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Report on the individual review of the annual submission of Lithuania 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 Lithuania, 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 5 to 10 September 2022 in Bonn.

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

Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
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"
C	carbon
CH_4	methane
CM	cropland management
CO_2	carbon dioxide
CO_2 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"
COPERT	software tool for calculating road transport emissions
CPR	commitment period reserve
CRF	common reporting format
CSC	carbon stock change
DOM	dead organic matter
EF	emission factor
EFISCEN	European Forest Information Scenario (model)
ERT	expert review team
FM	forest management
FMRL	forest management reference level
$FMRL_{corr}$	forest management reference level technical correction
FOD	first-order decay
$Frac_{LossMS}$	fraction of managed manure nitrogen that is lost in the manure management system
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 reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NF_3	nitrogen trifluoride
NFI	national forest inventory
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon

RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
UNFCCC Annex I inventory reporting guidelines	"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
UNFCCC review guidelines	"Guidelines for the technical review of information reported under the Convention related to greenhouse gas inventories, biennial reports and national communications by Parties included in Annex I to the Convention"
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*

I. Introduction

1. This report covers the review of the 2022 annual submission of Lithuania, 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 5 to 10 September 2022 in Bonn and was coordinated by Javier Hanna Figueroa, Federico Brocchieri, Claudia do Valle and Davor Vesligaj (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Lithuania.

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

Area of expertise	*Name*	*Party*
Generalist	Valentina Idrissova	Canada
	Eva Krtkova	Czechia
Energy	Renata Grisoli	Brazil
	Yves Marenne	Belgium
	Dingane Sithole	Zimbabwe
	Anand Sookun	Mauritius
IPPU	Joseph Baffoe	Ghana
	Siriluk Chiarakorn	Thailand
	Pia Forsell	Finland
	Maria Purzner	Austria
Agriculture	Jorge Alvarez	Peru
	Yauhenia Bertash	Belarus
	Anais Durand	France
	Steen Gyldenkærne	Denmark
LULUCF and KP-LULUCF	Tatenda Gotore	Zimbabwe
	Inge Jonckheere	Belgium
	Sekai Ngarize	Zimbabwe
Waste	Mayra Rocha	Brazil
	Sergii Shmarin	Ukraine
Lead reviewers	Valentina Idrissova	
	Mayra Rocha	

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 Lithuania resolve identified findings, including issues[1] designated as problems.[2] Other findings, and, if applicable, the encouragements of the ERT to Lithuania to resolve related issues, are also included in this report.

[1] Issues are defined in decision 13/CP.20, annex, para. 81.
[2] Problems are defined in decision 22/CMP.1, annex, paras. 68–69, as revised by decision 4/CMP.11.

4. A draft version of this report was communicated to the Government of Lithuania, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

5. Annex I presents the annual GHG emissions of Lithuania, including totals excluding and including LULUCF, indirect CO_2 emissions, and emissions by gas and by sector, and contains background data on emissions and removals from KP-LULUCF, if elected by the Party, by gas, sector and activity.

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

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 Lithuania

Assessment			*Issue/problem ID#(s) in table 3 or 5[a]*
Dates of submission	Original submission: NIR, 15 April 2022; CRF tables (version 1), 12 April 2022; SEF tables, 12 April 2022 Revised submission: CRF tables (version 2), 25 May 2022; SEF tables, 14 April 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 Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	I.2, A.6
	(c) Development and selection of EFs?	Yes	L.3
	(d) Collection and selection of AD?	Yes	I.5, I.10, A.2, A.7, L.1, W.3
	(e) Reporting of recalculations?	Yes	I.11
	(f) Reporting of a consistent time series?	No	
	(g) Reporting of uncertainties, including methodologies?	Yes	I.9
	(h) Quality assurance/quality control?	Quality assurance/quality control procedures were assessed in the context of the national system (see supplementary information under the Kyoto Protocol below)	
	(i) Missing categories, or completeness?[b]	No	
	(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	Have any issues been identified related to the following aspects of the national system:		

Assessment			*Issue/problem ID#(s) in table 3 or 5[a]*
the Kyoto Protocol	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements?	No	
	(b) Performance of the national system functions?	No	
	Have any issues been identified related to the national registry:		
	(a) Overall functioning of the national registry?	No	
	(b) Performance of the functions of the national registry and the adherence to technical standards for data exchange?	No	
	Have any issues been identified related to the reporting of information on assigned amount units, certified emission reductions, emission reduction units 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?	No	
	(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	No	
	(c) Reporting requirements of decision 6/CMP.9?	No	
	(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	NA	
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	Lithuania 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	

Assessment		*Issue/problem ID#(s) in table 3 or 5[a]*
Questions of implementation	Did the ERT list any questions of implementation?	No

[a] Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.
[b] Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex III.

III. Status of implementation of recommendations included in the previous review report

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 18 July 2022,[3] and had not been resolved by the time of publication of the report on the review of the Party's 2021 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 Lithuania

ID#	*Issue/problem classification*[a]	*Recommendation from previous review report*	*ERT assessment and rationale*
General			
G.1	Article 3.14 (G.1, 2021) (G.5, 2019) KP reporting adherence	Include a follow-up to activities initiated in past years, as reported in previous NIRs, and ensure the reporting of any changes in activities on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission.	Resolved. The Party reported in its NIR (section 15, p.555) the up-to-date information on various activities and projects to minimize the adverse social, environmental and economic impacts on developing countries, which were implemented through financial support provided to developing countries in the form of bilateral development cooperation projects in the field of climate change, and also information on the status of activities initiated in past years. Further, Lithuania specifically reported in its NIR details of the support provided in 2021, for instance support to African countries and to the European Investment Bank Eastern Partnership Technical Assistance Trust Fund.
Energy			
E.1	1.A.3.b Road transportation – liquid fuels – N_2O (E.8, 2021) (E.15, 2019) Accuracy	Continue reporting N_2O emissions from diesel oil use in cars and light-duty trucks using default N_2O EFs and a tier 1 approach until estimates calculated by the COPERT V model can be fully justified. If using the COPERT V model, investigate and document in the NIR the reasons for the very low N_2O emissions calculated by the COPERT V model for cars and light-duty trucks. Aim to improve the input parameters to allow the COPERT V model to provide more accurate and reliable estimates of N_2O emissions from these subcategories.	Resolved. The Party reported in its NIR (pp.122–131) detailed information on methodologies and improved input parameters for using the COPERT V model to obtain accurate and reliable estimates of N_2O emissions for cars and light-duty trucks. The Party investigated and documented the reasons for the very low N_2O emission estimates and the underlying low N_2O EFs used in the COPERT V model. These low EFs can be explained by several factors, particularly the share of Euro 1 and Euro 2 emission standard diesel oil vehicles dominating the fleet during 2004–2013 (NIR, p.131). During the review, the Party confirmed that the NIR (sections 3.5.2.2 and 3.5.2.3, pp.122–132) provides comprehensive details on the methodological approach. It also confirmed that COPERT V does not calculate N_2O emissions for vehicles that are older than Euro 1 standard, which is in line with the N_2O EF for diesel cars value of 0 provided in the 2006 IPCC Guidelines (vol. 2, chap. 3, table 3.2.5, p.3.24). Therefore, the relatively low N_2O IEF reported values for 1996–2004 were calculated using the emissions from newer categories of vehicles (Euro 1, Euro 2, etc.), but considering the total amount of fuel consumed by vehicles of all categories (conventional or pre-Euro, Euro 1, Euro 2, etc.).

[3] FCCC/ARR/2021/LTU.

ID#	Issue/problem classification[a]	Recommendation from previous review report	ERT assessment and rationale
			Lithuania showed that comparable values of N_2O IEFs have been reported by neighbouring countries with similar practices (vehicle mean fleet and mileage). The ERT considers that the recommendation has been addressed because the Party provided sufficient details and documentation on the reasons for the very low N_2O emission estimates and the underlying low N_2O EFs calculated by the COPERT V model for cars and light-duty trucks and on the improved parameters used in the model for these subcategories.
E.2	1.A.3.b Road transportation – liquid fuels – N_2O (E.12, 2021) Transparency	Increase the transparency of reporting by including in future NIRs the detailed explanations, tables and charts provided to the ERT during the review on the trends in IEFs and the differences in emission levels compared with previous annual submissions, in order to support the use of EFs derived using COPERT V.	Addressing. The Party reported in its NIR (pp.122–131) detailed information on methodologies and improved input parameters for using the COPERT V model for its N_2O estimates for this subcategory. The Party also reported in the NIR (table 3-33, p.127) N_2O IEF values for diesel oil passenger cars for 1996–2004 comparing these values with those of neighbouring countries and a chart on trends of N_2O IEFs for 1992–2019 comparing Lithuania's reported values with those of neighbouring countries (figure 3-44, p.127). It also reported in the NIR (p.128) that in the 2021 annual submission, CH_4 and N_2O emissions were recalculated using the COPERT V model (tier 3 method) with improved input parameters for 1990–2018. However, the Party did not report in the NIR on the differences in emission levels compared with previous annual submissions, in order to support its use of EFs derived using COPERT V. During the review, Lithuania provided additional information on emission trends and the results of the recalculations and the differences in emission estimates for the whole time series, which were reported in the NIR of the 2021 annual submission but not in the NIR of the 2022 annual submission. It indicated that the impacts of the recalculations on the emissions were less than 1 per cent. The ERT considers that the recommendation has not yet been fully addressed because the Party did not comprehensively provide in the NIR the detailed explanations, tables and charts for the trends in IEFs provided during the review and differences in emission levels compared with those reported in previous annual submissions.
E.3	1.A.3.b Road transportation – liquid fuels – CH_4 and N_2O (E.13, 2021) Transparency	Explain in detail in the future NIRs how the changes made to the COPERT V model have affected the N_2O and CH_4 EFs between the 2019 and 2021 annual submissions, and also explain how these changes do not lead to an underestimation of these emissions for the transport category.	Resolved. The Party reported in its NIR (sections 3.5.2.2–3.5.2.3, pp.122–131) detailed explanations on changes of EFs between the 2019 and 2021 annual submissions, including detailed information on methodologies and improved input parameters for using the COPERT V model for its estimates. During the review, the Party provided further details about the road transportation CH_4 and N_2O emissions and the underlying low EFs calculated by the COPERT V model, confirming how these changes do not lead to an underestimation of emissions, including by providing some additional information on inter-comparison with IEFs reported by other countries in the region, which was performed for validation purposes. The ERT considers that the recommendation has been addressed.
IPPU			
I.1	2.A.2 Lime production – CO_2	Correct the uncertainty estimate of the CO_2 EFs, correct the related calculations and	Resolved. The Party reported in its NIR (p.168) an uncertainty of 5 per cent for both the AD and CO_2 EF for category 2.A.2 lime production and a combined uncertainty of 7 per

