United Nations

FCCC/ARR/2020/LIE

Framework Convention on Climate Change

Distr.: General
30 September 2021

English only

Report on the individual review of the annual submission of Liechtenstein submitted in 2020*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual inventory of emissions and removals of greenhouse gases 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 review of the 2020 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 7 to 12 September 2020 remotely.

* In the symbol for this document, 2020 refers to the year in which the inventory was submitted, not to the year of publication.

Contents

Abbreviations and acronyms

AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
BEF	biomass expansion factor
CER	certified emission reduction
CH_4	methane
CM	cropland management
Convention reporting adherence	adherence to the "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"
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
FM	forest management
FMRL	forest management reference level
GE	gross energy intake
GHG	greenhouse gas
GM	grazing land management
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
N	nitrogen
NA	not applicable
NE	not estimated
Nex	nitrogen excretion
NFI	national forest inventory
NF_3	nitrogen trifluoride
NIR	national inventory report
NO	not occurring
N_2O	nitrous oxide
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation

SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
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	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*
Y_m	methane conversion rate
2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*

I. Introduction

1. This report covers the review of the 2020 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" (annex to decision 13/CP.20). The review took place from 7 to 12 September 2020 remotely[1] and was coordinated by Davor Vesligaj, Vitor Góis Ferreira and Nashib Kafle (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Liechtenstein.

Table 1
Composition of the expert review team that conducted the review for Liechtenstein

Area of expertise	*Name*	*Party*
Generalist	Mark Hunstone	Australia
Energy	Giorgi Mukhigulishvili	Georgia
	Hongwei Yang	China
IPPU	Julien Jabot	Norway
	Eva Krtková	Czechia
Agriculture	Olga Gavrilova	Estonia
	Joel Gibbs	New Zealand
LULUCF and KP-LULUCF	Mattias Lundblad	Sweden
	Harry Vreuls	Netherlands
Waste	Qingxian Gao	China
	Igor Ristovski	North Macedonia
Lead reviewers	Qingxian Gao	
	Mark Hunstone	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2020 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines.

3. The ERT has made recommendations that Liechtenstein resolve identified findings, including issues[2] designated as problems.[3] Other findings, and, if applicable, the encouragements of the ERT to Liechtenstein to resolve related issues, 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 presents the annual GHG emissions of Liechtenstein, including totals excluding and including LULUCF, indirect CO_2 emissions, and emissions by gas and by sector, and contains background data on emissions and removals from KP-LULUCF, if elected by the Party, by gas, sector and activity.

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

[1] Owing to the circumstances related to the coronavirus disease 2019, the review had to be conducted remotely.

[2] Issues are defined in decision 13/CP.20, annex, para. 81.

[3] Problems are defined in decision 22/CMP.1, annex, paras. 68–69, as revised by decision 4/CMP.11.

II. Summary and general assessment of the Party's 2020 annual submission

7. Table 2 provides the assessment by the ERT of the Party's 2020 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 2020 annual submission of Liechtenstein

Assessment			*Issue/problem ID#(s) in table 3 or 5*[a]
Date of submission	Original submission: NIR, 15 April 2020; CRF tables (version 1), 15 April 2020; standard electronic format tables, 15 April 2020		
Review format	Centralized review conducted remotely		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	A.8, A.15, L.11, L.12, W.1, W.3, W.5, W.8
	(c) Development and selection of EFs?	Yes	E.11, E.12, E.13, E.14, A.10, A.11, A.14
	(d) Collection and selection of AD?	Yes	A.17, L.12, W.5, W.8, W.9, W.11
	(e) Reporting of recalculations?	No	
	(f) Reporting of a consistent time series?	No	
	(g) Reporting of uncertainties, including methodologies?	Yes	W.2
	(h) QA/QC?	QA/QC procedures were assessed in the context of the national system (see supplementary information under the Kyoto Protocol below)	
	(i) Missing categories, or completeness?[b]	Yes	A.9, W.5
	(j) Application of corrections to the inventory?	No	
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?	No	A.9
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	Yes	
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:		
	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements?	No	
	(b) Performance of the national system functions?	No	
	Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry?	No	
	(b) Performance of the functions of the national registry and the adherence to technical standards for data exchange?	No	

Assessment			*Issue/problem ID#(s) in table 3 or 5*[a]
	Have any issues been identified related to the reporting of information on AAUs, CERs, ERUs and RMUs and on discrepancies 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	
	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 the 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?	No	
	Have any issues been identified related to the following reporting requirements for KP-LULUCF:		
	(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	Yes	KP.3, KP.4
	(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	No	
	(c) Reporting requirements of decision 6/CMP.9?	No	
	(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	No	
CPR	Was the CPR reported in accordance with decision 18/CP.7, annex; decision 11/CMP.1, annex; and decision 1/CMP.8, paragraph 18?	Yes	
Adjustments	Has the ERT applied any adjustments under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Has the Party submitted a revised estimate to replace a previously applied adjustment?	No	
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 assessing 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	
Questions of implementation	Did the ERT list any questions of implementation?	No	

[a] Further information on the issues identified, as well as additional findings, may be found in tables 3 and 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 recommendations included in the previous review report

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 27 May 2019,[4] and had not been resolved by the time of publication of the review report of the Party's 2018 annual submission. The ERT has specified whether it believes the Party had resolved, was addressing or had not resolved each issue or problem by the time of publication of this review report and has provided the rationale for its determination, which takes into consideration the publication date of the most recent previous review report and national circumstances. The ERT noted that the individual review of Liechtenstein's 2019 annual submission did not take place in 2019 owing to insufficient funding for the review process.

Table 3
Status of implementation of recommendations included in the previous review report for Liechtenstein

ID#	*Issue/problem classification[a, b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	Article 3, paragraph 14, of the Kyoto Protocol (G.1, 2018) (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 Party did not include information on how priority is given 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 price reforms to reflect market prices and externalities, or on the actions being taken to remove subsidies associated with the use of environmentally unsound and unsafe technologies. During the review, the Party clarified that this recommendation will remain unresolved because it is unable to influence the actions in Switzerland with regard to the customs treaty between Switzerland and Liechtenstein.
G.2	Article 3, paragraph 14, of the Kyoto Protocol (G.2, 2018) (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.	Resolved. The Party reported in its NIR (p.309) that there were no changes to the information provided under Article 3, paragraph 14, of the Kyoto Protocol, in accordance with decision 15/CMP.1, annex, chapter I.H, since the last submission.
G.3	QA/QC and verification (G.4, 2018) Convention reporting adherence	Enhance the reporting on the QA/QC plan in chapter 1 of the NIR by providing a summary description of the plan, including the use of checklists.	Resolved. The Party provided additional information on the QA/QC plan in chapter 1 of the NIR (p.36), including a reference to the use of QA/QC checklists included in annex 8 to the NIR.
G.4	QA/QC and verification (G.5, 2018) Transparency	Provide in the NIR information on the process for the internal review and verification of the methodologies and parameters used by	Resolved. The Party provided in its NIR (p.37) additional general information on the internal review and verification of methodologies and parameters for Switzerland that were used in Liechtenstein's inventory.

