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Report on the individual review of the annual submission of Czechia submitted in 2021*

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 2021 annual submission of Czechia, 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 6 to 11 September 2021 remotely.

* In the symbol for this document, 2021 refers to the year in which the inventory was submitted, not to the year of publication.



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Abbreviations and acronyms

2006 IPCC Guidelines	<i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i>
AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	“Guidelines for review under Article 8 of the Kyoto Protocol”
B ₀	maximum methane-producing capacity
BOD	biochemical oxygen demand
CaO	calcium oxide
CER	certified emission reduction
CH ₄	methane
CHMI	Czech Hydrometeorological Institute
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”
CPR	commitment period reserve
CRF	common reporting format
CRI	Czech Crop Research Institute
CSC	carbon stock change
CZSO	Czech Statistical Office
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
EU	European Union
EU ETS	European Union Emissions Trading System
EUROCONTROL	European Organisation for the Safety of Air Navigation
Eurostat	statistical office of the European Union
F-gas	fluorinated gas
FM	forest management
FMRL	forest management reference level
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
ISOH	information system on waste management of the Czech Ministry of the Environment
ISPOP	integrated system of mandatory reporting of the Czech Ministry of the Environment
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

Kyoto Protocol Supplement	<i>2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol</i>
LPG	liquefied petroleum gas
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MMS	manure management system(s)
N ₂ O	nitrous oxide
NA	not applicable
NCV	net calorific value
NE	not estimated
Nex	nitrogen excretion
NF ₃	nitrogen trifluoride
NFI	national forest inventory
NIR	national inventory report
NO	not occurring
NR	not reported
NSCR	non-selective catalytic reduction
PFC	perfluorocarbon
R	reported
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF ₆	sulfur hexafluoride
SIAR	standard independent assessment report
SOC	soil organic carbon
SWDS	solid waste disposal site(s)
TOW	total organic load in wastewater
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”
VISOH	public information system on waste management of the Czech Ministry of the Environment
VS	volatile solid(s)
WDR	wetland drainage and rewetting
Wetlands Supplement	<i>2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands</i>
Y _m	methane conversion rate

I. Introduction

1. This report covers the review of the 2021 annual submission of Czechia, 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 6 to 11 September 2021 remotely¹ and was coordinated by Nalin Srivastava, Claudia do Valle and Lisa Hanle (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Czechia.

Table 1

Composition of the expert review team that conducted the review for Czechia

<i>Area of expertise</i>	<i>Name</i>	<i>Party</i>
Generalist	Mausami Desai	United States
	Marius Țăranu	Republic of Moldova
Energy	Hiroshi Ito	Japan
	Carmen Teresa Meneses Lopez	Bolivarian Republic of Venezuela
	Benon Bibbu Yassin	Malawi
IPPU	Niculina Mihaela Balanescu	Romania
	Jet Chong	Australia
	Valentina Idrissova	Kazakhstan
Agriculture	Olga Gavrilova	Estonia
	Bernard Hyde	Ireland
	Asia Adlan Mohamed Abdalla	Sudan
LULUCF and KP-LULUCF	Valentin Bellassen	France
	Koki Okawa	Japan
	Amanda Thomson	United Kingdom
Waste	Qingxian Gao	China
	Takefumi Oda	Japan
	Igor Ristovski	North Macedonia
Lead reviewers	Mausami Desai	
	Marius Țăranu	

2. The basis of the findings in this report is the assessment by the ERT of the Party’s 2021 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines.

3. The ERT has made recommendations that Czechia resolve identified findings, including issues² designated as problems.³ Other findings, and, if applicable, the encouragements of the ERT to Czechia to resolve related issues, are also included in this report.

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

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

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

4. A draft version of this report was communicated to the Government of Czechia, 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 Czechia, including totals excluding and including LULUCF, indirect CO₂ 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 2021 annual submission

7. Table 2 provides the assessment by the ERT of the Party’s 2021 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 2021 annual submission of Czechia

<i>Assessment</i>	<i>Issue/problem ID#(s) in table 3 or 5^a</i>
Dates of submission	Original submission: NIR, 14 April 2021; CRF tables (version 1), 14 April 2021; SEF tables, 25 May 2021
Review format	Centralized review conducted remotely
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:
	(a) Identification of key categories? Yes G.2, G.3, G.6, I.21
	(b) Selection and use of methodologies and assumptions? Yes I.20, I.22, I.30, A.13, L.4, L.5, W.13, KL.7
	(c) Development and selection of EFs? Yes E.21, I.1, I.6, L.2, KL.9
	(d) Collection and selection of AD? Yes E.3, E.5, E.18, E.19, I.3, I.20, I.23, A.19, W.3, W.9, W.16, W.14, KL.2
	(e) Reporting of recalculations? Yes I.29
	(f) Reporting of a consistent time series? Yes E.13, A.6
	(g) Reporting of uncertainties, including methodologies? Yes G.5, G.9
	(h) QA/QC? QA/QC procedures were assessed in the context of the national system (see supplementary information under the Kyoto Protocol below)
	(i) Missing categories, or completeness? ^b Yes E.7, I.3, I.28, W.6
	(j) Application of corrections to the inventory? No
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines? No G.5, E.7, I.28
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable? Yes
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:
	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements? No

Assessment	Issue/problem ID#(s) in table 3 or 5 ^a
(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 AAUs, CERs, ERUs and RMUs and on discrepancies in accordance with decision 15/CMP.1, annex, chapter I.E, in conjunction with decision 3/CMP.11, taking into consideration any findings or recommendations contained in the SIAR?	No
Have any issues been identified in matters related to Article 3, paragraph 14, of the Kyoto Protocol, specifically problems related to the transparency, completeness or timeliness of the reporting on the Party's activities related to the priority actions listed in decision 15/CMP.1, annex, paragraph 24, in conjunction with decision 3/CMP.11, including any changes since the previous annual submission?	No
Have any issues been identified related to the following reporting requirements for KP-LULUCF:	
(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	Yes KL.2, KL.10
(b) Demonstration of methodological consistency between the reference level and reporting on FM in accordance with decision 2/CMP.7, annex, paragraph 14?	Yes KL.5, KL.6, KL.7, KL.11
(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
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for assessing conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties? Yes
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review? No
Questions of implementation	Did the ERT list any questions of implementation? No

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

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

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

8. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 23 January 2020,⁴ and had not been resolved by the time of publication of the report on the review of the Party's 2019 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 Czechia

