country. The land-related information reported in the NIR is very brief and not very transparent. The land transition matrix table (table NIR-2) is provided without sufficient information on how it has been developed and the information in the NIR (for example in chapters 11.1.1.1 and 7.2, figure 7-3, tables 7-3 and 7-4) on how the units of land encompassing activities under Article 3, paragraph 3, of the Kyoto Protocol are identifiable and traceable is not completely transparent. The ERT strongly recommends that Liechtenstein provide transparent and complete land-related information in the NIR of its next annual submission covering explicitly the requirements under paragraphs 5 to 9 of the annex to decision 15/CMP.1.

86. Liechtenstein reported all the pools under deforestation activities and reported above-ground biomass, below-ground biomass (as "IE") and soil organic carbon under afforestation and reforestation activities. Liechtenstein has not accounted for dead organic matter pools (litter and dead wood) under afforestation and reforestation but has provided verifiable information to justify that these pools are not a net source. Liechtenstein has reported emissions of non-CO_2 gases as "NO" in the CRF tables and included information in the NIR justifying the use of the notation key "NO" for N fertilization, drainage of soils, disturbance associated with land-use conversion to croplands, liming and biomass burning. The ERT considers the reporting of the activities and pools to be generally complete, but notes that, although biomass burning does occur in Liechtenstein the Party considers these emissions to be insignificant. Therefore, the ERT strongly recommends that Liechtenstein complete the reporting of these emissions in its next annual submission.

87. Liechtenstein has reported a number of recalculations in its 2011 submission for the year 2008: estimates of carbon stock changes for afforestation and reforestation in above-ground biomass due to improved data on growth of living biomass (table 7–8 of the NIR); estimates of carbon stock changes in soils due to the change from a 12-year to a 20-year conversion period, in response to the recommendation in previous review reports; area data due to the availability of new area statistics (chapter 7.2.2.1 of the NIR) according to which, the area for afforestation has changed slightly; and soil pool under deforestation following the recommendation of the previous review report, as the soil carbon content of the whole deforested area since 1990 is now based on data which are stratified by altitude and reduced by 50 per cent over a conversion period of 20 years. The reporting of the recalculations in the NIR is not fully transparent and does not provide an assessment of the impacts of these recalculations on the inventory estimates compared with the previous annual submission. For 2008, the recalculations resulted in a decrease of net removals for afforestation and reforestation of 73.0 per cent (8.67 Gg CO_2 eq) and a decrease in net emissions for deforestation of 90.2 per cent (3.30 Gg CO_2 eq). The ERT recommends that Liechtenstein improve the transparency and completeness of its reporting regarding recalculations in its next annual submission.

88. Liechtenstein has stated in the NIR that no emissions or removals have been factored out from the reporting of activities under Article 3, paragraph 3, of the Kyoto Protocol. However, Liechtenstein has reported that the activities of afforestation, reforestation and deforestation occur since 1990 and, according to its national definition, only directly

human-induced activities are considered under the Kyoto Protocol reporting. Harvesting does not currently occur in Liechtenstein due to the young age of forests. The definition of deforestation covers only permanent conversions from forest land into non-forest land and thus implicitly distinguishes between permanent conversions and transient situations such as harvesting or forest disturbance.

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

Afforestation and reforestation – CO_2

89. Liechtenstein has reported estimates of carbon stock changes for above-ground biomass and soil organic carbon under these activities using the same methods and parameters as used in the inventory of the LULUCF sector under the Convention (see para. 67 above). The ERT noted that Liechtenstein has reported below-ground biomass as "IE" and, therefore, encourages the Party to report these emissions separately in its next annual submission. The ERT recommends that Liechtenstein include additional information on below-ground biomass in its next annual submission.