[4] FCCC/ARR/2018/LIE. The ERT notes that the report on the individual inventory review of Party's 2019 annual submission has not been published yet. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2018 annual submission.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		Switzerland for their applicability to Liechtenstein's inventory.	
G.5	QA/QC and verification (G.6, 2018) Convention reporting adherence	Enhance the QA/QC procedures to ensure consistent provision of the information in the NIR and CRF tables regarding emissions of NF_3, unspecified mix of HFCs and PFCs, nitrogen oxides and carbon monoxide, and correct the inconsistencies in the emission values reported for non-methane volatile organic compounds.	Addressing. During the review, the Party indicated that it is examining options for additional systematic QC procedures that can be implemented in future submissions as part of its ongoing programme of continuous improvement.
G.6	Uncertainty analysis (G.7, 2018) Convention reporting adherence	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.	Resolved. The Party reported in its NIR (chap. 1.6, p.55) the results of the uncertainty analysis, approach 1, for the base year (table 1-9) and latest inventory year (table 1-10), including the trend (table 1-8).
G.7	Uncertainty analysis (G.8, 2018) Convention reporting adherence	Explain in the NIR how the uncertainty estimates are used to prioritize efforts to improve the accuracy of the inventory.	Addressing. The Party included in the NIR (p.41) a sentence indicating that it takes into account the results of the uncertainty analyses for the prioritization of planned improvements of the national inventory. However, it does not explain how uncertainty estimates are used to prioritize efforts to improve the accuracy of the inventory. The ERT considers that the explanation could be enhanced by including a discussion on the linkages between the key source, uncertainty analysis and the inventory development plan. This could be achieved by including specific references in the inventory development plan where uncertainty and key category analyses have been used to inform a particular priority improvement.
G.8	National registry (G.10, 2018) Transparency	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 and https://ec.europa.eu/clima/about-us/chart_en) and ensure that publicly accessible information has been updated as appropriate.	Resolved. The Party has updated its publicly accessible information referred to in decision 13/CMP.1. Furthermore, it is confirmed in part 2 of the SIAR that all the national registry related recommendations from the previous review report have been fully addressed.
Energy			
E.1	Fuel combustion – reference approach – liquid fuels – CO_2 (E.14, 2018) Comparability	Use the correct notation key "NO" for bitumen.	Resolved. The Party corrected the notation key for bitumen and reported "NO" for the fraction oxidized and the actual CO_2 emissions. However, net carbon emissions were still reported as "0" in CRF table 1.A(b). During the review, the Party clarified that, since the value for net carbon emissions is calculated by CRF Reporter automatically, it is not possible to enter "NO" manually, and therefore it intends to set the fraction of oxidized carbon to "1" instead of "NO". This will lead to an automatic calculation of actual CO_2 emissions.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
E.2	Fuel combustion – reference approach – liquid fuels – CO_2 (E.15, 2018) Comparability	Use the correct notation key "NO" for lubricants.	Resolved. The Party corrected the notation key and reported "NO" for the fraction oxidized and the actual CO_2 emissions for lubricants. However, net carbon emissions were still reported as "0" in CRF table 1.A(b). During the review, the Party clarified that, since the value for net carbon emissions is calculated by CRF Reporter automatically, it is not possible to enter "NO" manually, and therefore it intends to set the fraction of oxidized carbon to "1" instead of "NO". This will lead to an automatic calculation of actual CO_2 emissions.
E.3	International bunkers and multilateral operations – liquid fuels – CO_2, CH_4 and N_2O (E.2, 2018) (E.3, 2016) (E.3, 2015) (32, 2014) Convention reporting adherence	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.	Resolved. The Party is no longer reporting in the body of the NIR the share of fuel consumption for international aviation for 2001–2002. The information had previously been provided only to contextualize the methodology adopted and is no longer relevant. Moreover, the Party reported in NIR table 3-4 (p.84) the share of fuel between domestic and international aviation in accordance with the values reported in CRF tables 1.A(a)s3 and 1.D.
E.4	1.A.2.e Food processing, beverages and tobacco – liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.5, 2018) (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.	Resolved. The Party reallocated AD and emissions from category 1.A.2.g (other) to 1.A.2.e (food processing, beverages and tobacco). The original recommendation asked the Party to review confidentiality agreements with the companies because "IE" was reported for AD and emissions under this category for 2008–2012 in the 2014 submission. At that time the ERT noted that two companies under this category were covered under the European Union Emissions Trading System and asked the Party to review the confidentiality agreement of these two companies in order to use AD and emissions for reporting emissions under category 1.A.2.e. The AD and methodology applied are explained in the NIR (pp.100–104). During the review, the Party explained that, although under this category there are two companies participating in the European Union Emissions Trading System, it is not possible to report separately the values of AD and emissions in the NIR owing to confidentiality issues. Furthermore, the reporting of additional data at the level of these two operators in the NIR would not change the total emissions reported under category 1.A.2.e.
E.5	1.A.3.a Domestic aviation – liquid fuels – CO_2, CH_4 and N_2O (E.16, 2018) Convention reporting adherence	Report the time series in NIR table 3-25 once and improve its QC to prevent such errors.	Resolved. The Party reported table 3-25 once in its NIR (p.112).
E.6	1.A.4.a Commercial/ institutional – liquid fuels – CO_2, CH_4 and N_2O	Correct the values reported for alkylate gasoline consumption for 2012–2013.	Resolved. The Party reported in its NIR (p.92) that 20 per cent of alkylate gasoline is allocated to households and reported under category 1.A.4.b, with the remaining 80 per cent allocated to agriculture and forestry and reported under category 1.A.4.c.ii

ID#	*Issue/problem classification[a, b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(E.9, 2018) (E.18, 2016) (E.18, 2015) Accuracy		(off-road vehicles and other machinery, other fossil fuels). Liechtenstein corrected the values for 2012–2013 and there is no inconsistency between information reported in the NIR (table 3-31, p.119) and CRF table 1.A(a)s4.
E.7	1.A.4.c Agriculture/ forestry/fishing – liquid fuels – N_2O (E.10, 2018) (E.19, 2016) (E.19, 2015) Accuracy	Correct the values reported for alkylate gasoline consumption for 2012–2013.	Resolved. See ID# E.6 above.
E.8	1.B.2.b Natural gas – gaseous fuels – CH_4 (E.17, 2018) Accuracy	Provide in the NIR the reference for the EF used for calculating CH_4 fugitive emissions in the natural gas network and explain the applicability of the chosen EF to Liechtenstein's natural gas distribution network.	Resolved. The Party reported in its NIR (p.125) references for the EF used for calculating CH_4 fugitive emissions under category 1.B.2.b and explained that the EFs for gas distribution losses (source 1.B.2.b) depend on the type and pressure of the natural gas pipeline (NIR table 3-33) and are taken from literature. Specific EFs for different sources of fugitive emissions based on measurements for 1989 from Germany are provided in a 1994 study by Batelle. Specific data for Switzerland (and Liechtenstein) are provided in a 2004 study by Xinmin (NIR tables 3-33–3-35).
IPPU			
I.1	2.D Non-energy products from fuels and solvent use – CO_2 (I.2, 2018) Convention reporting adherence	Reword the sentence in the NIR explaining the relationship between reporting of indirect emissions and non-methane volatile organic compound and carbon monoxide 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 tables 1.A(b) and 1.A(d) and the NIR (chap. 9) clearly addresses the fact that the Party does not elect to report indirect CO_2 emissions.	Resolved. The Party updated NIR chapter 4.5.1 (p.132) and deleted the sentence.
I.2	2.E Electronics industry – NF_3 (I.3, 2018) Transparency	Make the necessary modifications and updates for this section of its NIR to reflect the status of NF_3 emissions.	Resolved. The Party updated NIR chapter 4.6.1 (p.134), deleting the outdated information.
I.3	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.4, 2018) Transparency	Explain in the NIR how the Party 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.	Addressing. The Party updated the description of the methodology used to estimate emissions for category 2.F.1 in its NIR (chap. 4.7.2, p.135). According to the Party, only emissions sources and gases that account for more than 10 per cent of the Swiss inventory are considered to be relevant for Liechtenstein's GHG inventory under source category 2.F. However, the ERT considers that it is still not clear whether the Party applies the 10 per cent threshold for each individual category (i.e. 2.F.1, 2.F.2 and 2.F.4) across category 2.F as a whole or across the GHG emission total for Switzerland. During the review, the Party clarified that the 10 per cent threshold is

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			applied at the level of each category (2.F.1, 2.F.2 and 2.F.4). The ERT considers that this information should be included in the NIR to fully explain the assumption and methodology applied.
I.4	2.G Other product manufacture and use – N_2O (I.5, 2018) Transparency	Remove the reference in the NIR to the "construction sector" and explain why the Swiss N_2O EF for other product manufacture and use is applicable for Liechtenstein.	Resolved. The Party updated NIR chapter 4.8.2.2 (p.146) and replaced the reference to the "construction sector" with a reference to the "manufacture and use of electrical equipment section". The Party further explained in chapter 4.8.2.1 (p.145) that the rationale for applying N_2O EF from the Swiss inventory is that the general characteristics for determining emissions are very similar in both Liechtenstein and Switzerland (e.g. use of similar products). The Party explained in annex 3 to the NIR (section A3.3, p.317) the methodology for calculating N_2O emissions for this category.
Agriculture			
A.1	3.A.1 Cattle – CH_4 (A.3, 2018) (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 3.As2.	Not resolved. The Party did not replace the notation keys with numerical values for the parameters in CRF table 3.As2. For example, gross energy and feeding situation for all cattle categories and weight for growing cattle are reported as "NA". The Party also did not justify the use of notation keys in a footnote or the documentation box to this CRF table. During the review, the Party clarified that this information was reported in tables A-1–A-2 in annex 3 to the NIR and indicated that the necessary improvements to CRF table 3.As2 are planned for future submissions.
A.2	3.B Manure management – CH_4 (A.2, 2018) (A.4, 2016) (A.4, 2015) (69, 2014) Transparency	Improve QC procedures to ensure the consistency of the information provided in the CRF tables 3.As2 and 3.B(a)s1.	Resolved. The Party ensured the consistency of the information for typical animal mass of mature dairy cattle (650 kg) and non-mature dairy cattle (550 kg) between CRF tables 3.As2 and 3.B(a)s1.
A.3	3.B.1 Cattle – CH_4 (A.5, 2018) (A.16, 2016) (A.16, 2015) Convention reporting adherence	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.	Addressing. The Party corrected the inconsistency in the information reported in CRF table 3.B(a)s2 and NIR table 5-12 on the allocation of animal waste management systems for growing cattle. However, the Party still reported the information on the allocation of manure for goats, mules, asses and horses as "NO". The ERT noted that this is not consistent with the information reported in NIR table 5-12, which includes numerical information on the allocation of manure across manure management systems for those animals for selected years. During the review, the Party clarified that it will continue to optimize the consistency of the CRF tables and the information provided in the NIR.
A.4	3.B Manure management – CH_4 (A.7, 2018) Comparability	Use the notation key "NO" for temperate and warm climate regions to improve consistency with the CRF tables.	Resolved. The Party reported "NO" for temperate and warm climate regions in CRF table 3.B(a).