<i>ID#</i>	<i>Issue/problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
General			
G.1	Archiving (G.1, 2019) (G.10, 2017) KP reporting adherence	Improve the documentation on how qualitative information (e.g. expert judgment) on key parameters (e.g. the parameters used in the uncertainty analysis) is generated and improve the archiving of this information in order to improve transparency.	Not resolved. The Party reported throughout its NIR (e.g. section 7.5.1.3, p.336) use of expert judgment for informing the assessment of uncertainties and other key parameters. However, the Party did not clearly document in the NIR how expert judgment on key parameters is generated or the relevant information archived. During the review, Czechia clarified that national experts have started to apply a new standardized template for improving the documentation and archiving of expert judgment based on the example provided in the 2006 IPCC Guidelines (vol. 1, chap. 2, table 2A.1) to support the information included across the chapters of the NIR. The Party indicated that the first set of expert judgments will be documented in the next annual submission and the rest in the following submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet applied the documentation template or updated its archive to include this information to improve transparency of underlying assumptions and parameters used in the uncertainty analysis.
G.2	Key category analysis (G.4, 2019) (G.4, 2017) (G.11, 2016) (G.11, 2015) Convention reporting adherence	Provide in the NIR a key category analysis that is prepared in accordance with the 2006 IPCC Guidelines.	Not resolved. The Party included in its NIR (section 1.5, p.43) a summary of its key category analysis and the full key category analysis was provided in annex 1 to the NIR. The key category analysis still identifies several categories that exceed the threshold of 95 per cent for both the level and trend assessments including and excluding LULUCF, which is not in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 4, p.4.12). For example, category 3.B (manure management – CH ₄) was identified as a key category for the approach 1 level analysis excluding LULUCF. During the review, the Party explained that in the next annual submission only the first category that surpasses the threshold will be included. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet updated the tables to identify categories as key in accordance with the 2006 IPCC Guidelines.

⁴ FCCC/ARR/2019/CZE. The ERT notes that the report on the individual inventory review of Czechia's 2020 annual submission has not been published yet owing to insufficient funding for the review process. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2019 annual submission.

<i>ID#</i>	<i>Issue/problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
G.3	Key category analysis (G.14, 2019) Convention reporting adherence	Review the key category analysis calculations and apply the approach 2 methodology from the 2006 IPCC Guidelines (vol. 1, chap. 4.3.2) for key category analysis correctly.	Not resolved. The Party reported the key category analysis and calculation tables using IPCC approach 2 methodology in its NIR (section 1.5, tables 1-10–1-11, pp.43–44, and annex 1, tables A1-7–A1-10, pp.447–464). During the review, the Party shared with the ERT files detailing the calculations underlying the key category analysis. The ERT noted that the steps and underlying calculations presented in the files are not in accordance with the methodology described in the 2006 IPCC Guidelines (vol. 1, chap. 4.3.2) and so key categories have been incorrectly identified. During the review, Czechia explained that there were still errors in the application of the methodological approach (the implementation of the approach 2 methods by applying uncertainty assessment to the results of approach 1 level and trend assessments differs from the methodology given in the 2006 IPCC Guidelines (vol. 1, chap. 4, equations 4.4–4.5); formula error in calculating the sums used in the equations; and excluding categories 2.H other (CO ₂), 2.H other (HFCs) and 2.E.1 integrated circuits or semiconductors (PFCs) from the analysis). The Party indicated that it plans to address the errors in the next annual submission. The ERT considers that the recommendation has not yet been addressed because Czechia has not yet correctly applied the IPCC approach 2 methodology.
G.4	QA/QC and verification (G.9, 2019) (G.15, 2017) Transparency	Use the 2006 IPCC Guidelines as the only guidelines on QA/QC procedures and remove all outdated references to earlier IPCC guidelines from the NIR in order to improve transparency and comparability.	Addressing. The Party reported in its NIR (section 1.2.3.6, p.28) that it uses the 2006 IPCC Guidelines as the basis for developing and implementing QA/QC procedures. However, the NIR (e.g. section 1.4, p.41) still contains references to earlier guidelines. During the review, Czechia clarified that the national compilation team has reviewed the NIR and removed all outdated references to earlier guidelines, instructing sector leads to do the same for the next annual submission.
Energy			
E.1	1. General (energy sector) – all fuels (E.10, 2019) Transparency	Either ensure that the energy balance information provided in the NIR matches the data reported in the CRF tables or include an explicit statement in the NIR explaining that the information provided has not been used in the inventory.	Not resolved. The energy balance information provided in the NIR does not completely match the data reported in the CRF tables because the data on natural gas are not consistent between the NIR and the CRF tables. For example, the Party reported 3,507 TJ for road in its NIR (table A4-7, annex 4, p.502) but 3,121.02 TJ for gaseous fuels in road transportation in CRF table 1.A(a)s3. During the review, Czechia explained that the discrepancy largely stems from using NCV and gross calorific value, respectively, for the two values and, to a lesser extent, from using different data sources, and stated that this will be corrected in the next annual submission.
E.2	1.A.2 Manufacturing industries and construction – gaseous fuels – CO ₂ (E.8, 2019) Transparency	Correctly report in the NIR the recalculations made for the subcategory non-metallic minerals (1.A.2.f) for CO ₂ emissions from gaseous fuels for 2016 between the 2018 and 2019 submissions.	Resolved. The Party correctly reported the recalculations made for the subcategory non-metallic minerals (1.A.2.f) for CO ₂ , CH ₄ and N ₂ O for 2018 between the 2020 and 2021 submissions in the NIR (section 3.2.15.5, p.103).
E.3	1.A.2.f Non-metallic minerals – other fossil fuels – CH ₄ and N ₂ O	Revise the estimates and report CO ₂ , CH ₄ and N ₂ O emissions from the biogenic fraction (CH ₄ and N ₂ O emissions reported	Not resolved. The Party did not revise the estimates. Czechia reported lower amounts of biomass consumption in the CRF tables than the amounts reported in the EU ETS reports. The ERT noted that the information provided in the NIR (section 3.2.15.1,

<i>ID#</i>	<i>Issue/problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
	(E.3, 2019) (E.17, 2017) Accuracy	under category 1.A.2.f; CO ₂ emissions reported as a memo item) of alternative fuels used in non-metallic industry for the whole time series.	p.101) is not sufficiently clear regarding the accounting for mixed fuels. During the review, the Party explained that adding biofuel data from the EU ETS to the officially reported data would lead to double counting. Czechia further explained in its response to the provisional main findings that it will recalculate the AD on liquid and solid other fossil fuel consumption by calculating the biogenic component of solid fuels separately as per the EU ETS data for 2013–2019. For 2003–2012 the Party will calculate the proportion of the biogenic component assuming a linear increase from 0 to 50 per cent, owing to a lack of sufficient information for determining the share of biogenic component in alternative fuels for those years. This approach is also supported by the fact that, although there was previously a very low proportion of solid biofuels in this subcategory, it is gradually increasing. For example, according to the Czech Cement Association yearbooks, the proportion of biofuels in 2000, 2002 and 2004 was 0.0, 2.7 and 5.8 per cent, respectively. The Party intends to explain the situation fully in its next annual submission.
E.4	1.A.2.f Non-metallic minerals – other fossil fuels – CO ₂ (E.14, 2019) Transparency	Include in the NIR more information on the consumption of other fossil fuels and the EFs used for them for the CO ₂ estimates for the subcategory and on any significant changes in the fuel mix to explain the fluctuations in the CO ₂ IEF.	Resolved. The Party reported the requested information in the NIR (section 3.2.15.2, p.102).
E.5	1.A.3.a Domestic aviation – jet kerosene – CO ₂ , CH ₄ and N ₂ O (E.4, 2019) (E.19, 2017) Accuracy	Obtain more accurate data on jet kerosene consumption for domestic aviation, following the approaches set out in the 2006 IPCC Guidelines (vol. 2, chap. 3.6.1.3), by obtaining either top-down data on jet kerosene consumption from taxation authorities or bottom-up data from surveys of airline companies or air traffic control records (e.g. data from EUROCONTROL on the number of domestic and international flights by aircraft type) (the higher fuel consumption per km for domestic flights should be considered in this approach).	Not resolved. The Party did not use more accurate data on jet kerosene consumption for domestic aviation. During the review, Czechia explained that its methodology for calculating domestic aviation emissions is based on a combination of EUROCONTROL, CZSO and country-specific data on visual flight rules flights and will be revised at the end of 2021. The Party also explained that new and correct data will be provided in the next annual submission.
E.6	1.A.5.b Mobile – all fuels – CO ₂ , CH ₄ and N ₂ O (E.6, 2019) (E.20, 2017) Transparency	Revise the description of emissions under category 1.A.5.b.i (mobile (other)) to indicate that they are emissions from agriculture, forestry and fishing and not from aviation by the army, State institutions or private air transport.	Addressing. The Party reported emissions from agricultural machinery under category 1.A.4.c.ii (off-road vehicles and other machinery) and not under agriculture, forestry and fishing under category 1.A.5.b. The Party did not include an explanation of emissions under category 1.A.5.b.i (mobile (other)) in CRF table 1.A(a)s4. Czechia reported in its NIR (section 3.2.21, p.136) that category 1.A.5.b is subdivided into two subcategories: 1.A.5.b.i (mobile (aviation component)) and 1.A.5.b.iii (mobile (other)). During the