90. Liechtenstein has not accounted for dead wood and litter pools (reported as "NO") under afforestation and reforestation activities and has stated that it used the tier 1 approach of the IPCC good practice guidance for LULUCF (section 3.1.5), which assumes these pools to be in balance. The ERT noted, based on decision 15/CMP.1, that in cases where Parties decided not to account for some pools, verifiable information needs to be presented by the Party in the NIR to justify the that these pools are not a net source of emissions. In response to a question raised by the ERT during the review, Liechtenstein provided information based on a study used for the Swiss annual submission that justified that soil and litter are not a net source. Since the forestry conditions in Liechtenstein are similar to Swiss forest conditions, this information can be used to justify Liechtenstein's reporting. However, this information should be included in the NIR and the justification could additionally be based on relevant national or Swiss studies. The ERT recommends that, in its next annual submission, Liechtenstein provide country-specific verifiable information or assessment in its next NIR, describing the specific condition of these pools and their management practices and how they affect carbon content.

Deforestation – CO_2 and N_2O

91. Liechtenstein reported that changes in total carbon stocks of living biomass, litter and dead wood is modelled by using the deforested area in 2009 and carbon stock change factors from the NIR table 7-8. In response to a question raised by the ERT during the review, Liechtenstein provided information on the sources of the data used but the information on the model or method used was not completely transparent. The ERT strongly recommends that Liechtenstein provide more transparent and complete documentation of the methods or models and assumptions used in its next annual submission.

92. Liechtenstein continues to report carbon stock changes for below-ground biomass as "IE, NE" in CRF table 5(KP-1)A.2. The previous review report identified this issue as a lack of transparency in the estimation of below-ground biomass carbon stock changes, and recommended that Liechtenstein either provide separate estimates for above-ground and below-ground biomass or additional information regarding the approach used and the justification for using an approach that does not allow the disaggregation of above-ground and below-ground biomass. No clear justification or specific information has been provided in the NIR of the 2011 submission in response to this recommendation. The ERT strongly reiterates the recommendation of the previous review report that Liechtenstein, in its next annual submission, provide either separate estimates for above-ground and below-ground

biomass or comprehensive additional information regarding the approach used and the justification for using an approach that does not allow the disaggregation of these pools. In addition, Liechtenstein has also reported carbon stock changes for organic soils as "IE, NE". The ERT strongly recommends that Liechtenstein provide estimates for this pool in its next annual submission.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

93. Liechtenstein has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 14/CMP.1 and 15/CMP.1. The ERT took note of the findings and recommendations included in the SIAR on the SEF tables and the SEF comparison report.[5] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

94. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with chapter I.E of the annex to decision 15/CMP.1, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements set out in paragraph 88(a–j) of the annex to decision 22/CMP.1. The ITL identified discrepancies with transactions proposed by the Liechtenstein during the reported period. However, the Party did not report information on any actions and the date of such actions taken to correct any problem that caused a discrepancy to occur, in accordance with paragraph 17 of the annex to decision 15/CMP.1. The ERT recommends that the Party include in its next annual submission the information required by paragraph 88 of the annex to decision 22/CMP.1 on the cause of the discrepancy. The ERT also recommends that Liechtenstein provide more detailed information on discrepancies (including the causes of discrepancies) when they have occurred. The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No non-replacement has occurred. Information reported by the Party on records of any discrepancies and on any records of non-replacement was found to be consistent with information provided to the secretariat by the ITL.

95. The ERT noted that Liechtenstein has not fulfilled the requirements regarding the public availability of information in accordance with section II.E of the annex to decision 13/CMP.1. The ERT recommends that Liechtenstein include the representative identifier defined as the Party identifier (the two-letter country code defined by ISO 3166) and a number unique to that representative within the Party's registry as required in paragraph 45(d) of the annex to decision 13/CMP.1. The ERT also recommends that Liechtenstein report, in its next annual submission, explanations on how the recommendations of previous review reports were addressed and their results.

Accounting of activities under Article 3, paragraph 3, of the Kyoto Protocol and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol

96. Liechtenstein has reported information on its accounting of KP-LULUCF in the accounting table, as included in the annex to decision 6/CMP.3. Information on the

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

accounting of KP-LULUCF has been prepared and reported in accordance with decisions 16/CMP.1 and 6/CMP.3. Table 4 shows the accounting quantities for KP-LULUCF as reported by the Party and the final values after the review.

