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Climate Change

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Report on the individual review of the annual submission of Liechtenstein submitted in 2018*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual greenhouse gas inventory covering emissions and removals of greenhouse gas emissions for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). Parties included in Annex I to the Convention that are Parties to the Kyoto Protocol are also required to report supplementary information under Article 7, paragraph 1, of the Kyoto Protocol with the inventory submission due under the Convention. This report presents the results of the individual inventory review of the 2018 annual submission of Liechtenstein, conducted by an expert review team in accordance with the “Guidelines for review under Article 8 of the Kyoto Protocol”. The review took place from 17 to 22 September 2018 in Bonn.

* In the symbol for this document, 2018 refers to the year in which the inventory was submitted, not to the year of publication.

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Abbreviations and acronyms

2006 IPCC Guidelines	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
AAU	assigned amount unit
AD	activity data
Annex A sources	source categories included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
AREA	Land Use Statistics of the Swiss Federal Statistical Office
ARR	annual review report
Article 8 review guidelines	“Guidelines for review under Article 8 of the Kyoto Protocol”
BEF	biomass expansion factor
C	confidential
CER	certified emission reduction
CH ₄	methane
CM	cropland management
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ eq	carbon dioxide equivalent
CPR	commitment period reserve
CRF	common reporting format
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
EU	European Union
FM	forest management
FMRL	forest management reference level
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
HWP	harvested wood products
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
KP-LULUCF activities	LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
MSW	municipal solid waste
N	nitrogen
NA	not applicable
NE	not estimated
NF ₃	nitrogen trifluoride
NH ₃	ammonia
NIR	national inventory report
NMVO	non-methane volatile organic compounds
NO	not occurring
NO _x	nitrogen oxides
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit

RV	revegetation
SEF	standard electronic format
SIAR	standard independent assessment report
UAN	urea ammonium nitrate
UNFCCC Annex I inventory reporting guidelines	“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories”
UNFCCC review guidelines	“Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention”
WDR	wetland drainage and rewetting
Wetlands Supplement	<i>2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands</i>

I. Introduction¹

1. This report covers the review of the 2018 annual submission of Liechtenstein organized by the secretariat, in accordance with the Article 8 review guidelines (adopted by decision 22/CMP.1 and revised by decision 4/CMP.11). In accordance with the Article 8 review guidelines, this review process also encompasses the review under the Convention as described in the UNFCCC review guidelines, particularly in part III thereof, namely the “UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention” (decision 13/CP.20). The review took place from 17 to 22 September 2018 in Bonn and was coordinated by Mr. Tomoyuki Aizawa and Simon Wear (secretariat). Table 1 provides information on the composition of the ERT that conducted the review of Liechtenstein.

Table 1

Composition of the expert review team that conducted the review of Liechtenstein

<i>Area of expertise</i>	<i>Name</i>	<i>Party</i>
Generalist	Mr. Mikhail Gytarskiy	Russian Federation
	Ms. Agnieszka Patoka-Janowska	Poland
Energy	Mr. Alexey Cherednichenko	Kazakhstan
	Mr. Pedro Faria	United Kingdom of Great Britain and Northern Ireland
	Mr. Peter Seizov	Bulgaria
IPPU	Ms. Elsa Hatanaka	Japan
	Ms. Qing Tong	China
Agriculture	Ms. Hongmin Dong	China
	Mr. Chang Liang	Canada
LULUCF	Ms. Oksana Butrym	Ukraine
	Mr. Markus Didion	Switzerland
	Mr. Igor Onopchuk	Ukraine
Waste	Mr. Philip Acquah	Ghana
	Mr. Pavel Gavrilita	Republic of Moldova
	Mr. Julius Madzore	Zimbabwe
Lead reviewers	Mr. Acquah	
	Mr. Gytarskiy	

2. The basis of the findings in this report is the assessment by the ERT of the Party’s 2018 annual submission, in accordance with the Article 8 review guidelines. The ERT notes that the individual inventory review of Liechtenstein’s 2017 annual submission did not take place in 2017 owing to insufficient funding for the review process.

¹ At the time of publication of this report, Liechtenstein had submitted its instrument of ratification of the Doha Amendment; however, the Amendment had not yet entered into force. The implementation of the provisions of the Doha Amendment is therefore considered in this report in the context of decision 1/CMP.8, paragraph 6, pending the entry into force of the Amendment.

3. The ERT has made recommendations that Liechtenstein resolve the findings related to issues,² including issues designated as problems.³ Other findings, and, if applicable, the encouragements of the ERT to Liechtenstein to resolve them, are also included.

4. 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.

5. Annex I shows annual GHG emissions for Liechtenstein, including totals excluding and including the LULUCF sector, indirect CO₂ emissions and emissions by gas and by sector. Annex I also contains background data related to emissions and removals from KP-LULUCF activities, if elected, by gas, sector and activity for Liechtenstein.

6. Information to be included in the compilation and accounting database can be found in annex II.

II. Summary and general assessment of the 2018 annual submission

7. Table 2 provides the assessment by the ERT of the annual submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

Table 2
Summary of review results and general assessment of the inventory of Liechtenstein

<i>Assessment</i>	<i>Issue or problem ID#(s) in table 3 and/or 5^a</i>		
Date of submission	Original submission: 12 April 2018 (NIR), 12 April 2018, Version 1 (CRF tables), 12 April 2018 (SEF-CP1-2017 and SEF-CP2-2017 tables)		
Review format	Centralized		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and Wetlands Supplement (if applicable)	1. Have any issues been identified in the following areas:		
	(a) Identification of key categories	No	
	(b) Selection and use of methodologies and assumptions	Yes	G.5, A.10
	(c) Development and selection of EFs	Yes	E.17
	(d) Collection and selection of AD	Yes	E.9, E.10
	(e) Reporting of recalculations	No	
	(f) Reporting of a consistent time series	Yes	E.6
	(g) Reporting of uncertainties, including methodologies	Yes	G.7, G.8, L.1, L.5, W.2, KL.1
	(h) QA/QC	QA/QC procedures were assessed in the context of the national system (see para. 2 in this table)	
	(i) Missing categories/completeness ^b	Yes	L.18
	(j) Application of corrections to the inventory	No	

² Issues are defined in decision 13/CP.20, annex, paragraph 81.

³ Problems are defined in decision 22/CMP.1, annex, paragraphs 68 and 69, as revised by decision 4/CMP.11.

<i>Assessment</i>			<i>Issue or problem ID#(s) in table 3 and/or 5^a</i>
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	Yes	A.11
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	No	L.17
Supplementary information under the Kyoto Protocol	2. Have any issues been identified related to the national system: (a) The overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements (b) Performance of the national system functions	No No	
	3. Have any issues been identified related to the national registry: (a) Overall functioning of the national registry (b) Performance of the functions of the national registry and the technical standards for data exchange	No Yes	G.10
	4. Have any issues been identified related to reporting of information on ERUs, CERs, AAUs and RMUs and on discrepancies reported in accordance with decision 15/CMP.1, annex, chapter I.E, in conjunction with decision 3/CMP.11, taking into consideration any findings or recommendations contained in the SIAR?	No	
	5. Have any issues been identified in matters related to Article 3, paragraph 14, of the Kyoto Protocol, specifically problems related to the transparency, completeness or timeliness of reporting on the Party's activities related to the priority actions listed in decision 15/CMP.1, annex, paragraph 24, in conjunction with decision 3/CMP.11, including any changes since the previous annual submission?	Yes	G.1, G.2
	6. Have any issues been identified related to the reporting of LULUCF activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as follows: (a) Reporting requirements in decision 2/CMP.8, annex II, paragraphs 1–5 (b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14 (c) Reporting requirements of decision 6/CMP.9 (d) Country-specific information to support provisions for natural disturbances, in accordance with decision 2/CMP.7, annex, paragraphs 33 and 34	Yes No Yes No	L.10, KL.6 KL.4

<i>Assessment</i>			<i>Issue or problem ID#(s) in table 3 and/or 5^a</i>
CPR	Was the CPR reported in accordance with the annex to decision 18/CP.7, the annex to decision 11/CMP.1 and decision 1/CMP.8, paragraph 18?	No	G.13
Adjustments	Has the ERT applied an adjustment under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Did the Party submit a revised estimate to replace a previously applied adjustment?	No	The Party does not have a previously applied adjustment
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for the assessment of conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	No	
Question of implementation	Did the ERT list any question of implementation?	No	

^a The ERT identified additional issues in all sectors that are not specifically listed in table 2 but are included in table 3 and/or 5.

^b Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex III.

III. Status of implementation of issues and/or problems raised in the previous review report

8. Table 3 compiles all the recommendations made in previous review reports that were included in the previous review report, published on 21 September 2017.⁴ For each issue and/or problem, the ERT specified whether it believes the issue and/or problem has been resolved by the conclusion of the review of the 2018 annual submission and provided the rationale for its determination, which takes into consideration the publication date of the previous review report and national circumstances.

Table 3
Status of implementation of issues and/or problems raised in the previous review report of Liechtenstein

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
General			
G.1	Article 3, paragraph 14, of the Kyoto Protocol – (G.4, 2016) (G.4, 2015) (115, 2014) Transparency	Include in the NIR information on how priority is given to the actions listed in decision 15/CMP.1, annex, paragraph 24(a) and (b), in implementing commitments under Article 3, paragraph 14, of the Kyoto Protocol.	Not resolved. The ERT noted that the information in the NIR on minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol did not clearly indicate the efforts undertaken to progressively reduce or phase out market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all GHG-emitting sectors, taking into account the need for energy

⁴ FCCC/ARR/2016/LIE. The ERT notes that the individual inventory review of Liechtenstein’s 2017 annual submission did not take place in 2017. As a result, the latest published ARR reflects the findings of the review of the Party’s 2016 annual submission.