ID#	*Issue/problem classification[a, b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
A.5	3.B.2 Sheep – CH_4 (A.8, 2018) Transparency	Include information in the NIR to justify the relatively high CH_4 IEF for manure management for sheep and to improve transparency of documentation and comparability among all Parties.	Addressing. The Party provided in NIR tables 5-11 and 5-12 information on the types of system used to manage manure produced by sheep and methane conversion factors corresponding to the manure management systems. However, the Party has not yet provided supporting information to explain the main difference between the CH_4 EFs used by Liechtenstein and those used by other Parties.
A.6	3.B.4 Other livestock – N_2O (A.9, 2018) Accuracy	Correct the error in the calculation model to ensure that the amount of manure N for goats reported using the population multiplied by the manure Nex rate is the same as the value using the summation of manure N from all manure management systems.	Resolved. The Party corrected the error in its calculation model to ensure that the amount of manure N for goats reported using the population multiplied by the manure Nex rate is the same as the value using the summation of manure N from all manure management systems.
A.7	3.D.a Direct N_2O emissions from managed soils – N_2O (A.6, 2018) (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.	Resolved. The Party reported in its NIR (p.184) information explaining the factors that influenced the sharp increase in emissions from nitrogen-fixing crops in 2011, namely input data on the managed area of meadows that show an increase in natural meadows for 2011.
A.8	3.D.b.1 Atmospheric deposition – N_2O (A.10, 2018) Convention reporting adherence	Correct the error in the equation for estimating N_2O emissions from atmospheric N deposition and revise the estimation method based on the Swiss model by the 2020 inventory submission according to the five-year inventory improvement plan.	Addressing. The Party corrected in the NIR (p.186) the error in the equation for estimating indirect N_2O emissions from atmospheric N deposition and revised the estimation method. However, the Party still makes reference to ammonia volatilized from vegetation cover on agricultural soils as a variable that was used in the estimates in the list of variables below the equation.
A.9	3.I Other carbon-containing fertilizers – CO_2 (A.11, 2018) Completeness	Either estimate CO_2 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.	Addressing. The Party reported in its NIR (p.197) that the amount of urea ammonium nitrate applied to the agricultural fields of Liechtenstein cannot be determined, but is likely to be less than 1 per cent of the total amount of urea ammonium nitrate applied in Switzerland, and therefore it is considered to be negligible. However, the Party has not provided a value for CO_2 emissions demonstrating that it is less than 0.05 per cent of the national total GHG emissions and does not exceed 500 kt CO_2 eq, and thus considered below the threshold of significance pursuant to paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. During the review, the Party clarified that notation key "NO" used in CRF table 3.G-I will be replaced by "NE" in future submissions.
LULUCF			
L.1	4. General (LULUCF) (L.1, 2018) (L.1, 2016) (L.1, 2015) (77, 2014) Transparency	Improve the descriptions of the methodology for estimating uncertainties and the reporting of the uncertainty values in the NIR.	Resolved. The Party reported on the methodology for estimating uncertainties and data in the NIR in general (chap. 6.1.5, p.210) and for each of the LULUCF categories in their respective sections in the NIR and in annex 7, section A7.2.

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
L.2	4. General (LULUCF) (L.4, 2018) (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.	Resolved. The Party reported in its NIR (chap. 6.2.1, pp.210–212) on how the country-specific land-use categories are classified in line with the IPCC land-use categories and presented this in detail in NIR table 6-6.
L.3	4. General (LULUCF) (L.5, 2018) (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.	Resolved. The Party reported information on uncertainties for the AD and EFs in its NIR (chap. 6.1.5) and for each of the LULUCF categories in their respective sections in the NIR and in annex 7, section A7.2.
L.4	4. General (LULUCF) (L.13, 2018) Transparency	Include in the NIR information on source and content of the soil map and source of the uncertainty estimate for the soil map.	Resolved. The Party reported on the source of the soil map (namely Büchel, 2006) and on the content in its NIR (p.213) and included information on the uncertainty estimate for the soil map (pp.237–238).
L.5	4. General (LULUCF) (L.14, 2018) Accuracy	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 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).	Addressing. The Party improved the reporting for some of the methods, namely for carbon stocks and stock changes of land-use change to forest land from cropland and from some grassland categories in its NIR (pp.227, 230 and 232–236). However, some of the methods for stocks and stock changes, namely for living biomass on afforested areas and BEF on forest land, still need to be applied or, where the Party considers them not to be appropriate, a rationale for the selection of specific methodologies needs to be provided.
L.6	4. General (LULUCF) (L.15, 2018) Accuracy	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, chap. 11.3.1.1, p.278), to make this approach more transparent.	Resolved. The Party reported transparently in its NIR on the cases in which it uses data from the pre-Alps region: BEF (p.221), unproductive forest (p.224), litter (p.225), mineral soils (p.228) and grassland (p.332).
L.7	4.A Forest land – CO_2 (L.16, 2018) Accuracy	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.	Resolved. Liechtenstein improved the reporting of deadwood and litter using the methods applied by Switzerland and provided a table with data on these two pools in its NIR (pp.225–226).

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
L.8	4.A.1 Forest land remaining forest land – CO_2 (L.17, 2018) Transparency	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.	Resolved. The Party reported in the NIR (chap. 2.3) emission trends by sector, including for the LULUCF sector an additional explanation of trends and the impact of storms (p.73).
L.9	4(II) Emissions and removals from drainage and rewetting and other management of organic/mineral soils – CO_2, CH_4 and N_2O (L.18, 2018) Completeness	Complete CRF table 4(II) for forest land.	Resolved. The Party reported in its NIR (p.228) that drainage of forests is not common practice in Liechtenstein and reported this in CRF table 4(II) as "NO".
L.10	4.G HWP – CO_2 (L.10, 2018) (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).	Resolved. The Party reported on export of HWP (sawnwood) in accordance with decision 2/CMP.8, annex II, paragraph 2(g)(i), in its NIR (pp.249–250) and included data on export and import of HWP in CRF table 4.Gs2.
Waste			
W.1	5. General (waste) (W.1, 2018) (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 included information in its NIR (p.252) explaining that living standards and infrastructure, as well as regulatory frameworks, technical standards and legal principles in the waste sector of Liechtenstein, correspond to Swiss standards and therefore Switzerland's country-specific methodology and EFs are usually adopted. The ERT noted that some assumptions should be clarified, as, for example, the composition of landfilled solid waste is estimated to be similar to that of Switzerland, but the data presented on fractions in waste are from a 1978 Swiss study and may not reflect the current situation in Liechtenstein. Furthermore, estimates of AD on the amount of municipal solid waste in the country are based on internal unpublished research. The ERT considers that the Party has not demonstrated how evaluation was undertaken to ensure that the conditions of the two countries are the same, not having provided a link to relevant studies or research to support these claims. See also ID# W.3 below.
W.2	5. General (waste) (W.2, 2018) (W.2, 2016) (W.2, 2015) (89, 2014) Convention reporting adherence	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.	Not resolved. The Party did not provide a quantitative uncertainty analysis for all waste categories. It reported in its NIR (section 7.2.3, p.256) that a simplified uncertainty analysis has been carried out, but only for key categories. Approach level 1 based on propagation of error was used. During the review, the Party explained that not all waste categories are key sources and this is why a simplified uncertainty analysis was performed. The Party clarified that category 5.D.1 (wastewater treatment and discharge) was a key category in the 2020 submission. The ERT notes that, according to paragraph 15 of the UNFCCC Annex I reporting guidelines, a

ID#	Issue/problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			quantitative uncertainty analysis shall be provided for all sources and sinks categories using at least approach 1 as provided in the 2006 IPCC Guidelines.
W.3	5. General (waste) – CO_2, CH_4 and N_2O (W.3, 2018) (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. The Party included in the NIR some information to justify the use of Swiss data to estimate Liechtenstein's emissions in the waste sector. The Party will be able to improve the transparency of reporting and provide detailed justification for the methods, EFs and assumptions used as well as a description of how standards in the waste sector of Liechtenstein correspond to those of the waste sector in Switzerland only once ID# W.1 above is resolved.
W.4	5.B.1 Composting – CH_4 and N_2O (W.7, 2018) (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.	Resolved. The Party reported the AD for the amount of waste composted in NIR table 7-7 (p.259) and in CRF table 5.B in dry matter and therefore the inconsistency in the reporting was resolved.
W.5	5.B.1 Composting – CH_4 and N_2O (W.10, 2018) Completeness	Report the updated AD for backyard composting as wet weight in the NIR and CRF table 5.B and report the emissions from backyard composting and 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.	Not resolved. The Party reported AD for backyard composting in its NIR (chap. 7.3.2 and table 7-8 (p.259)) as kg of wet weight per inhabitant. However, the Party stated in its NIR (chap. 7.3.6, p.260) that AD for backyard composting were not included in CRF table 5.B, although emission estimates take into account backyard composting. During the review, the Party clarified that it will correct the AD in the CRF table in the next submission.
W.6	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.11, 2018) Transparency	Indicate wet matter for the EFs (table 7-8) and AD (table 7-9) to improve consistency and transparency.	Resolved. The Party included information in the NIR indicating that EFs and AD reported in NIR tables 7-10 (p.261) and 7-11 (p.262) are in kg of wet matter, adopted from the Swiss NIR.
W.7	5.D.1 Domestic wastewater – CH_4 and N_2O (W.12, 2018) Transparency	Obtain the plant-specific information from the centralized wastewater treatment plant operators to identify and transparently explain inter-annual changes in CH_4 and N_2O emissions.	Resolved. The Party reported the information in its NIR (p.263 and table 7-14 (p.265)), providing AD from three plants. The AD were used to calculate the annual CH_4 and N_2O emission estimates in tables 7-14 and 7-15. During the review, the Party clarified that, since there are no country-specific data available and given the similarity to conditions in Switzerland, the chosen approach is the next best option for providing estimates. It added that there are no studies planned in the near future to gather the data needed for higher-tier estimation.
KP-LULUCF			
KL.1	General (KP-LULUCF) (KL.1, 2018) (KL.3,	Provide a clear description of the methodology for conducting the uncertainty analysis of KP-	Resolved. The Party reported in its NIR (p.292) on uncertainties of KP-LULUCF activities and refers to further details in relevant sections of chapter 6 and annex 7,