Table 4
Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol, in t CO_2 eq

Activity	*2011 submission*[a]		*2010 submission*[b]		*"Net" accounting quantity*[c]
	As reported	*Revised estimates*	*Final*	*Final*	
Afforestation and reforestation	–6 431	NA	–6 431	–11 879	5 448
Deforestation	792	NA	792	3 658	–2 866
Forest management	NA	NA	NA	NA	NA
Article 3.3 offset[d]	NA	NA	NA	NA	NA
Forest management cap[e]	NA	NA	NA	NA	NA
Cropland management	NA	NA	NA	NA	NA
Grazing land management	NA	NA	NA	NA	NA
Revegetation	NA	NA	NA	NA	NA

[a] The values included under the 2011 submission are the cumulative accounting values for 2008 and 2009 as reported in the accounting table of the KP-LULUCF CRF tables for the inventory year 2009.

[b] The values included under the 2010 submission are the final accounting values as a result of the 2010 review and are included in table 6 of the 2010 annual review report (FCCC/ARR/2010/LIE, page 22).

[c] The "net" accounting quantity is the quantity of Kyoto Protocol units that the Party shall issue or cancel under each activity under Article 3, paragraph 3, and paragraph 4, if relevant, based on the final accounting quantity in the 2011 submission and where the quantities issued or cancelled based on the 2010 review have been subtracted ("net" accounting quantity = final 2011 – final 2010).

[d] Article 3.3 offset: For the first commitment period, a Party included in Annex I that incurs a net source of emissions under the provisions of Article 3, paragraph 3, may account for anthropogenic greenhouse gas (GHG) emissions by sources and removals by sinks in areas under forest management under Article 3, paragraph 4, up to a level that is equal to the net source of emissions under the provisions of Article 3, paragraph 3, but not greater than 9.0 megatonnes of carbon times five, if the total anthropogenic GHG emissions by sources and removals by sinks in the managed forest since 1990 is equal to, or larger than, the net source of emissions incurred under Article 3, paragraph 3.

[e] In accordance with paragraph 11 of the annex to decision 16/CMP.1, for the first commitment period only, additions to and subtractions from the assigned amount of a Party resulting from forest management under Article 3, paragraph 4, after the application of paragraph 10 of the annex to decision 16/CMP.1 and resulting from forest management project activities undertaken under Article 6, shall not exceed the value inscribed in the appendix of the annex to decision 16/CMP.1, times five.

97. Based on the information provided in table 4 for the afforestation and reforestation activities, Liechtenstein shall cancel 5,448 assigned amount units, emission reduction units and/or certified emission reduction units in its national registry. This cancellation takes into account the recalculated estimates for afforestation and reforestation for the year 2008 reported in the 2011 submission. This recalculation considerably reduced the net removals from afforestation and deforestation reported for 2008 in the previous submission, leading to a net cancellation of units in 2009.

98. Based on the information provided in table 4 for the deforestation activities, Liechtenstein shall issue 2,866 removal units in its national registry. This issuance takes

into account the recalculated estimates for deforestation for the year 2008 reported in the 2011 submission. This recalculation considerably reduced the net emissions from deforestation reported for 2008 in the previous submission, leading to a net issuance of units in 2009.

National registry

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

Calculation of the commitment period reserve

100. Liechtenstein has reported its commitment period reserve in its 2011 annual submission. The Party reported that its commitment period reserve has not changed since the initial report review (950,061 t CO_2 eq), as it is based on the assigned amount and not on the most recently reviewed inventory. The ERT agrees with this figure.

3. Changes to the national system

101. Liechtenstein has reported that there are no changes in its national system since the previous annual submission. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

102. Liechtenstein has reported that there are no changes in its national registry since the previous annual submission. The ERT concluded that the Party's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions.