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
E.7	1.B.2.a Oil – liquid fuels – CO ₂ and CH ₄ (E.7, 2019) (E.13, 2017) (E.20, 2016) (E.19, 2015) Completeness	Change the notation key for oil exploration to “NE” and indicate in both the NIR and the CRF completeness table why those emissions or removals have not been estimated; and provide in the NIR a justification for the exclusion in terms of the likely level of emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	review, the Party explained that, as per the 2006 IPCC Guidelines (vol. 2, chap. 2, table 2.1), subcategory 1.A.4.c.ii should contain emissions from fuels combusted in traction vehicles on farmland and in forests, whereas subcategory 1.A.5.b.i should contain emissions from mobile aviation components and all remaining aviation emissions from fuel combustion that are not specified elsewhere. Czechia further explained that the names of categories 1.A.5.b.i and 1.A.5.b.iii have been changed in the CRF database to mobile (aviation component) and mobile (other) respectively, which will be used for the next annual submission. Addressing. The Party used the notation key “NE” to report oil exploration in CRF table 1.B.2 and explained in the NIR (section 3.3.2.1.1, p.156) that, according to the information received from MND a.s., which is the only company engaged in oil exploration in Czechia, the emissions for the category are not estimated because of a lack of AD, as exploration is not regularly performed in Czechia and the activity does not release emissions. However, the Party did not include in the NIR a justification for the exclusion in terms of the likely level of emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. The Party also did not include this explanation in CRF table 9 on completeness. During the review, Czechia stated that it included the answer received from MND a.s. in the NIR (section 3.3.2.1.1) but will add a short explanation to CRF table 9. The Party further stated that it will explain this issue in detail in the NIR of its next annual submission and include the share of maximum possible emissions for the category as per paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.
E.8	Comparison with international data – solid fuels – CO ₂ (E.11, 2019) Transparency	Improve the transparency of reporting on the AD and emissions from waste in the energy sector, for example by providing in the NIR information on the number of waste incineration plants, the total waste incineration capacity and the waste amounts included in the inventory.	Addressing. The Party reported the number of waste incineration plants, the total waste incineration capacity and the waste amounts in its NIR (section 3.2.7.3.1, p.79).
E.9	Comparison with international data – solid fuels – CO ₂ (E.11, 2019) Transparency	Clearly specify in the NIR the allocation of emissions from waste across the energy and waste sectors.	Not resolved. The Party did not report the allocation of emissions from waste across the energy and waste sectors. During the review, Czechia explained that the source of data on waste incineration is VISOH, which contains bottom-up data on individual waste management companies and is also used consistently as a source of data for the waste sector. VISOH is the official data source for the design and evaluation of national environmental policies. It is obligatory for waste generators and treatment facilities to report under this system, which comprises about 60,000 records. Data in VISOH are cross-checked between waste generators and treatment facilities and, in a few selected cases of discrepancies, verified by the Czech Environmental Inspectorate. Data on waste incineration in inventory are divided between the energy and waste sectors: all waste (predominantly municipal solid waste) incinerated in waste incinerators with energy use

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
E.10	Feedstocks, reductants and other non-energy use of fuels – liquid fuels – CO ₂ (E.12, 2019) Convention reporting adherence	Transparently report on LPG and gas/diesel oil in CRF table 1.A(d) and the NIR, including providing information on the CO ₂ emissions from the non-energy use reported in the inventory and the allocation of the emissions in the inventory.	is accounted for under the energy sector, while the rest of the incinerated waste is accounted for under the waste sector. The Party will explain this system more transparently in the NIR of its next annual submission. Addressing. The Party reported on LPG and gas/diesel oil in CRF table 1.A(d), providing information on the CO ₂ emissions from the non-energy use reported in the inventory and the allocation of the emissions in the inventory. However, while Czechia reported the NCV and EF for LPG in its NIR (table 3.10, p.67), it did not include these for gas/diesel oil. During the review, the Party provided the NCV and EF used for gas/diesel oil and explained that it will include them in its next annual submission.
E.11	Feedstocks, reductants and other non-energy use of fuels – solid fuels – CO ₂ (E.13, 2019) Convention reporting adherence	Correct in CRF table 1.A(d) the reporting of other bituminous coal excluded from the reference approach and ensure consistency in reporting between CRF tables 1.A(d) and 1.A(b) for 2017.	Resolved. The Party revised the reporting of other bituminous coal in CRF table 1.A(d) and reported the same value for other bituminous coal (214.92 kt carbon) for 2017 as reported in CRF table 1.A(b).
E.12	International bunkers and multilateral operations – liquid fuels – CO ₂ (E.15, 2019) Convention reporting adherence	Report consistent information for bunker fuels between CRF tables 1.A(b) and 1.D, or, if this cannot be done, clearly explain any discrepancies in the NIR.	Addressing. The Party reported jet kerosene consumption (international aviation bunkers) for 2019 as 17,696.71 TJ in CRF table 1.A(b), but as 17,698.72 TJ in CRF table 1.D. During the review, Czechia clarified that it used data from the official CZSO questionnaire. The only years with larger differences than 2019 are 2017 (1 per cent) and 2014 (0.06 per cent). The Party further explained that it will address the inconsistency in its next annual submission.
IPPU			
I.1	2.A.2 Lime production – CO ₂ (I.20, 2019) Consistency	Investigate whether a purity adjustment is required for the country-specific CO ₂ EF for lime production, and, if no purity adjustment is required, recalculate CO ₂ emissions from lime production for 1990–2009 using the EF of 0.7884 t CO ₂ /t lime.	Addressing. The Party reported in its NIR (section 4.2.2, p.173) that a tier 1 approach was used to estimate lime production emissions for 1990–2009 using a country-specific EF (0.7884 t CO ₂ /t lime) adjusted by multiplication using a purity factor of 93 per cent for a purity-adjusted EF of 0.7332 t CO ₂ /t lime. Emissions for 2010–2019 are based on EU ETS data. The ERT noted that this approach is the same as that reported in the Party's 2019 NIR. The ERT noted that the 2021 NIR (figure 4-4, p.173) illustrates that emissions estimated using a purity adjustment aligned more closely with reported EU ETS emissions than those estimated using the non-adjusted EF. Czechia noted that an AD source based on Czech Lime Association data was used for 1990–2009, whereas EU ETS data were used for 2010–2019 and so the lower IEF for 1990–2009 can be attributed to the difference in AD source. The Party stated that use of the non-adjusted EF would result in emission overestimation. During the review, Czechia clarified that the country-specific EF of 0.7884 t CO ₂ /t lime applies to pure lime (100 per cent CaO). Under the EU ETS for 2010–2019, lime production emissions are subdivided by process into pure lime production, which uses the country-specific EF, and carbonate additives, which are reported separately with specific EFs based on the additive's chemical composition. The