ID#	Issue and/or problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
			price reforms to reflect market prices and externalities. Further, the NIR does not contain a description of the actions taken on removing subsidies associated with the use of environmentally unsound and unsafe technologies. During the review, Liechtenstein clarified that most of the actions referred to above have been addressed through its Energy Strategy and decisions of the Government of Liechtenstein. The Party further clarified that it does not subsidize environmentally unsound and unsafe technologies. Furthermore, Liechtenstein informed the ERT of its additional difficulties in prioritizing the actions listed in decision 15/CMP.1, annex, paragraph 24(a) and (b), which have arisen because of the specificity of the customs treaty with Switzerland.
G.2	Article 3, paragraph 14, of the Kyoto Protocol – (G.5, 2016) (G.5, 2015) (116, 2014) Transparency	Report any changes in the information provided under Article 3, paragraph 14, of the Kyoto Protocol, in accordance with decision 15/CMP.1, annex, chapter I.H.	Not resolved. The ERT noted that the information in the NIR on minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol, did not include the identification of changes since the previous year's annual submission. During the review, the Party informed the ERT that there have been no changes since the previous submission.
G.3	National registry – (G.10, 2016) (G.10, 2015) Transparency	Include information to explain that the national registry is operated by the EU; hence the Party assigned the functions relating to the disaster recovery plan to the central administrator of the EU transaction log and EU consolidated registry.	Resolved. Liechtenstein explained how the SIAR recommendations were addressed in chapter 14 of its NIR (pp.297–299). The ERT further noted that the Party has submitted the disaster recovery plan, which is confidential information. Furthermore, the ERT noted that the Party's national registry is a part of the EU registry system, and it has passed common operational checks with no discrepancies identified.
Energy			
E.1	International bunkers and multilateral operations – liquid fuels – CO ₂ , CH ₄ and N ₂ O (E.2, 2016) (E.2, 2015) (31, 2014) Accuracy	Determine the shares of domestic and international aviation for the years of the 2003–2011 period based on data collected in 2002 and 2012 in a similar manner to the approach used for the period 1996–2000 (i.e. interpolation based on data available for 1995 and 2001).	Resolved. The NIR (p.80, p.81) confirms that for the years 2003–2011 a linear interpolation was applied to determine the share of domestic aviation AD, and this is explained in the NIR (p.108).
E.2	International bunkers and multilateral operations – liquid fuels – CO ₂ , CH ₄ and N ₂ O (E.3, 2016) (E.3, 2015) (31, 2014) Adherence to the	Correct the values reported in the NIR for the share of emissions from international aviation and improve the QC procedures so as to minimize discrepancies between the CRF tables and the NIR.	Addressing. The values reported in the NIR for the share of emissions from international aviation have been corrected; however, improvements to QC procedures so as to minimize discrepancies between the CRF tables and the NIR have not yet been resolved (specifically p.80, p.81 and p.108).

ID#	Issue and/or problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
	UNFCCC Annex I inventory reporting guidelines		
E.3	Feedstocks, reductants and other non-energy use of fuels – liquid fuels (lubricants and bitumen) – CO ₂ (E.4, 2016) (E.4, 2015) (33, 2014) (27, 2013) (36, 2012) Completeness	Report lubricants and bitumen use in CRF tables 1.A(b) and 1.A(d) for the entire time series, including lubricants used for two-stroke engines.	Resolved. Both lubricant and bitumen are reported in tables 1.A(b) and 1.A(d) instead of using the notation key “NO” reported in the 2016 submission. For the 2018 submission this was done for the entire time series and between 1990 and 2016.
E.4	Feedstocks, reductants and other non-energy use of fuels – liquid fuels – CO ₂ (E.15, 2016) (E.15, 2015) Completeness	Report lubricant and bitumen use in CRF tables 1.A(b) and 1.A(d), respectively, for the entire time series, including lubricants used for two-stroke engines. If these emissions are considered insignificant, the Party should report them as “NE” and provide a quantitative estimate of the likely level of the emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. Both lubricants and bitumen are reported in tables 1.A(b) and 1.A(d) instead of using the notation key “NO” applied previously. This was done for the entire time series between 1990 and 2016.
E.5	1.A.2.e Food processing, beverages and tobacco – liquid and gaseous fuels – CO ₂ , CH ₄ and N ₂ O (E.8, 2016) (E.8, 2015) (41, 2014) Transparency	Review the confidentiality of the emission estimates and AD of the two operators in order to be able to report information in the category food processing, beverages and tobacco for the period 2008–2012.	Not resolved. There emissions are still reported using the notation key “NO” instead of “C”.
E.6	1.A.3.a Domestic aviation – liquids fuels – CO ₂ , CH ₄ and N ₂ O (E.17, 2016) (E.17, 2015) Consistency	Apply a comprehensive data gap analysis and select the most relevant splicing technique to fill gaps in the time series for the percentage allocation of kerosene consumption between domestic and international aviation.	Resolved. Since 2012, consumption data have been available both for total consumption and for domestic consumption. The data are gathered separately from the operators, therefore there is no need to establish a ratio of domestic to international flights.
E.7	1.A.3.b Road transportation – biomass – CO ₂ (E.10, 2016) (E.10, 2015) (44, 2014) Consistency	Revise the information contained in the NIR to clarify that CO ₂ emissions from biofuels used in road transportation for the years 2007–2009 are not reported under memo items but under 1.A.3.b, consistent with the information reported in the CRF tables.	Resolved. Liechtenstein provided a full explanation in the NIR (p.104).
E.8	1.A.3.e Other transportation –	Include the information in the NIR that neither fuel consumption by	Resolved. The NIR explains (p.104) that fuel consumption by equipment supporting pipeline

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	liquid fuels – CO ₂ , CH ₄ and N ₂ O (E.11, 2016) (E.11, 2015) (47, 2014) Transparency	equipment supporting the pipeline transportation activities of natural gas nor ground activities in airports occur in Liechtenstein.	transportation activities of natural gas and ground activities in airports does not occur in Liechtenstein.
E.9	1.A.4.a Commercial/institutional – liquid fuels – CO ₂ , CH ₄ and N ₂ O (E.18, 2016) (E.18, 2015) Accuracy	Correct the values reported for alkylate gasoline consumption for 2012 and 2013.	Not resolved. The Party has not corrected the values reported for alkylate gasoline consumption for 2012 and 2013 nor improved the QA/QC in the NIR. The NIR does not explain the calculation of alkylate AD. The NIR explains (p. 89, p.113 and p.115) that the distribution between subcategories 1.A.4.b and 1.A.4.a is 20 per cent to 80 per cent, respectively, but data in the NIR show a distribution of 25 per cent and 75 per cent, respectively.
E.10	1.A.4.c Agriculture/forestry/fishing – liquid fuels – N ₂ O (E.19, 2016) (E.19, 2015) Accuracy	Correct the values reported for alkylate gasoline consumption for 2012 and 2013.	Not resolved. The Party has not corrected the values reported for alkylate gasoline consumption for 2012 and 2013 nor improved the QA/QC in the NIR. The NIR does not explain the calculation of alkylate AD. The NIR explains (p.89, p.113 and p.115) that the distribution between subcategories 1.A.4.b and 1.A.4.c is 20 per cent to 80 per cent, respectively, but data in the NIR show a distribution of 25 per cent and 75 per cent, respectively.
E.11	1.B.2.b Natural gas – gaseous fuels – CH ₄ (E.13, 2016) (E.13, 2015) (50, 2014) Transparency	Explain in detail the methodology for estimating emissions and provide and reference in the NIR all the AD and parameters used.	Resolved. The methodology for estimating emissions from fugitive emissions from solid fuels, oil and natural gas and other emissions from energy production is explained in sufficient detail in the NIR (pp.119–124).
E.12	1.B.2.b Natural gas – gaseous fuels – CH ₄ (E.20, 2016) (E.20, 2015) Accuracy	Correct the errors in the calculation spreadsheet for the category 1.B.2.b.5.	Resolved. The Party corrected the spreadsheet and provided an explanation of the recalculation in the NIR (chapter 3.3.2.5; category-specific recalculations, p.119).
IPPU			
I.1	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.3, 2016) (I.3, 2015) Transparency	Improve the reporting of recalculations associated with the use of F-gases in refrigeration and air conditioning.	Resolved. The NIR (chapter 4.7.5) includes information on what parameters changed for which year and which year's emissions are affected, as well as the scale of the recalculations.
Agriculture			
A.1	3.A Enteric fermentation and 3.B Manure management – CH ₄ (A.2, 2016) (A.2,	Include in the NIR relevant information on country-specific CH ₄ EFs as well as values for volatile solids excreted per animal subcategory for the categories enteric	Resolved. Liechtenstein has provided country-specific CH ₄ , EFs or AD for volatile solids excreted per animal subcategory for enteric fermentation and manure management (NIR, annex A.3.2, pp.307–308).

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	2015) (61, 2014) Transparency	fermentation and manure management.	
A.2	3.B Manure management – CH ₄ (A.4, 2016) (A.4, 2015) (69, 2014) Transparency	Improve QC procedures to ensure the consistency of the information provided in the CRF tables.	Not resolved. Liechtenstein has not corrected inconsistencies in the information provided in the CRF tables. For example, in CRF table 3.B(a).s2, Liechtenstein reported the allocation of manure for goats and mules and asses as “NO” for all animal waste management systems; however, CH ₄ emissions from manure management for these animals were reported in CRF table 3.B(a).s1, and information on nitrogen excretion was reported for some manure management systems in CRF table 3.B(b) for these animals. In addition, in CRF table 3.B(a).s2, the allocation of manure to estimate CH ₄ emissions for manure management for growing cattle is 1.4 per cent of the total growing cattle, while in table 5-11 of the NIR (“Manure management system distribution (MS) for Liechtenstein for selected years”), and 1.5 per cent of allocation of manure is given for growing cattle in other systems.
A.3	3.A.1 Cattle – CH ₄ (A.6, 2016) (A.6, 2015) (65, 2014) Transparency	Replace notation keys with numerical data in the additional information table, where appropriate, or justify the use of notation keys in a footnote or the documentation box to CRF table 4.A.	Addressing. Liechtenstein has replaced some of the notation keys with numerical data in the additional information table (i.e. for digestibility of feed for growing cattle, horses, and mules and asses). Information has not been provided in a footnote or the documentation box to CRF table 3.As1 (formerly CRF table 4.A) in cases where notation keys are used.
A.4	3.A.1 Cattle – CH ₄ (A.15, 2016) (A.15, 2015) Transparency	Use Switzerland’s values for the feeding situation and justify the relevance of these values to national circumstances.	Resolved. The Party provided an explanation in the NIR (pp.149–150) for its use of the feeding situation in Switzerland.
A.5	3.B.1 Cattle – CH ₄ (A.16, 2016) (A.16, 2015) Adherence to the UNFCCC Annex I inventory reporting guidelines	Review the consistency of the information reported within the CRF tables and between the CRF tables and the NIR on animal waste management systems for goats, mules and asses and on the allocation of manure for growing cattle.	Not resolved. In CRF table 3.B(a).s2, Liechtenstein reported the allocation of manure for goats and mules and asses as “NO” for all manure management systems; however, CH ₄ emissions from manure management for these animals were reported in CRF table 3.B(a).s1, and information on nitrogen excretion was reported for some manure management systems in CRF table 3.B(b) for these animals.
A.6	3.D.a Direct N ₂ O emissions from managed soils N ₂ O (A.12, 2016) (A.12, 2015) (71, 2014) Transparency	Include in the NIR information about factors that influenced the sharp increase of emissions from nitrogen-fixing crops in 2011.	Not resolved. Liechtenstein has not provided any information in its NIR to explain the sharp increase of emissions from nitrogen-fixing crops for 2011 (8.4 per cent).