ID#	Issue/problem classification[a]	Recommendation from previous review report	ERT assessment and rationale
	(I.1, 2021) (I.17, 2019) Convention reporting adherence	present the estimation method and uncertainty values used in the NIR of the next annual submission.	cent for emissions as was previously recommended. The Party described in the NIR (pp.41–42 and annex III) the method for estimating uncertainty and provided the sources of the values for the uncertainty analysis (p.168). The ERT considers that every element of the recommendation has been fully addressed.
I.2	2.B.1 Ammonia production – CO_2 (I.7, 2021) (I.23, 2019) Comparability	Report all CO_2 emissions from fuel consumption (used as feedstock and fuel) under category 2.B.1 ammonia production in accordance with the 2006 IPCC Guidelines.	Not resolved. The Party described the allocation of CO_2 emissions from ammonia production in the NIR (p.183). CO_2 emissions from natural gas consumption used for heat generation in ammonia production are reported under subcategory 1.A.2.c chemicals in the energy sector. The ERT noted that the Party included table 4-13 in the NIR of the 2021 annual submission with the aim of providing more information on CO_2 emissions from ammonia production, but did not change its reporting of CO_2 emissions from ammonia production for the 2022 annual submission. During the review, the Party informed the ERT that the recommendation would be addressed in the 2023 annual submission.
I.3	2.D.3 Other (non-energy products from fuels and solvent use) – CO_2 (I.16, 2021) Convention reporting adherence	Report national totals with and without indirect CO_2 emissions, in line with paragraph 29 of the UNFCCC Annex I inventory reporting guidelines. To enable the reporting of national totals with and without indirect emissions, report indirect CO_2 emissions separately from direct CO_2 emissions (i.e. in CRF table 6 and the relevant sectoral CRF tables).	Not resolved. The Party did not report national totals with and without indirect CO_2 emissions, in line with paragraph 29 of the UNFCCC Annex I inventory reporting guidelines. In CRF table 6 the Party reported indirect CO_2 emissions for IPPU for 1990–2019 as "IE" and the cell for 2020 was left blank. During the review, the Party clarified that it could report national totals with and without indirect CO_2 emissions in the next annual submission.
I.4	2.F.1 Refrigeration and air conditioning – HFCs (I.17, 2021) Transparency	Include detailed information in the NIR regarding HFC emissions for subcategory 2.F.1.b on the calculations performed to obtain the volume of gases in operation, describing the differences by timespan and including equations for the calculations performed.	Not resolved. The Party reported in its NIR (section 4.7.1.2, pp.216–219) updated information on the calculations for subcategory 2.F.1.b domestic refrigeration based on a report published in 2021 titled "Analysis and verification of the inventory of fluorinated greenhouse gases". In the 2022 annual submission the whole time series has been recalculated using information from that report. During the review, the Party provided the ERT with detailed calculations of HFC emissions from domestic refrigeration. The ERT noted that assumptions and variables described in the NIR were used to calculate the number of refrigerators and freezers to obtain the volume of gases in operation. However, it was not clearly described in the NIR how the calculation of the volume of gases in operation was performed, and the equations used for the calculations were not provided. The differences in the calculation methods used over time were not fully reported in the NIR.
I.5	2.F.1 Refrigeration and air conditioning – HFCs (I.18, 2021) Accuracy	Obtain data on the volume of gases incorporated into the bank of gases in operation (new products being installed (production plus imports minus exports)) and, in calculating the bank of gases in operation, consider all inputs and outputs of	Not resolved. The Party reported in its NIR (p.213) that it used the same method to calculate emissions for subcategories 2.F.1.a and 2.F.1.c as previously, that it has not yet obtained data on the volume of gases incorporated into the bank of gases in operation (new products being installed) and, in calculating the bank of gases in operation, it did not consider all inputs and outputs of gases, such as annual leakages and gases contained in products at end of life. During the review, the Party clarified that it calculates the

ID#	Issue/problem classification[a]	Recommendation from previous review report	ERT assessment and rationale
		gases, such as annual leakages and gases contained in products at end of life. Recalculate the emissions across the time series considering this new information, where available, and report them accordingly in the relevant CRF tables and the NIR.	bank of gases in operation based on data on the volume of gases refilled, taken from the Lithuanian Environmental Protection Agency database and average default EFs from the 2006 IPCC Guidelines, which is deemed a conservative and transparent approach. According to a recently completed study (2021) on the use of fluorinated gases in Lithuania, currently available data collected from companies on the use of fluorinated gases in equipment are not sufficient or suitable to use for GHG estimates. It also clarified that the emission estimation method will be updated after the Environmental Protection Agency database's data reporting functionalities are improved and that an update of the estimation method is planned for 2023–2024. An improved calculation method will be reported in 2025 at the earliest. The ERT considers that the recommendation has not yet been addressed because the Party has not yet recalculated the emissions across the time series using the required updated data; however, the ERT also considers that this issue does not represent an underestimation of emissions, because the current approach used in the calculations is considered conservative and transparent.
I.6	2.F.1 Refrigeration and air conditioning – HFCs (I.18, 2021) Transparency	Provide in the NIR the mathematical equation used to calculate the bank of gases in operation and the methodology used to calculate the emissions across the time series to further enhance the transparency of the reporting.	Addressing. The Party reported in its NIR (section 4.7.1.2, p.213) the equation used to calculate the bank of gases in operation, but it did not provide the methodology used to calculate emission estimates across the time series. The ERT considers that the recommendation has not yet been fully addressed.
I.7	2.F.1 Refrigeration and air conditioning – HFCs (I.19, 2021) Accuracy	Review the EF for HFC-134a used for freight wagons in the light of the new study on fluorinated gases carried out in 2021. Document in the NIR the sources for this EF, describing its nature and coverage, ensuring that emissions are not underestimated.	Resolved. The Party reported in its NIR (p.223) that the new study on fluorinated gases carried out in 2021 (see ID# I.4 above) confirmed the EF for HFC-134a (10 per cent) for freight wagons and that it applied this EF for the emission calculation for 2006–2014. The use of HFC-134a for freight wagons started in 2006 in the country. According to the study, the amount of HFCs filled into equipment in operation is used in calculations for 2015 onward, therefore no EF is needed to calculate HFC-134a emissions from freight wagons for 2015 onward. The results of the new study as implemented by Lithuania ensured that the emissions are not underestimated and the ERT noted that the documentation provided by the Party in the NIR described clearly the nature and coverage of the EF used. The ERT considers that the recommendation has been fully addressed because the Party has reviewed the EF for HFC-134a and documented in the NIR the relevant information.
I.8	2.F.3 Fire protection – HFCs (I.20, 2021) Transparency	Enhance the description in the NIR regarding the estimation of HFC-227ea emissions for category 2.F.3 fire protection by including information on the method and approaches followed, the data used, and how the different intermediate variables and	Resolved. The Party enhanced the description in the NIR (pp.241–242) regarding the estimation of HFC-227ea emissions for category 2.F.3 fire protection by adding information on the method and approaches followed, the data used and how different intermediate variables and assumptions were considered in the estimation.

ID#	Issue/problem classification[a]	Recommendation from previous review report	ERT assessment and rationale
		assumptions were considered in the estimation.	
I.9	2.G.1 Electrical equipment – SF_6 (I.21, 2021) Convention reporting adherence	Update the uncertainty values used for SF_6 emissions for category 2.G.1, considering specifically the uncertainty values associated with the estimates made, and report the results in the NIR. Include a qualitative discussion in the NIR on the reasons for the uncertainty values used for the category.	Not resolved. The Party reported in its NIR (p.247) that SF_6 emissions for category 2.G.1 are estimated using a tier 3 method (on the basis of the data directly obtained from each company) for 1995–2020, and the only SF_6 emissions occurring are those from operational losses from high voltage grid, since no production or system disposal emissions occur in the country. However, the Party reported in the NIR uncertainty values for input data and EFs that are not actually used. During the review, the Party confirmed that all SF_6 emissions are directly reported using information from companies' data on annual losses and no EFs are used for estimates for this category. The ERT considers that the recommendation has not yet been addressed because the Party has not yet updated the uncertainty values for SF_6 emissions for category 2.G.1. and did not include a qualitative discussion in the NIR on the reasons for the uncertainty values associated with the estimates.
Agriculture			
A.1	3.A Enteric fermentation – CH_4 (A.12, 2021) (A.17, 2019) Transparency	Include a description of the improvements of the estimates of CH_4 emissions from enteric fermentation, firstly on the refining of the number of suckling cows that affects the gross energy intake estimate, and secondly in the calculation of the annual average fur-bearing population.	Resolved. The Party explained in its NIR (p.270) the refinement of the number of suckling cows that was made for a previous annual submission as part of improvements. Furthermore, the Party indicated in its NIR (p.272) that the population of fur-bearing animals reported by Statistics Lithuania as at 1 January each year includes only animals used for breeding purposes. The Party indicated that the calculation of the annual average fur-bearing population was based on the coefficients of group size that are also provided in the NIR (annex VIII, table A.5-41, p.111). The ERT considers that the Party has fully addressed the recommendation.
A.2	3.B Manure management – CH_4 and N_2O (A.7, 2021) (A.18, 2019) Accuracy	Conduct a study to develop country-specific data on feed digestibility, and when available, apply these data for estimating CH_4 and N_2O emissions, and update the information reported on the manure management category in the NIR.	Addressing. The Party included information in the NIR (section 5.3.6, p.285) regarding the study to develop country-specific data on feed digestibility. The Party indicated that on 16 December 2020 a contract was signed between the Ministry of Environment and the Institute of Animal Science (Lithuanian University of Health Sciences) to develop a study on the determination of country-specific feed digestibility values by classic in vivo method. The Party mentioned that the study was under development and that the results were expected to be ready on 1 April 2022 and then incorporated into the 2023 annual submission. During the review, the Party confirmed that the study was concluded in April 2022 and that the results will be incorporated into the GHG inventory of the next annual submission. It is important to note that no under- or overestimation of emissions has been identified by the ERT, as the Party is currently using default values on feed digestibility from the 2006 IPCC Guidelines. However, using national values for this parameter will increase the accuracy of the emission estimates for the categories concerned. The ERT considers that the recommendation has not yet been fully addressed because the Party did not use the developed country-specific digestibility values for its 2022 annual submission.

