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## **Report on the individual review of the annual submission of Liechtenstein submitted in 2022\***

### **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 2022 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 19 to 24 September 2022 in Bonn.

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\* In the symbol for this document, 2022 refers to the year in which the inventory was submitted, not to the year of publication.



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## Abbreviations and acronyms

2006 IPCC Guidelines	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
AAU	assigned amount unit
AD	activity data
Annex A 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”
BCEF	biomass conversion and expansion factor
BEF	biomass expansion factor
C	carbon
CER	certified emission reduction
CH <sub>4</sub>	methane
CM	cropland management
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> eq	carbon dioxide equivalent
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”
CPR	commitment period reserve
CRF	common reporting format
DOC	degradable organic carbon
DOC <sub>f</sub>	fraction of degradable organic carbon that decomposes
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
FM	forest management
FMRL	forest management reference level
FRAC <sub>2008</sub>	fraction of forest considered non-permanent in 2008
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
MMS	manure management system(s)
N	nitrogen
N <sub>2</sub> O	nitrous oxide
NA	not applicable
NE	not estimated
Nex	nitrogen excretion
NF <sub>3</sub>	nitrogen trifluoride
NFI	national forest inventory

NH <sub>3</sub>	ammonia
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF <sub>6</sub>	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”
VS	volatile solid(s)
WDR	wetland drainage and rewetting
Wetlands Supplement	<i>2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands</i>
Y <sub>m</sub>	methane conversion rate

## I. Introduction

1. This report covers the review of the 2022 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 19 to 24 September 2022 in Bonn and was coordinated by Lisa Hanle and Jamie Howland (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

<i>Area of expertise</i>	<i>Name</i>	<i>Party</i>
Generalist	Carmen Teresa Meneses López	Bolivarian Republic of Venezuela
	Kristina Saarinen	Finland
Energy	Vincent Camobreco	United States
	Ricardo Fernandez	European Union
	Diana Guzman Barraza	Mexico
	Ioannis Sempos	Greece
IPPU	Koen Smekens	Belgium
	Katarina Yaramenka	Sweden
Agriculture	Daniel Bretscher	Switzerland
	Joel Gibbs	New Zealand
	Juan José Rincón Cristóbal	Spain
LULUCF and KP-LULUCF	Signe Kynding Borgen	Denmark
	Thelma Krug	Brazil
	Timothy Paul Liersch	Australia
	Nagmeldin Mahmoud	Sudan
Waste	Fatma Betül Demirok	Türkiye
	Stana Kopranić	Bosnia and Herzegovina
Lead reviewers	Fatma Betül Demirok	
	Ioannis Sempos	

2. The basis of the findings in this report is the assessment by the ERT of the Party’s 2022 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<sup>1</sup> designated as problems.<sup>2</sup> Other findings, and, if applicable, the encouragements of the ERT to Liechtenstein to resolve related issues, are also included in this report.

4. A draft version of this report was communicated to the Government of Liechtenstein, which provided no comments.

<sup>1</sup> Issues are defined in decision 13/CP.20, annex, para. 81.

<sup>2</sup> Problems are defined in decision 22/CMP.1, annex, paras. 68–69, as revised by decision 4/CMP.11.

5. Annex I presents the annual GHG emissions of Liechtenstein, including totals excluding and including LULUCF, indirect CO<sub>2</sub> 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.

## II. Summary and general assessment of the Party's 2022 annual submission

7. Table 2 provides the assessment by the ERT of the Party's 2022 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 2022 annual submission of Liechtenstein

Assessment		Issue/problem ID#(s) in table 3 or 5 <sup>a</sup>	
Date(s) of submission	Original submission: NIR, 14 April 2022; CRF tables (version 1), 14 April 2022; SEF tables, 14 April 2022 Revised submission: CRF tables (version 3), 9 November 2022 Unless otherwise specified, values from the most recent submission are included in this report		
Review format	Centralized		
Application of the requirements of the UNFCCC	Have any issues been identified in the following areas:		
Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	A.3, L.6, KL.7
	(c) Development and selection of EFs?	No	
	(d) Collection and selection of AD?	Yes	E.2, L.5, W.11
	(e) Reporting of recalculations?	No	
	(f) Reporting of a consistent time series?	No	
	(g) Reporting of uncertainties, including methodologies?	No	
	(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? <sup>b</sup>	Yes	E.7, I.2
	(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?	Yes	
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	

Assessment	Issue/problem ID#(s) in table 3 or 5 <sup>a</sup>	
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	
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 KL.2	
(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	Yes KL.8	
(c) Reporting requirements of decision 6/CMP.9?	Yes KL.9	
(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?	NA Liechtenstein does not have a previously applied adjustment
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for 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

<sup>a</sup> Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

<sup>b</sup> 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 30 September 2021,<sup>3</sup> and had not been resolved by the time of publication of the report on the review of the Party's 2020 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.

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

<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
General			
G.1	Article 3, paragraph 14, of the Kyoto Protocol (G.1, 2020) (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.	Resolved. The Party provided in its NIR (pp.14 and 325–326) information on the prioritization of actions carried out in accordance with the Customs Treaty between Liechtenstein and Switzerland and emphasized that climate policies and measures are addressed under the Energy Strategy 2030 and Energy Vision 2050 adopted by the Government of Liechtenstein. The focus areas of these strategies are the promotion of efficient energy use, the use of renewable energy and the conservation of energy. The Party has made its policies and measures highly compatible and consistent with those of the European Union so as to avoid trade distortions and non-tariff barriers to trade and to enable the setting of similar incentives.  During the review, the Party emphasized that under its Energy Strategy 2030, and in the context of the Government's aim to reduce GHG emissions by 40 per cent compared with the 1990 level by 2030, it has made efforts 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.
G.2	QA/QC and verification (G.5, 2020) (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 <sub>3</sub> , unspecified mix of HFCs and PFCs, nitrogen oxides and carbon monoxide, and correct the inconsistencies in the emission	Resolved. The Party reported in the NIR (p.143) and CRF tables in a consistent manner that emissions of NF <sub>3</sub> and unspecified mix of HFCs and PFCs are not occurring. The ERT notes that reporting of information on precursor gases, specifically, nitrogen oxides, carbon monoxide and non-methane volatile organic compounds, is not mandatory and therefore the reporting of such information is not required.

<sup>3</sup> FCCC/ARR/2020/LIE. The ERT notes that the report on the review of Liechtenstein's 2021 annual submission has not been published yet owing to insufficient funding for the review process. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2020 annual submission.



<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
		values reported for non-methane volatile organic compounds.	
G.3	Uncertainty analysis (G.7, 2020) (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.	Resolved. The Party reported in its NIR (pp.61–62 and 352) how the results of the uncertainty analysis are used for prioritizing planned improvements.
G.4	Methods (G.9, 2020) Transparency	Provide further information, as specified in ID#s I.3, I.5, A.9, A.11, W.1, W.3, W.5 and W.8–W.11 of the previous review report (FCCC/ARR/2020/LIE), to support the continued use of Swiss AD, EFs and methods, and consider undertaking further country-specific research to derive AD, EFs and methods reflective of local circumstances, if resources allow.	Resolved. The Party provided in the NIR (table A-13 and pp.149 and 212) explanations for the use of Swiss methods, AD and EFs. Regarding the specific issues identified in the previous review report, ID#s I.3, A.9, W.1, W.3, W.5 and W.8–W.11 have been resolved. ID# I.5 from the previous review report was an encouragement.  The ERT, while acknowledging that ID# A.11 from the previous review report (which, along with this general issue, was raised for the first time in that report) has not been resolved (see ID# A.3 below), finds that ID# A.11 from the previous review report is slightly different from this general issue, as it is not about justifying the continued use of Swiss methods. Therefore, the ERT considers this general issue to be resolved.
G.5	Notation keys (G.10, 2020) Transparency	Update CRF table 9 and annex 5 to the NIR to include information on where 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.	Not resolved. The Party did not populate CRF table 9 with updated information on where emissions from light- and heavy-duty trucks are accounted for, or a justification of the use of “NE” for other carbon-containing fertilizers.  During the review, the Party clarified that it is not aware of it being possible to manually fill in CRF table 9 or import data into this table using CRF Reporter; therefore, owing to this technical limitation, the relevant information was provided in the NIR. However, the ERT noted that this information was not in annex 5 but elsewhere in the NIR: regarding category 1.A.3.b (road transportation), pages 118 and 353 include the information that emissions for other vehicle categories are included in total road transport emissions because the national energy statistics only provide data on total fuel consumption; and regarding category 3.I (other carbon-containing fertilizers), pages 212 and 353 include information justifying the assumption that emissions for the category are insignificant.  The ERT noted that technical guidance on importing data into the CRF tables, including CRF table 9, is available in the CRF Reporter user manual.
Energy			
E.1	1.A.2.e Food processing, beverages and tobacco – gaseous fuels – CH <sub>4</sub> (E.9, 2020) Transparency	Explain in the NIR how the country-specific CH <sub>4</sub> EF for natural gas is derived and provide a justification for its selection.	Resolved. The Party reported in its NIR (section 3.2.6.5, p.116) that the country-specific CH <sub>4</sub> EF for natural gas was changed to the default EF from the 2006 IPCC Guidelines (vol. 2, chap. 2, table 2.3) (1.00 kg CH <sub>4</sub> /TJ) for the entire time series. This value is also used by Switzerland in its inventory. The ERT considers that the use of the default EF for CH <sub>4</sub> is consistent with the UNFCCC Annex I inventory reporting guidelines because CH <sub>4</sub> emissions from food processing, beverages and tobacco do not comprise a key category.