LULUCF

L.1	4. General (LULUCF) –	Improve the descriptions of the methodology for estimating	Addressing. Liechtenstein improved its description of uncertainties in the NIR
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ID#	Issue and/or problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
	(L.1, 2016) (L.1, 2015) (77, 2014) Transparency	uncertainties and the reporting of the uncertainty values in the NIR.	regarding expert judgment (chapters 6.4.3, 6.5.3 and 6.6.3). However, the ERT noted that there is still a lack of transparency: sources of uncertainty are described for the dominant processes only (e.g. for grassland remaining grassland only the uncertainty of AD is described, but not of EF); assumptions are not explained and justified (e.g. 30 per cent of the soil map, chapters 6.5.3 and 6.6.3). In response to a question raised by the ERT Liechtenstein noted that the justification of assumptions on dominant processes will be improved.
L.2	4. General (LULUCF) – (L.2, 2016) (L.2, 2015) (78, 2014) (68, 2013) Transparency	Continue to develop the land area identification system in order to obtain accurate data, or validate data calculated by extrapolation.	Resolved. Liechtenstein provides sufficient justification for its land area identification system and updated the AREA data (NIR, chapter 6.3).
L.3	4. General (LULUCF) – (L.10, 2016) (L.10, 2015) Consistency	Investigate the consistency of AD for HWP from the various sources it has used and correct any inconsistencies identified.	Resolved. Liechtenstein revised and recalculated its HWP data (NIR, chapter 6.11.5).
L.4	4. General (LULUCF) – (L.11, 2016) (L.11, 2015) Transparency	Demonstrate that country-specific land-use categories have been classified in accordance with the IPCC land-use classification.	Addressing. Liechtenstein improved its description and ensured the transparency of information on land-use areas and land-use changes (NIR chapter 6.3; see also ID# L.2). Land-use categories are categorized based on the land-use classification guidance in the 2006 IPCC Guidelines. Liechtenstein explains in the NIR (chapter 6.2) that it adopts the method and the classification (table 6-6) from Switzerland. However, the demonstration that the methodology is applicable and represents a country-specific categorization needs to be improved. (Chapter 6.2.1, p.204, of the NIR only states that the Swiss Land Use Statistics are the basis for the land area representation in Liechtenstein).
L.5	4. General (LULUCF) – (L.13, 2016) (L.13, 2015) Transparency	Provide information on methods used for estimating uncertainty in the form of an annex for the AD, EFs and other parameters.	Addressing – see ID# L.1. The Party has not included additional information in an annex.
L.6	4.A.2 Land converted to forest land – CO ₂ (L.8, 2016) (L.8, 2015) (83, 2014) Transparency	Report afforestation under the category land converted to forest land rather than the category forest land remaining forest land, explain the recalculation and include the explanation in the appropriate section of the NIR.	Resolved. Liechtenstein revised its description of the subcategories under forest land. Afforestation is reported under human-induced conversion to forest land (NIR, chapter 6.4.2.6).
L.7	4.C.1 Grassland remaining grassland – CO ₂	Include, in the NIR, a more detailed justification for the categorization of grasslands applied to subcategories representing carbon stocks and	Resolved. Liechtenstein provided information to justify the categorization of orchards and

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	(L.9, 2016) (L.9, 2015) (84, 2014) Transparency	dynamics of grasslands better than those of croplands to meet the requirements of the IPCC <i>Good Practice Guidance for Land Use, Land-Use Change and Forestry</i> , or use the categorization indicated in that guidance.	related subcategories as grasslands (NIR, chapter 6.2.1).
L.8	4.C.1 Grassland remaining grassland – CO ₂ (L.14, 2016) (L.14, 2015) Transparency	Report carbon stock changes of biomass from vineyards, low-stem orchards, tree nurseries, other orchards, copse and shrubs under cropland remaining cropland and not under grassland remaining grassland, because these are typical cropland vegetation types.	Resolved. See ID# L.7 above.
L.9	4.G Harvested wood products – CO ₂ (L.15, 2016) (L.15, 2015) Transparency	Explore the possibility of using industrial roundwood production in accordance with the good practice from the 2006 IPCC Guidelines.	Resolved. Liechtenstein revised the documentation of HWP and improved the transparency and accuracy on the basis of a survey on sawnwood (NIR, chapter 6.11.2).
L.10	4.G Harvested wood products – CO ₂ (L.16, 2016) (L.16, 2015) Transparency	Report information on HWP pools and categories in accordance with the requirements of decision 2/CMP.8, annex II, paragraph 2(g)(i).	Not resolved. Liechtenstein has not further developed the information on exported HWP as required by decision 2/CMP.8, annex II, paragraph 2(g)(i). The Party noted that a revision regarding this reporting is planned for the next submission (2019).
L.11	4.G Harvested wood products – CO ₂ (L.17, 2016) (L.17, 2015) Transparency	Explore the collection of data on the other types of HWP and provide information in the NIR on whether it uses the same half-life for export and import for these products.	Resolved. Liechtenstein provided a justification demonstrating that there is no wood panel and paper production in Liechtenstein (NIR, chapter 6.11.2).

Waste

W.1	5. General (waste) – (W.1, 2016) (W.1, 2015) (88, 2014) Transparency	Undertake an evaluation to ensure that the methods, parameters and other data provided in the inventory submission are applicable to the national circumstances, and document these checks in future annual submissions.	Addressing. The Party explained in the NIR (chapter 1.2.3.1, p.36) that for all sectors the Swiss experts have completed a review and evaluation of the applicability of Swiss methodologies and EFs with the experts in Liechtenstein’s administration. Regarding the waste sector specifically, according to the NIR (p.244) the living standards, the structure and the technical standards and legal principles (threshold values, etc.) in the waste sector of Liechtenstein correspond to Swiss standards; however, the specific evaluation undertaken and checks conducted were not provided. During the review the Party provided to the ERT a copy of the law and ordinance that govern waste management and treatment technologies in Switzerland and Liechtenstein however, although information was not provided in the NIR to summarize how the
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ID#	Issue and/or problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
W.2	5. General (waste) – (W.2, 2016) (W.2, 2015) (89, 2014) Adherence to the UNFCCC Annex I inventory reporting guidelines	Provide quantitative uncertainty estimates for all waste categories and discuss the reasons for the uncertainty estimates in the appropriate section of the waste chapter of the NIR, following the outline for the NIR in the UNFCCC Annex I inventory reporting guidelines.	Swiss framework for the waste sector is applicable to Liechtenstein. Not resolved. Liechtenstein did not report quantitative uncertainty values for all categories in the waste sector. During the review, the Party explained that this is because none of the subcategories in the waste sector is a key category. The Party indicated that it will provide an improvement plan for implementation in future submissions if any subcategory is identified as a key category. The ERT notes that according to the UNFCCC Annex I inventory reporting guidelines (para. 15), Parties are to quantitatively estimate the uncertainty of the data used for all source and sink categories using at least approach 1.
W.3	5. General (waste) – CO ₂ , CH ₄ and N ₂ O (W.4, 2016) (W.4, 2015) Transparency	Improve the transparency of reporting by providing in the NIR a detailed justification for the methods, EFs and assumptions of Switzerland being applicable to the estimation of emissions in Liechtenstein, and a description of how standards in the waste sector of Liechtenstein correspond to those of the waste sector in Switzerland.	Addressing. See ID# W.1. The previous ERT noted that the Party could use the information provided to the ERT during the review for this purpose.
W.4	5.A.1 Managed waste disposal sites and 5.A.2 Unmanaged waste disposal sites – CH ₄ (W.6, 2016) (W.6, 2015) Accuracy	Apply the first-order decay model and the parameters provided in the 2006 IPCC Guidelines (vol. 5, chapters 2 and 3) to quantify CH ₄ emissions from solid waste disposal and include this information in the next submission.	Resolved. Liechtenstein transitioned to the application of the 2006 IPCC Guidelines in the 2018 annual submission. Emissions in 2018 have thus been calculated using a tier 1 method based on the decision tree for solid waste disposal in the 2006 IPCC Guidelines (vol. 5, chapter 3, figure 3.1). The spreadsheet for the first-order decay model provided by the 2006 IPCC Guidelines has been applied, using default parameters relevant to Liechtenstein's local conditions, including use of the value 0.5 for the fraction of degradable organic carbon dissimilated from the 2006 IPCC Guidelines (NIR, chapter 7.2.2, pp.246–247).
W.5	5.A.2 Unmanaged waste disposal sites – CH ₄ (W.7, 2016) (W.7, 2015) Transparency	Include in the NIR an explanation for the assumption that all unmanaged solid waste disposal sites are of less than 5 m depth, and perform a country-wide survey to assess the current depth of its unmanaged landfill sites or provide justification for the assumption that even with a growth in height of the landfill, total CH ₄ emissions from this category will remain below the 500 kt threshold.	Resolved. The ERT notes that all the landfill sites are closed solid waste disposal sites (as defined in the 2006 IPCC Guidelines, p.324), and will continue to have declining CH ₄ emissions; Thus, the current total emissions estimated at 4.50 t CO ₂ eq for unmanaged sites (<5 m) will not exceed the 500 kt threshold if all the closed sites transition to deep sites (>5 m) and the methane correction factor is consequently changed from 0.4 to 0.6.
W.6	5.A.2 Unmanaged waste disposal sites – CH ₄	Provide in the NIR clear information on the selection of the bulk waste data option for the first-order decay	Resolved. Liechtenstein adopted the 2006 IPCC Guidelines for the waste sector in the 2018 annual submission. Emissions have therefore