ID#	*Issue/problem classification*[a]	*Recommendation from previous review report*	*ERT assessment and rationale*
A.3	3.B.1 Cattle – CH_4 (A.16, 2021) Transparency	Provide clear and sufficient information in the NIR on changes in the share of different manure management systems for cattle over the years and provide a transparent justification for any recalculations, including a discussion of the impact of the recalculations on the trends in emissions at the category, sector and national level.	Resolved. The Party reported in its NIR (section 5.1, pp.263–264) explanations regarding the changes in the share of different manure management systems for cattle over the years in the time series. Lithuania indicated that time spent in pasture is decreasing over time owing to the decrease in the number of small farms. Furthermore, following discussions with breeders, the data on the share of manure managed per system were refined, which resulted in an increased share in the use of liquid manure systems in recent years. No recalculations were performed for this category for the 2022 annual submission. The ERT considers that the Party has fully addressed the recommendation.
A.4	3.D.a.2 Organic N fertilizers – N_2O (A.12, 2021) (A.12, 2019) (A.12, 2017) (A.30, 2016) (A.30, 2015) Transparency	Include data on the amount of N in bedding per animal species in the NIR, with an appropriate reference to the 2006 IPCC Guidelines.	Resolved. The Party included in its NIR a table presenting N in bedding per animal species (table 5-10, p.264). Lithuania indicated that the data presented in this table are taken from a national study and provided the associated reference in the NIR. The ERT considers that the Party has fully addressed the recommendation.
A.5	3.D.a.5 Mineralization/immobilization associated with loss/gain of soil organic matter – N_2O (A.14, 2021) (A.23, 2019) Transparency	Report in the NIR that N_2O emissions for subcategory 3.D.a.5 have not occurred since 2015, and provide documented explanations as to why emissions ceased in 2015.	Resolved. The Party indicated in its NIR (section 5.6.1.2, pp.306–307) that consultations with specialists from the Ministry of Agriculture were held, resulting in updated information on organic cropland area and CSC factors. The result of these updates is that no loss of organic C in mineral soil of cropland remaining cropland occurred for 1990 or for 2002–2020. Therefore, N_2O emissions for subcategory 3.D.a.5 mineralization/immobilization associated with loss/gain of soil organic matter were reported as "NO". The ERT considers that the Party has fully addressed the recommendation.
LULUCF			
L.1	4.A.1 Forest land remaining forest land – CO_2 (L.12, 2021) (L.24, 2019) Accuracy	Conduct an analysis of significance at the pool level to determine whether the DOM pool is significant under category 4.A.1 forest land remaining forest land and, if so, adopt a higher tier to estimate the litter (and DOM) CSCs.	Not resolved. Lithuania did not provide information regarding conducting an analysis of significance at the pool level to determine whether the deadwood pool is significant under category 4.A.1 forest land remaining forest land. The Party continued to report in its NIR (pp.349–350) and CRF table 4.A estimates of DOM made using a tier 1 method, even though category 4.A.1 forest land remaining forest land is a key category, and assumed that the values for litter for forest land remaining forest land are zero, consequently reporting CSCs for litter as "NA" in CRF table 4.A. During the review, the Party clarified that there are plans to improve the estimation of CSC in the forest land DOM carbon pool for deadwood, as CSCs for litter have been reported using a tier 1 method. These include performing a primary analysis of scientific studies to obtain reliable data on deadwood CSCs in forest land remaining forest land. The ERT considers that the recommendation has not been addressed.
L.2	4.A.1 Forest land remaining forest land –	Provide accurate reporting of growing stock volume values for "overall total", "total	Resolved. The Party reported correct growing stock volume values for the "overall total" (559.6 million m^3), "total deciduous" (228.7 million m^3), "other species unaccounted"

ID#	Issue/problem classification[a]	Recommendation from previous review report	ERT assessment and rationale
	CO_2 (L.27, 2021) Accuracy	deciduous", "other species unaccounted" and "total coniferous" to ensure that all growing stock volume values are reported.	(9.0 million m^3) and "total coniferous" (330.8 million m^3) in the NIR (table 6-14, pp.348–349) and used these values for its estimates. The ERT considers that the Party has fully addressed the recommendation.
L.3	4.B.2.2 Grassland converted to cropland – CO_2 (L.19, 2021) (L.31, 2019) Accuracy	Report the CSC in litter from the conversion of grassland to cropland (perennial crops) and, if applying a value different from 0.4 t C/ha, explain in the NIR the reason for using a different value.	Not resolved. Lithuania continued to report in the NIR (p.381) that 0.8 t C/ha is lost at the time of conversion from grassland to cropland and that it only has reliable estimates of deadwood and litter for forest land and grassland prior to the conversion. Lithuania did not provide an explanation for applying a value different from 0.4 t C/ha for reporting CSC in litter from the conversion of grassland to cropland (perennial crops). During the review, Lithuania noted that carbon stock for grassland converted to perennial cropland was not estimated and that it is considering conducting a literature analysis and/or obtaining expert judgment with a view to developing a national carbon stock value for litter occurring on perennial cropland. The ERT considers that the recommendation has not been addressed.
L.4	4(I) Direct N_2O emissions from N input to managed soils – N_2O (L.24, 2021) (L.36, 2019) Transparency	Provide a justification for simplifying equation 11.1 from the 2006 IPCC Guidelines (vol. 4, chap. 11.2.1.1, p.11.7) and excluding certain N sources included in equation 11.1 and specify those reported under the agriculture sector or those that do not occur. Provide the corresponding information in the NIR and CRF table 4(I).	Addressing. Lithuania provided the required justification in the NIR (p.383) for land converted to cropland, grassland, flooded land, settlements and other land, and included corresponding estimates in CRF table 4(I), indicating that direct N_2O emissions due to cultivation of mineral soils (cropland remaining cropland) and drainage of organic soils in cropland and grassland categories are accounted under the agriculture sector, therefore AD only for land converted to other land are considered in calculating emissions due to carbon stock loss in mineral soils. The ERT considers that the recommendation has not been fully addressed because the Party provided the required justification in the NIR, but no corresponding information in the documentation box of CRF table 4(I).
L.5	4(IV) Indirect N_2O emissions from managed soils – N_2O (L.25, 2021) (L.37, 2019) Transparency	Provide in the NIR the justification for simplifying equation 11.1 from the 2006 IPCC Guidelines (vol. 4, chap. 11.2.1.1, p.11.7), which excludes synthetic N fertilizers; managed animal manure, compost, sewage sludge and other organic N additions applied to soils; urine and dung N deposited by grazing animals; and N in crop residues (above- and below-ground), including N-fixing crops and N from forage/pasture renewal, returned to soils annually from the calculation of indirect N_2O emissions from leaching/run-off from managed soils, and include a related explanation in the documentation box of CRF table 4(IV).	Resolved. Lithuania provided the required justification in the NIR (p.385) indicating that, according to the study "Geography of Lithuanian waters" (Kilkus and Stonevicius, 2011), run-off in Lithuania varies between 25 and 50 per cent of precipitation, depending on terrain and soil, and it also provided the justification for land converted to cropland, grassland, flooded land, settlements and other land (sections 6.3.2.2, pp.379–385; 6.4.2.2, pp.391–396; 6.5.2.5, pp.402–405; 6.6.2.2, pp.407–414; and 6.7.2.2, pp.416–420, respectively). The ERT considers that the recommendation has been fully addressed because the Party provided the justifications in the NIR and included relevant information in the documentation box of CRF table 4(IV).