<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
E.2	1.A.3.b Road transportation – liquid fuels, gaseous fuels and biomass – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O (E.10, 2020) Comparability	Make efforts to disaggregate AD and report emission estimates for gasoline, diesel oil, gaseous fuels and biomass under categories 1.A.3.b.ii (light-duty trucks), 1.A.3.b.iii (heavy-duty trucks and buses) and 1.A.3.b.iv (motorcycles); where this is not possible, provide information on the use of the notation key “IE” in CRF table 9.	<p>Not resolved. The Party reported in its NIR (p.353) that it does not have sufficiently detailed AD (e.g. distance travelled and fuel consumption per vehicle category) that would allow it to disaggregate the emission data for each fuel under the different vehicle subcategories of category 1.A.3.b (road transportation). During the review, Liechtenstein reiterated this view, noting that it is of the opinion that the effort needed to implement this improvement is not justified. Furthermore, the Party did not include any information in CRF table 9 on the use of “IE”.</p> <p>The ERT acknowledges that this recommendation is not related to the accuracy and completeness of emissions, but rather to the principle of comparability defined in paragraph 4(c) of the UNFCCC Annex I inventory reporting guidelines, which specifies that the allocation of different source/sink categories should follow the CRF tables at the level of the summary and sectoral tables. The ERT notes that the Party could consider applying approximate AD and drivers of emissions (e.g. number of vehicles, information from the Swiss inventory) and/or use expert judgment to allocate the AD and corresponding emissions to the relevant subcategories.</p>
E.3	1.A.3.b.i Cars – diesel oil – N <sub>2</sub> O (E.11, 2020) Accuracy	Update the N <sub>2</sub> O 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 Liechtenstein’s national circumstances than the default IPCC values.	<p>Resolved. The Party reported in its NIR (p.353) that it updated the N<sub>2</sub>O EFs for diesel oil on the basis of the latest version (4.1) of Switzerland’s Handbook Emission Factors for Road Transport (INFRAS, 2019) for the road transportation model used for the 2022 submission. As a result of the update, the N<sub>2</sub>O EF for 1990 increased from 0.55 to 0.58 kg N<sub>2</sub>O/TJ and for 2018 increased from 2.34 to 3.20 kg N<sub>2</sub>O/TJ between the 2020 and 2022 submissions. The Party justified the EFs from the Swiss inventory and the handbook as being more applicable to its national circumstances than the IPCC default values owing to the regulations of Liechtenstein and Switzerland being identical and their fleet composition being very similar. The ERT has concluded that the NIR (pp.14 and 109) provides detailed information on bilateral relations between Liechtenstein and Switzerland, including the formation of a customs and monetary union governed by a Customs Treaty. This Treaty has a significant impact on environmental and fiscal strategies. Many Swiss environmental provisions and climate protection regulations are implemented in the legislation of Liechtenstein.</p> <p>The ERT agrees with the updated N<sub>2</sub>O EFs for diesel oil and the explanation provided.</p>
E.4	1.A.3.b.i Cars – gaseous fuels – CH <sub>4</sub> (E.12, 2020) Accuracy	Update the CH <sub>4</sub> 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 Liechtenstein’s national circumstances than the default IPCC values.	<p>Resolved. The Party reported in its NIR (p.353) that it updated the CH<sub>4</sub> EFs for gaseous fuels on the basis of the latest version (4.1) of Switzerland’s Handbook Emission Factors for Road Transport for the road transportation model used for the 2022 submission. As a result of the update, the CH<sub>4</sub> IEF for 2018 increased from 7.73 to 15.15 kg CH<sub>4</sub>/TJ between the 2020 and 2022 submissions. Regarding justification for the use of the handbook for estimating CH<sub>4</sub> emissions from road transport, see ID# E.3 above.</p> <p>The ERT agrees with the updated CH<sub>4</sub> EFs for gaseous fuels and the explanation provided.</p>

<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
E.5	1.A.3.b.i Cars – diesel oil – CH <sub>4</sub> (E.13, 2020) Accuracy	Update the CH <sub>4</sub> 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 Liechtenstein’s national circumstances than the default IPCC values.	Resolved. The Party reported in its NIR (p.353) that it updated the CH <sub>4</sub> EFs for diesel oil on the basis of the latest version (4.1) of Switzerland’s Handbook Emission Factors for Road Transport for the road transportation model used for the 2022 submission. As a result of the update, the CH <sub>4</sub> IEF for 2018 increased from 0.16 to 2.09 kg CH <sub>4</sub> /TJ between the 2020 and 2022 submissions. Regarding justification for the use of the handbook for estimating CH <sub>4</sub> emissions from road transport, see ID# E.3 above.  The ERT agrees with the updated CH <sub>4</sub> EFs for diesel fuels and the explanation provided.
E.6	1.A.3.b.i Cars – gasoline – CO <sub>2</sub> (E.14, 2020) Accuracy	Update the CO <sub>2</sub> 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 Liechtenstein’s national circumstances than the default IPCC values.	Resolved. The Party reported in its NIR (p.353) that it applied a CO <sub>2</sub> EF for gasoline based on the latest version (4.1) of Switzerland’s Handbook Emission Factors for Road Transport for the road transportation model used for the 2022 submission. Use of this version of the handbook did not lead to a recalculation of the CO <sub>2</sub> IEF for either the base year or 2018. Regarding justification for the use of the handbook for estimating CO <sub>2</sub> emissions from road transport, see ID# E.3 above.
IPPU			
I.1	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.3, 2020) (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.	Resolved. The Party provided in its NIR (section 4.7.2.1, p.149) an explanation of the method it used for estimating emissions of HFCs and PFCs, including how it applied the Swiss methodology. In particular, the Party clearly reported that only gases that account for more than 10 per cent of the emissions in the corresponding subcategories of category 2.F (product uses as substitutes for ozone-depleting substances) of the Swiss inventory are considered to be relevant for Liechtenstein’s inventory. This 10 per cent threshold was applied to subcategories 2.F.1 (refrigeration and air conditioning), 2.F.2 (foam blowing agents) and 2.F.4 (aerosols).  The ERT considers that the information reported is clear and sufficient to resolve the issue.
Agriculture			
A.1	3.A.1 Cattle – CH <sub>4</sub> (A.1, 2020) (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.	Resolved. The Party provided the necessary additional information on GE and weight for cattle in CRF table 3.As2 and in NIR tables 5-4 (p.173), A-1 (p.331) and A-2 (p.332), noting that provision of additional information in CRF table 3.As2 is not a mandatory requirement.
A.2	3.A.1 Cattle – CH <sub>4</sub> (A.10, 2020) Accuracy	Include information in the NIR to justify (by providing the relevant reference source) that a Y <sub>m</sub> of 0 per cent corresponds to the feed ration served for the fattening calves subcategory.	Resolved. The Party clarified in its NIR (p.175) that fattening calves are milk fed and noted that according to the 2006 IPCC Guidelines (vol. 4, chap. 10, p.30), a Y <sub>m</sub> of 0 per cent should be assumed for all juvenile calves consuming only milk.

<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
A.3	3.A.2 Sheep – CH <sub>4</sub> (A.11, 2020) Accuracy	Use a consistent approach to evaluate CH <sub>4</sub> enteric fermentation EFs using a consistent time series of GE and Y <sub>m</sub> values for the entire reporting period.	<p>Not resolved. The Party continued to report a constant GE value for the entire time series (22.52 MJ/head/day) in CRF table 3.As1, while Y<sub>m</sub> values varied.</p> <p>During the review, the Party expressed its view that implementing this recommendation would require a disproportionate effort compared with other inventory improvement priorities. The ERT noted that this issue does not lead to a potential underestimation of emissions as the CH<sub>4</sub> IEFs trend upward in line with the Y<sub>m</sub> values, suggesting that the reported GE values are not directly linked to the calculations of CH<sub>4</sub> emissions from enteric fermentation. The upward trend in CH<sub>4</sub> IEFs also implies that reported emissions per head are increasing in line with productivity increases, as would be expected.</p> <p>The ERT considers that the recommendation has not yet been addressed because the Party has not yet adopted a consistent approach to calculating emissions from enteric fermentation by either adopting a consistent time series of GE and Y<sub>m</sub> values or applying another method.</p>
A.4	3.A.4 Other livestock – CH <sub>4</sub> (A.12, 2020) Transparency	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.	Resolved. The Party provided the necessary additional information on GE for sheep, swine, goats, horses, mules, asses and poultry in CRF table 3.As2 and in NIR table 5-5 (p.174), noting that provision of additional information in CRF table 3.As2 is not a mandatory requirement.
A.5	3.B Manure management – N <sub>2</sub> O (A.13, 2020) Convention reporting adherence	Review the consistency of the information reported between the CRF tables and NIR table 5-15 on Nex rates for other mature cattle and swine for the entire reporting period	Resolved. The Party corrected the errors identified in the previous review report and Nex rates for swine and other mature cattle are now consistent between NIR table 5-15 and CRF table 3.B(b).
A.6	3.B Manure management – N <sub>2</sub> O (A.14, 2020) Transparency	Provide information in the NIR to justify the applicability of the N <sub>2</sub> O EF values used for liquid/slurry manure management systems, which were developed by researchers of the Netherlands, to the national circumstances of Liechtenstein for the entire reporting period.	<p>Not resolved. The Party reported in its NIR (pp.186–187) the N<sub>2</sub>O EF values used for manure management, noting they were reviewed by a Swiss inventory expert and deemed suitable for Liechtenstein's inventory. However, no evidence to verify the conclusion of this expert was provided in the NIR.</p> <p>During the review, the Party reiterated that all EFs, estimates and assumptions in the agriculture model are reviewed and checked for suitability for Liechtenstein's GHG inventory; however, it noted that there is no documentation or report regarding the suitability of specific EFs or assumptions. The ERT considered the applicability of Liechtenstein's N<sub>2</sub>O EF for liquid/slurry manure management systems to its national circumstances and concluded that use of the N<sub>2</sub>O EF does not result in an identifiable accuracy issue.</p> <p>The ERT considers that the recommendation has not yet been addressed because the Party has not yet provided evidence of the suitability of the N<sub>2</sub>O EF values used by</p>