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	(W.8, 2016) (W.8, 2015) Transparency	model used to estimate emissions in this category.	been calculated using a tier 1 method based on the decision tree for solid waste disposal (2006 IPCC Guidelines, vol. 5, chapter 3, figure 3.1). The spreadsheet for the first-order decay model from the 2006 IPCC Guidelines has been applied, using composition of landfilled MSW based on Swiss data instead of bulk waste data. This allowed the Party to obtain values for degradable organic carbon for each waste fraction required in the first-order decay model. Further, appropriate default values from the 2006 IPCC Guidelines are used and documented (NIR, table 7.3, p.247), and recalculations have been performed for the entire time series.
W.7	5.B.1 Composting – CH ₄ and N ₂ O (W.9, 2016) (W.9, 2015) Transparency	Provide in the NIR clear information on the AD related to dry matter and wet matter, and ensure that the AD are consistent between the NIR and the CRF tables.	Addressing. The AD in NIR table 7-6 match those reported in CRF table 5.B; however, the NIR does not indicate whether data are reported on a wet or dry matter basis. During the review Liechtenstein confirmed that the AD and EFs in the NIR and the CRF tables are based on wet matter.
W.8	5.D Wastewater treatment and discharge – CH ₄ and N ₂ O (W.10, 2016) (W.10, 2015) Transparency	Report transparently on the methodology and parameters used.	Resolved. Liechtenstein applied the tier 3 methodology to estimate emissions from centralized wastewater treatment plants based on the decision tree in the 2006 IPCC Guidelines (chapter 6, figures 6.2 and 6.3) for CH ₄ and N ₂ O emissions and performed the necessary recalculations for the entire time series (1990–2015). Liechtenstein has included in the NIR detailed information on the AD and EFs used (table 7.12 and chapter 7.5.2.2, p.256) on annual per capita protein consumption and mass of nitrogen contained in the removed sludge (NIR, p.255).
KP-LULUCF			
KL.1	General (KP-LULUCF) – (KL.3, 2016) (KL.3, 2015) Transparency	Provide a clear description of the methodology for conducting the uncertainty analysis of KP-LULUCF activities (AR, deforestation, FM and HWP) based on the uncertainty of AD and EFs in each carbon pool and each emission estimate.	Addressing. The description of the uncertainty analysis has been improved (subchapters for individual categories in the NIR, chapter 11.3.2) but some of the information on sources of the data used is still not well documented (e.g. sampling uncertainty of 33.6 per cent for afforestation; NIR, chapter 11.3.2.1). The Party explained the sources of the data during the review week (NIR, tables 11-4 and 11-6).
KL.2	Deforestation – CO ₂ (KL.1, 2016) (KL.1, 2015) Transparency	Provide in the NIR a detailed explanation of the estimation of the areas reported for deforestation.	Not resolved. Liechtenstein implemented a methodology (see ID# KL.3 below) and provided additional information in the NIR (chapter 11.1.3.2, pp.274–275). However, the methodology is not well documented in the NIR and NIR table 11-5 does not show all the necessary information, including information identified in the figure such as the actual area of forest loss. Based on the explanation provided by the Party during the review, the fraction of permanent forest loss can decrease during the

<i>ID#</i>	<i>Issue and/or problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
			second commitment period of the Kyoto Protocol. The ERT is an important aspect to transparently describe because areas cannot leave deforestation once accounted under deforestation.
KL.3	Deforestation – (KL.2, 2016) (KL.2, 2015) Accuracy	Follow the methodology that was proposed during the review week for tracking deforestation in future submissions, noting that the transparency of reporting would be enhanced if the Party provides in the next NIR, in tabular format, the four variations of survey results presented during the review week that could be used for calculating areas subject to deforestation, considering the areas that are subsequently regenerated.	Resolved. This has been replaced by ID# KL.2 above. The four variations of survey results were included in the present methodology; they correspond to the three fractions shown in NIR table 11-5 (Frac 1996, Frac 2002, and Frac 2008) plus a further fraction calculated in the period 1996–2008, which was not relevant.

^a References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) where the issue and/or problem was raised. Issues are identified in accordance with paragraphs 80–83 of the UNFCCC review guidelines and classified as per paragraph 81 of the same guidelines. Problems are identified and classified as problems of transparency, accuracy, consistency, completeness or comparability in accordance with paragraph 69 of the Article 8 review guidelines, in conjunction with decision 4/CMP.11.

^b The review of the 2017 annual submission of Liechtenstein did not take place during 2017 and, as such, the 2017 ARR was not available at the time of this review. Therefore, the recommendations reflected in table 3 are taken from the 2016 ARR. For the same reason, the year 2017 is excluded from the list of years in which the issue has been identified.

IV. Issues identified in three successive reviews and not addressed by the Party

9. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues included in table 4 have been identified in three successive reviews, including the review of the 2018 annual submission of Liechtenstein, and have not been addressed by the Party.

Table 4

Issues identified in three successive reviews and not addressed by Liechtenstein

<i>ID#</i>	<i>Previous recommendation for the issue identified</i>	<i>Number of successive reviews issue not addressed</i>
General		
G.1	Include in the NIR information on how priority is given to the actions listed in decision 15/CMP.1, annex, paragraph 24(a) and (b), in implementing commitments under Article 3, paragraph 14, of the Kyoto Protocol	3 (2014–2018)
G.2	Report any changes in the information provided under Article 3, paragraph 14, of the Kyoto Protocol, in accordance with decision 15/CMP.1, annex, chapter I.H	3 (2014–2018)
Energy		
E.2	Correct the values reported in the NIR for the share of emissions from international aviation and improve the QC procedures so as to minimize discrepancies between the CRF tables and the NIR	3 (2014–2018)
IPPU		

<i>ID#</i>	<i>Previous recommendation for the issue identified</i>	<i>Number of successive reviews issue not addressed</i>
No such issues identified		
Agriculture		
A.2	Improve QC procedures to ensure the consistency of the information provided in the CRF tables	3 (2014–2018)
A.3	Replace notation keys with numerical data in the additional information table, where appropriate, or justify the use of notation keys in a footnote or the documentation box to CRF table 4.A	3 (2014–2018)
A.6	Include in the NIR information about factors that influenced the sharp increase of emissions from nitrogen-fixing crops in 2011	3 (2014–2018)
LULUCF		
L.1	Improve the descriptions of the methodology for estimating uncertainties and the reporting of the uncertainty values in the NIR	3 (2014–2018)
Waste		
W.1	Undertake an evaluation to ensure that the methods, parameters and other data provided in the inventory submission are applicable to the national circumstances, and document these checks in future annual submissions	3 (2014–2018)
W.2	Provide quantitative uncertainty estimates for all waste categories and discuss the reasons for the uncertainty estimates in the appropriate section of the waste chapter of the NIR, following the outline for the NIR in the UNFCCC Annex I inventory reporting guidelines	3 (2014–2018)
KP-LULUCF		
No such issues identified		

^a The review of the 2017 annual submission of Liechtenstein did not take place during 2017. Therefore, the year 2017 is not taken into account when counting the number of successive years in table 4. In addition, as the reviews of the 2015 and 2016 annual submissions were held in conjunction with each other, they are not considered “successive” years and 2015/2016 is considered as one year.

V. Additional findings made during the individual review of the 2018 annual submission

10. Table 5 contains findings made by the ERT during the individual review of the 2018 annual submission of Liechtenstein that are additional to those identified in table 3.

Table 5

Additional findings made during the individual review of the 2018 annual submission of Liechtenstein

<i>ID#</i>	<i>Finding classification</i>	<i>Description of the finding with recommendation or encouragement</i>	<i>Is finding an issue and/or a problem?^a If yes, classify by type</i>
General			
G.4	QA/QC and verification	<p>The ERT noted that Liechtenstein has a QA/QC plan that was produced by the Office of Environment, which is the designated inventory agency (NIR, pp.33–34 and 38). The ERT further noted that the QA/QC plan has been insufficiently described in the NIR. During the review, Liechtenstein clarified that the QA/QC plan was presented in the form of checklists contained in annex 8 to its NIR (pp.317–319). The Party further informed the ERT that it will provide a summary description of the QA/QC plan in chapter 1 of the NIR in its next inventory submission.</p> <p>To maintain consistency with the UNFCCC Annex I inventory reporting guidelines (para. 46), the ERT recommends that Liechtenstein enhance the reporting on its QA/QC plan in chapter 1 of the NIR by providing a summary description of the plan, including the use of checklists.</p>	Adherence to the UNFCCC Annex I inventory reporting guidelines
G.5	QA/QC and verification	<p>The ERT noted that the description of QA activities performed by Liechtenstein mainly focuses on reviews of the Swiss GHG inventory (NIR, pp.34–35). During the review, Liechtenstein explained that the methods and parameters from Switzerland’s GHG inventory were reviewed for applicability under the Party’s national conditions. If found relevant, they were subsequently used for specific sectors of Liechtenstein’s inventory.</p> <p>The ERT recommends that Liechtenstein provide in the NIR information on its process for the internal review and verification of the methodologies and parameters used by Switzerland for their applicability to Liechtenstein’s inventory.</p>	Transparency
G.6	QA/QC and verification	<p>The ERT noted inconsistencies between the NIR and CRF tables. In particular, Liechtenstein does not report NF₃ and unspecified mixes of gases in table 2 of the executive summary of its NIR (p.19 and p.65); and the quantitative emission values of NO_x and CO are provided in table 2.4 of the NIR (p.72), but are reported using the notation keys “NA”, “NE” and “NO” in CRF table 6. The ERT further noted the differences in emission values for NMVOCs reported in the NIR and CRF tables. Additional cases of inconsistencies were identified in the IPPU sector (see ID# I.2 below). During the review Liechtenstein clarified that emissions of NF₃ and unspecified mix of HFCs and PFCs were not occurring. The Party further informed the ERT that it would enhance the reporting of this information in the next inventory submission. Furthermore, Liechtenstein indicated that inconsistencies in reporting on NO_x and CO emissions occurred because of the different dates for the preparation and submission of the NIR to the Convention on Long-Range Transboundary Air Pollution, where this information is contained. The Party further informed the ERT of its intention to include the reporting on precursor gases in CRF table 6 following the provision in the UNFCCC Annex I inventory reporting guidelines (para. 29).</p> <p>The ERT recommends that Liechtenstein enhance its QA/QC procedures to ensure consistent provision of the information in the NIR and CRF tables regarding emissions of NF₃, unspecified mix of HFCs and PFCs, NO_x and CO, and correct the inconsistencies in the emission values reported for NMVOCs.</p>	Adherence to the UNFCCC Annex I inventory reporting guidelines