ID#	Issue/problem classification[a]	Recommendation from previous review report	ERT assessment and rationale
L.6	4.G HWP – CO_2 (L.26, 2021) (L.38, 2019) Convention reporting adherence	Correct the inconsistencies between the data in the NIR and CRF table 4.G (sheet 2) and provide updated production, export and import data in the next annual submission, as well as additional information on the factors used to convert product units to carbon units in CRF table 4.G (sheet 2).	Resolved. Lithuania corrected the inconsistencies between the data in the NIR and CRF table 4.G (sheet 2) and provided updated information on production, export and import data (NIR, pp.421–426), as well as additional information on the factors used to convert product units to carbon units in CRF table 4.G (sheet 2) (NIR, table 6-46, p.425). During the review, Lithuania confirmed that data on imported HWP for sawnwood, wood-based panels and paper and paper board were included in the NIR (section 6.8.1, table 6-44, p.423), including AD used for estimating CSCs for HWP.
Waste			
		No previous recommendations identified.	
KP-LULUCF			
KL.1	General (KP-LULUCF) – (KL.4, 2021) Transparency	Correct the inconsistencies in the land-transition matrix in the next annual submission.	Resolved. Lithuania reported corrected KP-LULUCF data in the land-transition matrix for 2020 in its NIR (table 11-7, p.516). However, the ERT noted that inconsistencies in the areas reported in this land-transition matrix remain and identified inconsistencies with the areas reported in the CRF tables. During the review, the Party indicated that the land-use matrix presented in table 11-7 shows land area information that adds up to the total land area of the country. The ERT considers that the recommendation has not been addressed as inconsistencies in the area information reported in the land-transition matrix in the NIR remain; however, it notes that the Party reported and correctly accounted all areas subject to activities under the Kyoto Protocol in CRF table NIR-2, making the issue of transparency previously identified no longer relevant. Therefore, the ERT concluded that this potential problem does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and did not include this issue in the list of potential problems and further questions raised.
KL.2	Article 3.3 activities – CO_2 (KL.6, 2021) Transparency	In accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, include in the next annual submission the explanation provided during the review and clarify the use of "NE" in the documentation box of the relevant CRF table and the NIR.	Resolved. The Party explained in the NIR (p.532) the decision to use the notation key "NO" for reporting the deadwood pool in AR activities. The Party indicated that the deadwood pool under AR was calculated using actual NFI measurements data and CSC in deadwood would account for on average only 5 t CO_2 eq per year. The Party also indicated that the threshold of significance according to paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines for Lithuania would account for approximately 10 kt CO_2 eq and that the total sum of insignificant inventory categories is around 3–4 kt CO_2 eq on average. Therefore, the Party assumed that emissions from the deadwood pool under AR activities can be treated as insignificant and reported them as "NO". During the review, the Party acknowledged that the correct notation key in this case is "NE". The ERT noted that the correct notation key to be used in this case in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines is indeed "NE" and that the recommendation has not been resolved; however, it also notes that Lithuania provided a description of the methodologies and the underlying assumptions used and justification for omitting a carbon pool and related emissions from activities under Article 3, paragraph 3 of the Kyoto Protocol, making the

ID#	Issue/problem classification[a]	Recommendation from previous review report	ERT assessment and rationale
			issue of transparency previously identified no longer relevant. Therefore, the ERT concluded that this potential problem does not influence the Party's ability to fulfil its commitments for the second commitment period of the Kyoto Protocol and did not include this issue in the list of potential problems and further questions raised.
KL.3	Article 3.3 activities – CO_2 (KL.7, 2021) Transparency	Include in the NIR the explanation provided during the review (i.e. under Lithuanian forestry law, where afforestation follows deforestation, the afforested area has to be at least three times larger than the deforested area in protected ecosystems and recreational forests (functional group II) and at least two times larger in protected forests (functional group III), or an appropriate level of government compensation must be provided for those deforested lands).	Resolved. The Party explained in the NIR (section 11.1.3, p.506) that Lithuanian forest law regulates cases where afforestation follows deforestation, and that the afforested area has to be at least three times larger than the deforested area in protected ecosystems and recreational forests (functional group II) and at least two times larger in protected forests (functional group III), or an appropriate level of government compensation must be provided for those deforested lands. The ERT considers that the recommendation has been fully addressed and that definitions of each activity under Article 3, paragraph 3, of the Kyoto Protocol have been implemented in the calculations and applied consistently over time.
KL.4	Deforestation – CO_2 (KL.8, 2021) Accuracy	Ensure that all areas deforested under the Kyoto Protocol are correctly accounted for and correct the inconsistencies between the areas reported as forest land converted to other land-use categories in the CRF tables and those reported as deforested under the Kyoto Protocol in the next annual submission.	Resolved. The ERT noted that although the inconsistencies between the areas reported as forest land converted to other land uses in the CRF tables and those reported as deforested under the Kyoto Protocol in the NIR remain, the Party nevertheless reported and correctly accounted all areas deforested under the Kyoto Protocol in CRF table NIR-2. The ERT therefore acknowledges that, because the original issue on land representation has been resolved, the issue of accuracy has also been resolved. The ERT also noted that Lithuania provided information in its NIR (section 11.2.2, p.516) and CRF table NIR-2 on AD for forest land conversions to other land uses (deforestation) estimated using a sampling method (NFI data) and wall-to-wall method (State Forest Cadaster data). Differences between AD for deforestation (forest land converted to other land uses) estimated by sampling (Convention reporting) and wall-to-wall AD (Kyoto Protocol reporting) were presented in the NIR (table 11-8, p.517). The Party also reported that the average annual deforestation area (196 ha) taken from State Forest Cadaster data is considerably smaller than the area represented by the sampling plot of forest conversion to other land uses (399 ha) and cannot be reported annually under the Convention reporting. Lithuania also provided additional information in the NIR (table 11-7, p.516) for other (area of the country that is not reported under Article 3, paragraph 3, or elected Article 3, paragraph 4, of the Kyoto Protocol activity) and reported it with a value of 4,315.32 kha for 2020, while in CRF table NIR-2 a value of 4,368.34 kha was reported. During the review, the Party clarified that the land-use matrix presented in NIR table 11-7 shows areas that should add up to the total land area of the country and that the correct value for other is 4,368.34 kha. The Party indicated that the observed inconsistencies in the NIR will be corrected. The ERT considers that the recommendation has been resolved because Lithuania ensured that accounting of all areas deforested under the Kyoto Protocol is accurate and provided the correct value of

ID#	Issue/problem classification[a]	Recommendation from previous review report	ERT assessment and rationale
			4,368.34 ha for other to ensure that the total land area of the country was added up correctly.
KL.5	FM – (KL.5, 2021) Transparency	In the next NIR, report the accounted quantity and the main factors generating the accounted quantity for FM and state whether the accounted quantity is consistent with the guidance given in the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol* (p.2.97).	Resolved. Lithuania provided in the NIR (section 11.5.3.5, p.541) information on the accounted quantity for FM and its main generating factors. The Party explained that the FM removals were much higher than the FMRL (i.e. the accounted quantity) as a result of higher biomass increments and age class distribution of pine forests during 2012–2015 and FM policy interventions, such as a political decision on exploitable forests (functional group IV) for preserving protected and other biologically valuable areas. The Party indicated that starting from 2016, removals from FM activities were only slightly higher than the FMRL, whereas in 2019 they were below the FMRL. The ERT considers that the recommendation has been fully addressed because the Party provided a comparison between FM removals and the FMRL, including historical input data that were used to generate the FMRL, while the accounted quantity and its generating factors were described in the NIR (p.541). The ERT considers that the accounting quantity is consistent with those factors and the guidance given in the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol* (p.2.97).
KL.6	FM – (KL.9, 2021) Transparency	Include in the NIR the detailed explanation provided during the review regarding the adjustment of rotation lengths of FM regimes incorporated into the FMRL correction calculations and any other detailed information required for subsequent FMRL corrections.	Resolved. Lithuania applied a technical correction to the FMRL of –922.00 kt CO_2 eq (NIR, section 11.5.3.4, pp.539–540). The Global Forest Model (known as G4M) and EFISCEN model were used for FMRL estimation and were updated with more recent NFI data to calculate the technical correction. The Party explained in the NIR (section 11.5.3.4, pp.539–540) why the technical correction was needed, citing that the adjustment of rotation lengths of FM regimes was incorporated into the FMRL correction calculations. The Party indicated that updated NFI data containing fewer species, updated forest area reported for FM and a scaling factor of 0.967 were used to correct differences in area. It also used updated carbon stocks of tree species (e.g. carbon stock of coniferous species was set to 51 per cent and carbon stock of broadleaved species to 48 per cent in comparison with 50 per cent set in the initial FMRL for all species) and different age structure estimated by NFI data and then simulated by EFISCEN (based on national data). For the FMRL projection, EFISCEN was initialized with the NFI data referring to 2000 and respective age structure, while the Global Forest Model was initialized with age structure projected by the EFISCEN for 2010. The ERT considers that the recommendation has been fully addressed because the Party included a detailed explanation in the NIR regarding the adjustment of rotation lengths of FM and provided transparent information on the rationale for calculating $FMRL_{corr}$, methods used, the results obtained, a discussion of the differences between $FMRL_{corr}$ and the FMRL, and additional information in tabular format summarizing how the methodological inconsistencies that may trigger a technical correction were addressed.
KL.7	FM – (KL.10, 2021) Transparency	Provide detailed information in NIR chapter 11 on the consistency between the FMRL and FM reporting during the second	Resolved. A section on comparison of historical data between FM and the FMRL was added to the NIR (section 11.5.3.5, p.541), providing detailed information on the consistency between the FMRL and FM reporting during the second commitment period

ID#	Issue/problem classification[a]	Recommendation from previous review report	ERT assessment and rationale
		commitment period of the Kyoto Protocol in accordance with paragraph 5(e) of annex II to decision 2/CMP.8.	of the Kyoto Protocol. During the review, the Party clarified that removals from FM activities were compared with model outputs for the FMRL and $FMRL_{corr}$ and removals from FM activities under KP-LULUCF were consistent with the model outputs for the FMRL and $FMRL_{corr}$. The ERT considers that the recommendation has been addressed because the Party provided in the NIR detailed information on the consistency between the FMRL and FM reporting based on comparison of historical data between FM and the FMRL.

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

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

9. In accordance with paragraph 83 of the UNFCCC review guidelines, the ERT noted that the issues and/or problems included in table 4 have been identified in three or more successive reviews, including the review of the 2022 annual submission of Lithuania, and had not been addressed by the Party by the time of publication of this review report.