ID#	*Issue/problem classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	2016) (KL.3, 2015) Transparency	LULUCF activities (AR, deforestation, FM and HWP) based on the uncertainty of AD and EFs in each carbon pool and each emission estimate.	section A7.2. The descriptions have improved since the 2018 submission (see ID#s L.1 and L.3 above).
KL.2	Deforestation – CO_2 (KL.2, 2018) (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. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported transparently that the areas that are considered as forest land with a temporary loss of forest cover were not reported as deforested in previous NIRs.
KL.3	FM – CO_2 (KL.6, 2018) Transparency	Provide transparent and verifiable information to demonstrate that the litter and deadwood pools are not a source, as required by decision 2/CMP.8.	Not resolved. For the litter and deadwood pools the Party referred in its NIR (p.391) to the LULUCF section, specifically to pages 225–226: "After 2011, litter has become a net source on the average", which means that emissions and removals must be reported for the litter pool (see also ID# KL.6 in table 5).

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

[b] The report on the review of the 2019 annual submission of Liechtenstein was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2018 annual review report. For the same reason, 2019 is excluded from the list of review years in which issues could have been identified.

IV. Issues and problems identified in three or more 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 and/or problems included in table 4 have been identified in three or more successive reviews, including the review of the 2020 annual submission of Liechtenstein, and had not been addressed by the Party at the time of publication of this review report.

Table 4
Issues and/or problems identified in three or more successive reviews and not addressed by Liechtenstein

ID#	*Previous recommendation for the issue*	*Number of successive reviews issue not addressed*[a]
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–b), in implementing commitments under Article 3, paragraph 14, of the Kyoto Protocol.	4 (2014–2020)
Energy	No issues identified.	
IPPU	No issues identified.	
Agriculture		
A.1	Improve QC procedures to ensure the consistency of the information provided in the CRF tables.	4 (2014–2020)

ID#	*Previous recommendation for the issue*	*Number of successive reviews issue not addressed*[a]
A.2	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.	4 (2014–2020)
A.3	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 assess and on the allocation of manure for growing cattle.	3 (2015–2020)
A.4	Include in the NIR information about factors that influenced the sharp increase of emissions from nitrogen-fixing crops in 2011.	4 (2014–2020)
LULUCF	No issues identified.	
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.	4 (2014–2020)
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.	4 (2014–2020)
W.3	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.	3 (2015–2020)
W.4	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.	3 (2015–2020)
KP-LULUCF		
KL.2	Provide in the NIR a detailed explanation of the estimation of the areas reported for deforestation.	3 (2015–2020)

[a] The review of the 2017 and 2019 annual submissions of Liechtenstein did not take place during 2017 and 2019. Therefore, 2017 and 2019 were not included when counting the number of successive years for this table. In addition, as the reviews of the Party's 2015 and 2016 annual submissions were conducted together, they are not considered successive reviews and 2015/2016 is counted as one year.

V. Additional findings made during the individual review of the Party's 2020 annual submission

10. Table 5 presents findings made by the ERT during the individual review of the 2020 annual submission of Liechtenstein that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2020 annual submission of Liechtenstein

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
General			
G.9	Methods	The ERT identified a number of instances where the use of Swiss AD, EFs and methods is not well justified and where transparency could be improved in the explanations of the applicability of Swiss parameters to Liechtenstein (see ID#s I.5, A.11 and W.8 below and W.1 in table 3). Issues remain with the documentation of supporting information on the use of AD, EFs and/or methods from Switzerland for specific sectors (see ID#s W.8, W.9, W.10 and W.11 below and I.3, A.9, W.1, W.3 and W.5 in table 3). The ERT recommends that the Party provide further information as specified in the issues listed to support the continued use of Swiss AD, EFs and methods and to consider undertaking further country-specific research to derive AD, EFs and methods reflective of local circumstances if resources allow.	Yes. Transparency
G.10	Notation keys	The Party reported light- and heavy-duty trucks as "IE" in CRF table 1.A(a)s3 but provided no documentation supporting the use of this notation key in CRF table 9 or in the NIR (see ID# E.10 below). Furthermore, the Party reported category 3.I other carbon-containing fertilizers as "NO" in CRF table 3.G-I but in the NIR (p.197) it is indicated that this source was not estimated and is likely to be insignificant in accordance with the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines; however, no further details were provided in NIR chapter 1.7, NIR chapter 5.10 or NIR annex 5 or in CRF table 9. The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines because information on the use of notation keys "IE" and "NE" is required in CRF table 9 and annex 5 to the NIR. The ERT recommends that the Party update CRF table 9 and annex 5 to the NIR to include information on where the emissions from light- and heavy-duty trucks are accounted for and information justifying the assumption that emissions for category 3.I other carbon-containing fertilizers are insignificant in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Yes. Transparency
G.11	Uncertainty analysis	The Party reported in its NIR (p.55) that it applied a simplified approach 1 uncertainty analysis that focuses on the uncertainty of key sources specifically and an aggregate of non-key sources. The ERT considers that the uncertainty analysis could be enhanced to improve the overall estimate of inventory uncertainty and to more fully understand the underlying sources of uncertainty in the inventory. The ERT encourages the Party to undertake a quantitative uncertainty analysis for individual non-key categories to better inform the prioritization of the inventory development plan and improve the overall transparency of the NIR. The ERT also encourages the Party to undertake an updated approach 2 uncertainty analysis for the next inventory submission if resources allow.	Not an issue/problem