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^{2a} If yes, classify by type
G.7	Uncertainty analysis	<p>The ERT noted that Liechtenstein has performed quantitative uncertainty assessments following approaches 1 and 2 from the 2006 IPCC Guidelines. The ERT further noted that the results of the uncertainty assessments following approach 1 in the NIR (tables 1-8 and 1-9) were provided for the latest inventory year (2016) and the trend between the base year (1990) and the latest inventory year (2016). Furthermore, the ERT noted that the result of the uncertainty analysis was not provided for the base year (1990), as required by the UNFCCC Annex I inventory reporting guidelines (para. 15). During the review Liechtenstein clarified that the uncertainty assessment for the base year was not conducted as part of the preparation of the 2018 inventory submission owing to lack of resources. Liechtenstein further informed the ERT that it would conduct the uncertainty analysis for the base year for the 2019 inventory submission.</p> <p>The ERT recommends that Liechtenstein undertake the uncertainty analysis of the base year, in addition to the uncertainty analysis of the latest inventory year and of the trend currently carried out, and report on the results of these in the NIR.</p>	Adherence to the UNFCCC Annex I inventory reporting guidelines
G.8	Uncertainty analysis	<p>The ERT noted that it was not clear from the 2018 annual submission how the uncertainty estimates help to prioritize efforts to improve the accuracy of national inventories in the future and to guide decisions on methodological choice, as required by the UNFCCC Annex I inventory reporting guidelines (para. 42). During the review, Liechtenstein explained that the results of the uncertainty analyses were used for prioritizing improvements to the accuracy of the national inventory.</p> <p>The ERT recommends that Liechtenstein explain in the NIR how the uncertainty estimates are used to prioritize efforts to improve the accuracy of the inventory.</p>	Adherence to the UNFCCC Annex I inventory reporting guidelines
G.9	National registry	<p>The ERT noted that the 2018 annual submission of Liechtenstein included the information on changes in the database structure and performance capacity of its national registry which had occurred because of the release of a new version of the EU centralized registry. The ERT further noted that the changes had a limited effect on the functionality of the registry and were followed by subsequent consistency and disaster recovery checks and regression and acceptance tests to ensure conformity to technical standards, to secure the database and to ensure that the operational functions have been maintained. The ERT concludes that the national registry of Liechtenstein continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol.</p>	Not an issue/problem
G.10	National registry	<p>The ERT noted that part 2 of the SIAR included a recommendation to Liechtenstein to update its publicly accessible information referred to in decision 13/CMP.1 (annex, para. 47) (see also ID# P2.4.2.1, SIAR/2018/LI/2/1). During the review, Liechtenstein informed the ERT that it did not know how this information should be updated. The Party further explained that it had communication difficulties with the EU registry that could affect timely implementation of the updates required. The ERT recommends that Liechtenstein communicate with the Directorate General for Climate Action of the European Commission (CLIMA B.2 “ETS Implementation and IT”, https://ec.europa.eu/clima/index_en</p>	Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		and https://ec.europa.eu/clima/about-us/chart_en) and ensure that publicly accessible information has been updated as appropriate.	
G.11	Kyoto Protocol units	The ERT noted that together with its 2018 annual submission Liechtenstein submitted the SEF tables with all the necessary information on Kyoto Protocol units, and these were made available to the ERT during the review. The ERT further noted that no transactions had been conducted so far for the second commitment period of the Kyoto Protocol. It is clear to the ERT that the information on the transfer and acquisition of Kyoto Protocol units is not relevant to Liechtenstein.	Not an issue/problem
G.12	National system	The ERT noted that chapter 13 of the NIR provides the information on the changes in the national system. The information refers to staff changes in the national inventory team and rearrangements for coordinating QA/QC activities with the Office of the Environment, which is the designated inventory agency. The changes are adequately described in the NIR. The ERT is of the view that the described changes do not affect the overall organization of the national system, including its effectiveness and the reliability of the institutional, procedural and legal arrangements. The ERT concludes that the national system of Liechtenstein is capable of performing its functions.	Not an issue/problem
G.13	Commitment period reserve	<p>The ERT noted that in the calculation of the CPR, Liechtenstein used the value “total equivalent emissions” including indirect emissions, and emissions and removals from the LULUCF sector for the year 2013 as the latest reviewed inventory. The ERT further noted that the value of the assigned amount used by the Party in the calculations differed from the value provided in the report on the review to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of Liechtenstein (FCCC/IRR/2016/LIE).</p> <p>During the review, Liechtenstein provided a revised estimate of the CPR calculated in accordance with provisions of decision 11/CMP.1 in conjunction with decision 1/CMP.8. The revised CPR estimate provided by the Party is equal to 1,400,440 t CO₂ eq. The ERT agrees with the revised estimate provided by the Party.</p>	Adherence to reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
Energy			
E.13	1. General (energy sector)	<p>The ERT noted that differences between the reference and sectoral approaches (NIR, figure 3-3, p.80) are reasonable; however, the gap for the reporting years 2016, 2017 and 2018 is on an upward trend. These changes are shown in table 3.3 of the NIR. The difference between energy consumption under the reference and sectoral approaches has increased from –0.04 (2014) to –0.10 (2015) and –0.14 (2016), and for CO₂ emissions from 0.30 (2014) to 0.58 (2015) and 0.79 (2016).</p> <p>The ERT encourages the Party to review the differences between the reference and sectoral approaches for energy consumption and CO₂, particularly for the years 2014, 2015 and 2016, and explain this divergence.</p>	Not an issue/problem
E.14	Reference approach – liquid fuels – CO ₂	During the review the ERT noted that, for bitumen, the net carbon emissions and actual CO ₂ emissions were reported as “0” (zero), and the fraction oxidized was reported as “1” (CRF table 1.A(b)). The ERT considers that the correct notation key for net carbon emissions, fraction oxidized, and actual CO ₂ emissions should be “NO”.	Yes. Comparability