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

ID#	Previous recommendation for issue	Number of successive reviews issue not addressed[a]
General	No issues identified.	
Energy	No issues identified.	
IPPU		
I.2	Report all CO_2 emissions from fuel consumption (used as feedstock and fuel) under category 2.B.1 ammonia production in accordance with the 2006 IPCC Guidelines.	3 (2019–2022)
Agriculture		
A.2	Conduct a study to develop country-specific data on feed digestibility, and when available, apply these data for estimating CH_4 and N_2O emissions, and update the information reported on the manure management category in the NIR.	3 (2019–2022)
LULUCF		
L1	Conduct an analysis of significance at the pool level to determine whether the DOM pool is significant under category 4.A.1 forest land remaining forest land and, if so, adopt a higher tier to estimate the litter (and DOM) CSCs.	3 (2019–2022)
L.3	Report the CSC in litter from the conversion of grassland to cropland (perennial crops) and, if applying a value different from 0.4 t C/ha, explain in the NIR the reason for using a different value.	3 (2019–2022)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
L.4	Provide a justification for simplifying equation 11.1 from the 2006 IPCC Guidelines (vol. 4, chap. 11.2.1.1, p.11.7) and excluding certain N sources included in equation 11.1 and specify those reported under the agriculture sector or those that do not occur. Provide the corresponding information in the NIR and CRF table 4(I).	3 (2019–2022)
Waste	No issues identified.	
KP-LULUCF	No issues identified.	

[a] Reports on the reviews of the 2018 and 2020 annual submissions of Lithuania have not yet been published. Therefore, 2018 and 2020 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 Lithuania that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2022 annual submission of Lithuania

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
General		No general findings additional to those included in table 3 were made by the ERT during the review.	
Energy		No findings for the energy sector additional to those included in table 3 were made by the ERT during the review.	
IPPU			
I.10	2.B.1 Ammonia production – CO_2	The Party reported in its NIR (section 4.3.1.2, pp.181–184) that the CO_2 emissions recovered for use in urea production are subtracted from the amount of CO_2 emitted under category 2.B.1 ammonia production and the emissions from urea use are accounted for in the corresponding sectors elsewhere in the inventory. The Party subtracted from the total CO_2 emissions for category 2.B.1 ammonia production the CO_2 emissions from urea applied in agriculture and from use of urea-based catalyst in transport. In addition, the CO_2 recovered and used for production of the exported urea was excluded from the emissions for this category, as the emissions will not occur within the borders of the country. During the review, the Party provided national statistical data on the urea and N solution balances (production, imports and exports) in its response to a question from the ERT related to the agriculture sector (see ID# A.7 below). According to these data and discussion with the Party, the ERT found that not only pure urea is exported from Lithuania, but also N solution. N solution is a fertilizer that usually contains up to 40 per cent of urea in term of mass of product. According to national statistical data, an important share (91 per cent in 2020) of the N solution produced in Lithuania is exported, which was not accounted for in	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		the inventory calculations. As stated in the 2006 IPCC Guidelines (vol. 4, chap. 3, p.3.12), the CO_2 recovered to produce urea can be deducted, provided that CO_2 emissions from urea use are included elsewhere in the inventory, if these emissions occur within the borders of the Party concerned. Thus, similarly to the amount of CO_2 subtracted from category 2.B.1 ammonia production made for urea used in the country and exported, CO_2 emissions recovered for urea production, which is afterwards used to produce N solution for export, could be deducted from emissions reported under category 2.B.1 ammonia production. In the same way, CO_2 emissions recovered for urea production and used in N solution production that are spread and accounted for in the agriculture sector could be deducted from emissions reported under category 2.B.1 ammonia production (see ID# A.7 below). The ERT recommends that the Party accurately define the use of the urea produced in the country, clarify all pathways of the use of urea generating CO_2 emissions in the country, including N solution use, and estimate the CO_2 emissions that could be deducted from the emissions for category 2.B.1 ammonia production. The ERT also recommends that the Party ensure that the emissions deducted from the emissions for category 2.B.1 ammonia production are included elsewhere in the inventory, if these emissions occur within the country's borders.	
I.11	2.F.1 Refrigeration and air conditioning – HFCs	The Party reported in its NIR (section 4.7.1.5, pp.236–237, and section 10.1, p.495) that the only recalculation it performed for HFC emissions for subcategory 2.F.1.f stationary air conditioning was for 2019, but according to data reported in CRF table 2(II).B-H (sheet 2), small recalculations were made also for 2002–2010 and 2017–2018. The recalculated HFC emissions for subcategory 2.F.1.f decreased in a range between 0.01 and 0.08 per cent for all these years when compared with those submitted in the previous annual submission. During the review, the Party explained that it made a technical error in entering the values for the HFC emissions of subcategory 2.F.1.f into the CRF tables, for which no recalculations were performed and therefore emissions for those years were incorrectly reported. Owing to this technical error, these emissions were underestimated for 2002–2010 and 2017–2018. The ERT found that the Party had underestimated emissions by approximately 0.0006 to 0.014 kt CO_2 eq for these years, which is below the significance threshold according to paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines for the Party for application of an adjustment in accordance with decision 22/CMP.1, annex, paragraph 80(b), in conjunction with decision 4/CMP.11 (10.09 kt CO_2 eq in 2020) and therefore the ERT did not include this issue in the list of potential problems and further questions raised. The ERT recommends that the Party correct the HFC emission estimates for subcategory 2.F.1.f stationary air conditioning in CRF table 2(II).B-H (sheet 2), in particular for 2002–2010 and 2017–2018 and ensure that HFC emissions are reported accurately and consistently in future annual submissions.	Yes. Accuracy
Agriculture			
A.6	3.D.a.2 Organic N fertilizers – N_2O	The Party reported in the NIR (p.309) that recalculations for subcategory 3.D.a.2.a animal manure applied to soils were made owing to recalculations made for subcategory 3.B.2 sheep (manure management), that emissions from anaerobic digester systems of swine were included, and that typing errors in values used in calculations for non-dairy cattle and swine were corrected. During the review, the ERT asked the Party for the detailed calculation values of N from animal manure applied to soils used for 2020 to better understand the recalculations made. Lithuania provided an Excel file with calculations, in which the ERT noted (1) a discrepancy between the fraction of N excreted by dairy cows managed in solid storage and dry lot estimated using the reported data in	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		CRF table 3.B(b) and the value reported in the calculation file provided by Lithuania; (2) a discrepancy between the fraction of N excreted by poultry managed in the system "other" estimated using the reported data in CRF table 3.B(b) and the value reported in the calculation file provided by Lithuania; and (3) that for horse manure managed in deep bedding, Lithuania used a value of 15 per cent for $Frac_{LossMS}$; however, in the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.23, p.10.67), $Frac_{LossMS}$ for "other" in deep bedding management systems is 35 per cent. During the review, the Party provided the following clarifications for all points noted by the ERT above: (1) for dairy cows, a typing error regarding the share of manure managed in solid storage was made in the N_2O emission estimation for subcategory 3.D.a.2.a animal manure applied to soil; (2) for poultry, the N excreted on pasture by geese, ducks and other poultry was double counted, as it was accounted for under subcategories 3.D.a.2.a animal manure applied to soils and 3.D.a.3 urine and dung deposited by grazing animals; and (3) for horses, the value used for $Frac_{LossMS}$ associated with deep bedding was incorrect and should be 35 per cent. The ERT considers that these issues do not lead to underestimations of emissions for subcategories 3.D.a.2.a and 3.D.a.3.	
		The ERT recommends that for the calculation of emissions for subcategory 3.D.a.2.a animal manure applied to soils, the Party use fractions of N excreted per manure management system that are consistent with the values used for emission calculations under category 3.B manure management, ensure that no double counting occurs with subcategory 3.D.a.3 urine and dung deposited by grazing animals, and ensure that values used for $Frac_{LossMS}$ are in line with the 2006 IPCC Guidelines. The ERT also recommends that Lithuania add to NIR table 5-33 (pp.286–287) fractions of manure produced per manure management system for all poultry subcategories.	
A.7	3.H Urea application – CO_2	The Party reported in the NIR (table 5-52, p.312) that N solution (urea ammonium nitrate) is spread in Lithuania. N solution can contain up to 40 per cent of urea in terms of mass. Explanations regarding the calculation of CO_2 emissions from urea application are included in the NIR (section 5.10, p.318). However, it was not clear to the ERT that the total amount of urea used to estimate CO_2 emissions from urea application included the urea contained in N solution. During the review, the Party clarified that only CO_2 emissions from urea fertilizer were included under category 3.H urea application. CO_2 emissions from N solution spread on agricultural fields were not included in the agriculture sector. However, the Party indicated in the NIR (table 4-14, p.184) that CO_2 emissions from urea production were included under category 2.B.1 ammonia production. The Party also indicated that CO_2 emissions from N solution spread on agricultural fields would not have been missing but rather misallocated. Further during the review, the ERT asked the Party for the balance of urea and N solution in the country (production, imports and exports) to ensure that no CO_2 emissions were missing from the GHG inventory reporting. Lithuania indicated that a small amount of N solution is imported and thus that CO_2 emissions related to the N solution imported were probably missing. According to national statistical data provided during the review, the ERT noted that most of the N solution produced in Lithuania is exported. As stated in the 2006 IPCC Guidelines (vol. 3, chap. 3, p.3.12), the CO_2 recovered to produce urea can be subtracted from CO_2 emissions for category 2.B.1 ammonia production, ensuring that CO_2 emissions from urea use are included elsewhere in the inventory if these emissions occur within the borders of the Party concerned. For urea, the Party subtracted for category 2.B.1 ammonia production the amount of CO_2 used for the production of urea spread in agriculture, urea exported, and urea used for urea-based catalysts. The ERT considers that the same subtraction could be made for the amount of CO_2 used for the production of urea contained in N solution that is spread on agricultural fields and urea contained in N solution that is exported. According to the data provided by	Yes. Comparability