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I.2	2.A.2 Lime production – CO ₂ (I.20, 2019) Transparency	Otherwise (see ID# I.1 above), explain the difference between the EF verified under the EU ETS and the EF used for the CO ₂ emission estimates for 1990–2009 (0.733 t CO ₂ /t lime) and justify in the NIR the approach of applying a purity adjustment to the country-specific EF.	Party further explained that Czech Lime Association AD used for 1990–2009 do not account separately for pure lime and carbonate additives. To account for carbonate additives and other impurities, the national purity of produced lime is applied to total lime produced to determine the total quantity of pure CaO in produced lime. This quantity of pure CaO is then taken as the relevant AD and multiplied by the country-specific EF. The Party stated that information on the use of the purity factor will be enhanced in subsequent NIRs to improve transparency. Addressing. The Party reported in its NIR (section 4.2.2.2, p.173) the difference in the EFs used for 1990–2009 and for 2010 onward, including the purity adjustment applied to the EFs used for 1990–2009 (see ID# I.1 above). However, the Party did not justify in the NIR the approach of applying a purity adjustment to the country-specific EF. During the review, Czechia provided further information on the differences in AD for 1990–2009, which use Czech Lime Association data, and 2010–2019, which use EU ETS data, and clarified that a purity adjustment to the country-specific EF is necessary to account for non-CaO components in produced lime. The Party stated that information on the use of the purity factor will be enhanced in subsequent NIRs to improve transparency.
I.3	2.A.4 Other process uses of carbonates – CO ₂ (I.1, 2019) (I.1, 2017) (I.10, 2016) (I.10, 2015) Completeness	Collect the missing AD for 1990–2006 on mineral wool production and estimate and report CO ₂ emissions.	Addressing. The Party reported emissions from mineral wool production for 2000–2019 and using notation key “NE” for 1990–1999 in NIR table 4-8 (pp.178–179) and CRF table 2(I).A-Hs1. As in the 2019 and 2020 NIRs, Czechia explained in the 2021 NIR that AD are available for 2000–2002 and 2007–2019, and that CO ₂ emissions for 2003–2006 were interpolated (section 4.2.4.2, p.177). The Party also explained that emissions from this source were not estimated for 1990–1999 because, while a small level of production took place during this period, data are not readily available for estimation. No estimate was made because emissions are below the significance threshold, in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines (p.177 and table 4-8, pp.178–179) and consistent with the emission trend for 2000–2019. The ERT noted that Czechia was advised by the ERT during the previous review that the provisions in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines regarding the exclusion of emissions for categories that fall below the threshold of significance are not applicable when only part of a time series has not been estimated. During the review, the Party explained that mineral wool emission estimates for the missing years will be provided in the next annual submission.
I.4	2.A.4 Other process uses of carbonates – CO ₂ (I.19, 2019) Convention reporting adherence	Ensure that the reporting of the results of recalculations made for subcategory 2.A.4.d (other (mineral wool production, flue-gas desulphurization, denitrification)) for 2015 and 2016 between the 2018 and 2019 submissions is consistent between the data reported in the CRF tables and the	Resolved. During the review, the Party confirmed that appropriate QC procedures were implemented to ensure consistency in data reporting between the NIR and the CRF tables. The ERT confirmed that the recalculated values for subcategory 2.A.4.d (other (mineral wool production, flue-gas desulphurization, denitrification)) in the NIR (section 4.2.4.5, table 4-10) are consistent with emissions reported for the subcategory in CRF table 2(I).A-Hs1.

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		NIR, implementing relevant QC procedures in order to do so.	
I.5	2.B.1 Ammonia production – CO ₂ (I.21, 2019) Transparency	Improve the transparency of reporting by including information on urea application and/or relevant cross references in the section of the NIR on ammonia production.	Resolved. The Party reported in the NIR (section 4.3.1.2, p.183) that CO ₂ recovered from ammonia production for urea production was deducted from the emission estimates in line with the 2006 IPCC Guidelines (vol. 3, chap. 3). The NIR states that urea production and corresponding CO ₂ recovery have not occurred since 2014. For 1990–2013, when urea production was occurring, Czechia stated that all urea application emissions were reported under the agriculture sector, as noted in the NIR (section 5.8, p.268) and CRF table 3.G-I.
I.6	2.B.4 Caprolactam, glyoxal and glyoxylic acid production – N ₂ O (I.2, 2019) (I.17, 2017) Accuracy	Explore the possibility of obtaining additional data directly from the plant (e.g. operating conditions, AD, abatement technology) in order to increase the accuracy of the EF used and the N ₂ O emissions reported.	Addressing. The Party did not obtain additional information (e.g. operating conditions, AD, abatement technology) from the country's sole caprolactam producer to increase the accuracy of the EF used. The Party provided in the NIR (section 4.3.4.2, p.188) an explanation of the methodology used for estimating the N ₂ O emissions from caprolactam production, based on a country-specific EF of 5.7 kg N ₂ O/t caprolactam derived using a mass balance approach and plant-level data from the country's sole caprolactam producer for 2014–2016. This EF is lower than the IPCC default EF of 9 kg N ₂ O/t caprolactam. During the review process, Czechia clarified that this EF has been verified as accurate and is based on actual ammonia consumption and caprolactam production, using a 2 per cent conversion rate of ammonia to N ₂ O. The Party noted that the production facility does not provide information on any abatement technology that may be applied in the process, but that it may be possible to obtain this information from the producer.
I.7	2.C.1 Iron and steel production – CO ₂ (I.6, 2019) (I.3, 2017) (I.2, 2016) (I.2, 2015) (38, 2014) (54, 2013) Transparency	Include information in the NIR on the changes in iron and steel production processes.	Addressing. The Party reported in its NIR (section 4.4.1.2, pp.195–196) that blast furnaces, oxygen steel-making furnaces and electric furnaces are all employed in national iron and steel production. Czechia stated in the NIR (p.196) that electric furnaces are responsible for less than 5 per cent of iron and steel production, but provided no further information about the emissions or production share of each furnace type across the time series. The ERT noted that information on furnace technology would improve transparency of reported trends in the CO ₂ IEFs for the category. During the review, the Party explained that a detailed verification of iron and steel production AD has commenced and explanations of the share of electric arc furnaces and recycling of scrap iron, and their impact on emission calculations, will be examined. The Party noted that the methodology and findings of said internal review will be detailed in future annual submissions.
I.8	2.C.1 Iron and steel production – CO ₂ (I.7, 2019) (I.18, 2017) Transparency	Include a description of the different processes in iron and steel production occurring in the country, including the different mass flows and the mass balance of inputs and outputs of carbon in each process.	Addressing. The Party reported information on iron and steel production, including AD on use of reducing agents, to support emission estimations under a tier 2 carbon flow approach in the NIR (section 4.4.1.2, pp.195–197). However, the ERT noted that information was not provided on the method used to estimate limestone and dolomite consumption for 1990–2010, for which EU ETS data were not available (see ID# I.10 below). The method used to estimate emissions from pellet production was also not described (see ID# I.23 in table 5). During the review, Czechia clarified that it is in the