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
Energy			
E.9	1.A.2.e Food processing, beverages and tobacco – gaseous fuels – CH_4	The Party reported in CRF table 1.A(a)s2 an IEF of 6 kg/TJ for 1990–2018 for natural gas. It also reported in its NIR (p.102) that the CH_4 EFs are country-specific, being based on an analysis of industrial boilers documented in a 2020 report by the Swiss Agency for Environment, Forests and Landscape. The ERT noted that this IEF is above the IPCC default value of 1 kg/TJ. The ERT also noted that in the Swiss inventory the default CH_4 IEF of 1 kg/TJ was applied. During the review, the Party clarified that the country-specific EF for CH_4 applied by Liechtenstein (6 kg/TJ for natural gas) is derived from a Swiss fact sheet from 2015 on EFs for emissions from combustion, which documents an EF of 6 kg/TJ for natural gas for stationary combustion and makes reference to the aforementioned report. The ERT checked the fact sheet and noted that it contains a table showing the EFs for natural gas in boilers; however, there is no explanation of how these EFs were derived. The ERT recommends that the Party explain in the NIR how the country-specific CH_4 EF is derived and provide a justification for its selection.	Yes. Transparency
E.10	1.A.3.b Road transportation – liquid fuels, gaseous fuels, biomass – CO_2, CH_4 and N_2O	The Party reported emissions as "IE" for gasoline, diesel oil, gaseous fuels and biomass under categories 1.A.3.b.ii (light-duty trucks) and 1.A.3.b.iii (heavy-duty trucks and buses), and for diesel oil and biomass under category 1.A.3.b.iv (motorcycles) for the entire time series. The Party did not indicate in CRF table 9 or in the NIR where the emissions for these categories were included. During the review, the Party clarified that it applied a top-down tier 2 approach for category 1.A.3.b. The EFs used in Liechtenstein are from Switzerland's Handbook Emission Factors for Road Transport (see https://www.hbefa.net/e/), which offers an average EF for the total road transport sector (all vehicle categories). Since it is not possible to report the emissions in the CRF tables in an overarching category (1.A.3.b), Liechtenstein reported AD and the total emissions for all other vehicle subcategories under 1.A.3.b.i (cars). Therefore, as AD and emissions for all the vehicle categories were included in subcategory 1.A.3.b.i, emissions for the other subcategories were reported as "IE" in the CRF tables (1.A.3.b.ii, 1.A.3.b.iii and 1.A.3.iv). The ERT recommends that the Party make efforts to disaggregate AD and report emission estimates for gasoline, diesel oil, gaseous fuels and biomass under categories 1.A.3.b.ii, 1.A.3.b.iii and 1.A.3.b.iv. Where this is not possible, the ERT recommends providing information on the use of the notation key "IE" in CRF table 9.	Yes. Comparability
E.11	1.A.3.b.i Cars – diesel oil – N_2O	The Party applied an N_2O IEF of 0.555 kg/TJ for 1990 and 2.343 kg/TJ in 2018 for diesel oil in CRF table 1.A(a)s3. This is lower than the default N_2O EF of 3.9 kg/TJ from the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.2.2). Emissions from road transportation in Liechtenstein were calculated using a tier 2 approach and Swiss EFs (NIR p.313). The ERT noted that in the Swiss annual submission the N_2O IEFs equal 3.337 kg/TJ for 2018. During the review, the Party clarified that the EFs for the road transport sector (1.A.3.b) were taken from Switzerland's Handbook Emission Factors for Road Transport, which is used for emission modelling and reporting by several countries in Europe. The rationale for using this handbook is that the passenger car fleet composition and the road conditions in Switzerland and Liechtenstein are very similar. However, the value of the N_2O IEF used in Liechtenstein's 2020 annual submission differs from that of Switzerland because the latest version of the handbook (version 4.1), which Switzerland used for its 2020 submission, was not available at the time of preparation of Liechtenstein's 2020 submission. In addition, Liechtenstein used a top-down approach for category 1.A.3.b (road transport) and applied the average N_2O IEF	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		suggested in the handbook for the total road transport sector category. The Party provided a justification in its NIR (p.109) for using such an approach. The ERT recommends that the Party update the N_2O EF for diesel oil in accordance with the latest version available of Switzerland's Handbook Emission Factors for Road Transport and provide a justification as to why this EF for diesel oil is more appropriate for its national circumstances than the default IPCC values.	
E.12	1.A.3.b.i Cars – gaseous fuels – CH_4	The Party applied a CH_4 IEF for estimated emissions from gaseous fuels (e.g. 7.73 kg/TJ for 2018) that is lower than the default CH_4 EF of 92 kg/TJ for the entire time series from the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.2.2). Emissions from road transportation were calculated using a tier 2 approach and Swiss EFs (NIR p.313). The ERT noted that in the Swiss inventory the CH_4 IEF is 16.72 kg/TJ for 2018. During the review, the Party clarified that the EFs for the road transport sector (1.A.3.b) were taken from Switzerland's Handbook Emission Factors for Road Transport. See ID# E.10 above. The ERT recommends that the Party update the CH_4 EF for gaseous fuels in accordance with the latest version available of Switzerland's Handbook Emission Factors for Road Transport and provide a justification as to why this EF for gaseous fuels is more appropriate for its national circumstances than the default IPCC values.	Yes. Accuracy
E.13	1.A.3.b.i Cars – diesel oil – CH_4	The Party applied a CH_4 IEF for estimated emissions from diesel oil (1.77 kg/TJ for 1990 and 0.16 kg/TJ for 2018) that is lower than the default CH_4 EF of 3.9 kg/TJ for the entire time series from the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.2.2). Emissions from road transportation were calculated using a tier 2 approach and Swiss EFs (NIR p.313). The ERT noted that in the Swiss inventory the CH_4 IEF is 3.36 kg/TJ for 2018. During the review, the Party clarified that the EFs for the road transport sector (1.A.3.b) were taken from Switzerland's Handbook Emission Factors for Road Transport. See ID# E.10 above. The ERT recommends that the Party update the CH_4 EF for diesel oil in accordance with the latest version available of Switzerland's Handbook Emission Factors for Road Transport and provide a justification as to why this EF for diesel oil is more appropriate for its national circumstances than the default IPCC values.	Yes. Accuracy
E.14	1.A.3.b.i Cars – gasoline – CO_2	The Party reported in CRF table 1.A(a)s3 a CO_2 IEF of 73.9 t/TJ for 1990 and 73.8 t/TJ for 2018. The ERT noted that these IEFs are greater than the default CO_2 EF of 69.3 t/TJ from the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.2.1). Emissions from road transportation were calculated using a tier 2 approach and Swiss EFs (NIR p.313). The ERT noted that in the Swiss inventory the CH_4 IEF is also 73.8 t/TJ for 2018. During the review, the Party clarified that the EFs for the road transport sector (1.A.3.b) were taken from Switzerland's Handbook of Emission Factors for Road Transport. See ID# E.10 above. The ERT recommends that the Party update the CO_2 EF for gasoline in accordance with the latest version available of Switzerland's Handbook Emission Factors for Road Transport and provide a justification as to why this EF for gasoline is more appropriate for its national circumstances than the default IPCC values.	Yes. Accuracy
IPPU			
I.5	2. General (IPPU)	The ERT noted that the Party estimates emissions from the IPPU sector (categories 2.D and 2.F) using proxy emissions in Switzerland and specific indicators such as the number of inhabitants for category 2.D.1 (NIR table 4-3, p.133) and the number of households, cars, inhabitants or employees for categories 2.F.1, 2.F.2 and 2.F.4 (NIR table 4-6, p.137).	Not an issue/problem

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
		The Party explained in its NIR and to the ERT during the review that, among the neighbouring countries, Switzerland is the most similar to Liechtenstein owing to the customs and monetary union, which has a considerable impact on environmental and fiscal strategies. Many Swiss levies and regulations for special goods (e.g. environmental standards) are adopted and applied in Liechtenstein. Nevertheless, the ERT noted that the Party does not have any category-specific QA/QC for the IPPU categories that are estimated. It therefore encourages the Party to implement category-specific QA/QC for those categories to confirm the emission estimations based on the Swiss inventory.	
Agriculture			
A.10	3.A.1 Cattle – CH_4	The Party reported in its NIR (annex 3, table A-1 (p.315)) the information used to evaluate the enteric fermentation EFs for dairy and non-dairy cattle. The ERT noted that, for the calculation of the enteric fermentation EF for fattening calves, the Party applied a Y_m of 0 per cent, determining that the fattening calves are fed with unskimmed milk and supplement feed when live weight exceeds 100 kg. During the review, the Party provided more details on feed ingredients in the ration and specified a reference source that indicates that the Y_m value of 0 per cent is relevant to this diet. The Party also provided a table (in German) that illustrated the changes in ration (by diet component) of fattening calves over a growing period from 60 to 200 kg. The ERT noted that the main diet ingredient is milk (e.g. about 100 per cent (calculated as kg of milk consumed by total kg consumed) of the total feed ration consumed at a weight of 60–71 kg and 70 per cent of the total feed ration consumed at a weight of 191–200 kg); however, at a weight of 191–200 kg fattening calves are fed by dry substances in a ratio of 18 per cent (calculated as kg of dry substances consumed divided by the total consumed amount of feed in kg) of the total amount of feed consumed by fattening calves. The ERT noted that guidance presented in the 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.30) states that "a CH_4 conversion factor of zero is assumed for all juveniles consuming only milk (i.e. milk-fed lambs as well as calves)". The ERT recommends that the Party include information in its NIR to justify (by providing the relevant reference source) that a Y_m of 0 per cent corresponds to the feed ration served for the fattening calves subcategory.	Yes. Accuracy
A.11	3.A.2 Sheep – CH_4	The Party reported in its NIR (chap. 5.2.5, p.161) that a weighted-average value of Y_m was used to estimate CH_4 emissions from enteric fermentation of sheep (e.g. 5.68 per cent for 1990 and 5.94 per cent for 2018). However, the ERT noted that CRF table 3.As1 provides a constant GE of 22.52 MJ/head/day for sheep for the entire time series. As GE is a function of Y_m, according to equation 10.21 of the 2006 IPCC Guidelines (vol. 4), it cannot be constant, as Y_m is not constant. Therefore, it was not clear to the ERT how EFs for the two subcategories of sheep (lambs <1 year old and mature sheep) were developed. In response to a question raised by the ERT on how CH_4 emissions due to enteric fermentation of sheep were evaluated for the entire reporting period and whether GE values developed for each subcategory of sheep (lambs <1 year old and mature sheep) were applied in the estimates, the Party explained that the estimates of CH_4 emissions from enteric fermentation of sheep were conducted by multiplying the weighted-average value of GE for 1990–2018, derived from Switzerland's inventory; the value corresponds to the weighted-average GE values for sheep from Switzerland's 2019 NIR in 1990–2017 and the weighted-average Y_m values, evaluated based on the sheep population structure (by subcategory) of Liechtenstein for 1990–2018. Moreover, the Party acknowledged that the procedure, which is based on	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue/problem?[a]
		the weighted-average Y_m values (based on the sheep population structure of Liechtenstein) and the weighted-average GE (based on the sheep population structure of Switzerland), is not consistent. The ERT recommends that the Party use a consistent approach to evaluate CH_4 enteric fermentation EFs using a consistent time series of GE and Y_m values for the entire reporting period.	
A.12	3.A.4 Other livestock – CH_4	In its NIR (p.152) the Party reported that a tier 2 approach was employed to evaluate enteric fermentation EFs for sheep, swine, goats, horses, mules, asses and poultry. Moreover, the Party referred to the reference sources to be used in the development of the country-specific enteric fermentation EFs (NIR pp.157–158). However, the ERT noted that no supplemental information on performance parameters for these livestock categories was reported in the NIR or CRF table 3.As2. In response to a question raised by the ERT during the review to clarify the information on performance parameters used to evaluate the tier 2 enteric fermentation EFs, namely energy requirements and gross energy intake of sheep, swine, goats and poultry and the information on GE of horses, mules and asses, Liechtenstein stated that the information was obtained from the external sources indicated in the NIR (pp.157–158). Moreover, the Party stated that the collective contribution of CH_4 emissions due to enteric fermentation of these categories of animal to the total CH_4 emissions of enteric fermentation of all livestock categories was about 15 per cent in 2018. Hence, according to the decision tree in figure 10.2 of the 2006 IPCC Guidelines, these livestock categories can be defined as not significant species and, in view of the relatively low importance of these species and the trustworthiness of the respective data providers, the Party stated that further investigation of the validity of the information on the performance parameters used is not planned. The ERT acknowledged the Party's statement. However, the ERT considers that, since Liechtenstein has made the decision to apply a tier 2 approach to estimate CH_4 emissions from enteric fermentation of sheep, swine, goats, horses, mules, asses and poultry, it should report the additional information for those livestock types for which tier 2 was used, as required in CRF table 3.As2, or justify the use of notation keys in a footnote or the documentation box to that CRF table. The ERT recommends that the Party report additional information on the performance parameters of sheep, swine, goats, horses, mules, asses and poultry used to evaluate the country-specific enteric fermentation EFs, as required in CRF table 3.As2, or justify the use of notation keys in a footnote or the documentation box to that CRF table.	Yes. Transparency
A.13	3.B Manure management – N_2O	The Party reported in CRF table 3.B(b) a Nex rate of 80 N/head/year for other mature cattle for 1990–2017 and a blank value for 2018. However, the ERT noted that NIR table 5-15 (p.173) indicates a Nex rate of 85 kg N/head/year for other mature cattle for the entire reporting period. Moreover, the Nex rates for swine reported in CRF table 3.B(b) for the entire reporting period do not correspond to those reported in NIR table 5-15 (e.g. NIR table 5-15 provides a Nex rate of 8.8 kg/head/year for swine for 1990 and 9.5 kg/head/year for 2018, but CRF table 3.B(b) reports 7,530.08 kg/head/year and 11,914.01 kg/head/year, respectively). During the review, the Party clarified the inconsistency in the information on Nex values for other mature cattle and swine provided in the NIR and the CRF table, stating that the values of Nex rates for other mature cattle and swine in CRF table 3.B(b) for 1990–2017 and 1990–2018, respectively, were reported in error; however, the Party ensured that the correct values of Nex rates for other mature cattle and swine, which are reported in NIR table 5-15, were used in the estimation of N_2O emissions from manure management of other mature cattle and swine.	Yes. Convention reporting adherence