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		Lithuania during the review, the ERT estimated that CO_2 emissions from N solution spread missing from the reporting for the agriculture sector (30.18 kt CO_2 in 2020) were much lower than the CO_2 emissions that could be deducted from the emissions for category 2.B.1 ammonia production (215.41 kt CO_2 in 2020) linked to the amount of CO_2 used for the production of urea contained in N solution that is spread on agricultural fields and urea contained in N solution that is exported (see ID# I.11 above). Thus, the ERT considers that the overall CO_2 emissions related to urea (from the IPPU and agriculture sectors) reported in the GHG inventory were overestimated. The ERT recommends that the Party estimate and report CO_2 emissions from N solution spread in agriculture, including any amount of N solution imported, using data that are consistent with the calculation of N_2O emissions from inorganic fertilizers and consistent with the CO_2 emission estimates from urea produced in Lithuania used for N solution that could be deducted from the emissions under category 2.B.1 ammonia production.	
LULUCF		No findings for the LULUCF sector additional to those included in table 3 were made by the ERT during the review.	
Waste			
W.1	5.A Solid waste disposal on land – CH_4	Lithuania reported in its NIR (table 7-18, p.447) the composition of disposed waste for 1990–2020. Accordingly, biodegradable components of waste were classified and subdivided by paper and cardboard waste, wood waste, textile waste, food waste and green waste. The ERT noted that, according to the 2006 IPCC Guidelines (vol. 5, chap. 2, table 2.4, p.2.14) nappies, and rubber and leather are the two other waste components that contain degradable organic carbon, and thus potentially may lead to CH_4 emissions from its disposal. The ERT also noted that no information was provided in the NIR regarding under which waste components defined by the Party nappies, and rubber and leather were reported. During the review, Lithuania explained that nappies are assumed to be included under the textile component, and rubber and leather were excluded from biodegradable components of the FOD model, in accordance with an order of the Ministry of Environment, which sets the obligation to perform analyses of waste composition in the regional waste management centres and includes rubber and leather in the list of non-biodegradable waste. The ERT considers that the inclusion of nappies under the textile component would lead to neither under- nor overestimations of CH_4 emissions because the degradable organic carbon value for textile waste and nappies is the same (24 per cent) in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 2, table 2.4, p.2.14). Regarding rubber and leather, even though this component may contain certain amount of non-fossil fuel, this is hardly degradable in accordance with the 2006 IPCC Guidelines (vol. 5, chap. 2, p.2.11), thus it may not be a source of CH_4 emissions when disposed, depending on the country-specific conditions for municipal solid waste generation, namely the typical origin of rubber and leather component in the country. The ERT agrees with the assumption made by Lithuania regarding rubber and leather. The ERT recommends that Lithuania, in its NIR, report the assumption that nappy disposal is included under the textile waste component, and provide the rationale for reporting rubber and leather under non-biodegradable waste components, with the justification that this approach does not lead to underestimation of CH_4 emissions from solid waste disposal sites.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue/problem?*[a]
W.2	5.A.1.a Anaerobic – CH_4	Lithuania reported in its NIR (p.457) that the amount of landfill gas recovery in volume units (million m^3) was obtained directly from Statistics Lithuania. The amount of recovered CH_4 in kt was calculated using the default value of 0.5 for the fraction of CH_4 in generated landfill gas (2006 IPCC Guidelines, vol. 5, chap. 3, p.3.15) and the conversion factor of 0.67×10^{-6} kt/m^3 (2006 IPCC Guidelines, vol. 2, chap. 4, p.4.12). The ERT noted that no information was provided in the NIR on the landfill gas preliminary treatment and purification practices in Lithuania. The ERT also noted that landfill gas is currently used after upgrading processes, involving removal of CO_2 and other trace gas compounds in order to improve its quality (Li et al., 2017), consequently preliminary treatment of landfill gas (e.g. removal of CO_2) may lead to an increase in its CH_4 concentration and thus may have an impact on the estimated amount of CH_4 recovery, depending on the nature of primary statistics on landfill gas recovery. During the review, Lithuania explained that raw landfill biogas undergoes preliminary treatment for removal of impurities before its use as an energy source. The ERT considers that it is desirable for information on raw landfill biogas preliminary treatment and purification practices to be reflected in the NIR to justify the robustness of the method applied to convert data on landfill gas recovery provided in volume units by Statistics Lithuania to the amount of CH_4 recovery at the landfills. The ERT encourages Lithuania to provide in its NIR a description of raw landfill biogas preliminary treatment and purification practices used at landfills; and the rationale for using the default value of 0.5 for the fraction of CH_4 in landfill gas used for energy purposes and the default density conversion factor of 0.67×10^{-6} kt/m^3 to estimate CH_4 recovery at landfills based on statistical data from Statistics Lithuania, taking into account that raw landfill biogas preliminary treatment for removal of impurities is common practice in the country.	Not an issue/problem
W.3	5.A.2 Unmanaged waste disposal sites – CH_4	Lithuania reported in its NIR (table 7-10, pp.439–440) that the total amount of sewage sludge already disposed at unmanaged solid waste disposal sites decreased by 12.6 kt wet weight in 2020 compared with 2019 because sewage sludge accumulated at sludge storage sites has been extracted for treatment and the total amount of treated sludge exceeded sludge generation. The ERT noted that the NIR did not provide any information on how the reduction of the amount of already disposed sewage sludge in 2020 was taken into account to estimate CH_4 emissions from sewage sludge disposed prior to 2020. In particular, the ERT noted that the reduction of sewage sludge disposal by 12.6 kt might need to be reflected through corrected values of sewage sludge disposal amount in the FOD model for prior to 2020. During the review, Lithuania explained that the negative value of disposed sludge for 2020 was entered in the FOD model and informed the ERT about the plans to make corrections for the sewage sludge disposal prior to 2020 in the next annual submission. The ERT considers that the CH_4 emissions in 2020 from sewage sludge disposal are overestimated owing to the fact that the amount of sewage sludge disposal prior to 2020 was not corrected in line with the reduction of its total disposal amount in 2020. Assuming that such a reduction in 2020 affected the amount of the sewage sludge disposed in 2019 (higher layer of disposed sewage sludge was extracted), the ERT calculated the potential CH_4 emission overestimation for 2020 as 0.7 kt CO_2 eq. The ERT recommends that Lithuania revise the CH_4 emission estimates from sewage sludge disposal by using a corrected amount of sewage sludge disposal for prior to 2020 in the FOD model taking into account that the total amount of already disposed sewage sludge in 2020 decreased compared with 2019.	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
W.4	5.B Biological treatment of solid waste – CH_4	Lithuania reported in its NIR (p.427) that CH_4 emissions for category 5.B biological treatment of solid waste were identified as a key category. Nevertheless, as reported in the NIR (p.427), these emissions were estimated applying a tier 1 method and no explanation for not applying a higher-tier estimation method was provided. In particular, CH_4 emissions from anaerobic digestion were estimated by multiplying the derived amount of CH_4 generation by the default EF value for leakage equal to 5 per cent (2006 IPCC Guidelines, vol. 5, chap. 4, p.4.4); and CH_4 emissions from composting were estimated by multiplying the mass of organic waste by the default CH_4 EF value for composting equal to 10 g CH_4/kg waste treated (2006 IPCC Guidelines, vol. 5, chap. 4, p.4.6). The ERT noted that, in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 4.1.2, p.4.5), in general, more detailed higher-tier methods should be selected for key categories. At the same time, the tier 1 method could be applied for a key category in cases where the data necessary to apply a higher-tier method could not be collected without significantly jeopardizing the resources available for addressing other key categories, which is in line with the requirements of paragraph 11 of the UNFCCC Annex I inventory reporting guidelines. During the review, Lithuania explained that determining country-specific CH_4 EFs for category 5.B biological treatment of solid waste in any pathway requires significant effort and resources in the country, and that conducting detailed investigations that cover all required pathways in the near future is unaffordable. The ERT noted that CH_4 emissions from both composting and anaerobic digestion are significant sources of emissions in accordance with the definition provided in the 2006 IPCC Guidelines (vol. 1, chap. 4.2, p.4.8). Thus, CH_4 emissions from composting and anaerobic digestion should be estimated applying higher-tier methods or a clear explanation should be provided in the NIR of why a higher-tier method could not be applied without significantly jeopardizing the resources available for addressing other key categories. The ERT recommends that Lithuania either provide a clear explanation in the NIR of why a higher-tier method could not be applied to estimate CH_4 emissions from composting and anaerobic digestion at biogas facilities under category 5.B biological treatment of solid waste without significantly jeopardizing the resources available for addressing other key categories, which is in line with the requirements of paragraph 11 of the UNFCCC Annex I inventory reporting guidelines, or estimate and report the CH_4 emissions applying a higher-tier method.	Yes. Transparency
W.5	5.B Biological treatment of solid waste – N_2O	Lithuania reported in its NIR (p.427) that N_2O emissions in category 5.B biological treatment of solid waste were identified as a key category. Nevertheless, as reported in the NIR (p.427), these emissions were estimated applying a tier 1 method and no explanation for not applying a higher-tier estimation method was provided. In particular, N_2O emissions from composting of waste were estimated by multiplying mass of organic waste by a default N_2O EF value for composting equal to 0.6 g N_2O/kg waste treated (2006 IPCC Guidelines, vol. 5, chap. 4, p.4.6). The ERT noted that in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 4.1.2, p.4.5), in general, more detailed higher-tier methods should be selected for key categories. At the same time, the tier 1 method could be applied for a key category in cases where the data necessary to apply a higher-tier method could not be collected without significantly jeopardizing the resources available for addressing other key categories, which is in line with the requirements of paragraph 11 of the UNFCCC Annex I inventory reporting guidelines. During the review, Lithuania explained that determining country-specific N_2O EFs for category 5.B biological treatment of solid waste in any pathway requires significant effort and resources in the country, and that conducting detailed investigations that cover all required pathways in the near future is unaffordable. The ERT recommends that Lithuania either provide a clear explanation in the NIR of why a higher-tier method could not be applied to estimate N_2O emissions from composting under category 5.B biological treatment of	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		solid waste without significantly jeopardizing the resources available for addressing other key categories, which is in line with the requirements of paragraph 11 of the UNFCCC Annex I inventory reporting guidelines, or estimate and report the N_2O emissions applying a higher-tier method.	
W.6	5.B.2 Anaerobic digestion at biogas facilities – CH_4	Lithuania reported in its NIR (p.467) that the amount of biogas recovery at anaerobic digestion biogas facilities in volume units (million m^3) was obtained directly from Statistics Lithuania. The amount of recovered CH_4 in kt was calculated using the default value of 0.5 for the fraction of CH_4 in generated landfill gas (2006 IPCC Guidelines, vol. 5, chap. 3, p.3.15) and the conversion factor of 0.67×10^{-6} kt/m^3 (2006 IPCC Guidelines, vol. 2, chap. 4, p.4.12). The ERT noted that no information was provided in the NIR on the country-specific conditions of anaerobic digestion practices in Lithuania. The ERT also noted that biogas is currently used after upgrading processes, which involves removing CO_2 and other trace gas compounds, in order to improve its quality (Angelidaki et al., 2019; Farghali et al., 2022), and after biogas preliminary treatment, the final product may be referred to as biomethane, which contains up to 95–99 per cent of CH_4 (Nguyen et al., 2021). Consequently, preliminary treatment of biogas may lead to an increase in its CH_4 concentration and thus may have an impact on the estimated amount of CH_4 recovery, depending on the nature of primary statistics on biogas recovery. During the review, Lithuania explained that raw sewage sludge biogas undergoes preliminary treatment for removal of excessive water and remaining sludge particles before its use as an energy source. The ERT considers that it is desirable for information on country-specific conditions, such as preliminary treatment and purification practices, to be reflected in the NIR to justify the robustness of the method applied to convert data on anaerobic digestion biogas recovery in volume units provided by Statistics Lithuania to the amount of CH_4 recovery at the anaerobic digestion biogas facilities. The ERT encourages Lithuania to provide in its NIR a description of biogas preliminary treatment and purification practices used at anaerobic digestion biogas facilities; and the rationale for using the default value of 0.5 for the fraction of CH_4 in anaerobic digestion biogas used for energy purposes and the default density conversion factor of 0.67×10^{-6} kt/m^3 to estimate CH_4 recovery at anaerobic digestion biogas facilities based on biogas recovery statistics reported by Statistics Lithuania, taking into account that raw biogas preliminary treatment for removal of impurities may tangibly influence the physical and chemical properties (including density and CH_4 concentration) of the treated biogas.	Not an issue/problem
W.7	5.D Wastewater treatment and discharge – CH_4	Lithuania reported in its NIR (p.427) that CH_4 emissions for category 5.D wastewater treatment and discharge were identified as a key category. Nevertheless, as reported in the NIR (p.427) these emissions were estimated using a tier 1 method and no explanation for not applying a higher-tier estimation method was provided. The ERT noted that, in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 4.1.2, p.4.5), in general, more detailed higher-tier methods should be selected for key categories. At the same time, the tier 1 method could be applied for a key category in cases where the data necessary to apply a higher-tier method could not be collected without significantly jeopardizing the resources available for addressing other key categories, which is in line with the requirements of paragraph 11 of the UNFCCC Annex I inventory reporting guidelines. During the review, Lithuania explained that septic tanks and latrines are the source of the majority of CH_4 emissions from wastewater treatment and discharge, and that, since country-specific EFs for these pathways are not available, the tier 1 method was applied to estimate CH_4 emissions from septic tanks and latrines. Lithuania also explained that	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem?[a]
		determining country-specific EFs in any pathway requires significant effort and resources, and that conducting detailed investigations that cover all required pathways in the near future is unaffordable.	
		The ERT recommends that Lithuania either provide a clear explanation in the NIR of why a higher-tier method could not be applied to estimate CH_4 emissions from septic tanks and latrines under category 5.D wastewater treatment and discharge without significantly jeopardizing the resources available for addressing other key categories, which is in line with the requirements of paragraph 11 of the UNFCCC Annex I inventory reporting guidelines, or estimate and report the CH_4 emissions applying a higher-tier method.	
KP-LULUCF		No findings for KP-LULUCF additional to those included in table 3 were made by the ERT during the review.	