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			process of moving to a higher-tier estimation methodology for iron and steel production. The Party explained that more detailed information and precise emission estimates for reducing agent carbon flows, including limestone and dolomite use and pellet production, will be provided in future annual submissions when a higher-tier estimation methodology is used.
I.9	2.C.1 Iron and steel production – CO ₂ (I.22, 2019) Consistency	Review the estimated use of limestone and dolomite in iron and steel production for 1990–2009.	Addressing. The Party provided further information on the estimation of limestone and dolomite used in iron and steel production for 1990–2010 (see ID# I.10 below). However, no recalculations were made to the estimates for this period. During the review, Czechia clarified that it is in the process of moving to a higher-tier estimation methodology for iron and steel production, including a review of the application of EU ETS data that could potentially allow for a higher-tier plant-specific method to be applied in future. As part of this process, the Party explained that more precise emission estimates for limestone and dolomite use will be provided when a higher methodological tier is used. The ERT notes that the estimation methodology for limestone and dolomite used for this period may be updated to improve accuracy when the Party uses a higher-tier estimation methodology for iron and steel production.
I.10	2.C.1 Iron and steel production – CO ₂ (I.22, 2019) Transparency	Include in the NIR an explanation of the approach used to estimate the use of limestone and dolomite for the years before EU ETS data were available.	Addressing. The Party explained in the NIR (section 4.4.1.2, p.196) that the extrapolation method was used for limestone and dolomite consumption for 1990–2010, based on EU ETS data available for 2011–2019. However, details on how the extrapolation method was applied for 1990–2010 were not reported. The ERT noted that limestone and dolomite consumption for 1990–2010 was not consistent with a linear best-fit approach used with the EU ETS data for 2011–2019.
I.11	2.F Product uses as substitutes for ozone-depleting substances – HFCs and PFCs (I.14, 2019) (I.21, 2017) Transparency	Report a complete time series for emissions of F-gases from 1990, for example by using proxy data from comparable countries or any other method as suggested in chapter 5 of the 2006 IPCC Guidelines (if data are unavailable, temporarily change the notation key from “NO” to “NE”; if emissions do not occur, explain this in the NIR).	Resolved. The Party reported a complete time series for emissions of F-gases for 1995–2019. Czechia reported in the NIR (section 4.7, p.207) the base year for category 2.F (product uses as substitutes for ozone-depleting substances) as 1995 and noted that this determination is based on potential emissions sources and information from neighbouring countries with a similar composition. Emissions for this category were therefore reported as “NO” for 1990–1994.
I.12	2.F.1 Refrigeration and air conditioning – HFCs and PFCs (I.15, 2019) (I.13, 2017) (I.16, 2016) (I.16, 2015) Transparency	Provide in the NIR an explanation of AD, customs statistics and ISPOP data in order to prove the completeness of the estimation of F-gas emissions from imported products.	Addressing. The Party included in the NIR (section 4.7.1.2, pp.210–211) a high-level description of the data inputs into the Phoenix model that is used to calculate emissions from refrigeration and air conditioning subcategories 2.F.1.a–2.F.1.d and 2.F.1.f. Czechia explained in the NIR that data on import and export of F-gases and their use and destruction are obtained from ISPOP, the F-gas register and customs data. The NIR provides information on the types of activity covered by each data set. ISPOP only covers trade within the EU and movement of bulk F-gases, so product charges are not covered. The F-gas register covers non-EU trade and includes both bulk and product charges. Customs data include both EU and non-EU trade. The Party further explained in

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I.13	2.F.1 Refrigeration and air conditioning – HFCs (I.23, 2019) Transparency	Include in the NIR details of the information (e.g. vehicle age, level of implementation of HFC recovery from destroyed cars) and data provided by the main Czech car bazaar and explain how the data are used for estimating the HFC emissions.	<p>the NIR that reporting thresholds apply for ISPOP (F-gas emissions of 200 t CO₂ eq or greater) and F-gas register (F-gas emissions of 1 t or 1 Mt CO₂ eq or greater), though information on the time frame for which these thresholds apply was not provided. Czechia provided further qualitative explanation on AD and import and export statistics in the NIR. During the review, the Party clarified that customs data only include bulk gases and that thresholds for reporting are applied on the basis of annual trade volumes. The ERT noted that the Party provided a report on collection of data on F-gas activity in Czechia in response to a different question, which provided further detail on the coverage of each data set and their combined use to determine F-gas use statistics.</p> <p>The ERT considers that the recommendation has not yet been fully addressed because the information reported by Czechia does not provide sufficient transparency on how the three F-gas data sets are applied as inputs to the Phoenix model. This is particularly significant in view of the potential overlap in the coverage of the data sets (e.g. the ISPOP and customs data both include EU trade data) and the lack of information on how data set inconsistencies are accounted for. Inclusion of information summarized in the report on collection of data on F-gas activity in Czechia, where possible, would improve transparency of how F-gas AD are obtained.</p> <p>Addressing. The Party reported in its NIR (table 4-34, p.214) parameters for vehicle lifetime, EFs, end-of-life emissions and emission recovery based on vehicle type. These factors are consistent with Czechia's application of a tier 2a methodology for estimating emissions under subcategory 2.F.1.e, as specified in the NIR (section 4.7.1.2, p.210). However, the NIR does not provide the initial charge factor used to estimate emissions for this subcategory. Czechia reported in its NIR that emissions from filling new cars, trucks and buses are estimated on the basis of the production year, manufacturer and model, and by applying data provided by the main used Czech car bazaar (reseller) and expert judgment (section 4.7.1.2, p.214), but no values were provided in the NIR for these estimates. During the review, the Party provided the data templates used to make expert judgment on the number of cars equipped with air conditioning, noting that the data supplied only apply to estimations of disposal, not current stock. The Party noted that it may be possible to publish information on overall national car production in future annual submissions.</p>
Agriculture			
A.1	3. General (agriculture) – CH ₄ , N ₂ O and CO ₂ (A.30, 2019) Convention reporting adherence	Correct the errors in the NIR, ensure that an annual update is made of table headings and content, and incorporate specific QC procedures that result in up-to-date and consistent reporting in the NIR.	<p>Addressing. The Party corrected some of the errors in the NIR, including ensuring that an annual update is made of table headings and content and that specific QC procedures are incorporated that result in up-to-date and consistent reporting in the NIR. However, the ERT noted that some errors remain, such as the inconsistency in the number of cattle categories listed on page 235 with those provided on page 236. During the review, Czechia explained that the sectoral experts follow the QA/QC processes of the national system. CRI experts also support the sectoral experts with the QA/QC process. The Party also explained that the team of compilers perform checks on sectors, within the time</p>