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue/problem?[a]
		The ERT recommends that the Party review the consistency of the information reported between the CRF tables and the NIR on Nex rates for other mature cattle and swine for the entire reporting period.	
A.14	3.B Manure management – N_2O	The Party reported in its NIR (p.176) that the EFs applied to estimate N_2O emissions from liquid/slurry manure management systems were updated and adjusted in the 2020 submission in accordance with the information presented in the Netherlands' GHG inventory. Namely, Liechtenstein applied N_2O EFs of 0.002 kg N_2O-N (kg N excreted)$^{-1}$ for a liquid/slurry system with a natural crust cover and a liquid/slurry system without a natural crust cover (versus the default EFs of 0.005 and 0.00 N_2O-N (kg N excreted)$^{-1}$, respectively, in table 10.21 of the 2006 IPCC Guidelines). The ERT noted that the implementation of the updated N_2O EFs has resulted in a significant increase in estimated N_2O emissions from liquid/slurry manure management systems (e.g. from 0.0003 kt N_2O in 2017, as reported in the 2019 submission, to 8.34 kt N_2O in 2017, as reported in the 2020 submission). In response to a question raised by the ERT during the review on how the N_2O EFs developed for liquid/slurry manure management systems managed in the Netherlands correspond to the national circumstances of Liechtenstein, the Party stated that the above-mentioned EFs for N_2O from manure management systems were revisited during the update of the Swiss ammonia model AGRAMMON and the decision to apply the values from the Netherlands model was based on an extensive literature review that considered the specific management conditions in Switzerland (and thus also Liechtenstein). The ERT recommends that the Party provide the information in its NIR to justify the applicability of the N_2O EF values it uses, which were developed by researchers of the Netherlands, to the national circumstances of Liechtenstein for the entire reporting period.	Yes. Accuracy
A.15	3.B.1 Cattle – CH_4 and N_2O	In CRF table 3.B(a), the Party reported information on the allocation of manure management by system type to estimate CH_4 emissions from manure management. The ERT noted that the data on manure management system usage reported for growing cattle for 2017 do not correspond to those used in the estimation of N_2O emissions from manure management of growing cattle for 2017 (calculated as amount of N manure managed in each manure management system divided by the total N excreted by growing cattle). In response to a question raised by the ERT during the review to clarify the inconsistency in the data on manure management system usage applied to estimate CH_4 and N_2O emissions from manure management of growing cattle, Liechtenstein specified that on the basis of the information obtained from the Swiss AGRAMMON model it was assumed that the distribution of animal excreta to the various manure management systems is different with regard to estimating CH_4 emissions for category 3.B manure management compared with estimating N_2O emissions for the same category, since cattle stables usually have simultaneously both liquid and solid manure storage systems. Hence, volatile solids are mainly excreted in dung and N mainly in urine, and therefore the proportion of volatile solids stored as solid manure is higher than the proportion of N. The ERT considers that the approach employed by the Party is not consistent with the 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.61), which state that "the manure management system usage data used to estimate N_2O emissions from Manure Management should be the same as those that are used to estimate CH_4 emissions from Manure Management". Moreover, the ERT noted that Liechtenstein has used inconsistent data on the manure management system to estimate N_2O emissions from manure management of growing cattle, as for other subcategories of cattle (mature dairy cattle and	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue/problem?[a]
		mature non-dairy cattle) and swine, the data on manure management systems reported in CRF table 3.B(a)s2 and those used in the estimation of N_2O emissions from manure management (CRF table 3.B(b)) are consistent. The ERT recommends that Liechtenstein justify the approach employed to estimate CH_4 and N_2O emissions from manure management of growing cattle or ensure consistency in the data on allocation of manure generated by growing cattle used to estimate CH_4 and N_2O emissions from manure management of growing cattle. Moreover, the ERT believes that future ERTs should consider this issue further to ensure that the data on allocation of manure management systems of growing cattle are updated and that there is no overestimation or underestimation of direct or indirect N_2O emissions from manure management of growing cattle, or direct or indirect N_2O emissions from agricultural soils.	
A.16	3.B.2 Sheep – N_2O	The ERT noted that the Nex value of sheep for 1995 (6.15 kg/head) reported in CRF table 3.B(b) is the lowest in the entire time series. Compared with the Nex values reported for 1994 (8.86 kg/head) and 1996 (9.52 kg/head) it is 44.0 per cent and 54.8 per cent lower, respectively. During the review, Liechtenstein explained that the Nex rates for the entire time period were evaluated as a weighted-average based on population number of fattening sheep and milk sheep and relevant Nex rates. Moreover, it specified that the key driver for the significant inter-annual fluctuations in the values of Nex rates in 1994–1996 is the changes in the population structure of sheep. The ERT recommends that the Party include in the NIR information about the factors that influenced the sharp decrease in the Nex rate of sheep for 1995.	Yes. Transparency
A.17	3.D.a.4 Crop residues – N_2O	The Party reported in its NIR (pp.183–184) information on the methodology used to estimate N_2O emissions from crop residues left on agricultural fields. Namely, the model used to estimate N_2O emissions from arable crop residues relies on the data on standard N amount in crop residues per hectare for crops, data on area of cropland per hectare for crops and a ratio of crop residues left on site. However, the ERT noted that Liechtenstein has not included any input data used in the above-mentioned model, which makes it difficult to assess the model. In response to a question raised by the ERT during the review to specify whether statistical data on annual crop yields per hectare were used, the Party specified that since yearly data for crop yields per area are not available, it applied the values of standard (constant) yields by crop species along with total area under each crop to estimate the amounts of crop residues produced annually (in dry matter and in N content) and N_2O emissions from crop residues left on site for the whole time series. The ERT considers that the implementation of the values on standard (constant) yields by crop species might lead to overestimation or underestimation of N_2O emissions, since annual crop yields may vary from one year to another as a result of changes in climatic condition (e.g. temperature) or level of fertilization. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions for this category. The ERT recommends that the Party justify that the use of the information on standard yields by crop species does not lead to overestimation or underestimation of N_2O emissions or use the data on crop yields collected and reported by other neighbouring Parties (e.g. Switzerland) as a proxy to evaluate the input data on annual crop yields used to estimate N_2O emissions due to crop residues left on agricultural soils.	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
A.18	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O	The ERT noted that the data on the area of cultivated organic soils reported in CRF table 3.D (183.3 ha in 2018), which were used to calculate N_2O emissions from managed soils, do not correspond to the total area of organic soils (181.7 ha in 2018) reported under the LULUCF sector (a sum of the area of organic soils under cropland (CRF table 4.B) and grassland (table 4.C). During the review, the Party acknowledged the inconsistency (due to rounding) in the AD of the agriculture sector and clarified that the correct values are those reported in CRF tables 4.B and 4.C in the LULUCF sector. The ERT recommends that the Party correct the inconsistency in the area of cultivated organic soils reported in CRF table 3.D.	Yes. Accuracy
LULUCF			
L.11	4.A Forest land – CO_2	The Party reported in its NIR (chap. 6.4.2.2) BEFs (table 6-11) and wood densities (table 6-12). The source of these values is the Swiss NFI 2, region 3 (pre-Alps). Liechtenstein also reported that Switzerland is no longer using these BEFs and that in the Swiss 2013 NIR the old and new BEFs were very similar (see table 7-27 in the Swiss 2013 NIR). The ERT noted that the information in this table is not region-specific. The ERT also noted that Switzerland reported information based on its NFI 3 and, more recently, on its NFI 4. During the review, the Party informed the ERT that there is no comparison available for Swiss region 3. Additionally, the Party informed the ERT that there are no planned improvements for the BEFs and wood densities. As the present values are based on a 2008 report or the Swiss NFI 2, they might be not accurate enough to estimate removals in recent years. The ERT recommends that the Party verify that the BEFs and wood densities are still accurate for recent years or use information from more recent Swiss NFIs to estimate BEFs and wood densities.	Yes. Accuracy
L.12	4.A Forest land – CO_2	The Party reported in its NIR (pp.284–286) on the area of deforestation and provided estimates for emissions in CRF tables 4.B-F. During the review the Party informed the ERT that there is a calculation error in NIR table 11-5 and in the CRF tables 4.B–F owing to the fact that 'Frac-factors' were partially applied to the wrong numbers, excluding forest that has temporarily lost tree cover. The ERT recommends that the Party apply correct 'Frac-factors' to estimate emissions under categories 4.B–F.	Yes. Accuracy
Waste			
W.8	5.A.2 Unmanaged waste disposal sites – CH_4	In NIR table 7-4 (p.256), the Party reported the percentages of different fractions in the waste, based on a study carried out in Switzerland, which does not reflect the real situation of Liechtenstein. AD have been estimated on the basis of unpublished research and EFs are adopted from those of Switzerland. The Party stated that emissions are calculated using a tier 2 approach with country-specific data. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 3, figure 3.1 and equation 3.1) because good-quality country-specific AD and parameters are missing and need to be gathered in the future in order to estimate emissions using higher-tier methods. During the review, the Party clarified that there are no studies planned in the near future to gather these data. It explained that the whole Rhine Valley region on the two sides of the River Rhine is almost identical in terms of waste composition. The ERT recommends that the Party provide evidence that the AD and parameters from Switzerland are appropriate for its national circumstances, or estimate emissions using a tier 1 approach with the default values presented in the 2006 IPCC Guidelines (vol. 5, chap. 2, tables 2.1–2.4 and annex 2A.1) for future submissions.	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
W.9	5.B.1 Composting – CH_4 and N_2O	The Party reported in its NIR (p.258) emissions, EFs and AD for both centralized and backyard composting. However, the data for backyard composting are missing from the CRF tables. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 4.1.1) because in order to use a tier 2 method the Party needs to provide country-specific data or satisfactorily demonstrate that the parameters from Switzerland can be used in the estimates. During the review, the Party clarified that the AD in the CRF tables state the amounts of organic waste composted in centralized plants only. AD for backyard composting are missing. However, there is no underestimation of emissions because backyard composting is taken into account in the emission estimates. The ERT recommends that the Party correct the AD calculation concerning the conversion from wet matter to dry matter and conduct studies to demonstrate that parameters from Switzerland can be adopted in the calculations. The ERT also recommends that the Party correct the mistakes in the data reporting and the data missing from CRF table 5.B in future submissions.	Yes. Accuracy
W.10	5.D.1 Domestic wastewater – CH_4	The Party reported emissions for this category in its NIR (p.264) under category 5.D.1 (domestic wastewater), since all industrial wastewater is processed in the municipal wastewater treatment plant (located in Bendern), and emissions are calculated using a tier 3 method in accordance with the 2006 IPCC Guidelines, using parameters and adopting EFs from Switzerland. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 6) because in order to use a tier 3 method the Party needs to provide country-specific data or satisfactorily demonstrate that the parameters from Switzerland can be used in the calculations to obtain better estimates of CH_4 emissions. Moreover, plant-specific data should be obtained from two or three industries and chemical oxygen demand should be used instead of biochemical oxygen demand. During the review, the Party clarified that two plants carry out pretreatment of their effluents. The Party is investigating the availability of chemical oxygen demand data from these two plants; if these data are easily available they might be included in future submissions. The ERT recommends that the Party use a tier 2 method to calculate CH_4 emissions from wastewater treatment until it is able to obtain plant-specific values from two or three industries and determine the similarity to the values used by Switzerland.	Yes. Accuracy
W.11	5.D.1 Domestic wastewater – N_2O	The Party reported N_2O emissions from wastewater treatment plants in its NIR (p.265) and CRF table 5.D. The Party stated that a tier 3 method was used in accordance with the 2006 IPCC Guidelines but Swiss values on protein consumption were used instead of country-specific values. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 6) because in order to use a higher-tier method the Party needs to provide country-specific data or satisfactorily demonstrate that the parameters from Switzerland can be used in the estimates. During the review, the Party clarified that there are no protein consumption data from Liechtenstein available and, given the country's similarity to Switzerland, it considers using Swiss data an adequate approach. According to the 2006 IPCC Guidelines, these are not considered to be country-specific data. The chosen approach is the next best option for providing the estimates. The ERT recommends that the Party use a tier 1 method and IPCC default values in the estimates for future submissions until it is able to obtain protein consumption values and determine whether Liechtenstein's protein consumption is similar to the values used by Switzerland.	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
KP-LULUCF			
KL.4	Deforestation – CO_2	The Party reported in its NIR (pp.284–286) that the area of deforestation excludes forest that has temporarily lost tree cover. To estimate these areas for 2013–2020 the Party used a fraction value that is valid for 2002–2008. As there is no validation of this value since 2008, there is a potential underestimation of the emissions resulting from deforestation. During the review, the Party informed the ERT that it expects to report the results from the 2020 survey in the 2023 NIR. The ERT recommends that the Party make efforts to use the results of the 2020 survey to improve the estimate of the area of forest that has temporarily lost tree cover to ensure that emissions for the area of deforestation are not underestimated.	Yes. Accuracy
KL.5	Deforestation – CO_2	The Party reported in its NIR (pp.284–286) on the area of deforestation and provided emission estimates in CRF table 4(KP-1)A.2. During the review the Party informed the ERT that there is a calculation error in NIR table 11-5 as well as in the CRF tables ('Frac-factors' were partially applied to the wrong numbers, excluding forest that has temporarily lost tree cover). The ERT recommends that the Party correct this error and report the correct numbers in the CRF tables.	Yes. Accuracy
KL.6	FM – CO_2	For the litter and deadwood pools the Party referred in its NIR (p.391) to the LULUCF section, where it reported (p.226) that after 2011 litter became a net source on average. The Party did not report emissions or removals for litter. The ERT recommends that the Party estimate and report emissions and removals for litter for the complete time series.	Yes. Accuracy