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

103. Liechtenstein has not provided information on changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, in its annual submission. However, the ERT noted that, compared with the 2010 annual submission, Liechtenstein has expanded the information provided on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. Liechtenstein has reported that the policies and measures are very much compatible and consistent with those of the European Union to avoid trade distortions, non-tariff barriers to trade and to set similar incentives. In accordance with international law, this approach strives to ensure that Liechtenstein is implementing those climate change response measures that are least trade distortive and do not create unnecessary barriers to trade.

104. The ERT concluded that the information provided is transparent but not totally complete, as Liechtenstein has still not reported on how it gives priority, in implementing its commitments mentioned in Article 3, paragraph 1, of the Kyoto Protocol, to the actions listed in paragraph 24 of the annex to decision 15/CMP.1. Therefore, the ERT reiterates the

recommendation of the previous review report that Liechtenstein improve its reporting on how it gives priority, in implementing its commitments under Article 3, paragraph 14, of the Kyoto Protocol to the actions listed in paragraph 24 of the annex to decision 15/CMP.1.

III. Conclusions and recommendations

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

106. The ERT concludes that the inventory submission of Liechtenstein has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and Liechtenstein has submitted a complete set of CRF tables for the years 1990–2009 and an NIR; these are complete in terms of geographical coverage, gases, years and sectors, and generally complete in terms of categories (see paras. 41, 42 and 66 above).

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

108. Liechtenstein's inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, except for the allocation from the category food processing, beverages and tobacco (see para. 38 above).

109. Liechtenstein has made recalculations for the inventory between the 2010 and 2011 submissions for the whole time series 1990–2008 in response to recommendations of the 2010 annual review report and following changes in AD and EFs. The impact of these recalculations on the national totals is an increase in estimated total GHG emissions in 1990 (of 0.01 per cent) and in 2008 (of 0.11 per cent). The main recalculations took place in the following sectors/categories:

(a) Energy (see para. 32 above);

(b) Industrial processes and solvent and other product use (see para. 44 above);

(c) Agriculture (see para. 49 above);

(d) LULUCF (see para. 63 above);

(e) Waste (see para. 76 above).

110. Liechtenstein has reported afforestation and deforestation activities under Article 3, paragraph 3, of the Kyoto Protocol for 2008 and 2009 (the Party has reported that reforestation does not occur in the country). Liechtenstein has not elected any activities under Article 3, paragraph 4, of the Kyoto Protocol. Liechtenstein has chosen not to account for dead organic matter pools under afforestation and reforestation activities and provided verifiable information to justify that these pools are not a net source of emissions. Liechtenstein has reported emissions of non-CO_2 gases as "NO" and included information in the NIR justifying that these sources are not occurring, except for biomass burning (see para. 86 above). The ERT considered the reporting of the KP-LULUCF activities and pools to be generally complete.

111. Liechtenstein has made recalculations for the KP-LULUCF activities between the 2010 and 2011 submissions in response to recommendations of the 2010 annual review report and following changes in AD and EFs. The impact of these recalculations on each KP-LULUCF activity for 2008 is as follows:

(a) Afforestation and reforestation net removals decreased by 73.0 per cent;

(b) Deforestation net emissions decreased by 90.2 per cent.

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

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

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

115. Liechtenstein has reported information under chapter I.H of the annex to decision 15/CMP.1, "Minimization of adverse impacts in accordance with Article 3, paragraph 14" as part of its 2011 annual submission. The information was provided on 15 April 2011 and is transparent, but Liechtenstein has not reported on how it gives priority, in implementing its commitments mentioned in Article 3, paragraph 1, of the Kyoto Protocol, to the actions listed in paragraph 24 of the annex to decision 15/CMP.1 (see para. 103 above).