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

VI. Application of adjustments

11. The ERT did not identify the need to apply any adjustments for the 2022 annual submission of Lithuania.

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 Lithuania 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 Lithuania in its 2022 annual submission

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

Table I.1
Total greenhouse gas emissions and removals for Lithuania, base year–2020
(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions and removals including indirect CO_2 emissions*[a]		*Land-use change (Article 3.7 bis as contained in the Doha Amendment)*[b]	*KP-LULUCF (Article 3.3 of the Kyoto Protocol)*[c]	*KP-LULUCF (Article 3.4 of the Kyoto Protocol)*	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*			*CM, GM, RV, WDR*	*FM*
FMRL								–4 552.00
Base year[d]	42 336.01	47 867.29	NA	NA	NA		NA	
1990	42 329.61	47 860.90	NA	NA				
1995	17 700.86	22 233.49	NA	NA				
2000	10 008.86	19 441.01	NA	NA				
2010	10 327.02	20 750.16	NA	NA				
2011	10 750.60	21 343.22	NA	NA				
2012	11 265.83	21 266.73	NA	NA				
2013	10 623.48	20 026.92	NA	NA		37.48	NA	–9 111.24
2014	11 516.61	19 995.70	NA	NA		47.88	NA	–8 078.07
2015	12 459.42	20 303.89	NA	NA		–186.33	NA	–7 009.15
2016	13 194.77	20 326.58	NA	NA		–146.85	NA	–5 989.91
2017	14 030.22	20 528.91	NA	NA		–179.49	NA	–5 852.24
2018	13 805.54	20 159.02	NA	NA		886.21	NA	–5 705.20
2019	15 058.49	20 360.59	NA	NA		161.90	NA	–5 375.99
2020	14 775.16	20 182.55	NA	NA		–200.04	NA	–5 653.25

Note: Emissions and removals reported for the sector other (sector 6) are not included in the total GHG emissions.
[a] The Party did not report indirect CO_2 emissions in CRF table 6.
[b] 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.
[c] Activities under Article 3, para. 3, of the Kyoto Protocol, namely AR and deforestation.

[d] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O and 1995 for HFCs, PFCs, SF_6 and NF_3. Lithuania 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.

Table I.2

Greenhouse gas emissions and removals by gas for Lithuania, excluding land use, land-use change and forestry, 1990–2020

(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	35 767.73	6 945.49	5 147.67	NO	NO	NO	NO	NO
1995	15 091.55	4 401.17	2 734.37	6.35	NO	NO	0.05	NO
2000	11 876.40	3 842.69	3 699.19	22.00	NO	NO	0.72	NO
2010	13 946.61	3 605.06	2 936.28	256.29	NO	NO	5.91	NO
2011	14 292.83	3 451.10	3 288.42	303.24	NO	NO	7.64	NO
2012	14 349.49	3 460.28	3 102.70	350.40	NO	NO	3.87	NO
2013	13 355.97	3 393.42	2 864.50	406.77	NO	NO	6.20	0.06
2014	13 108.08	3 401.69	3 019.18	460.59	NO	NO	5.85	0.29
2015	13 319.68	3 371.06	3 041.63	566.14	NO	NO	5.13	0.26
2016	13 351.18	3 271.80	2 984.84	714.11	NO	NO	4.46	0.20
2017	13 571.83	3 208.06	3 035.06	706.32	NO	NO	7.62	0.01
2018	13 691.35	3 013.33	2 894.61	553.41	NO	NO	6.30	0.03
2019	13 923.31	2 956.64	2 941.71	533.93	NO	NO	5.01	NO
2020	13 653.15	2 863.69	3 147.86	508.10	NO	NO	9.75	NO
Percentage change 1990–2020	**–61.8**	**–58.8**	**–38.8**	**NA**	**NA**	**NA**	**NA**	**NA**

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

[a] Lithuania did not report indirect CO_2 emissions in CRF table 6.

Table I.3

Greenhouse gas emissions and removals by sector for Lithuania, 1990–2020

(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	33 122.49	4 460.24	8 756.04	–5 531.28	1 522.13	NO
1995	14 161.33	2 212.34	4 327.15	–4 532.63	1 532.67	NO
2000	10 916.16	3 068.31	3 936.11	–9 432.15	1 520.43	NO
2010	13 094.72	2 235.37	4 156.71	–10 423.14	1 263.35	NO
2011	12 245.04	3 714.37	4 196.68	–10 592.62	1 187.13	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2012	12 278.44	3 564.99	4 271.56	–10 000.90	1 151.74	NO
2013	11 659.55	3 000.17	4 246.07	–9 403.43	1 121.12	NO
2014	11 278.22	3 186.32	4 467.26	–8 479.09	1 063.90	NO
2015	11 248.43	3 507.67	4 537.70	–7 844.47	1 010.10	NO
2016	11 578.93	3 324.29	4 431.90	–7 131.81	991.46	NO
2017	11 508.38	3 637.38	4 390.12	–6 498.68	993.02	NO
2018	11 872.59	3 165.84	4 248.02	–6 353.48	872.57	NO
2019	11 890.34	3 375.15	4 256.50	–5 302.10	838.60	NO
2020	11 816.75	3 093.50	4 450.72	–5 407.39	821.58	NO
Percentage change 1990–2020	**–64.3**	**–30.6**	**–49.2**	**–2.2**	**–46.0**	**NA**

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

Table I.4

Greenhouse gas emissions and removals from activities under Article 3, paragraphs 3–4, of the Kyoto Protocol by activity, base year–2020, for Lithuania

(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[a]	*Activities under Article 3.3 of the Kyoto Protocol*		*FM and elected activities under Article 3.4 of the Kyoto Protocol*				
	Land-use change	*AR*	*Deforestation*	*FM*	*CM*	*GM*	*RV*	*WDR*
FMRL				–4 552.00				
Technical correction				–922.00				
Base year[b]	NA				NA	NA	NA	NA
2013		–167.38	204.86	–9 111.24	NA	NA	NA	NA
2014		–222.92	270.80	–8 078.07	NA	NA	NA	NA
2015		–213.71	27.39	–7 009.15	NA	NA	NA	NA
2016		–311.40	164.55	–5 989.91	NA	NA	NA	NA
2017		–264.76	85.27	–5 852.24	NA	NA	NA	NA
2018		–401.02	1 287.23	–5 705.20	NA	NA	NA	NA
2019		–394.66	556.56	–5 375.99	NA	NA	NA	NA
2020		–424.56	224.52	–5 653.25	NA	NA	NA	NA
Percentage change base year–2019					**NA**	**NA**	**NA**	**NA**