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			available, to ensure that planned improvements have been addressed in a transparent manner and that sector experts have completed the QC checks indicated in both the general and category-specific QC checklists to ensure that the data are updated fully and consistently. The inventory is shared among inventory team members, the Institute of Forest Ecosystem Research Ltd., CRI and CHMI, and the changes implemented are discussed regularly throughout the year. Czechia further explained that 10 cattle categories are used for estimating emissions and that the mistake in the overview of cattle categories provided in section 5.2.1.2 (p.235) and inconsistencies between table 5-5 (p.236) and tables 5-6–5-7 (pp.236–237) relating to the number of cattle categories will be corrected in the next annual submission.
A.2	3. General (agriculture) – CH ₄ and N ₂ O (A.31, 2019) Transparency	Revise the presentation of the feeding and grazing situation in NIR table 5-6, presenting the information on an annual basis.	Not resolved. The Party did not revise the presentation of the feeding and grazing situation in the NIR (table 5-6, p.236). During the review, Czechia explained that it improved the text of the NIR by including table 5-7 (p.237), which provides the absolute number of grazing days per year. However, the ERT considers that this does not address the previous recommendation regarding presenting the information on an annual basis in NIR table 5-6. During the review, in response to the provisional main findings, the Party further explained that, while it considers that the variable number of days better characterizes the required indicator, it will add to table 5-7 the share of days on pasture in relation to the total number of days in the year.
A.3	3. General (agriculture) – CH ₄ and N ₂ O (A.32, 2019) Consistency	Improve consistency in the time series regarding the age categories used for cattle and clearly explain in the NIR the changes in the statistical information used in the inventory and their impact on the estimated emissions from livestock.	Resolved. The Party improved the information reported on the consistency in the time series regarding the age categories used for cattle, and clearly explained in the NIR (footnote to table 5-5, p.236) the changes in the statistical information used in the inventory and their impact on the estimated emissions from livestock.
A.4	3.A.1 Cattle – CH ₄ (A.5, 2019) (A.4, 2017) (A.17, 2016) (A.17, 2015) Transparency	Increase transparency by including some of the assumptions behind gross energy estimation in the NIR and a whole time series of gross energy values in order to explain the fluctuating EFs for non-dairy cattle.	Resolved. The Party included in the NIR (tables 5-9–5-10, pp.238–239) information regarding some of the assumptions behind gross energy estimation (e.g. average body weight and weight gain) and the gross energy values for non-dairy cattle for the inventory year. Czechia also provided in the NIR values of gross energy for dairy and non-dairy cattle for selected years covering the whole time series (section 5.2.2.2.2, table 5-18, p.248) and CH ₄ EFs for enteric fermentation for dairy and non-dairy cattle (other cattle) for the whole time series (section 5.2.1.2, table 5-11, pp.239–240).
A.5	3.A.1 Dairy cattle – enteric fermentation – CH ₄ (A.33, 2019) Transparency	Report in the NIR the results of the planned validation of the tier 2 EF for dairy cattle.	Not resolved. The Party did not report in the NIR the results of the planned validation of the tier 2 EF for dairy cattle. During the review, Czechia explained that it is working in collaboration with experts from the Faculty of Agriscience at Mendel University in Brno and from the Ministry of Agriculture. The Party further explained that the planned validation of the tier 2 methodology for dairy cattle that started in 2021 will consist of several steps, beginning with the collection of relevant data on feed properties and the revision of the calculation of gross energy values.

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A.6	3.A.1 Dairy cattle – enteric fermentation – CH ₄ (A.33, 2019) Consistency	If the planned validation of the tier 2 EF for dairy cattle (see ID# A.5 above) reveals inconsistencies in the time series, revise the calculation of the country-specific EF and recalculate the time series accordingly.	Not resolved. The Party did not report in the NIR the results of the planned validation of the tier 2 EF for dairy cattle (see ID# A.5 above).
A.7	3.A.1 Non-dairy cattle – CH ₄ (A.34, 2019) Transparency	Provide more detailed information on the input parameters used in estimating the weighted average of the CH ₄ conversion rate and its trend in its next annual submission.	Resolved. The Party provided in the NIR (section 5.2.1.2, table 5-9, p.238) more detailed information on the livestock population and default Y _m values from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.12) used in estimating the weighted average of the CH ₄ conversion rate for the inventory year but did not provide information to explain the trend for non-dairy cattle. During the review, Czechia explained that there is no trend in the values of Y _m used for the estimation. The value is calculated as a weighted average on the basis of the populations of different livestock subcategories. The value of Y _m has therefore been between 0.059 and 0.060 for the entire time series.
A.8	3.B Manure management – CH ₄ (A.7, 2019) (A.6, 2017) (A.6, 2016) (A.6, 2015) (57(b), 2014) Transparency	Provide the data used to estimate the weighted EF for non-dairy cattle at an animal subcategory level in the NIR, including livestock population statistics, body weight, excretion of VS, B _o and animal waste management system allocation.	Resolved. The Party included in the NIR (table 5-19, p.248) the data used to estimate the weighted EF for non-dairy cattle at an animal subcategory level, including livestock population statistics, body weight, excretion of VS, B _o and animal waste management system allocation.
A.9	3.B Manure management – CH ₄ and N ₂ O (A.12, 2019) (A.27, 2017) Transparency	Provide in the NIR the rationale for the use of region-specific parameters (Nex values for manure management of swine).	Resolved. The Party explained in the NIR (section 5.2.2.2.3, p.251) that it used a new country-specific value of Nex, which was derived from national legislation (implementing decree 377/2013 Coll.) on the storage and use of fertilizers. This decree provides values for average annual nitrogen production, calculated per unit of livestock, which were used as coefficients to calculate the Nex rate. The ERT considers the issue to be resolved because the Party no longer uses IPCC default Nex values for manure management of swine.
A.10	3.B.1 Cattle – CH ₄ (A.13, 2019) (A.14, 2017) (A.24, 2016) (A.24, 2015) Transparency	Clarify in the NIR which MCFs are derived from which source.	Resolved. The Party included a list of MCF values used for estimating emissions from manure management in the NIR (table 5-20, p.249), which are taken from the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.17).
A.11	3.B.1 Dairy cattle – CH ₄ (A.35, 2019) Transparency	Provide in the NIR the input data used for the tier 2 calculations for CH ₄ emissions from dairy cattle across the time series, as well as a description of the specific parameters used and the rationale for significant changes in their trends.	Resolved. The Party provided the input data used for the tier 2 calculations for CH ₄ emissions from dairy cattle for 2019 in the NIR (tables 5-19–5-20, pp.248–249). Czechia also provided values of key parameters and AD used for tier 2 calculations for CH ₄ emissions from dairy cattle for the time series, including fractions of manure handled in various MMS (table 5-15, pp.245–246), gross energy values (table 5-18, p.248) and