<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
			Liechtenstein for its national circumstances. The ERT suggests that documentation (preferably published, but if not, unpublished) confirming the conclusion of the Swiss inventory expert could be included in future NIRs.
A.7	3.B Manure management – CH <sub>4</sub> (A.3, 2020) (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.	Resolved. The information reported on the allocation of manure for growing cattle and animal waste in different management systems for goats, mules and asses is consistent between NIR table 5-12 (p.185) and CRF table 3.B(a)s2 and between the allocation reported in CRF table 3.B(a)s1 and the livestock types in CRF table 3.B(a)s2.
A.8	3.B.1 Cattle – CH <sub>4</sub> (A.15, 2020) Accuracy	Justify the approach employed to estimate CH <sub>4</sub> and N <sub>2</sub> O 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 <sub>4</sub> and N <sub>2</sub> O emissions from manure management of growing cattle.	Resolved. The Party provided in its NIR (pp.184–185) a justification for the approach used to allocate different proportions of VS and N to different MMS for growing cattle. It noted that cattle stables in Liechtenstein usually have both liquid and solid manure storage systems, with the liquid system storing a higher proportion of N (in the form of urine) compared with the solid manure storage systems, which store a higher proportion of VS.
A.9	3.B.2 Sheep – CH <sub>4</sub> (A.5, 2020) (A.8, 2018) Transparency	Include information in the NIR to justify the relatively high CH <sub>4</sub> IEF for manure management for sheep and to improve the transparency of documentation and comparability among all Parties.	Resolved. The Party included the requested information justifying the CH <sub>4</sub> IEF for manure management for sheep in its NIR (pp.183–184), thereby improving the transparency of its documentation and comparability among all Parties.
A.10	3.B.2 Sheep – N <sub>2</sub> O (A.16, 2020) Transparency	Include in the NIR information about the factors that influenced the sharp decrease in the Nex rate for sheep for 1995.	Resolved. The Party reported in its NIR (p.190) that the large decrease in the Nex rate between 1994 and 1995 (from 8.86 kg/head/year to 6.15 kg/head/year) was due to changes in the population structure of sheep.  During the review, the Party added that the main reason for the changes in the population structure of sheep was a change in the relative population of fattening sheep. The Party stated that given that the issue relates to older data (from 1994 and 1995), the Office for the Environment is not able to provide further elaboration.  The ERT accepts that the description of the trend in the NIR is sufficient given the nature of the issue and the year for which it has been identified.
A.11	3.D.a.4 Crop residues – N <sub>2</sub> O (A.17, 2020) Accuracy	Justify that the use of the information on standard yields by crop species does not lead to overestimation or underestimation of N <sub>2</sub> O emissions or use the data on crop yields collected and reported by neighbouring countries (e.g. Switzerland) as a proxy to evaluate the input data on annual crop yields	Resolved. The Party reported in its NIR (p.199) the method used to estimate N from crop residues deposited onto soil, noting that research from 2001 (FAL/RAC, 2001) and 2017 (Richner et al., 2017) was used obtain standard crop yield values for crops grown in Liechtenstein. It has not revised the calculations for N <sub>2</sub> O emissions from crop residues since the 2020 submission.  During the review, the Party indicated that it believes the effort needed to implement this recommendation is disproportionate in relation to the improvement of the emission

ID#	Issue/problem classification <sup>a,b</sup>	Recommendation from previous review report	ERT assessment and rationale
		used to estimate N <sub>2</sub> O emissions due to crop residues left on agricultural soils.	estimate that could be achieved with the more detailed data, particularly considering Liechtenstein's limited administrative capacities. The Party noted that N <sub>2</sub> O emissions from crop residues left on agricultural soils account for only 12.5 per cent of the direct N <sub>2</sub> O emissions from agricultural soils. Furthermore, the requested data are not available and modelling the data would be difficult and require a disproportionately great effort. The ERT noted the lack of periodic statistics – from both international and national sources – on cropping activities in Liechtenstein and concluded that the use of the above-mentioned research studies is the most accurate approach in this context. The ERT believes the use of the figures provided by these studies does not lead to a systemic overestimation or underestimation of N <sub>2</sub> O emissions from crop residues left on agricultural soils. While actual crop yield varies from year to year owing to climate and other factors, the research figures provide the best available estimate of average yields.
A.12	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N <sub>2</sub> O (A.18, 2020) Accuracy	Correct the inconsistency in the area of cultivated organic soils reported in CRF table 3.D.	Resolved. The Party made the correction to the area of cultivated organic soils reported in CRF table 3.D, which is now consistent with CRF tables 4.B and 4.C (180.60 ha for 2020).
A.13	3.D.b.1 Atmospheric deposition – N <sub>2</sub> O (A.8, 2020) (A.10, 2018) Convention reporting adherence	Correct the error in the equation for estimating N <sub>2</sub> O 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.	Resolved. The Party had already revised the methodology and corrected the equation for estimating N <sub>2</sub> O emissions from atmospheric N deposition by the time of the 2020 submission, but had not removed from the list of variables below the equation the reference to NH <sub>3</sub> volatilized from vegetation cover on agricultural soils as a variable that was used in the estimation. The Party made this correction in its 2022 submission (NIR pp.202–203).
A.14	3.I Other carbon-containing fertilizers – CO <sub>2</sub> (A.9, 2020) (A.11, 2018) Completeness	Either estimate CO <sub>2</sub> emissions for this category, or if these emissions are considered 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.	Resolved. The Party provided in the NIR (p.212) additional information on emissions from urea ammonium nitrate, which were estimated to be <0.00041 kt CO <sub>2</sub> eq. They were estimated on the basis of the share of urea ammonium nitrate being less than 1 per cent of total urea applied as fertilizer in Switzerland and the assumption that the share in Liechtenstein is similar.
LULUCF			
L.1	4. General (LULUCF) (L.5, 2020) (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 these methods are considered not appropriate, provide a rationale for the selection of specific methodologies, including higher-tier methods and models,	Resolved. The Party applied the most recent methods for estimating stocks and stock changes in living biomass on afforested areas and for estimating BEFs for forest land and select grassland categories (in the case of grassland, some categories were already addressed in the 2020 submission – see ID# L.5 in document FCCC/ARR/2020/LIE). The Party reported in its NIR (pp.248–249) the selected subcategories of grassland as well as the living biomass carbon stocks estimated based on the factors from the 2022 submission of Switzerland, including root biomass estimates based on allometric functions, derived from a Swiss study (Wüst-Galley et al., 2020) as described in the NIR

<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
		assumptions, EFs and AD, in line with the UNFCCC Annex I inventory reporting guidelines (para. 50).	(p.248). For forest land, the most recent BCEF values from the Swiss NFI have been implemented instead of the previously used BEF and wood densities (see ID# L.2 below).
L.2	4.A Forest land – CO <sub>2</sub> (L.11, 2020) Accuracy	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.	Resolved. The Party reported in its NIR (p.236) that the most recent BCEFs, namely, those from the fourth Swiss NFI, were used for estimating CO <sub>2</sub> emissions from forest land. The ERT confirmed this. The Party provided in NIR tables 6-11 and 6-12 a comparison between the BCEFs in the 2020 submission (which were based on BEFs from the second Swiss NFI, multiplied by wood density) and the new BCEFs, used first for the 2021 submission. The Party stated in the NIR (p.236) that the BCEFs were stratified for each spatial stratum, assuming wood densities of 0.40 and 0.55 t/m <sup>3</sup> for coniferous and deciduous trees, respectively, referencing Thürig and Schmid (2008).  During the review, the Party clarified that it is no longer using wood densities together with BEFs because of the implementation of BCEFs from the fourth Swiss NFI.
L.3	4.A Forest land – CO <sub>2</sub> (L.12, 2020) Accuracy	Apply correct ‘Frac-factors’ to estimate emissions under categories 4.B–F.	Resolved. According to the previous review report, the Party had applied ‘Frac-factors’ incorrectly to the areas in CRF tables 4.B–F in the 2020 submission (see ID# L.12 in document FCCC/ARR/2020/LIE).  During the current review, the Party informed the ERT that ‘Frac-factors’ should in fact not be, and had not been, applied under the Convention because they represent the fraction of temporary forest loss that is not human induced and therefore apply only to areas reported as deforestation under the Kyoto Protocol. Furthermore, the Party confirmed that ‘Frac-factors’ were not applied in the current annual submission under the Convention.  The ERT considers this approach is correct and in accordance with the Party’s definition of deforestation under the Kyoto Protocol and deforested forest land under the Convention.
Waste			
W.1	5. General (waste) (W.1, 2020) (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.	Resolved. The Party reported in its NIR (pp.268–269) information on living standards and infrastructure in the Principality as well as on regulatory frameworks, technical standards and legal principles for the waste sector that correspond to those of Switzerland. More broadly, the NIR (p.14) provides detailed information on bilateral relations between Liechtenstein and Switzerland, including the formation of a customs and monetary union governed by a Customs Treaty. This Treaty has a significant impact on environmental and fiscal strategies. Many Swiss environmental provisions and climate protection regulations are implemented in the legislation of Liechtenstein.  The ERT, after reviewing the information provided, concludes that the Party has demonstrated in its NIR that the use of Swiss methods, parameters and other data for the 2022 submission is appropriate for and consistent with the national circumstances of Liechtenstein.