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

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

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

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 Lithuania
(kt CO_2 eq)

GHG source/sink activity	*Net emissions/removals*										*Accounting parameters*	*Accounting quantity*[a]
	Base year[b]	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*Total*[c]		
A.1. AR		–167.378	–222.924	–213.713	–311.397	–264.764	–401.023	–394.660	–424.557	–2 400.417		–2 400.416
Excluded emissions from natural disturbances[d]		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
Excluded subsequent removals from land subject to natural disturbances		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
A.2. Deforestation		204.861	270.804	27.386	164.546	85.270	1 287.229	556.562	224.518	2 821.176		2 821.176
B.1. FM										–52 775.056		–8 983.056
Net emissions/ removals		–9 111.236	–8 078.073	–7 009.151	–5 989.910	–5 852.242	–5 705.202	–5 375.990	–5 653.252	–52 775.056		
Excluded emissions from natural disturbances[d]		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
Excluded subsequent removals from land subject to natural disturbances		NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
Any debits from newly established forest		IE	IE	IE	IE	IE	IE	IE	IE	IE		IE
FMRL[e]											–4 552.000	

GHG source/sink activity	*Net emissions/removals*										*Accounting parameters*	*Accounting quantity*[a]
	Base year[b]	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*Total*[c]		
Technical corrections to FMRL											–922.000	
FM cap											13 495.031	–8 983.056
B.2. CM (if elected)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
B.3. GM (if elected)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
B.4. RV (if elected)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA
B.5. WDR (if elected)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA

[a] Cumulative net emissions and removals for all years of the commitment period reported in the annual submission under review.
[b] 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.
[c] The accounting quantity is the total quantity of units to be issued or cancelled for a particular activity.
[d] The Party indicated that it does not intend to exclude emissions from natural disturbances.
[e] As inscribed in the appendix to the annex to decision 2/CMP.7 in kt CO_2 eq per year.

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

Table I.6
Key data for Lithuania under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2022 annual submission

Parameter	*Data values*
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: not elected (e) GM: not elected (f) RV: not elected (g) WDR: not elected
Elected activities under Article 3, paragraph 4, of the Kyoto Protocol	None
Election of application of provisions for natural disturbances	No
3.5% of total base-year GHG emissions, excluding LULUCF	1 686.878 kt CO_2 eq (13 495.031 kt CO_2 eq for the duration of the commitment period)
Cancellation of assigned amount units, certified emission reductions and emission reduction units and/or issuance of RMUs in the national registry for:	
1. AR	Issue 2 400 416 RMUs
2. Deforestation	Cancel 2 821 176 units
3. FM	Issue 8 983 056 RMUs

Note: Values in this table reflect the accounting quantities for activities under Article 3, para. 3, and FM and any elected activities under Article 3, para. 4, of the Kyoto Protocol as reported in table I.5.

Annex II

Information to be included in the compilation and accounting database

Tables II.1–II.5 include the information to be included in the compilation and accounting database for Lithuania. 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 Lithuania
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
CPR	**102 240 739**	–	–	**102 240 739**
Annex A emissions				
CO_2	13 653 155	–	–	13 653 155
CH_4	2 863 687	–	–	2 863 687
N_2O	3 147 860	–	–	3 147 860
HFCs	508 103	–	–	508 103
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	9 749	–	–	9 749
NF_3	NO	–	–	NO
Total Annex A sources[a]	**20 182 554**	–	–	**20 182 554**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–424 557	–	–	–424 557
Deforestation	224 518	–	–	224 518
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 653 252	–	–	–5 653 252

[a] 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 Lithuania
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	13 923 306	–	–	13 923 306
CH_4	2 956 642	–	–	2 956 642
N_2O	2 941 706	–	–	2 941 706
HFCs	533 927	–	–	533 927
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	5 012	–	–	5 012
NF_3	NO	–	–	NO
Total Annex A sources[a]	**20 360 593**	–	–	**20 360 593**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–394 660	–	–	–394 660
Deforestation	556 562	–	–	556 562

	Original submission	*Revised submission*	*Adjustment*	*Final value*
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 375 990	–	–	–5 375 990

[a] 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 Lithuania
($t CO_2$ eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	13 691 349	–	–	13 691 349
CH_4	3 013 327	–	–	3 013 327
N_2O	2 894 608	–	–	2 894 608
HFCs	553 405	–	–	553 405
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	6 303	–	–	6 303
NF_3	27	–	–	27
Total Annex A sources[a]	**20 159 020**	–	–	**20 159 020**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–401 023	–	–	–401 023
Deforestation	1 287 229	–	–	1 287 229
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 705 202	–	–	–5 705 202

[a] 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 Lithuania
($t CO_2$ eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	13 571 834	–	–	13 571 834
CH_4	3 208 064	–	–	3 208 064
N_2O	3 035 057	–	–	3 035 057
HFCs	706 323	–	–	706 323
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	7 617	–	–	7 617
NF_3	12	–	–	12
Total Annex A sources[a]	**20 528 906**	–	–	**20 528 906**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–264 764	–	–	–264 764
Deforestation	85 270	–	–	85 270
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 852 242	–	–	–5 852 242

[a] 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 Lithuania
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	13 351 177	–	–	13 351 177
CH_4	3 271 797	–	–	3 271 797
N_2O	2 984 837	–	–	2 984 837
HFCs	714 107	–	–	714 107
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	4 461	–	–	4 461
NF_3	201	–	–	201
Total Annex A sources[a]	**20 326 580**	–	–	**20 326 580**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–311 397	–	–	–311 397
Deforestation	164 546	–	–	164 546
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 989 910	–	–	–5 989 910

[a] 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 Lithuania
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	13 319 679	–	–	13 319 679
CH_4	3 371 057	–	–	3 371 057
N_2O	3 041 633	–	–	3 041 633
HFCs	566 136	–	–	566 136
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	5 127	–	–	5 127
NF_3	257	–	–	257
Total Annex A sources[a]	**20 303 890**	–	–	**20 303 890**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–213 713	–	–	–213 713
Deforestation	27 386	–	–	27 386
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–7 009 151	–	–	–7 009 151

[a] 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 Lithuania
($t CO_2 eq$)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	13 108 084	–	–	13 108 084
CH_4	3 401 690	–	–	3 401 690
N_2O	3 019 184	–	–	3 019 184
HFCs	460 593	–	–	460 593

	Original submission	*Revised submission*	*Adjustment*	*Final value*
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	5 852	–	–	5 852
NF_3	291	–	–	291
Total Annex A sources[a]	**19 995 696**	–	–	**19 995 696**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–222 924	–	–	–222 924
Deforestation	270 804	–	–	270 804
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–8 078 073	–	–	–8 078 073

[a] 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 Lithuania
(t CO_2 eq)

	Original submission	*Revised submission*	*Adjustment*	*Final value*
Annex A emissions				
CO_2	13 355 973	–	–	13 355 973
CH_4	3 393 415	–	–	3 393 415
N_2O	2 864 505	–	–	2 864 505
HFCs	406 770	–	–	406 770
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	6 199	–	–	6 199
NF_3	56	–	–	56
Total Annex A sources[a]	**20 026 918**	–	–	**20 026 918**
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–167 378	–	–	–167 378
Deforestation	204 861	–	–	204 861
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–9 111 236	–	–	–9 111 236

[a] 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

No mandatory categories from the 2006 IPCC Guidelines were identified as missing.

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 2015, 2016, 2017, 2019 and 2021 annual submissions of Lithuania, contained in documents FCCC/ARR/2015/LTU, FCCC/ARR/2016/LTU, FCCC/ARR/2017/LTU, FCCC/ARR/2019/LTU and FCCC/ARR/2021/LTU, respectively.

Other

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at https://unfccc.int/sites/default/files/resource/AGI_2022_Final.pdf.

Annual status report for Lithuania for 2022. Available at https://unfccc.int/sites/default/files/resource/asr2022_LTU.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Jolanta Merkelienė (Ministry of Environment of Lithuania), including additional material on the methodology and assumptions used.

Farghali Mohamed, Osman Ahmed, Umetsu Kazutaka, Rooney David, 2022. Integration of biogas systems into a carbon zero and hydrogen economy: a review. Environmental Chemistry Letters. Available at https://link.springer.com/article/10.1007/s10311-022-01468-z.

Irini Angelidaki, Li Xie, Gang Luo, Yifeng Zhang, Hans Oechsner, Andreas Lemmer, Raul Munoz, Panagiotis G. Kougias, 2019. Biogas upgrading: current and emerging technologies. Biofuels: alternative feedstocks and conversion processes for the production of liquid and gaseous biofuels (second edition). Academic Press, pp.817–843. Available at https://www.sciencedirect.com/science/article/pii/B9780128168561000336.

Luong N Nguyen, Jeevan Kumar, Minh T Vu, Johir A H Mohammed, Nirenkumar Pathak, Audrey S Commault, Donna Sutherland, Jakub Zdarta, Vinay Kumar Tyagi, Long D Nghiem, 2021. Biomethane production from anaerobic co-digestion at wastewater treatment plants: A critical review on development and innovations in biogas upgrading

techniques. Sci Total Environ 765:142753. Available at https://pubmed.ncbi.nlm.nih.gov/33121765/.

Yifu Li, Li 'ao Wang, Pengrui Jin, Xue Song, Xinyuan Zhan, 2017. Removal of carbon dioxide from pressurized landfill gas by physical absorbents using a hollow fiber membrane contactor. Chemical Engineering and Processing: Process Intensification, volume 121, 2017, pp.149–161. Available at https://www.sciencedirect.com/science/article/pii/S0255270117302386.