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		The ERT recommends that Liechtenstein use the correct notation key “NO” for bitumen.	
E.15	Reference approach – liquid fuels – CO ₂	<p>During the review the ERT noted that, for lubricants, the net carbon emissions and actual CO₂ emissions were reported as “0” (zero), and the fraction oxidized was reported as “1” (CRF table 1.A(b)). The ERT considers that the correct notation key for net carbon emissions, fraction oxidized, and actual CO₂ emissions should be “NO”.</p> <p>The ERT recommends that Liechtenstein use the correct notation key “NO” for lubricants.</p>	Yes. Comparability
E.16	1.A.3.a Domestic aviation – liquid fuels – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted that some data are reported twice in the NIR (table 3-25). The Party explained that this was an error to report the time series of fuel consumption for domestic aviation twice.</p> <p>The ERT recommends that the Party report the time series in NIR table 3-25 once and to improve its QC to prevent such errors.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
E.17	1.B.2.b Natural gas – gaseous fuels – CH ₄	<p>The ERT did not find any reference for the source of the EF used for calculating CH₄ fugitive emissions in the natural gas network in the NIR and could not determine how emissions were calculated. During the review in response to a question from the ERT the Party explained the data source are however no longer available. The ERT compared their estimates using default values (IPCC 2006) and obtained 0.69 kt CO₂eq therefore Liechtenstein appear overestimate emissions. The method applied by Liechtenstein results in 1.05 kt CO₂eq so the Party overestimates the fugitive emissions from natural gas distribution.</p> <p>The ERT recommends that the Party provide in the NIR the reference for the EF used for calculating CH₄ fugitive emissions in the natural gas network and explain the applicability of the chosen EF to Liechtenstein’s natural gas distribution network.</p>	Yes. Accuracy
IPPU			
I.2	2.D Non-energy products from fuels and solvents use – CO ₂	<p>The ERT noted that some of the reporting in the NIR for the IPPU sector is not yet in line with the UNFCCC Annex I inventory reporting guidelines, and some descriptions are inaccurate or outdated. Specifically, chapter 4.5.1 states that “Liechtenstein does not report indirect emissions. Therefore, NMVOC or CO emissions are not reported”. The ERT considers that the relationship between the two sentences is unclear because whether the Party decides to report indirect CO₂ emissions is independent of whether NMVOC or CO emissions are reported.</p> <p>The ERT recommends that the Party reword the sentence in the NIR explaining the relationship between reporting of indirect emissions and NMVOC and CO emissions, or delete it, because the issue is related to the use of bitumen and the Party has already addressed the issue on bitumen in CRF table 1.A (b) and 1.A (d) and the NIR (chapter 9) clearly addresses the fact that the Party does not elect to report indirect CO₂ emissions.</p>	Yes. Adherence to the UNFCCC Annex I inventory reporting guidelines
I.3	2.E. Electronics industry – NF ₃ –	The ERT noted that chapter 4.6.1 of the NIR includes the explanation that emissions from the electronics industry are not occurring and that this also holds for NF ₃ emissions, which would have to be reported under the revised UNFCCC	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^{2a} If yes, classify by type
		<p>Annex I inventory reporting guidelines. The ERT also noted that these guidelines have been in place since the 2015 annual submissions, and therefore this sentence is outdated (i.e. there is no longer a need to specifically mention NF₃).</p> <p>The ERT recommends that Liechtenstein make the necessary modifications and updates for this section of its NIR to reflect the status of NF₃ emissions.</p>	
I.4	2.F.1 Refrigeration and air conditioning – HFCs and PFCs	<p>The ERT noted that Liechtenstein explains in its NIR that it uses the Swiss inventory to make estimates for its own inventory through the rule of proportion, using indicators such as the number of employees in the industrial and services sector, or inhabitants, or number of registered passenger cars. However, the ERT noted that the gas species reported in the CRF tables differ from those in the Swiss CRF tables for commercial refrigeration, transport refrigeration and mobile air conditioning. During the review, the Party explained that each category of the Swiss CRF tables is analysed to identify gases that account for at least 80 per cent of the total emissions for that respective category, and only for those gases whose emissions are assumed to also occur in Liechtenstein. Therefore, the rule of proportion is applied to only those gases.</p> <p>The ERT notes the practicality of this approach of borrowing from the Swiss methodology, but considers that the current descriptions in the NIR are not fully representative of the methodology applied by Liechtenstein, and recommends that the Party transparently explain in the NIR how it applies the Swiss methodology to its inventory, in particular why certain gas species that are reported in the Swiss inventory are considered to not occur in Liechtenstein.</p>	Yes. Transparency
I.5	2.G Other product manufacture and use – N ₂ O	<p>The ERT noted that some of the descriptions in the NIR explaining how Liechtenstein uses the Swiss inventory to make estimates for its own inventory are unclear. For example, chapter 4.8.2.2 of the NIR explains that, since circumstances are similar in the construction sector of the two countries, it is justified to adopt the Swiss methodology/EFs for category 2.G. (other product manufacture and use). The Party acknowledged during the review that this description was incorrect. Since Liechtenstein’s estimation methodology relies on the Swiss inventory, the ERT considers it important that Liechtenstein clearly justify why it applies the Swiss methodology.</p> <p>The ERT recommends that the Party remove the reference in the NIR to the “construction sector” and explain why the Swiss N₂O EF for other product manufacture and use is applicable for Liechtenstein.</p>	Yes. Transparency
Agriculture			
A.7	3.B Manure management – CH ₄	<p>In CRF table 3.B(a) Liechtenstein allocates all climate regions to cool (100 per cent) and reports “0.00” for the other climate types. During the review Liechtenstein acknowledged that the notation key “NO” should be used for temperate and warm climate regions.</p> <p>The ERT recommends that Liechtenstein use the notation key “NO” for temperate and warm climate regions to improve consistency with the CRF tables.</p>	Yes. Comparability
A.8	3.B.2 Sheep – CH ₄	<p>As reported in document FCCC/WEB/AGI/2018 (https://unfccc.int/sites/default/files/resource/AGI%20report_2018.pdf), Liechtenstein and Switzerland report the highest CH₄ IEF (1.3 kg/head per year) among all Parties from manure</p>	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^{2a} If yes, classify by type
		<p>management for sheep. During the review Liechtenstein explained that it used default values from the 2006 IPCC Guidelines for volatile solids and maximum methane-producing capacity of manure. In 2016 the shares of manure management systems for sheep are approximately 65 per cent for deep litter and 35 per cent for pasture. For the deep litter system a methane correction factor of 10 per cent is applied. For the pasture system the default methane correction factor of 1 per cent is applied. The ERT noted that the difference between the CH₄ EFs used by Liechtenstein and those used by other Parties must lie in the choice of methane correction factors. The Party explained that the methane correction factor of 10 for the deep litter system is the mean value between the default values for cattle and swine deep bedding at 10 °C from the 2006 IPCC Guidelines. The choice of a methane correction factor of 10 per cent for deep litter is supported by the specific feeding and manure management regime in Liechtenstein and confirmed by a number of studies representative of the country-specific management conditions. The ERT considers these explanations adequate and helpful.</p> <p>The ERT recommends that Liechtenstein include information in its NIR to justify the relatively high CH₄ IEF for manure management for sheep and to improve transparency of documentation and comparability among all Parties.</p>	
A.9	3.B.4 Other livestock – N ₂ O	<p>The ERT noted that, in CRF table 3.B(b), the amount of manure N for goats is different when calculated using the population multiplied by the manure N excretion rate compared with the value using the summation of manure N from all manure management systems for the entire time series. During the review Liechtenstein acknowledged an error in the model.</p> <p>The ERT recommends that Liechtenstein correct the error in its calculation model to ensure that the amount of manure N for goats reported using the population multiplied by the manure N excretion rate is the same as the value using the summation of manure N from all manure management systems.</p>	Yes. Accuracy
A.10	3.D.b.1 Atmospheric deposition – N ₂ O	<p>In the NIR (p.181) Liechtenstein uses the method developed by Switzerland to estimate N₂O emissions from atmospheric N deposition from managed soils. However, the ERT noted that the equation provided by Liechtenstein (p.182) deviates significantly from the Swiss model (Swiss NIR 2018, p.319), the Party included NH₃ emissions from the vegetation cover on agricultural soils and there is an error in Liechtenstein's model. During the review, Liechtenstein acknowledged the difference in estimating NH₃ emissions from the vegetation cover, that it has deviated from the Swiss model and missed a pair of curved brackets before EF₄ in the equation.</p> <p>The ERT recommends that Liechtenstein correct the error in the equation for estimating N₂O emissions from atmospheric N deposition and revise its estimation method based on the Swiss model by the 2020 inventory submission according to its 5-year inventory improvement plan.</p>	Yes. Accuracy
A.11	3.I Other carbon-containing fertilizers – CO ₂	<p>Liechtenstein states in the NIR (p.177) that it has no data on the application of synthetic N fertilizers (NIR, p.177) and therefore estimated using average inorganic N input per area in Switzerland multiplied by the area fertilized in Liechtenstein. The split of inorganic N fertilizers between urea and other inorganic N fertilizers is based on the mean value from 1990 to 2012 in the Swiss inventory. As a result, a share of 15 per cent is allocated to urea and 85 per cent to other inorganic N fertilizers for Liechtenstein. The ERT noted that FAOSTAT has values for UAN used in</p>	Yes. Completeness

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^a If yes, classify by type
		<p>Switzerland (see http://www.fao.org/faostat/en). During the review Liechtenstein acknowledged that UAN might be also used in Liechtenstein, but in very small quantities (on average, less than 1 per cent of the amounts of urea used). Therefore, CO₂ emissions from the application of UAN for Liechtenstein are negligible. The ERT agrees with the Party and notes that any underestimate in CO₂ emissions would be below the threshold given in paragraph 37 of the UNFCCC Annex I inventory reporting guidelines and therefore not subject to adjustment in accordance with paragraph 80(b) of the annex to decision 22/CMP.1 in conjunction with decision 4/CMP.11.</p> <p>The ERT recommends that Liechtenstein either estimate CO₂ emissions from this category, or if the Party considers these emissions as insignificant, provide in the NIR sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.</p>	
LULUCF			
L.12	4. General (LULUCF)	<p>In the previous review report (FCCC/ARR/2016/LIE, ID# L.12), the ERT encouraged Liechtenstein to use the new AREA survey to update land use and land-use changes after 2009. The ERT noted that Liechtenstein updated its land use and land-use change data.</p> <p>The ERT encourages the Party to include the necessary regular updates in the chapter on “Planned improvements for activity data” (NIR, chapter 6.3.6) to clarify that it is continuously extrapolating or interpolating data and, when available, include new data from the AREA land-use statistics.</p>	Not an issue/problem
L.13	4. General (LULUCF)	<p>In response to a question from the ERT during the review regarding the transparent documentation of land stratification by organic and mineral soils, Liechtenstein provided additional information, including source and content of the soil map and source of the uncertainty estimate for the soil map.</p> <p>The ERT recommends that the Party include in its NIR information on source and content of the soil map and source of the uncertainty estimate for the soil map.</p>	Yes. Transparency
L.14	4. General (LULUCF)	<p>For many categories, Liechtenstein applies methods used by Switzerland. The ERT considers this to be appropriate and noted that the Party has justified the use of those methods.</p> <p>However, the ERT noted that the Party applies some methods inconsistently. For example, in some cases the latest methods used by Switzerland are applied (e.g. permanent grassland, NIR table 6-18), but in other cases outdated methods are used (e.g. stocks and stock changes in living biomass on afforested areas (NIR, chapter 6.4.2.6), BEF on forest land (NIR, table 6-11) and some grassland subcategories). The ERT noted that when outdated methods are applied, the accuracy of emission/removal estimates is not ensured, and that consistency, comparability and transparency are affected.</p> <p>Based on the discussion with the Party during the review week (see ID# G.4 above on QA/QC and verification), the ERT recommends that Liechtenstein apply the most recent methods for stocks and stock changes in living biomass on afforested areas, BEF on forest land, and select grassland subcategories or, in cases where the Party considers them</p>	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^{2a} If yes, classify by type
		not appropriate, provide a rationale for the selection of specific methodologies, including higher-tier methods and models, assumptions, EFs and AD, in line with the UNFCCC Annex I inventory reporting guidelines (para. 50).	
L.15	4. General (LULUCF)	<p>Liechtenstein explains in its NIR that the topographic, climatic and geological conditions in Liechtenstein are very similar to the pre-Alps region of Switzerland, to justify the use of Swiss data from this region; for example, this justification is applied for reporting growing carbon stocks in unproductive forests (NIR, chapter 6.4.2.4, p.217), carbon stocks in litter and mineral soils (NIR, chapter 6.4.2.8, p.221) and carbon pools in grassland (NIR, chapter 6.6.1, p.225). The ERT considers that this assumption is valid.</p> <p>However, the ERT noted that the Party does not apply this assumption consistently. For example, for the uncertainty estimates of EFs for forest land subcategories Liechtenstein refers to national data from Switzerland for forest land remaining forest land but to data from the canton of Glarus for land converted to forest land (NIR, chapter 6.4.3, p.222). The ERT further noted that although the use of data from the Swiss pre-Alps region is explicitly identified (e.g. NIR table 6-15), this is not transparent in other cases (e.g. in NIR, chapter 6.4.2.6 “the Swiss growing stocks and growth rates”).</p> <p>The ERT recommends that the Party be consistent in the application of Swiss data for reporting and verification purposes and highlight the use of Swiss data from the pre-Alps region prominently at the beginning of the LULUCF chapter, as done in the KP-LULUCF chapter (NIR, chapter 11.3.1.1, p.278), to make this approach more transparent.</p>	Yes. Accuracy
L.16	4.A Forest land – CO ₂	<p>Liechtenstein states in the NIR (chapter 6.4.2.5) that deadwood was estimated based on the “same wood densities, BEFs and carbon content as for the living growing stock” (p.218). The ERT noted that this approach implies that the deadwood pool also includes foliage and other tree elements typically associated with the litter pool in the 2006 IPCC Guidelines. The ERT further noted that litter components have different turnover times from those for deadwood, and that the biomass of dead organic material depends on its state of decay. The Party agreed that applying the BEF (for living biomass) to deadwood volumes leads to an overestimation of the carbon stocks in deadwood. Specific expansion factors for deadwood would be more appropriate.</p> <p>The ERT recommends that Liechtenstein improve the accuracy of emission/removal estimates for deadwood and litter and ensure that estimates are consistent with the UNFCCC Annex I inventory reporting guidelines (para. 4) by, for example, using expansion factors for woody components only and separating non-woody and woody litter. The Party may also explore the applicability of methods applied in Switzerland, as Liechtenstein adopts those methods in other cases.</p>	Yes. Accuracy
L.17	4.A.1 Forest land remaining forest land – CO ₂	<p>Liechtenstein’s CO₂ emissions/removals for the LULUCF sector (NIR, figure 6-2) show a high inter-annual variability in the years 1990–2004. The variability decreases considerably after 2004. The Party explained that the primary source for this variability is annual harvests. The annual harvests presented in the NIR (table 6-13) confirm this evaluation. The Party does not provide an explanation of the very high variability in the annual harvests. Liechtenstein noted that it will include an explanation in the 2019 inventory submission.</p>	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^{2a} If yes, classify by type
		The ERT recommends that the Party include an explanation of the source for the variability in the CO ₂ emissions/removals of the LULUCF sector, to ensure accuracy and time series consistency.	
L.18	4 (II) Emissions and removals from drainage and rewetting and other management of organic/mineral soils – CO ₂ , CH ₄ and N ₂ O	<p>Liechtenstein did not complete CRF table 4(II) for the year 2016; no information was entered for the forest land category notation keys.</p> <p>The Party acknowledged the omission and stated that it will provide the missing information in its next submission.</p> <p>The ERT recommends that Liechtenstein complete CRF table 4(II) for forest land.</p>	Yes. Completeness
Waste			
W.9	5. General (waste)	<p>The fractions of MSW generated (t/year) after 1974 (when the landfills were closed) are reported in various tables and, specifically, in the NIR as follows: the amount of waste generated (wet weight) and incinerated in Switzerland; the amount of biogenic and non-biogenic (fossil share) waste incinerated in Liechtenstein (NIR, table 7-9, p.253); the amount composted in Liechtenstein (wet weight) (NIR, table 7-6, p.250); and the amount open-burned in Liechtenstein (wet weight) (NIR, table 7-9, p.253). However, the amount recycled was not reported. In response to a request from the ERT during the review that the Party apply a material balance approach to waste inventories and include a single table in the NIR for the amounts of each waste, to improve transparency, Liechtenstein provided tabular information on the amount recycled; namely, 65 per cent of the MSW generated including organic waste, paper, cardboard and aluminium.</p> <p>The ERT encourages Liechtenstein to provide a general table in the NIR indicating amounts of MSW generated, recycled, composted and incinerated, to reflect the impact of waste management policies (such as the ‘polluter pays principle’ introduced in 1993 for mixed waste), which can offer a plausible explanation of the emission trends and outliers in the waste sector categories.</p>	Not an issue/problem
W.10	5.B.1 Composting – CH ₄ and N ₂ O	<p>Liechtenstein uses AD for backyard composting estimated at 8 per cent in 1990; declining by 0.2 per cent per annum from 7.8 per cent in 1991 to 5.2 per cent in 2004; and 5 per cent of waste composted in centralized compost from 2005 to 2016 based on expert judgment. Liechtenstein indicated in the NIR 2017 (chapter 7.3.6, p.251) a planned improvement in 2017, namely, using updated data in its future submissions based on ongoing measurements by Switzerland. In response to a question from the ERT during the review on the status of the improvement plan Liechtenstein provided the updated AD for industrial and backyard composting that were thoroughly reassessed in 2017. The ERT also observed that Liechtenstein has not been reporting CH₄ and N₂O emissions from the fraction of backyard composting estimated by expert judgment in subcategory 5.B.1 other (composting). The Party acknowledged the need to use the new data in the CRF tables.</p> <p>The ERT recommends that Liechtenstein report the updated AD for backyard composting as wet weight in the NIR and CRF table 5.B. The ERT further recommends that the Party report the emissions from backyard composting and</p>	Yes. Completeness