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

(a) Reporting the key category analysis for 1990 (see para. 9 above);

(b) Ensuring that sufficient sectoral expertise is available during the review week to react timely to the questions raised by the ERT during the review (see para. 13 above);

(c) Introducing a QC check that verifies the final update of CRF table 7 (see para. 15 above);

(d) Including information on recalculations in CRF table 8(b), at least for 1990 and the latest submission year, and on all recalculations in the NIR (see para. 20 above);

(e) Increasing the use of country-specific methods, including the provision in the NIR of more precise descriptions of the methodologies that differ from those of the IPCC good practice guidance, the IPCC good practice guidance for LULUCF or the Revised 1996 IPCC Guidelines (see para. 26(a) above);

(f) Enhancing the consistency of the information provided in the NIR and the CRF table 7 on the key category analysis (see para. 26(b) above);

(g) Resolving and implementing the recommendations on the national registry (see paras. 94 and 95 above).

117. In the course of the review, the ERT formulated a number of recommendations relating to the completeness, transparency and consistency of the information presented in Liechtenstein's annual submission. The key recommendations are that Liechtenstein:

(a) Improve the consistency of the information on energy consumption between the NIR and the CRF (see para. 35 above);

(b) Complete the information on feedstocks and non-energy use of fuels (see para. 37 above); and reallocate the emissions from liquid and gaseous fuels from food processing, beverages and tobacco (see para. 38 above);

(c) Improve the transparency of the information on CO_2 EFs for gasoline and diesel oil for road transportation (see para. 39 above) and reallocate emissions from off-road and other mobile equipment (see para. 40 above);

(d) Review the reporting of fugitive emissions from energy and industrial plants and the commercial/institutional and residential categories and from natural gas transmission (see paras. 41 and 42 above);

(e) Increase the use of country-specific methods and parameters in fugitive emissions from natural gas (see para. 41 above);

(f) Report on all recalculations for the industrial processes sector (see para. 44 above) and activities under Article 3, paragraph 3, of the Kyoto Protocol (see para. 87 above);

(g) Improve the completeness and transparency of the information reported in the NIR, in particular in the agriculture (see paras. 49, 51, 53 and 56–61 above) and LULUCF sectors (see paras. 63, 65, 68 and 70 above);

(h) Review the reporting of emissions from biomass burning (see paras. 66 and 86 above);

(i) Enhance its QA/QC practices for the agriculture sector (see paras. 57, 58 and 61 above);

(j) Improve the transparency of the reporting of illegal waste incineration (see para. 82 above);

(k) Improve the transparency of the supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol (see para. 84 above), including information on land units (see para. 85above), below-ground biomass (see paras. 89 and 92 above), dead wood and litter pools (see para. 90 above), methods used to estimate emissions from deforestation activities (see para. 91 above);

(l) Complete the reporting of carbon stock changes for organic soils (see para. 92 above);

(m) Report on how Liechtenstein gives priority, in implementing its commitments mentioned in Article 3, paragraph 1, of the Kyoto Protocol, to the actions listed in paragraph 24 of the annex to decision 15/CMP.1 (see para. 103 above).

IV. Questions of implementation

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

Annex I

Documents and information used during the review

A. Reference documents

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

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

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

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

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

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

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

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

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

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

FCCC/ARR/2010/LIE. Report of the individual review of the greenhouse gas inventory of Liechtenstein submitted in 2010. Available at <http://unfccc.int/resource/docs/2010/arr/lie2.pdf.>.

UNFCCC. Standard Independent Assessment Report, parts I and II. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Patrick Insinna (Air Quality, Climate, Noise and NIR Division, Liechtenstein National Administration), including additional material on the methodology and assumptions used.

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
ERT	expert review team
FAO	Food and Agriculture Organization of the United Nations
$Frac_{GASM}$	fraction of N from livestock that volatilizes as ammonia and N oxides
$Frac_{GASF}$	fraction of N from synthetic fertilizer applied to soils that volatilizes as ammonia and N oxides
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IDP	inventory development plan
IE	included elsewhere
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
KP-LULUCF	Land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
UNFCCC	United Nations Framework Convention on Climate Change
Ym	methane conversion factor