<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
W.2	5. General (waste) (W.2, 2020) (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.	Resolved. The Party reported in its NIR (pp.273, 276, 279 and 283) in the relevant sections for each category of the sector, in line with the UNFCCC Annex I inventory reporting guidelines, that a simplified uncertainty analysis was carried out for the sector. Individual uncertainty analyses were undertaken for key categories while the remaining categories were assessed in an aggregated manner.  During the review, the Party confirmed that considering that no waste categories were identified as key, a simplified uncertainty analysis was carried out. Default values from the 2006 IPCC Guidelines (vol. 5, chaps. 3–6) were adopted for estimating uncertainties of GHG emissions. The Party noted that in 2020, the waste sector was responsible for emissions of 1.60 kt CO <sub>2</sub> eq, which is 0.9 per cent of the overall GHG emissions in Liechtenstein (excluding LULUCF) for that year.  The ERT, considering the size of Liechtenstein as well as the amount of emissions of the waste sector, concludes that a simplified uncertainty analysis is appropriate.
W.3	5. General (waste) – CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O (W.3, 2020) (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.	Resolved. See ID# W.1 above.
W.4	5.A.2 Unmanaged waste disposal sites – CH <sub>4</sub> (W.8, 2020) Accuracy	Provide evidence that the AD and parameters from Switzerland are appropriate for Liechtenstein's 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.	Resolved. The Party reported in its NIR (pp.271–272) emissions from unmanaged waste disposal sites that were estimated using the first-order decay model, AD from the Office for the Environment that reflect the conditions in Liechtenstein, data on waste composition assessed in a study conducted in Switzerland (BUS, 1978) and default first-order decay parameters from the 2006 IPCC Guidelines (vol. 5, chap. 2, tables 2.1–2.4 and annex 2A.1). See also ID# W.1 above.  The ERT does not have any concerns with the accuracy of the estimates provided
W.5	5.B.1 Composting – CH <sub>4</sub> and N <sub>2</sub> O (W.5, 2020) (W.10, 2018) Completeness	Report updated AD for backyard composting as wet weight in the NIR and CRF table 5.B and report emissions from backyard composting, and recalculate emissions for the entire time series to improve completeness, consistency and accuracy.	Resolved. The Party reported in NIR table 7-8 updated AD for backyard composting as organic waste in wet matter per inhabitant and recalculated CH <sub>4</sub> and N <sub>2</sub> O emissions for the entire time series. AD on dry content were reported and included in CRF table 5.B by combining data on backyard composting with the amount of waste centrally composted. AD and emissions from backyard composting were recalculated for the entire time series and included in the estimates reported in CRF table 5.B.
W.6	5.B.1 Composting – CH <sub>4</sub> and N <sub>2</sub> O (W.9, 2020) Accuracy	Correct the AD calculation concerning the conversion from wet matter to dry matter and conduct studies to demonstrate that	Resolved- The Party reported in NIR table 7-8 (p.276) the amount of backyard waste composted as dry matter and in section 7.3.5 of the NIR explained that AD for backyard composting were corrected owing to conversion from wet to dry waste.



<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
		parameters from Switzerland can be adopted in the calculations.	During the review, the Party explained that for the purpose of conversion from wet to dry waste, a ratio for wet to dry matter of 70 to 30 per cent was applied. The Party informed the ERT that the Office for the Environment has undertaken a comprehensive study of composting and fermentation plants in Switzerland and Liechtenstein. The study is a scientifically sound analysis of the types of plants and procedures that are currently in use, the amounts of biodegradable waste being processed and the status of current waste and material flows (Mandaliev and Schleiss, 2016). Furthermore, 250 of the 368 composting and digestion plants operating in Switzerland and Liechtenstein are inspected annually by an independent company, which applies consistent quality standards for all plants. The ERT does not have any concerns with the accuracy of the estimates provided.
W.7	5.B.1 Composting – CH <sub>4</sub> and N <sub>2</sub> O (W.9, 2020) Accuracy	Correct the mistakes in the data reporting and the data missing from CRF table 5.B (i.e. missing AD for backyard composting) in future submissions.	Resolved. The Party reported in CRF table 5.B under the subcategory other (open air composting (subcategory 5.B.1)) the amount of waste composted, combining backyard waste composted (NIR table 7-8) and waste composted centrally (NIR table 7-7).
W.8	5.D.1 Domestic wastewater – CH <sub>4</sub> (W.10, 2020) Accuracy	Use a tier 2 method to calculate CH <sub>4</sub> emissions from wastewater treatment until plant-specific values from two or three industries are able to be obtained and determine the similarity to the values used by Switzerland.	Resolved. The Party reported in its NIR (p.281) that CH <sub>4</sub> emissions from wastewater treatment and discharge were estimated with a tier 3 method. However, instead of using country-specific EFs, the Party used EFs from Switzerland, under the assumption that similar conditions prevail in Liechtenstein. The Party also reported in the NIR (p.280) that all industrial wastewater, after pre-treatment, is treated at the municipal wastewater treatment plant in Bendern, Liechtenstein, together with domestic wastewater. During the review, the Party explained that in both Liechtenstein and Switzerland, the same advanced centralized wastewater treatment plants with primary, secondary and tertiary treatment, and sludge handling, sewage gas recovery, etc., are in operation. As explained in ID# W.1 above, the ERT considers that application of methods, parameters and other data from Switzerland is appropriate for the national circumstances of Liechtenstein for the waste sector. As all wastewater (industrial and domestic) is treated at the single wastewater treatment plant in Liechtenstein, the ERT confirms that the Party followed the 2006 IPCC Guidelines (vol. 5, chap. 6).
W.9	5.D.1 Domestic wastewater – N <sub>2</sub> O (W.11, 2020) Accuracy	Use a tier 1 method and IPCC default values in the estimates for future submissions until protein consumption values are able to be obtained and determine whether Liechtenstein's protein consumption is similar to the values used by Switzerland.	Resolved. See ID# W.1 above. The ERT agrees with the tier 3 method applied by Liechtenstein (NIR pp.282–283). The ERT concludes that it is appropriate for the Party to apply the protein consumption values from Switzerland to Liechtenstein's estimates of N <sub>2</sub> O emissions from domestic wastewater.
KP-LULUCF			
KL.1	Deforestation – CO <sub>2</sub> (KL.2, 2020) (KL.2, 2018) (KL.1, 2016)	Provide in the NIR a detailed explanation of the estimation of the areas reported for deforestation.	Resolved. The Party provided in its NIR (p.300–302) an explanation of how areas with temporary forest loss were estimated for time intervals of six years on the basis of analyses of Swiss Land Use Statistics surveys from 1984, 1996, 2002, 2008 and 2014.

<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
	(KL.1, 2015) (98, 2014) (99, 2014) Transparency		<p>Furthermore, the Party showed in NIR table 11-5 how the area-weighted fraction for each year was calculated and applied.</p> <p>During the review, the Party confirmed that the areas reported in CRF table 4(KP-I).A2 are areas of permanent forest loss, which have accumulated since 1990, and that the areas of temporary forest loss have been subtracted.</p> <p>The ERT considers that the recommendation has been fully addressed because the Party has provided transparent information on how it estimated the fraction of temporary forest loss that can be considered non-human-induced deforestation.</p>
KL.2	Deforestation – CO <sub>2</sub> (KL.4, 2020) Accuracy	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.	<p>Not resolved. The Party reported in its NIR (p.301) that the fractions of temporary forest loss, also called ‘Frac-factors’, were calculated on the basis of analyses of Swiss Land Use Statistics surveys from 1984, 1996, 2002, 2008 and 2014. The 2020 survey results are not mentioned as a data source.</p> <p>During the review, the Party indicated that, owing to a delay, the 2020 Swiss Land Use Statistics survey data will not be implemented in its inventory until the 2024 submission. Furthermore, the Party clarified that land-use change processes in the Principality continue occurring in a uniform manner because there are no known changes in management or legislation that would affect them. Therefore, the Party considers it appropriate to continue using Frac<sub>2008</sub> based on data from 2003–2014. The Party informed the ERT that the areas affected by ‘Frac-factors’ are generally situated on forest edges and switch between forest and non-forest in the surveys and, as the surveys are based on sampling points, a small change in the crown cover can lead to a land-use change on a specific sampling point according to the criteria applied by the (human) interpreter.</p> <p>The ERT considers that the recommendation has not yet been addressed because the Party has not yet assessed the 2020 Swiss Land Use Statistics survey data and updated the ‘Frac-factors’ with the most recent data. However, the ERT accepts the view of the Party that the new data are not likely to affect the reported emissions under the second commitment period of the Kyoto Protocol such that an underestimation of emissions above the level of significance (0.09 kt CO<sub>2</sub> eq for 2020) would result, and therefore has not included this issue in the list of potential problems and further questions raised by the ERT.</p>
KL.3	Deforestation – CO <sub>2</sub> (KL.5, 2020) Accuracy	Correct the 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) and report the correct numbers in the CRF tables.	<p>Resolved. The Party reported in NIR table 11-5 the fraction of temporary forest loss for each Swiss Land Use Statistics survey interval and explained how ‘Frac-factors’ were applied to estimate the permanent accumulated forest loss reported under deforestation.</p> <p>During the review, the Party provided the ERT with an Excel spreadsheet showing how the calculations were performed and how the calculation error affecting CRF tables NIR-2 and 4(KP-I)2 was corrected.</p>
KL.4	FM – CO <sub>2</sub> (KL.3, 2020) (KL.6,	Provide transparent and verifiable information to demonstrate that the litter and	Resolved. See ID# KL.5 below.

<i>ID#</i>	<i>Issue/problem classification<sup>a,b</sup></i>	<i>Recommendation from previous review report</i>	<i>ERT assessment and rationale</i>
	2018) Transparency	deadwood pools are not a source, as required by decision 2/CMP.8.	
KL.5	FM – CO <sub>2</sub> (KL.6, 2020) Accuracy	Estimate and report emissions and removals for litter for the complete time series.	Resolved. The Party reported carbon stock changes in the litter and deadwood pools for productive forests in CRF table 4(KP-1)B.1 for the entire time series. The Party described in its NIR (p.307) the methods, AD and EFs used.

<sup>a</sup> 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.

<sup>b</sup> The report on the review of the 2021 annual submission of Liechtenstein was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2020 annual review report. For the same reason, 2021, 2019 and 2017 are 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, and as documented in table 4, the ERT assessed that there were no issues identified in three or more successive reviews that had not been addressed by the Party.

Table 4

##### **Issues and/or problems identified in three or more successive reviews and not addressed by Liechtenstein**

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed<sup>a</sup></i>
General	No issues identified.	
Energy	No issues identified.	
IPPU	No issues identified.	
Agriculture	No issues identified.	
LULUCF	No issues identified.	
Waste	No issues identified.	
KP-LULUCF	No issues identified.	