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem? ^{2a} If yes, classify by type
		recalculate emissions for the entire time series to improve completeness, consistency and accuracy. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions.	
W.11	5.C.2 Open burning of waste – CO ₂ , CH ₄ and N ₂ O	<p>CO₂ emissions from open burning of waste for 1990–2015 are recalculated based on the improvement in AD reported in the NIR (table 7-9, p.253), resulting from the estimation and accounting for the fossil fraction in MSW in the NIR submission (chapter 7.4.2, p.252). However, Liechtenstein did not indicate whether the EFs in table 7-8 are based on wet weight or dry weight. During the review Liechtenstein confirmed that the AD and EFs provided by Switzerland and reported in the NIR and the CRF tables of Liechtenstein are both based on wet weight.</p> <p>The ERT recommends that Liechtenstein indicate wet matter for the EFs (table 7-8) and AD (table 7-9) to improve consistency and transparency.</p>	Yes. Transparency
W.12	5.D.1 Domestic wastewater – CH ₄ and N ₂ O	<p>In response to a question from the ERT during the review on tracking and explaining outliers of inter-annual changes in category emissions, the Party acknowledged that the drivers for inter-annual changes are not obvious, and indicated that plant-specific information is available and the causes of significant inter-annual changes will be assessed. The information in the NIR includes losses and leakages from sewage gas handling technologies; namely, efficiency of new wastewater treatment plants, fractions of sewage gas used by the various technologies (boilers, combined heat and power, flaring by torches) and their efficiencies, as well as improved handling technology practices for upgrading sewage gas and injection in natural gas pipelines.</p> <p>The ERT recommends that Party obtain the plant-specific information from the centralized wastewater treatment plant operators to identify and transparently explain inter-annual changes in CH₄ and N₂O emissions.</p>	Yes. Transparency
KP-LULUCF			
KL.4	General (KP-LULUCF)	<p>Liechtenstein did not complete CRF table NIR2 and the notation key “NA” was entered in cell I17 for the area under “Other”, which identifies the area of the country that has never been subject to any activity under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. As a result, the value for the total area in CRF table NIR2 does not agree with the total area in CRF table 4.1 (6.42 kha and 16.05 kha, respectively). The Party acknowledged the omissions and indicated that it will supply the missing information in the next submission.</p> <p>Although this information is not mandatory (footnote 2 to CRF table 4(KP-I) A.2), the ERT encourages the Party to ensure consistency in reporting of CRF table 4(KP-I) A.2, and in land area conversions, as appropriate, reported between CRF table 4.1 and 4(KP-I) A.2.</p>	Not a problem
KL.5	General (KP-LULUCF)	<p>Liechtenstein did not enter all information in CRF table 4(KP-I) A.2, to facilitate the replication and assessment of the inventory by users of the reported information.</p> <p>The ERT noted that in CRF table 4(KP-I) A.2 information on the areas converted from forest land to non-forest land is missing (all cells were reported as “NO”, except for organic soils on forest land, which was left blank), whereas in</p>	Not a problem

ID#	Finding classification	Description of the finding with recommendation or encouragement	<i>Is finding an issue and/or a problem?^a If yes, classify by type</i>
		<p>CRF table 4.1 areas of forest land were reported to be converted to grassland (managed and unmanaged), wetlands (unmanaged), settlements and other land.</p> <p>Although this information is not mandatory (footnote 2 to CRF table 4(KP-I) A.2), the ERT encourages the Party to ensure consistency in reporting of CRF table 4(KP-I) A.2, and in land area conversions, as appropriate, reported between CRF table 4.1 and 4(KP-I) A.2.</p>	
KL.6	Forest management – CO ₂	<p>Liechtenstein omits the deadwood, litter and soil organic carbon pools under FM. The ERT noted that the justification presented by the Party in the NIR (chapter 11.3.1.2) is not consistent with decision 2/CMP.8, annex II, paragraph 2(e), because the Party does not provide transparent and verifiable information that demonstrates that, particularly, the litter and deadwood pools are not a source. The provided justification based on the Swiss inventory from 2015 is outdated; furthermore, the justification is based on data on the average national conditions, which differ from the conditions in the pre-Alps or in the Swiss canton of Glarus which are presented by Liechtenstein as comparable to the forests in Liechtenstein. In particular, the carbon balance of litter can be highly variable and depend on tree growth, mortality and FM. During the review, Liechtenstein noted that it will evaluate the methodology used by Switzerland and provide updated information to describe how it applies to Liechtenstein’s reporting system for forest land.</p> <p>The ERT recommends that, as required by decision 2/CMP.8, Liechtenstein provide transparent and verifiable information to demonstrates that the litter and deadwood pools are not a source.</p>	Yes. Transparency

^a Recommendations made by the ERT during the review are related to issues as defined in paragraph 81 of the UNFCCC review guidelines, or problems as defined in paragraph 69 of the Article 8 review guidelines. Encouragements are made to the Party to address all findings not related to such issues or problems.

VI. Application of adjustments

11. The ERT did not identify the need to apply any adjustments to the 2018 annual submission of Liechtenstein.

VII. Accounting quantities for activities under Article 3, paragraph 3, and, if any, activities under Article 3, paragraph 4, of the Kyoto Protocol

12. Liechtenstein has elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF activities is not applicable for the 2018 review.

VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2018 annual submission.