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			amounts of VS (table 5-21, pp.249–250). The Party further included the rationale for significant trend changes in the NIR (section 5.2.2.2.2, p.247).
A.12	3.B.1 Non-dairy cattle – N ₂ O (A.36, 2019) Transparency	Include in the NIR details of the underlying parameters, including a reference to their sources, used in the tier 2 calculations to determine the N ₂ O emissions across the time series.	Addressing. The Party explained during the review that it included in the NIR (section 5.2.2.2.3, tables 5-24–5-25, pp.251–252) details of the underlying parameters, including a reference to their sources, used in the tier 2 calculations to determine the N ₂ O emissions across the time series. These include AD (e.g. livestock population), input data and calculated data used for estimation of the Nex rate for 2019. However, Czechia did not provide this information across the whole time series in the NIR. During the review, the Party explained that, while the NIR (table 5-28, p.255) provides a comparison of the Nex values used for the 2020 and 2021 submissions, an overview of the evolution of Nex values across the time series will be included in the next annual submission.
A.13	3.B.3 Swine – CH ₄ (A.15, 2019) (A.15, 2017) (A.25, 2016) (A.25, 2015) Accuracy	Consider swine a significant species for CH ₄ emissions from manure and apply a tier 2 method to estimate CH ₄ emissions from manure management for swine.	Not resolved. The Party did not apply a tier 2 method to estimate CH ₄ emissions from manure management for swine. Czechia explained in its NIR (section 5.2.2.6, p.258) plans to develop tier 2 methods for this category. During the review, the Party further explained that a tier 2 method will be applied for the category for the next annual submission, in line with the improvement plan based on the recent review by the EU effort-sharing decision technical expert review team, which provided a technical correction demonstrating how to estimate CH ₄ emissions for swine using the tier 2 method. Czechia noted that the planned recalculation will be prepared on the basis of national legislation (implementing decree 377/2013 Coll.), and with country-specific data on VS according to different age categories of swine.
A.14	3.B.3 Swine – N ₂ O (A.18, 2019) (A.30, 2017) Transparency	Provide a rationale for the decreases in typical animal mass and Nex for swine in the NIR by explaining that they are mainly a consequence of the food market requirements for low-fat pork and by including any other relevant information.	Not resolved. The Party did not include in the NIR the data used to estimate Nex for all swine subcategories to clarify the reported trends. During the review, the Party reported that it used the country-specific Nex values based on national legislation (implementing decree 377/2013 Coll.) that includes detailed information about the average weight of swine of different ages and genders. Czechia explained that the requested information is available in the data source, but not in the NIR text and could be included in the NIR of the next annual submission. The ERT considers that including in the NIR the data used to estimate Nex for all swine subcategories will help to address this issue.
A.15	3.B.4 Other livestock – CH ₄ (A.27, 2019) Transparency	Improve the transparency of the reporting by providing in the NIR a more detailed description of the category poultry and ensuring consistent reporting of the category between the NIR and CRF table 3.B(a).	Resolved. The Party provided in the NIR (table 5-29, p.256) a more detailed description of CH ₄ emissions from manure management for the poultry category, including a detailed breakdown of the fraction of manure nitrogen for each MMS across the time series. Czechia also reported consistent information on the CH ₄ IEF for the category across the NIR and CRF table 3.B(a).
A.16	3.D.a Direct N ₂ O emissions from managed soils – N ₂ O (A.28, 2019) Transparency	Improve reporting on recalculations by clearly documenting and justifying all recalculations in the NIR in line with	Resolved. The Party provided in the NIR (section 5.4.5, pp.265–266) specific information on the recalculations made for category 3.D.a (direct N ₂ O emissions from managed soils) at subcategory level, including the type of recalculation (e.g. correcting an error or incorporating updated AD) and its impact on the emission estimates for the

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A.17	3.D.a.2 Organic nitrogen fertilizers – N ₂ O (A.37, 2019) Transparency	paragraph 45 of the UNFCCC Annex I inventory reporting guidelines. Include in the NIR further information on the selected method for extrapolation of data (on amount of sewage sludge applied to managed soils) for 1990–2001 and on how the consistency of the time series is ensured.	subcategory. A comparison of N ₂ O emissions and input data used for the 2020 and 2021 submissions is available in the NIR (table 5.41, p.266). Resolved. The Party included in the NIR (section 5.4.2.2, p.261) information on the selected method for extrapolation of data for 1990–2001 on the amount of sewage sludge applied to managed soils and on how the consistency of the time series is ensured. Czechia explained that the data reported on the amount of sewage sludge applied to managed soils for 1990–2002 were estimated using linear regression on the basis of the trend in known AD for 2003–2016.
A.18	3.D.a.5 Mineralization/immobilization associated with loss/gain of soil organic matter – N ₂ O (A.38, 2019) Transparency	Provide the correct value for the carbon to nitrogen ratio and all other underlying data used for estimating emissions from the mineralization of soil organic matter under cropland remaining cropland in the relevant section of the agriculture chapter of the NIR.	Addressing. The Party provided the correct value for the carbon to nitrogen ratio (10) in line with the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.16) in the NIR (section 5.4.2.2, p.264). However, it did not provide the AD used for estimating emissions from the mineralization of soil organic matter under cropland remaining cropland in the relevant section of the agriculture chapter of the NIR. Czechia explained in the NIR that the LULUCF sector provides relevant AD on soil CSC in cropland remaining cropland (CRF table 4.B.1). During the review, the Party explained that it provided the relevant information in the NIR without specifying where it was provided.
A.19	3.D.b Indirect N ₂ O emissions from managed soils – N ₂ O (A.23, 2019) (A.19, 2017) (A.13, 2016) (A.13, 2015) (63, 2014) (68, 2013) Accuracy	Improve the reporting of indirect emissions from soils by, for example, harmonizing the reporting of ammonia emissions to different international bodies or by using well-documented national data.	Not resolved. The Party explained in the NIR (section 5.4.6, p.266) that it is planning improvements to provide a consistent nitrogen balance approach in the estimation of the amount of manure nitrogen applied to agricultural soils by harmonizing this with the reporting conducted under the United Nations Economic Commission for Europe. However, Czechia did not provide details of this work or include preliminary results in the NIR. During the review, the Party explained that it is working with experts from CRI and CHMI on the national nitrogen balance in the agriculture sector. As a first step, the input data (e.g. on MMS, Nex rate, inorganic fertilizers, digestate amount and amount of manure) have been validated and differences between the estimated inputs (e.g. fraction of nitrogen in crop residues) have been analysed. The ERT considers that including details on the ongoing work on harmonization of the nitrogen balance in the planned improvements section of the NIR will help to address this issue.
A.20	3.D.b Indirect N ₂ O emissions from managed soils – N ₂ O (A.29, 2019) Transparency	Improve the reporting on recalculations by clearly documenting and justifying all recalculations regarding N ₂ O emissions from the atmospheric deposition of nitrogen in the NIR in line with paragraph 45 of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. The Party performed recalculations for the category between its 2020 and 2021 submissions. However, Czechia did not clearly document or justify recalculations that resulted in the changes in estimated N ₂ O emissions from the atmospheric deposition of nitrogen in the NIR. During the review, Czechia explained that all recalculations are well documented and described in the NIR (section 5.4.5, pp.265–266). However, as noted above, the information provided does not address N ₂ O emissions from the atmospheric deposition of nitrogen.
A.21	3.D.b.1 Atmospheric deposition – N ₂ O (A.25, 2019) (A.36, 2017)	Include the use of a higher-tier method for the estimation of indirect N ₂ O emissions from atmospheric deposition in the	Not resolved. The Party did not include in the planned improvements for category 3.D listed in the NIR (section 5.4.6, p.266) the use of a higher-tier method for the estimation of indirect N ₂ O emissions from atmospheric deposition with a corresponding timetable.