<sup>a</sup> Reports on the reviews of the 2017, 2019 and 2021 annual submissions of Liechtenstein have not yet been published. Therefore, 2017, 2019 and 2021 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 2022 annual submission

10. Table 5 presents findings made by the ERT during the individual review of the 2022 annual submission of Liechtenstein that are additional to those identified in table 3.

Table 5

### Additional findings made during the individual review of the 2022 annual submission of Liechtenstein

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?<sup>a</sup></i>
General			
G.6	Notation keys	<p>In several of the CRF tables submitted by the Party, some cells were left blank. Blank cells were found for several categories of many sectors across the time series in CRF tables 1.A(a), 2(I)A–H, 3.A, 3.B(a–b), 4(I–III), 4.G, 6, 8 (sheet 4) and 4(KP-II)2–4.</p> <p>During the review, the Party provided its assessment of which notation key should have been reported for each category. The ERT confirmed that no underestimation of emissions related to incorrect use of notation keys occurred.</p> <p>The ERT recommends that the Party fill any blank cells in the CRF tables with values or appropriate notation keys.</p>	Yes. Comparability
Energy			
E.7	1.A.3.b Road transportation – biodiesel – CO <sub>2</sub>	<p>The Party did not include in its inventory CO<sub>2</sub> emissions associated with the fossil component of the carbon content of biofuels used for road transportation. The ERT noted that according to the 2006 IPCC Guidelines (vol. 2, chap. 3, pp.3.17–3.18), some of the carbon content of biofuels may have a fossil origin and thus associated CO<sub>2</sub> emissions should be included in the national total emissions.</p> <p>During the review, the Party provided an estimate of the CO<sub>2</sub> emissions associated with the fossil component of biodiesel used in transport for 1997–2020. The estimate was based on Sebos (2022), according to which the CO<sub>2</sub> emissions from the fossil component of biodiesel are 5.4 per cent of total emissions from biodiesel. For Liechtenstein, these CO<sub>2</sub> emissions range from 0.001 kt CO<sub>2</sub> for 1997 to 0.064 kt CO<sub>2</sub> for 2019; for 2020, they are 0.063 kt CO<sub>2</sub>. Before 1997, biodiesel was not used in Liechtenstein. For all subcategories of category 1.A.3.b (road transportation), the CO<sub>2</sub> emissions from the fossil component of biodiesel are lower than the threshold of significance in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (0.09 kt CO<sub>2</sub> eq for 2020). Therefore, this issue was not included in the list of potential problems and further questions raised.</p> <p>The ERT recommends that the Party estimate and report CO<sub>2</sub> emissions associated with the fossil component of the carbon content of biofuels for all subcategories of category 1.A.3.b (road transportation), or if these emissions are considered insignificant, report them as “NE” and provide a quantitative estimate of the likely level of the emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.</p>	Yes. Completeness

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?<sup>a</sup></i>
E.8	1.B.2.b Natural gas – CO <sub>2</sub> and CH <sub>4</sub>	<p>The inter-annual changes in the CO<sub>2</sub> and CH<sub>4</sub> IEFs for category 1.B.2.b.5 (natural gas distribution) were significant reductions between 2019 and 2020: the CO<sub>2</sub> IEF decreased from 0.38 to 0.24 kg/unit and the CH<sub>4</sub> IEF from 47.95 to 31.04 kg/unit. These reductions in IEFs contradict the reporting in NIR tables 3.33–3.35, in which the Party reported that the same EFs were applied for 2019 and 2020. In addition, the Party reported in the NIR (p.139) that there was an error in the preparation of the AD for category 1.B.2.b for 2020, leading to an underestimation of the total emissions for this category for that year of 0.40 kt CO<sub>2</sub> eq. The Party indicated that this error will be corrected in the next annual submission.</p> <p>During the review, the Party provided the ERT with a detailed spreadsheet showing the calculations for estimating CO<sub>2</sub> and CH<sub>4</sub> emissions for category 1.B.2.b.5 for 2019 and 2020. The ERT confirmed that there was an underestimation of emissions of 0.40 kt CO<sub>2</sub> eq for category 1.B.2.b.5, which is higher than the threshold of significance in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (0.09 kt CO<sub>2</sub> eq for Liechtenstein for 2020). Therefore, this issue was included in the list of potential problems and further questions raised by the ERT. In response to this list, Liechtenstein provided revised estimates for CO<sub>2</sub> and CH<sub>4</sub> emissions for category 1.B.2.b.5 for 2020, which were calculated by correcting the AD related to the length of high density polyethylene pipes in the gas distribution network. The revision resulted in an increase in emissions of 0.40 kt CO<sub>2</sub> eq. Because the amount of natural gas available for combustion under category 1.A (fuel combustion) is calculated using the total amount of natural gas supplied by Liechtenstein’s gas utility, with distribution losses deducted, the revised estimates of natural gas losses for category 1.B.2.b.5 have a minor impact on AD (i.e. natural gas consumption) for category 1.A. The Party provided revised estimates of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions for category 1.A, resulting in a reduction in total GHG emissions of 0.05 kt CO<sub>2</sub> eq.</p> <p>The ERT agrees with the revised emission values and concludes that the revised submission of CRF tables on 9 November 2022 resolved the potential problem identified by the ERT.</p>	Not an issue/problem
IPPU			
I.2	2.F.4 Aerosols – HFCs	<p>The Party reported in CRF table 2(II)B-Hs2 emissions of HFC-134a from stocks of metered dose inhalers for 1997–2019, but for 2020, emissions were reported as “NO”.</p> <p>During the review, the Party clarified that the emissions for 2020 were not included in the CRF table owing to an error in data preparation. The value that should have been reported for 2020 is 0.00026 t HFC-134a (9.867 t CO<sub>2</sub> eq), which is significantly lower than the threshold of significance in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (0.09 kt CO<sub>2</sub> eq for Liechtenstein for 2020). Therefore, this issue was not included in the list of potential problems and further questions raised.</p> <p>The ERT recommends that the Party include in CRF table 2(II)B-Hs2 the HFC-134a emissions associated with metered dose inhalers for 2020.</p>	Yes. Completeness
Agriculture			
LULUCF			
L.4	4. General (LULUCF) – CO <sub>2</sub>	<p>The Party reported in its NIR (pp.220–221) a method for calculating carbon stock changes in living biomass, dead organic matter and mineral soils. The method, referred to as the stock-difference approach, is described as being</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? <sup>a</sup>
		<p>the same for all land uses, land-use conversions and carbon pools, although different factors are used in conjunction with the method.</p> <p>The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines for information to be reported in the NIR, as outlined in annex I to decision 24/CP.19, and its appendix, because specific methodological issues should be outlined for each CRF category (e.g. 4.A.1 and 4.A.2). Furthermore, the description of the method did not allow the ERT to evaluate whether the 2006 IPCC Guidelines were applied correctly.</p> <p>During the review, the Party affirmed that the stock-difference approach, incorporating a 20-year conversion time, is applied for all land uses, land-use conversions and carbon pools (see also ID#s L.6 and KL.9 below).</p> <p>The ERT recommends that the Party improve in the NIR the methodological description for the LULUCF sector by including specific information, such as tier level, carbon stocks and calculation formula, for each carbon pool and land-use category; for example, in NIR sections 6.5.2.2 and 6.6.2.2, under (a) and (b), the calculation formula, including conversion time and carbon stocks, could be described.</p>	
L.5	Land representation	<p>The Party reported in CRF table 4.1 initial and final areas for each land-use class, but the final area of the previous inventory year is not the same as the initial area for the subsequent inventory year. For example, the final areas for 2019 were 0.81 ha (managed forest land), 1.75 ha (cropland) and 9.39 ha (managed grassland) smaller and 12.13 ha (settlements) larger than the initial areas for 2020 of the corresponding land-use classes.</p> <p>The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 3) because the final area of the previous inventory year should match exactly the initial area of the current inventory year. Furthermore, the Party should report the final areas in CRF tables 4.A–F; however, Liechtenstein reported in those tables the initial areas for each inventory year.</p> <p>During the review, the Party clarified that it was not able to identify the precise reason for the inconsistencies but indicated that it will revise CRF table 4.1 when data from the 2020 Swiss Land Use Statistics survey become available. The area data are expected to be implemented for the 2024 submission. The Party informed the ERT that the data are not extracted from CRF table 4.1 for the emissions calculations, rather, they are taken directly from the Swiss Land Use Statistics survey database. Therefore, the ERT concludes that emissions are not impacted.</p> <p>The ERT recommends that the Party (1) review the consistency of land representation between inventory years to ensure that the final areas of one year are equal to the initial areas of the next year in CRF table 4.1 and (2) report the final areas for the current inventory year in CRF tables 4.A–F.</p>	Yes. Consistency
L.6	4.C.2.1 Forest land converted to grassland – CO <sub>2</sub>	<p>The Party reported in its NIR (pp.220–221 and 251) that the carbon stock changes in living biomass are estimated using the stock-difference approach; however, the Party described the method in a generic manner, making it unclear if a conversion time had been applied to the stock change difference (see also ID# L.4 above).</p> <p>During the review, the Party clarified that, indeed, a simple stock-difference approach was used for calculating carbon stock changes on forest land converted to grassland (and all other land uses), where the stock difference is divided by 20 years as is done for the stock difference in mineral soils. The ERT concluded that application of this method is not in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 2, equation 2.15) because changes in</p>	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? <sup>a</sup>
L.7	4(II) Emissions/removals from drainage and rewetting and other management of organic/mineral soils – CO <sub>2</sub> and CH <sub>4</sub>	<p>living biomass carbon stocks should be accounted for completely in the year of the conversion (as ΔC_disturbance) and should not be divided by a conversion time.</p> <p>The ERT recommends that the Party change the methodology it uses for estimating carbon stock changes in living biomass by instead applying equations 2.15 and 2.16 from the 2006 IPCC Guidelines (vol. 4, chap. 2) so that carbon stocks are accounted for completely in the year of the conversion and explain the new methodology transparently in the NIR.</p> <p>The Party reported in its NIR (p.245) that CO<sub>2</sub> emissions from cropland remaining cropland constitute a key category by level and trend. Emissions occur from the cultivation and drainage of organic soils over an area of 0.11 kha (CRF table 4.B). Liechtenstein used a tier 2 method with an EF of 9.52 t C/ha for estimating direct CO<sub>2</sub> emissions from this area. However, in CRF table 4(II), Liechtenstein reported “NO” for areas of drained organic soils on cropland and grassland and “NO” for the associated CH<sub>4</sub> and indirect DOC-CO<sub>2</sub> emissions. The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines because appropriate notation keys have not been applied.</p> <p>During the review, the Party replied that the use of the Wetlands Supplement to report these sources is not mandatory, which the ERT agrees with. Furthermore, Liechtenstein indicated that its resources have to be focused on priority improvements and developing a methodology for estimating emissions for this category has not, thus far, been considered as such.</p> <p>The ERT, noting that use of the Wetlands Supplement is not mandatory, recommends that if the Party chooses not to estimate CH<sub>4</sub> and indirect DOC-CO<sub>2</sub> emissions from drained organic soils on cropland and grassland, it report these emissions as “NE” in CRF table 4(II), provide a related explanation in CRF table 9 and report the areas identical to those reported as organic soils in CRF tables 4.B and 4.C. Furthermore, the ERT encourages Liechtenstein to use the Wetlands Supplement in preparing its inventory for future annual submissions and report estimated CH<sub>4</sub> and indirect DOC-CO<sub>2</sub> emissions from drained organic soils on cropland and grassland.</p>	Yes. Comparability
L.8	4.G.1 Solid wood – CO <sub>2</sub>	<p>The Party reported in NIR figure 6-7 the historical data for sawnwood production from 1900 to 2020, and noted that import and export data for sawnwood from 1990 to 2020 are reported in CRF table 4.Gs2. However, the Party did not include in CRF table 4.Gs2 data for sawnwood production, import and export for the entire time series – values for 1960 to 1989 are missing. The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines because in CRF table 4.Gs2, sawnwood production, import and export should be reported for 1960 onward.</p> <p>During the review, the Party clarified that the data are shown in NIR figure 6-7 and can be imported into CRF table 4.Gs2 for the next annual submission. The ERT noted that technical guidance on importing data into the CRF tables is available in the CRF Reporter user manual.</p> <p>See ID# G.6 above for the recommendation related to this issue.</p>	Yes. Transparency
L.9	4.G HWP – information items	<p>The Party reported in its NIR (p.263) the use of default values for the factors used to convert from product units to carbon, but did not report these factors as additional information items in CRF table 4.Gs2. The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines because additional information items should be reported.</p>	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? <sup>a</sup>
		<p>During the review, the Party stated its intent to report these additional information items in the CRF table in the next annual submission.</p> <p>The ERT encourages the Party to report in CRF table 4.Gs2 the additional information items of factors used to convert from product units to carbon for HWP.</p>	
Waste			
W.10	5.A Solid waste disposal on land – CH <sub>4</sub>	<p>The Party reported in its NIR (p.271) the parameters used in estimating CH<sub>4</sub> emissions from solid waste disposal at unmanaged waste disposal sites, including DOC<sub>f</sub>, for which the default value of 0.5 was reported as being applied. In CRF table 5.A, however, the DOC<sub>f</sub> value is reported as 15.40 for the entire time series. The ERT noted that this is not in accordance with the UNFCCC Annex I inventory reporting guidelines because the data are not consistently reported in the NIR and CRF table 5.A.</p> <p>During the review, the Party clarified that the correct value for DOC<sub>f</sub> is 0.5 and this value was applied in estimating the CH<sub>4</sub> emissions. The value of 15.40 in CRF table 5.A is wrong and will be corrected in the next annual submission.</p> <p>The ERT recommends that the Party correct the value of DOC<sub>f</sub> in CRF table 5.A so that it is consistent with the value reported in the NIR (0.5), which is the correct value.</p>	Yes. Convention reporting adherence
W.11	5.D Wastewater treatment and discharge – CH <sub>4</sub>	<p>The Party reported in its NIR (p.284) that there is an error in the AD for sewage gas losses for 2006 onward.</p> <p>During the review, the Party clarified that the error arose when applying the formula for calculating the AD for sewage gas losses. For 2006–2014, the error resulted in an underestimation of the AD and consequently an underestimation of CH<sub>4</sub> emissions from wastewater treatment and discharge, and for 2015–2020, it resulted in an overestimation of the AD and consequently an overestimation of CH<sub>4</sub> emissions. The Party provided the ERT with a table containing both the incorrect and the corrected values for sewage gas losses and confirmed that the error will be rectified for the next annual submission.</p> <p>The ERT recommends that the Party correct the error in the calculation of the AD for sewage gas losses for 2006–2020 and related CH<sub>4</sub> emissions from wastewater treatment and discharge and report the revised estimates in the next annual submission.</p>	Yes. Accuracy
KP-LULUCF			
KL.6	General (KP-LULUCF)	<p>The Party reported in CRF table NIR-2 a land-use matrix that is inconsistent because the value entered under “Total area at the end of the previous inventory year” reported for the current inventory year, t, is not equal to that entered under “Total area at the end of the current inventory year”, as reported for inventory year t – 1. For example, “Total area at the end of the current inventory year” for inventory year 2019 is 0.50 ha larger (AR), 0.01 ha smaller (deforestation) and 19.19 ha larger (FM) than that reported for inventory year 2020 under “Total area at the end of the previous inventory year” (i.e. 2019) for the corresponding activities.</p> <p>During the review, the Party acknowledged the discrepancies identified by the ERT, but clarified that this did not affect emission estimates as the areas in the sectoral tables 4.A–F are correct and that the emission estimates were calculated using data taken directly from the Swiss Land Use Statistics survey database and not from CRF table NIR-2.</p>	Yes. KP reporting adherence



ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? <sup>a</sup>
KL.7	Deforestation – CO <sub>2</sub>	<p>The ERT concludes that this potential problem related to a mandatory reporting requirement does not influence the Party’s ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised by the ERT.</p> <p>The Party reported in its NIR (p.221) a general description of the methodology used for estimating carbon stock changes in all pools on land under conversion. Although not clear, it seemed to the ERT that the Party calculated carbon stock changes from living biomass on forest land converted to other land uses as the difference between the country-specific carbon stocks divided by a conversion time of 20 years. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 2, equation 2.15) because according to the tier 2 method, changes in carbon stocks should be accounted for in the year of the conversion and not divided by a conversion time.</p> <p>During the review, the Party clarified that, indeed, a simple stock-difference approach was used for calculating carbon stock changes on land under conversion, which does not distinguish between the different pools (living biomass, mineral soils, etc.). Carbon stock changes in living biomass on deforested land were therefore estimated by applying a 20-year conversion time or stock-change dependency factor.</p> <p>The ERT recalculated the emissions using a one-year conversion time for deforested land converted to grassland, which resulted in emissions from living biomass for 2013–2020 of 15.50 kt CO<sub>2</sub>, which is lower than the 16.65 kt CO<sub>2</sub> reported by the Party for the same period. The impact of this erroneous methodological implementation on emissions reported and accounted under the Kyoto Protocol leads to an overestimation of emissions for the second commitment period of the Kyoto Protocol.</p>	Yes. Accuracy
KL.8	FM – CO <sub>2</sub>	<p>The Party reported in NIR table 11-7 and in CRF table “Accounting” an FMRL technical correction of 0.26 kt CO<sub>2</sub> eq, although methodological updates for FM were made since the FMRL was established. The corrected FMRL submitted in 2016 included revised estimates for living biomass, HWP and mineral soils.</p> <p>The ERT noted a methodological inconsistency between the FMRL corrected in 2016 and the FM reporting method applied for the 2022 submission because of the inclusion of litter and deadwood estimates (which were first implemented for the 2021 submission) (see ID# KL.5 in table 3) and updated BCEFs for living biomass (see ID# L.2 in table 3). According to the <i>2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol</i>, it is good practice for the Party to annually apply the checklist in table 2.7.1 to evaluate whether a new technical correction is needed.</p> <p>During the review, the Party provided the ERT with a recalculated FMRL that incorporated the new estimates for litter and deadwood and updated BCEFs for living biomass, resulting in a technical correction of 0.55 kt CO<sub>2</sub> eq. This updated value was not included in the revised submission of CRF tables on 9 November 2022 (version 3).</p> <p>The ERT concludes that, because the revision leads to lower accounted emissions, this potential problem related to a mandatory reporting requirement does not influence the Party’s ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised by the ERT.</p>	Yes. KP reporting adherence
KL.9	FM – CO <sub>2</sub>	<p>The Party reported in CRF table “Accounting” an FM cap of 66.092 kt CO<sub>2</sub> eq, which is not the same as the value inscribed in the report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol (64.169 kt CO<sub>2</sub> eq). The ERT noted that this is not in accordance with decision 6/CMP.9,</p>	Yes. KP reporting adherence

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? <sup>a</sup>
		<p>paragraph 12, because the FM cap is fixed upon conclusion of the review of the report to facilitate the calculation of the assigned amount and shall remain fixed for the duration of the second commitment period.</p> <p>During the review, the Party clarified that the FM cap was recalculated in error and that it should be the value contained in the report to facilitate the calculation of the assigned amount (i.e. 64.169 kt CO<sub>2</sub> eq). This updated value was not included in the revised submission of CRF tables on 9 November 2022 (version 3). The ERT concludes that, given the FM cap is not triggered because the reported emissions from FM are a net source, this potential problem related to a mandatory reporting requirement does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and therefore this issue was not included in the list of potential problems and further questions raised by the ERT.</p>	

<sup>a</sup> 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 2022 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. Table I.5 presents the accounting quantities for KP-LULUCF reported by Liechtenstein and the final values agreed by the ERT. The final quantities of units to be issued and cancelled are presented in table I.6.

## VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2022 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 2022 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 and removals for Liechtenstein, base year–2020**  
 (kt CO<sub>2</sub> eq)

	<i>Total GHG emissions excluding indirect CO<sub>2</sub> emissions</i>		<i>Total GHG emissions and removals including indirect CO<sub>2</sub> emissions<sup>d</sup></i>		<i>Land-use change (Article 3.7 bis as contained in the Doha Amendment)<sup>b</sup></i>	<i>KP-LULUCF (Article 3.3 of the Kyoto Protocol)<sup>c</sup></i>	<i>KP-LULUCF (Article 3.4 of the Kyoto Protocol)</i>	
	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>			<i>CM, GM, RV, WDR</i>	<i>FM</i>
FMRL								0.10
Base year <sup>d</sup>	236.04	228.47	NA	NA	2.38		–	
1990	236.04	228.47	NA	NA				
1995	238.87	233.54	NA	NA				
2000	272.15	247.01	NA	NA				
2010	249.17	228.17	NA	NA				
2011	240.05	215.32	NA	NA				
2012	249.52	224.51	NA	NA				
2013	248.29	230.73	NA	NA		4.36	–	5.67
2014	217.21	199.73	NA	NA		4.45	NO	5.58
2015	210.36	198.15	NA	NA		4.54	–	0.14
2016	198.19	187.76	NA	NA		4.63	NO	–1.72
2017	205.17	193.46	NA	NA		4.46	NO	–0.04
2018	203.66	181.27	NA	NA		4.29	NO	11.33
2019	200.07	187.67	NA	NA		4.12	NO	1.34
2020	184.85	180.01	NA	NA		3.94	NO	–6.15

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

<sup>a</sup> The Party did not report indirect CO<sub>2</sub> emissions in CRF table 6.

<sup>b</sup> 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 Party's report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol.

<sup>c</sup> Activities under Article 3, para. 3, of the Kyoto Protocol, namely AR and deforestation.

<sup>d</sup> “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. The corresponding cells in the CRF tables were left blank in the 2022 annual submission for the base year, 2013 and 2015.

Table I.2

**Greenhouse gas emissions and removals by gas for Liechtenstein, excluding land use, land-use change and forestry, 1990–2020**(kt CO<sub>2</sub> eq)

	<i>CO<sub>2</sub></i> <sup>a</sup>	<i>CH<sub>4</sub></i>	<i>N<sub>2</sub>O</i>	<i>HFCs</i>	<i>PFCs</i>	<i>Unspecified mix of HFCs and PFCs</i>	<i>SF<sub>6</sub></i>	<i>NF<sub>3</sub></i>
1990	198.97	19.24	10.27	0.00	NO	NO	NO	NO
1995	204.20	17.92	10.18	1.24	0.00	NO	NO	NO
2000	216.86	16.69	9.48	3.87	0.01	NO	0.09	NO
2010	190.83	19.01	9.29	8.95	0.05	NO	0.02	NO
2011	176.78	19.36	9.66	9.44	0.06	NO	0.01	NO
2012	185.33	19.80	9.53	9.81	0.04	NO	0.00	NO
2013	192.54	18.99	9.22	9.75	0.04	NO	0.17	NO
2014	161.26	19.17	9.13	10.03	0.03	NO	0.12	NO
2015	159.77	19.01	9.17	10.13	0.01	NO	0.04	NO
2016	149.84	19.13	9.01	9.76	0.01	NO	0.01	NO
2017	155.77	18.64	8.97	10.03	0.00	NO	0.05	NO
2018	142.95	18.90	9.15	10.20	0.00	NO	0.07	NO
2019	149.03	19.57	9.30	9.73	0.00	NO	0.05	NO
2020	141.94	19.71	9.19	9.11	0.00	NO	0.05	NO
<b>Percentage change 1990– 2020</b>	<b>28.7</b>	<b>2.5</b>	<b>10.5</b>	<b>8 624 277.6</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

*Note:* Emissions and removals reported for the sector other (sector 6) are not included in this table.

<sup>a</sup> Liechtenstein did not report indirect CO<sub>2</sub> emissions in CRF table 6.

Table I.3

**Greenhouse gas emissions and removals by sector for Liechtenstein, 1990–2020**(kt CO<sub>2</sub> eq)

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
1990	201.25	0.66	24.90	7.57	1.66	NO
1995	207.06	1.77	23.10	5.33	1.62	NO
2000	220.06	4.41	20.91	25.14	1.62	NO
2010	193.43	9.39	23.73	21.01	1.62	NO

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
2011	179.32	9.86	24.50	24.73	1.64	NO
2012	187.93	10.18	24.77	25.01	1.62	NO
2013	195.15	10.28	23.65	17.56	1.65	NO
2014	163.63	10.48	24.03	17.48	1.59	NO
2015	162.18	10.48	23.87	12.21	1.62	NO
2016	152.22	10.06	23.88	10.43	1.60	NO
2017	158.21	10.35	23.29	11.72	1.60	NO
2018	145.42	10.53	23.74	22.39	1.58	NO
2019	151.52	10.05	24.50	12.40	1.60	NO
2020	144.31	9.43	24.67	4.84	1.60	NO
<b>Percentage change 1990–2020</b>	<b>28.3</b>	<b>1 321.0</b>	<b>0.9</b>	<b>36.1</b>	<b>3.2</b>	<b>NA</b>

*Note:* Liechtenstein did not report indirect CO<sub>2</sub> 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–2020, for Liechtenstein**  
(kt CO<sub>2</sub> eq)

	<i>Article 3.7 bis as contained in the Doha Amendment<sup>d</sup></i>	<i>Activities under Article 3.3 of the Kyoto Protocol</i>		<i>FM and elected activities under Article 3.4 of the Kyoto Protocol</i>				
	<i>Land-use change</i>	<i>AR</i>	<i>Deforestation</i>	<i>FM</i>	<i>CM</i>	<i>GM</i>	<i>RV</i>	<i>WDR</i>
FMRL				0.10				
Technical correction				0.26				
Base year <sup>b</sup>	2.38				–	–	–	–
2013		0.32	4.68	5.67	–	–	–	–
2014		0.32	4.77	5.58	NO	NO	NO	NO
2015		0.33	4.87	0.14	–	–	–	–
2016		0.33	4.96	1.72	NO	NO	NO	NO
2017		0.34	4.80	0.04	NO	NO	NO	NO
2018		0.34	4.63	11.33	NO	NO	NO	NO
2019		0.35	4.46	1.34	NO	NO	NO	NO
2020		0.35	4.29	6.15	NO	NO	NO	NO
<b>Percentage change base year–2019</b>					<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

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

<sup>a</sup> The value reported in this column relates to 1990.

<sup>b</sup> Liechtenstein has not elected to report on any activities under Article 3, para. 4, of the Kyoto Protocol. The corresponding cells in the CRF tables were left blank in the 2022 annual submission for the base year, 2013 and 2015. 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.

2. Table I.5 provides information on the Party's accounting quantities for reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5

**Accounting quantities for activities under Article 3, paragraph 3, and forest management and any elected activities under Article 3, paragraph 4, of the Kyoto Protocol for Liechtenstein**

(kt CO<sub>2</sub> eq)

GHG source/sink activity	Base year <sup>d</sup>	Net emissions/removals									Accounting parameters	Accounting quantities <sup>e</sup>
		2013	2014	2015	2016	2017	2018	2019	2020	Total <sup>b</sup>		
A.1. AR		0.319	0.323	0.327	0.331	0.336	0.341	0.346	0.351	2.673		2.672
Excluded emissions from natural disturbances <sup>d</sup>			NO	NO	NO	NO	NO	NO		NO		NO
Excluded subsequent removals from land subject to natural disturbances			NO	NO	NO	NO		NO	NO	NO		NO
A.2. Deforestation		4.680	4.773	4.871	4.965	4.798	4.631	4.462	4.292	37.472		37.473
B.1. FM										16.145		13.273
Net emissions/removals		5.666	5.577	0.138	-1.717	-0.043	11.330	1.343	6.148	16.145		
Excluded emissions from natural disturbances <sup>d</sup>			NO		NO	NO	NO	NO		NO		NO
Excluded subsequent removals from land subject to natural disturbances			NO		NO	NO	NO	NO	NO	NO		NO
Any debits from newly established forest												
FMRL <sup>e</sup>											0.100	
Technical corrections to FMRL											0.259	
FM cap											66.092	13.273
B.2. CM (if elected)			NO		NO	NO	NO	NO	NO	NO		NO
B.3. GM (if elected)			NO		NO	NO	NO	NO	NO	NO		NO

<i>GHG source/sink activity</i>	<i>Net emissions/removals</i>										<i>Accounting parameters</i>	<i>Accounting quantities<sup>c</sup></i>
	<i>Base year<sup>a</sup></i>	<i>2013</i>	<i>2014</i>	<i>2015</i>	<i>2016</i>	<i>2017</i>	<i>2018</i>	<i>2019</i>	<i>2020</i>	<i>Total<sup>b</sup></i>		
B.4. RV (if elected)			NO		NO	NO	NO	NO	NO	NO		NO
B.5. WDR (if elected)			NO		NO	NO	NO	NO	NO	NO		NO

<sup>a</sup> Net emissions and removals from CM, GM, RV and/or WDR, if elected, in the Party's base year as established in decision 9/CP.2.

<sup>b</sup> The accounting quantity is the total quantity of units to be issued or cancelled for a particular activity.

<sup>c</sup> Cumulative net emissions and removals for all years of the commitment period reported in the annual submission under review.

<sup>d</sup> The Party indicated in its report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol its intention to apply the provisions from natural disturbances to its accounting of FM at the end of the commitment period. The Party decided not to exclude emissions and subsequent removals from natural disturbances in its accounting for the 2022 annual submission.