[a] Recommendations made by the ERT during the review are related to issues as defined in para. 81 of the UNFCCC review guidelines or problems as defined in para. 69 of the Article 8 review guidelines.

VI. Application of adjustments

11. The ERT did not identify the need to apply any adjustments for the 2020 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 elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF is not applicable to the 2020 review.

VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2020 annual submission.

Annex I

Overview of greenhouse gas emissions and removals and data and information on activities under Article 3, paragraphs 3–4, of the Kyoto Protocol, as submitted by Liechtenstein in its 2020 annual submission

1. Tables I.1–I.4 provide an overview of the total GHG emissions and removals as submitted by Liechtenstein.

Table I.1

Total greenhouse gas emissions for Liechtenstein, base year[a]–2018

(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions including indirect CO_2 emissions[b]*		*Land-use change (Article 3.7 bis as contained in the Doha Amendment)[c]*	*KP-LULUCF (Article 3.3 of the Kyoto Protocol)[d]*	*KP-LULUCF (Article 3.4 of the Kyoto Protocol)*	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*			*CM, GM, RV, WDR*	*FM*
FMRL								0.10
Base year	235.34	228.39	NA	NA	2.38		–	
1990	235.34	228.39	NA	NA				
1995	238.14	233.53	NA	NA				
2000	271.94	247.12	NA	NA				
2010	249.27	229.02	NA	NA				
2011	240.02	215.97	NA	NA				
2012	249.50	225.20	NA	NA				
2013	248.38	231.77	NA	NA		4.17	NO	5.43
2014	216.24	199.73	NA	NA		4.27	NO	5.33
2015	208.85	197.79	NA	NA		4.37	NO	–0.26
2016	197.20	187.99	NA	NA		4.45	NO	–2.27
2017	204.54	194.00	NA	NA		4.28	NO	–0.46
2018	203.00	181.08	NA	NA		4.11	NO	11.65

Note: Emissions and 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, para. 4, of the Kyoto Protocol. For activities under Article 3, para. 3, of the Kyoto Protocol and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

[b] The Party did not report indirect CO_2 emissions in CRF table 6.