Annex I

Overview of greenhouse gas emissions and removals for Liechtenstein for submission year 2018 and data and information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as submitted by Liechtenstein in its 2018 annual submission

1. Tables 6–9 provide an overview of total GHG emissions and removals as submitted by Liechtenstein.

Table 6
Total greenhouse gas emissions for Liechtenstein, base year^a–2016
 (kt CO₂ eq)

	<i>Total GHG emissions excluding indirect CO₂ emissions</i>		<i>Total GHG emissions including indirect CO₂ emissions^b</i>		<i>Land-use change (Article 3.7 bis as contained in the Doha Amendment)^c</i>	<i>KP-LULUCF activities (Article 3.3 of the Kyoto Protocol)^d</i>	<i>KP-LULUCF activities (Article 3.4 of the Kyoto Protocol)</i>	
	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>			<i>CM, GM, RV, WDR</i>	<i>FM</i>
FMRL								0.10
Base year	234.80	229.28	NA	NA	2.38		–	
1990	234.80	229.28	NA	NA				
1995	237.58	234.40	NA	NA				
2000	271.63	248.26	NA	NA				
2010	249.42	230.27	NA	NA				
2011	240.24	217.31	NA	NA				
2012	249.70	226.52	NA	NA				
2013	248.58	233.05	NA	NA			–	5.43
2014	216.73	201.40	NA	NA			NO	5.33
2015	208.43	198.59	NA	NA			NO	–0.26
2016	196.01	188.04	NA	NA			NO	–2.17

Note: Emissions/removals reported in the sector other (sector 6) are not included in the total GHG emissions.

^a Base year refers to the base year under the Kyoto Protocol, which is 1990 for all gases. Liechtenstein has not elected any activities under Article 3, paragraph 4, of the Kyoto Protocol. For activities under Article 3, paragraph 3, of the Kyoto Protocol and FM under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

^b The Party has not reported indirect CO₂ emissions in CRF table 6.

^c The value reported in this column refers to 1990.

^d Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely AR and deforestation.

Table 7
Greenhouse gas emissions by gas for Liechtenstein, excluding land use, land-use change and forestry, 1990–2016
 (kt CO₂eq)

	<i>CO₂^a</i>	<i>CH₄</i>	<i>N₂O</i>	<i>HFCs</i>	<i>PFCs</i>	<i>Unspecified mix of HFCs and PFCs</i>	<i>SF₆</i>	<i>NF₃</i>
1990	198.97	19.42	10.88	0.00	NO	NO	NO	NO
1995	204.20	18.24	10.61	1.35	0.00	NO	NO	NO
2000	216.86	17.36	9.83	4.11	0.01	NO	0.09	NO
2010	190.81	19.77	9.89	9.71	0.07	NO	0.02	NO
2011	176.78	20.20	10.28	9.98	0.06	NO	0.01	NO
2012	185.32	20.61	10.15	10.38	0.06	NO	0.00	NO
2013	192.54	19.74	9.89	10.65	0.06	NO	0.17	NO
2014	161.10	19.71	9.78	10.66	0.04	NO	0.12	NO
2015	158.89	19.39	9.80	10.44	0.04	NO	0.04	NO
2016	148.36	19.41	9.67	10.55	0.03	NO	0.01	NO
Per cent change 1990– 2016	-25.4	-0.1	-11.2	10 103 184.1	NA	NA	NA	NA

Note: Emissions/removals reported in the sector other (sector 6) are not included in the total GHG emissions.

^a Liechtenstein did not report indirect CO₂ emissions in CRF table 6.

Table 8
Greenhouse gas emissions by sector for Liechtenstein, 1990–2016
 (kt CO₂eq)

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
1990	200.95	0.65	25.51	5.52	2.16	NO
1995	206.70	1.88	23.68	3.17	2.14	NO
2000	219.78	4.64	21.48	23.37	2.35	NO
2010	193.59	10.16	24.19	19.14	2.34	NO
2011	179.54	10.39	24.91	22.93	2.47	NO
2012	188.10	10.77	25.13	23.18	2.52	NO
2013	195.26	11.22	24.02	15.53	2.55	NO
2014	163.61	11.16	24.38	15.33	2.24	NO

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
2015	161.46	10.86	24.09	9.84	2.18	NO
2016	150.89	10.93	24.05	7.97	2.17	NO
Per cent change 1990–2016	–24.9	1 573.9	–5.7	44.4	0.2	NA

Note: Emissions/removals reported in the sector other (sector 6) are not included in the total GHG emissions.

Table 9
Greenhouse gas emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol by activity, base year^a–2016, for Liechtenstein
 (kt CO₂eq)

	<i>Article 3.7 bis as contained in the Doha Amendment^b</i>			<i>FM and elected Article 3.4 activities of the Kyoto Protocol</i>				
	<i>Article 3.3 of the Kyoto Protocol</i>			<i>FM</i>	<i>CM</i>	<i>GM</i>	<i>RV</i>	<i>WDR</i>
	<i>Land-use change</i>	<i>AR</i>	<i>Deforestation</i>					
FMRL				0.10				
Technical correction				0.26				
Base year	2.38				–	–	–	–
2013		–0.24	4.46	5.43	–	–	–	–
2014		–0.25	4.40	5.33	NO	NO	–	–
2015		–0.26	4.43	–0.26	NO	NO	NO	NO
2016		–0.28	4.43	–2.17	NO	NO	NO	NO
Per cent change base year–2016					NA	NA	NA	NA

Note: Values in this table include emissions from land subject to natural disturbances, if applicable.

^a Liechtenstein has not elected any activities under Article 3, paragraph 4, of the Kyoto Protocol. For activities under Article 3, paragraph 3, of the Kyoto Protocol, and FM under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

^b The value reported in this column refers to 1990.

2. Table 10 provides an overview of relevant key data for Liechtenstein's reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 10

Key relevant data for Liechtenstein under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in the 2018 annual submission

<i>Key parameters</i>	<i>Values</i>
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: not elected (e) GM: not elected (f) RV: not elected (g) WDR: not elected
Election of activities under Article 3, paragraph 4	None
Election of application of provisions for natural disturbances	No for AR, Yes for FM
3.5% of total base-year period GHG emissions, excluding LULUCF	8.021 kt CO ₂ eq (64.169 kt CO ₂ eq for the duration of the commitment period)
Cancellation of AAUs, ERUs, CERs and/or issuance of RMUs in the national registry for:	
1. AR in 2016	NA
2. Deforestation in 2016	NA
3. FM in 2016	NA
4. CM in 2016	NA
5. GM in 2016	NA
6. RV in 2016	NA
7. WDR in 2016	NA

Annex II

Information to be included in the compilation and accounting database

Tables 11–14 include the information to be included in the compilation and accounting database for Liechtenstein. Data shown are from the original annual submission of the Party, including the latest revised estimates submitted, adjustments (if applicable), as well as the final data to be included in the compilation and accounting database.

Table 11

Information to be included in the compilation and accounting database for 2016 including on the commitment period reserve, for Liechtenstein

(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
CPR	1 413 756			1 400 440
Annex A emissions for 2016				
CO ₂	148 362			148 362
CH ₄	19 411			19 411
N ₂ O	9 668			9 668
HFCs	10 555			10 555
PFCs	26			26
Unspecified mix of HFCs and PFCs	NO			NO
SF ₆	14			14
NF ₃	NO			NO
Total Annex A sources	188 037			188 037
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2016				
3.3 AR	–278			–278
3.3 Deforestation	4 427			4 427
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2016				
3.4 FM	–2 173			–2 173

Table 12

Information to be included in the compilation and accounting database for 2015, for Liechtenstein

(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
Annex A emissions for 2015				
CO ₂	158 885			158 885
CH ₄	19 386			19 386
N ₂ O	9 801			9 801
HFCs	10 444			10 444
PFCs	38			38
Unspecified mix of HFCs and PFCs	NO			NO
SF ₆	37			37
NF ₃	NO			NO
Total Annex A sources	198 592			198 592
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2015				

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
3.3 AR	-265			-265
3.3 Deforestation	4 427			4 427
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2015				
3.4 FM	-262			-262

Table 13

Information to be included in the compilation and accounting database for 2014, for Liechtenstein
(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
Annex A emissions for 2014				
CO ₂	161 102			161 102
CH ₄	19 707			19 707
N ₂ O	9 775			9 775
HFCs	10 656			10 656
PFCs	42			42
Unspecified mix of HFCs and PFCs	NO			NO
SF ₆	116			116
NF ₃	NO			NO
Total Annex A sources	201 398			201 398
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2014				
3.3 AR	-252			-252
3.3 Deforestation	4 402			4 402
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2014				
3.4 FM	5 328			5 328

Table 14

Information to be included in the compilation and accounting database for 2013, for Liechtenstein
(t CO₂ eq)

	<i>Original submission</i>	<i>Revised estimates</i>	<i>Adjustment</i>	<i>Final</i>
Annex A emissions for 2013				
CO ₂	192 540			192 540
CH ₄	19 737			19 737
N ₂ O	9 889			9 889
HFCs	10 647			10 647
PFCs	60			60
Unspecified mix of HFCs and PFCs	NO			NO
SF ₆	175			175
NF ₃	NO			NO
Total Annex A sources	233 047			233 047
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2013				
3.3 AR	-239			-239
3.3 Deforestation	4 464			4 464
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2013				
3.4 FM	5 426			5 426

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

The categories for which methods are included in the 2006 IPCC Guidelines that were reported as “NE” or for which the ERT otherwise determined that there may be an issue with the completeness of reporting in the Party’s inventory are:

- (a) CO₂ emissions and removals from drainage and rewetting and other management of organic/mineral soils on forest land (see ID# L.18 in table 5);
- (b) CH₄ and N₂O emissions from backyard composting (see ID # W.10 in table 5).

Annex IV

Documents and information used during the review

A. Reference documents

Reports of the Intergovernmental Panel on Climate Change

IPCC. 2006. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. S Eggleston, L Buendia, K Miwa, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl>.

IPCC. 2014. *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at <http://www.ipcc-nggip.iges.or.jp/public/kpsg>.

IPCC. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Geneva, Switzerland: IPCC. Available at <http://www.ipcc-nggip.iges.or.jp/public/wetlands/>.

Annual review reports

Reports on the individual reviews of the 2013, 2014, 2015 and 2016 annual submissions of Liechtenstein contained in documents FCCC/ARR/2013/LIE, FCCC/ARR/2014/LIE, FCCC/ARR/2015/LIE and FCCC/ARR/2016/LIE, respectively.

Other

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at https://unfccc.int/sites/default/files/resource/AGI%20report_2018.pdf.

Annual status report for Liechtenstein for 2018. Available at https://unfccc.int/sites/default/files/resource/asr2018_LIE.pdf.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Heike Summer (Office of Environment), including additional material on the methodology and assumptions used.