<sup>e</sup> As inscribed in the appendix to the annex to decision 2/CMP.7 in kt CO<sub>2</sub> eq per year.

3. Table I.6 provides an overview of key data from Liechtenstein's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.6

**Key data for Liechtenstein under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2022 annual submission**

<i>Parameter</i>	<i>Data</i>
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: not elected (e) GM: not elected (f) RV: not elected (g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	None
Election of application of provisions for natural disturbances <sup>a</sup>	No for AR, Yes for FM
3.5% of total base-year GHG emissions, excluding LULUCF	8.021 kt CO <sub>2</sub> eq (64.169 kt CO <sub>2</sub> eq for the duration of the commitment period) (see ID# KL.9 in table 5)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	Issue 2 672 RMUs
2. Deforestation	Cancel 37 473 units
3. FM	Cancel 13 273 units

<sup>a</sup> The Party decided not to exclude emissions and subsequent removals from natural disturbances in its accounting for the 2022 annual submission.



## Annex II

### Information to be included in the compilation and accounting database

Tables II.1–II.8 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 2020, including on the commitment period reserve, for Liechtenstein**  
(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>CPR</b>	<b>1 400 440</b>			<b>1 400 440</b>
<b>Annex A emissions</b>				
CO <sub>2</sub>	141 996	141 945		141 945
CH <sub>4</sub>	19 310	19 713		19 713
N <sub>2</sub> O	9 186	9 186		9 186
HFCs	9 112			9 112
PFCs	1			1
Unspecified mix of HFCs and PFCs	NO			NO
SF <sub>6</sub>	54			54
NF <sub>3</sub>	NO			NO
<b>Total Annex A sources<sup>a</sup></b>	<b>179 659</b>	<b>180 011</b>		<b>180 011</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	351			351
Deforestation	4 292			4 292
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM	6 148			6 148

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.2

**Information to be included in the compilation and accounting database for 2019 for Liechtenstein**  
(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	149 026			149 026
CH <sub>4</sub>	19 568			19 568
N <sub>2</sub> O	9 297			9 297
HFCs	9 734			9 734
PFCs	2			2
Unspecified mix of HFCs and PFCs	NO			NO
SF <sub>6</sub>	47			47
NF <sub>3</sub>	NO			NO
<b>Total Annex A sources<sup>a</sup></b>	<b>187 674</b>			<b>187 674</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	346			346
Deforestation	4 462			4 462

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM		1 343		1 343

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.3

**Information to be included in the compilation and accounting database for 2018 for Liechtenstein**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	142 950			142 950
CH <sub>4</sub>	18 900			18 900
N <sub>2</sub> O	9 155			9 155
HFCs	10 196			10 196
PFCs	2			2
Unspecified mix of HFCs and PFCs	NO			NO
SF <sub>6</sub>	69			69
NF <sub>3</sub>	NO			NO
<b>Total Annex A sources<sup>a</sup></b>	<b>181 273</b>			<b>181 273</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	341			341
Deforestation	4 631			4 631
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM		11 330		11 330

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.4

**Information to be included in the compilation and accounting database for 2017 for Liechtenstein**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	155 769			155 769
CH <sub>4</sub>	18 638			18 638
N <sub>2</sub> O	8 972			8 972
HFCs	10 030			10 030
PFCs	3			3
Unspecified mix of HFCs and PFCs	NO			NO
SF <sub>6</sub>	45			45
NF <sub>3</sub>	No			No
<b>Total Annex A sources<sup>a</sup></b>	<b>193 457</b>			<b>193 457</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	336			336
Deforestation	4 798			4 798
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM		43		43

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.5

**Information to be included in the compilation and accounting database for 2016 for Liechtenstein**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	149 838			149 838
CH <sub>4</sub>	19 126			19 126
N <sub>2</sub> O	9 015			9 015
HFCs	9 759			9 759
PFCs	5			5
Unspecified mix of HFCs and PFCs	NO			NO
SF <sub>6</sub>	14			14
NF <sub>3</sub>	NO			NO
<b>Total Annex A sources<sup>a</sup></b>	<b>187 758</b>			<b>187 758</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	331			331
Deforestation	4 965			4 965
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM	1 717			1 717

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.6

**Information to be included in the compilation and accounting database for 2015 for Liechtenstein**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	159 774			159 774
CH <sub>4</sub>	19 013			19 013
N <sub>2</sub> O	9 174			9 174
HFCs	10 135			10 135
PFCs	14			14
Unspecified mix of HFCs and PFCs	NO			NO
SF <sub>6</sub>	37			37
NF <sub>3</sub>	NO			NO
<b>Total Annex A sources<sup>a</sup></b>	<b>198 147</b>			<b>198 147</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	327			327
Deforestation	4 871			4 871
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM	138			138

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.7

**Information to be included in the compilation and accounting database for 2014 for Liechtenstein**(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	161 259			161 259
CH <sub>4</sub>	19 171			19 171
N <sub>2</sub> O	9 126			9 126

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
HFCs	10 029			10 029
PFCs	26			26
Unspecified mix of HFCs and PFCs	NO			NO
SF <sub>6</sub>	116			116
NF <sub>3</sub>	NO			NO
<b>Total Annex A sources<sup>a</sup></b>	<b>199 727</b>			<b>199 727</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	323			323
Deforestation	4 773			4 773
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM	5 577			5 577

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

Table II.8

**Information to be included in the compilation and accounting database for 2013 for Liechtenstein**  
(t CO<sub>2</sub> eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
<b>Annex A emissions</b>				
CO <sub>2</sub>	192 545			192 545
CH <sub>4</sub>	18 989			18 989
N <sub>2</sub> O	9 225			9 225
HFCs	9 754			9 754
PFCs	42			42
Unspecified mix of HFCs and PFCs	NO			NO
SF <sub>6</sub>	175			175
NF <sub>3</sub>	NO			NO
<b>Total Annex A sources<sup>a</sup></b>	<b>230 730</b>			<b>230 730</b>
<b>Activities under Article 3, paragraph 3, of the Kyoto Protocol</b>				
AR	319			319
Deforestation	4 680			4 680
<b>FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol</b>				
FM	5 666			5 666

<sup>a</sup> The sum of the values for the individual gases and groups of gases may not match the total owing to rounding.

## **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) 1.A.3.b Road transportation – fossil fraction of biomass fuels – biodiesel (CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O) (see ID# E.7 in table 5);
- (b) 2.F.4 Aerosols – metered dose inhalers (HFC-134a) (see ID# I.2 in table 5).

## 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 2014, 2015, 2016, 2018 and 2020 annual submissions of Liechtenstein, contained in documents FCCC/ARR/2014/LIE, FCCC/ARR/2015/LIE, FCCC/ARR/2016/LIE, FCCC/ARR/2018/LIE and FCCC/ARR/2020/LIE respectively.

##### Other

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at <https://unfccc.int/documents/510888>.

Annual status report for Liechtenstein for 2022. Available at [https://unfccc.int/sites/default/files/resource/asr2022\\_LIE.pdf](https://unfccc.int/sites/default/files/resource/asr2022_LIE.pdf).

#### C. Other documents used during the review

Responses to questions during the review were received from Nora Zenhäusern and Karin Jehle (Office for the Environment), including additional material on the methodology and assumptions used. The following references may not conform to UNFCCC editorial style as some have been reproduced as received:

BUS 1978: Stand der kommunalen Abfallbeseitigung in der Schweiz. Bern, 1. Januar 1978.

FAL/RAC 2001: Grundlagen für die Düngung im Acker- und Futterbau 2001. Eidgenössische Forschungsanstalt für Agrarökologie und Landbau / Eidgenössische Forschungsanstalt für Pflanzenbau (Principles of fertilization in arable and forage production 2001. Swiss Federal Research Institute for Agroecology and Agriculture / Swiss Federal Research Institute for Crop Production) Agrarforschung, June 2001, Zürich-Reckenholz / Nyon.

INFRAS 2019: The Handbook Emission Factors for Road Transport (HBEFA), version 4.1 (MS Access runtime application and report). INFRAS in cooperation with further editors: FOEN/Switzerland; Umweltbundesamt Dessau/Germany; Umweltbundesamt Wien/Austria; Swedish Road Administration, ADEME/France; SFT/Norway. Bern. Available at <http://www.hbefa.net/e/index.html> [13.12.2021].

Mandaliev P., Schleiss K. 2016: Kompostier- und Vergärungsanlagen. Erhebung in der Schweiz und in Liechtenstein. Bundesamt für Umwelt, Bern. Umwelt-Zustand Nr. 1602: 32 pages.

Richner, W. et al. 2017: GRUD 2017: Grundlagen für die Düngung landwirtschaftlicher Kulturen in der Schweiz (Principles of Fertilisation in Arable and Forage Crop Production in Switzerland). Agroscope. Bern, Schweiz.

Sebos (2022) Fossil fraction of CO<sub>2</sub> emissions of biofuels, Carbon Management, 13:1, 154-163, DOI: 10.1080/17583004.2022.2046173.

Thürig, E and S. Schmid (2008) Jährliche CO<sub>2</sub>-Flüsse im Wald: Berechnungsmethode für das Treibhausgasinventar (Annual CO<sub>2</sub> fluxes in forests: calculation method for the Greenhouse Gas Inventory). Schweizerische Zeitschrift für Forstwesen (2008) 159 (2): 31–38. Available at: [https://meridian.allenpress.com/szf/article/159/2/31/349406/Jaehrliche-CO2-Flusse-im-Wald-Berechnungsmethode.](https://meridian.allenpress.com/szf/article/159/2/31/349406/Jaehrliche-CO2-Flusse-im-Wald-Berechnungsmethode))

Wüst-Galley, C., Keel, S. G., Leifeld, J. 2020. A model-based carbon inventory for Switzerland's mineral agricultural soils using RothC. Agroscope Science No. 105. Zürich. <https://doi.org/10.34776/as105e>

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