[c] The value reported in this column relates to GHG emissions from conversion of forests (deforestation) in 1990, as contained in the report on the review of the report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of the Party.

[d] Activities under Article 3, para. 3, of the Kyoto Protocol, namely AR and deforestation.

Table I.2
Greenhouse gas emissions by gas for Liechtenstein, excluding land use, land-use change and forestry, 1990–2018
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	198.97	19.25	10.17	0.0001	NO	NO	NO	NO
1995	204.20	18.02	9.94	1.37	0.0002	NO	NO	NO
2000	216.85	16.83	9.22	4.11	0.01	NO	0.09	NO
2010	190.81	19.11	9.29	9.71	0.07	NO	0.02	NO
2011	176.78	19.47	9.67	9.98	0.06	NO	0.01	NO
2012	185.31	19.92	9.53	10.38	0.06	NO	0.0005	NO
2013	192.54	19.11	9.24	10.65	0.06	NO	0.17	NO
2014	161.24	18.55	9.13	10.66	0.04	NO	0.12	NO
2015	159.71	18.38	9.18	10.45	0.04	NO	0.04	NO
2016	149.88	18.49	9.02	10.56	0.03	NO	0.01	NO
2017	156.28	17.99	8.97	10.69	0.02	NO	0.05	NO
2018	143.75	18.17	9.13	9.95	0.01	NO	0.07	NO
Percentage change 1990–2018	**–27.8**	**–5.6**	**–10.2**	**NA**	**100.0**	**NA**	**100.0**	**NA**

Note: Emissions and removals reported in the sector other (sector 6) are not included in this table.
[a] Liechtenstein did not report indirect CO_2 emissions in CRF table 6.

Table I.3
Greenhouse gas emissions by sector for Liechtenstein, 1990–2018
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	201.06	0.65	24.91	6.95	1.77	NO
1995	206.79	1.89	23.10	4.61	1.74	NO
2000	219.77	4.64	20.92	24.82	1.79	NO
2010	193.34	10.16	23.74	20.25	1.78	NO
2011	179.25	10.39	24.51	24.05	1.82	NO
2012	187.84	10.78	24.78	24.30	1.81	NO
2013	195.05	11.22	23.65	16.62	1.84	NO
2014	163.51	11.16	24.03	16.51	1.02	NO
2015	162.03	10.86	23.87	11.06	1.03	NO
2016	152.16	10.94	23.88	9.21	1.02	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2017	158.60	11.09	23.29	10.55	1.02	NO
2018	146.08	10.35	23.68	21.93	0.97	NO
Percentage change 1990–2018	**–27.3**	**1 484.5**	**–4.9**	**215.5**	**–45.4**	**NA**

Notes: (1) Liechtenstein did not report emissions or removals in the sector other (sector 6); (2) Liechtenstein did not report indirect CO_2 emissions in CRF table 6.

Table I.4

Greenhouse gas emissions and removals from activities under Article 3, paragraphs 3–4, of the Kyoto Protocol by activity, base year[a]–2018, for Liechtenstein

(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[b]	*Activities under Article 3.3 of the Kyoto Protocol*		*FM and elected activities under Article 3.4 of the Kyoto Protocol*				
	Land-use change	*AR*	*Deforestation*	*FM*	*CM*	*GM*	*RV*	*WDR*
FMRL				0.10				
Technical correction				0.26				
Base year	2.38				–	–	–	–
2013		–0.29	4.47	5.43	–	–	–	–
2014		–0.30	4.57	5.33	NO	NO	NO	NO
2015		–0.31	4.68	–0.26	–	–	–	–
2016		–0.32	4.76	–2.17	NO	NO	NO	NO
2017		–0.32	4.60	–0.46	NO	NO	NO	NO
2018		–0.33	4.45	11.65	NO	NO	NO	NO
Percentage change base year–2018					**NA**	**NA**	**NA**	**NA**

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

[a] Liechtenstein has not elected to report on any activities under Article 3, para. 4, of the Kyoto Protocol. For activities under Article 3, para. 3, of the Kyoto Protocol, and FM under Article 3, para. 4, only the inventory years of the commitment period must be reported.

[b] The value reported in this column relates to 1990.

2. Table I.5 provides an overview of key relevant data from Liechtenstein's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5
Key relevant data for Liechtenstein under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2020 annual submission

Parameter	*Data values*
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
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	None
Election of application of provisions for natural disturbances	No for AR; yes for FM
3.5% of total base-year 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, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	NA
2. Deforestation	NA
3. FM	NA

Annex II

Information to be included in the compilation and accounting database

Tables II.1–II.6 include the information to be included in the compilation and accounting database for Liechtenstein. Data shown are from the Party's annual submission, including the latest revised estimates submitted, adjustments (if applicable) and the final data to be included in the compilation and accounting database.

Table II.1
Information to be included in the compilation and accounting database for 2018, including on the commitment period reserve, for Liechtenstein
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
CPR	**1 400 440**	–	–	**1 400 440**
Annex A emissions				
CO_2	143 750	–	–	143 750
CH_4	18 172	–	–	18 172
N_2O	9 132	–	–	9 132
HFCs	9 946	–	–	9 946
PFCs	7	–	–	7
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	69	–	–	69
NF_3	NO	–	–	NO
Total Annex A sources	**181 076**	–	–	**181 076**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–330	–	–	–330
Deforestation	4 445	–	–	4 445
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	11 650	–	–	11 650

Table II.2
Information to be included in the compilation and accounting database for 2017 for Liechtenstein
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	156 280	–	–	156 280
CH_4	17 992	–	–	17 992
N_2O	8 973	–	–	8 973
HFCs	10 691	–	–	10 691
PFCs	17	–	–	17
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	45	–	–	45
NF_3	NO	–	–	NO
Total Annex A sources	**193 998**	–	–	**193 998**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–324	–	–	–324
Deforestation	4 604	–	–	4 604
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–461	–	–	–461

Table II.3
Information to be included in the compilation and accounting database for 2016 for Liechtenstein
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	149 881	–	–	149 881
CH_4	18 490	–	–	18 490
N_2O	9 025	–	–	9 025
HFCs	10 557	–	–	10 557
PFCs	26	–	–	26
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	14	–	–	14
NF_3	NO	–	–	NO
Total Annex A sources	**187 994**	–	–	**187 994**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–318	–	–	–318
Deforestation	4 763	–	–	4 763
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–2 173	–	–	–2 173

Table II.4
Information to be included in the compilation and accounting database for 2015 for Liechtenstein
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	159 711	–	–	159 711
CH_4	18 377	–	–	18 377
N_2O	9 179	–	–	9 179
HFCs	10 446	–	–	10 446
PFCs	38	–	–	38
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	37	–	–	37
NF_3	NO	–	–	NO
Total Annex A sources	**197 788**	–	–	**197 788**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–310	–	–	–310
Deforestation	4 681	–	–	4 681
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–262	–	–	–262

Table II.5
Information to be included in the compilation and accounting database for 2014 for Liechtenstein
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	161 239	–	–	161 239
CH_4	18 549	–	–	18 549
N_2O	9 127	–	–	9 127
HFCs	10 657	–	–	10 657
PFCs	42	–	–	42
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	116	–	–	116

	Original submission	*Revised submission*	*Adjustment*	*Final value*
NF_3	NO	–	–	NO
Total Annex A sources	**199 729**	–	–	**199 729**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–302	–	–	–302
Deforestation	4 570	–	–	4 570
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	5 328	–	–	5 328

Table II.6
Information to be included in the compilation and accounting database for 2013 for Liechtenstein
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	192 537	–	–	192 537
CH_4	19 108	–	–	19 108
N_2O	9 238	–	–	9 238
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	**231 765**	–	–	**231 765**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–294	–	–	–294
Deforestation	4 466	–	–	4 466
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
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 estimation 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 the reporting in the Party's inventory are the following:

(a) 3.I other carbon-containing fertilizers (CO_2) (see ID# A.9 in table 3);

(b) 5.B.1 composting (CH_4 and N_2O) (see ID# W.5 in table 3).

Annex IV

Reference documents

A. 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 https://www.ipcc.ch/publication/2013-revised-supplementary-methods-and-good-practice-guidance-arising-from-the-kyoto-protocol/.

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: IPCC. Available at https://www.ipcc.ch/publication/2013-supplement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories-wetlands/.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2013, 2014, 2015, 2016 and 2018 annual submissions of Liechtenstein, contained in documents FCCC/ARR/2013/LIE, FCCC/ARR/2014/LIE, FCCC/ARR/2015/LIE, FCCC/ARR/2016/LIE and FCCC/ARR/2018/LIE, respectively.

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%202020_final.pdf.

Annual status report for Liechtenstein for 2020. Available at https://unfccc.int/sites/default/files/resource/asr2020_LIE.pdf.

C. Other documents used during the review

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