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	Convention reporting adherence	inventory development plan, with a corresponding timetable (harmonization with the reporting under the Convention on Long-range Transboundary Air Pollution is suggested).	During the review, Czechia explained that it is working with CRI and CHMI experts on this issue.
A.22	3.G Liming – CO ₂ (A.39, 2019) Transparency	Include in the NIR further details on the data source (e.g. expert judgment) for the share of dolomite applied and the justification for the 90/10 limestone/dolomite split used.	Addressing. The Party included in the NIR (section 5.7.2, p.267) further details on the data source for the share of dolomite applied. Czechia explained in the NIR as well as during the review that, while the total amount of lime applied to soils reported for 1990–2017 (90 and 10 per cent for limestone and dolomite, respectively) was based on expert judgement owing to a lack of information in the Czech Statistical Yearbook, the availability of more accurate AD on dolomite consumption from the Ministry of Agriculture for 2018–2019 made it possible to estimate more accurately the proportion of limestone and dolomite consumption in 2018–2019. However, the Party did not explain in the NIR the basis for the expert judgment used to derive the total amount of lime applied to soils reported for 1990–2017.
LULUCF			
L.1	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O (L.22, 2019) Transparency	Increase the transparency of LULUCF reporting by including in the NIR a more detailed explanation of the changes occurring in relation to national forest resources, and in particular harvesting, to explain the large inter-annual variation in net LULUCF emissions and removals (net removals decreased by 58.6 per cent between 2016 and 2017).	Resolved. The Party reported in its NIR (section 6.4.1, pp.281–285) more information on the changes occurring in relation to national forest resources, including a table of harvest data by disturbance type (table 6-6, p.285) and the background to the recent insect outbreak.
L.2	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O (L.22, 2019) Consistency	Review all EFs and parameters associated with harvest emissions that may have changed due to the type of forest being harvested given the large changes that are currently being observed, revise the estimates if necessary and ensure the consistency of the reported time series.	Not resolved. The Party did not review the EFs or parameters associated with harvest emissions or revise the estimates. Czechia did not transparently list EFs or parameters associated with harvest emissions. As explained during the review, the Party reported in its NIR (section 6.4.2.1, pp.285–291) the methodology used to estimate carbon loss in forest land remaining forest land, along with an additional parameter to represent additional removals of solid wood and forest residues.
L.3	4.A.1 Forest land remaining forest land – CO ₂ (L.6, 2019) (L.3, 2017) (L.2, 2016) (L.2, 2015) (71, 2014) (76, 2013) (90, 2012) Accuracy	Use the results of the next NFI, when they are available, to estimate CSC in the dead organic matter pool.	Resolved. The Party used data from the first and second NFIs to estimate CSC in deadwood. Czechia explained in the NIR (section 6.4.1, p.282) that there have been two NFIs, covering 2001–2004 and 2011–2015, respectively. The results of the second NFI were released between 2016 and 2019. Regarding litter, the Party explained in the NIR (section 6.4.2.1, p.289) that only the data from the first CzechTerra landscape inventory cycle (2008–2009) are available and these data are not sufficient for estimating CSC in litter for category 4.A.1. During the review, the Party explained that it used the available

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L.4	4.A.1 Forest land remaining forest land – CO ₂ (L.11, 2019) (L.14, 2017) Accuracy	Use the auxiliary data to estimate CSC in deadwood and litter, or review and document in the NIR the likely significance of the deadwood and litter pools.	NFI data for the dead organic matter pool, which originate from the first two NFIs, and the estimates could be revised once updated data from the third NFI are available. Addressing. The Party reported the estimates of CSC in deadwood in its NIR (section 6.4.2.1, p.289) and CRF table 4.A on the basis of the first two NFIs (see ID# L.3 above). Regarding litter, Czechia uses the tier 1 assumption of no change (section 6.4.2.1, p.289). The ERT considers that additional evidence of the likely insignificance of CSC in litter pools should be provided in the NIR to allow for the determination of the appropriate tier to be used for estimating it for forest land remaining forest land. During the review, the Party clarified that the inventory team is preparing revised estimates for CSC in deadwood and litter using a tier 3 method (estimation of key processes and flows affecting CSC in these pools using the Carbon Budget Model of the Canadian Forest Sector (Kull et al., 2016)), which will be included in the next annual submission, replacing the current estimate.
L.5	4.A.1 Forest land remaining forest land – CO ₂ (L.12, 2019) (L.14, 2017) Accuracy	Review and document in the NIR the likely significance of the soils pool.	Addressing. The Party did not review or document the likely significance of the soils pool. The Party reported in its NIR (section 6.4.2.1, p.289) that the verification data for forest soil CSC under category 4.A.1 will be available from the repeated quantitative forest soil surveys conducted as part of the NFI programme. During the review, the Party clarified that the quantitative soil survey of SOC stocks, first performed under the second NFI, will continue under the third NFI and allow for the use of the stock change method to estimate changes in the soil carbon pool.
L.6	4.A.1 Forest land remaining forest land – CO ₂ (L.23, 2019) Convention reporting adherence	Revise the notation keys reported for the litter and soils pools in CRF table 4.A, noting that “NA” is to be reported in the CRF tables for the tier 1 assumptions provided in the 2006 IPCC Guidelines for carbon stocks in equilibrium.	Not resolved. The Party reported “NO” for CSC in the litter and soils pools over the entire time series in CRF table 4.A. During the review, Czechia indicated that it is working on a tier 3 model-based estimation of dead organic matter and soils (see NIR section 6.4.6, p.296) and that different notation keys will likely be reported in the next annual submission.
L.7	4.A.1 Forest land remaining forest land – CO ₂ (L.24, 2019) Consistency	Report a consistent time series for deadwood by using a tier 2 approach as applied for 2004–2015 or by applying an appropriate technique in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 5.3.3).	Resolved. The Party reported a consistent time series for deadwood by using a tier 2 stock-difference approach in its NIR (section 6.4.2.1, p.289) and CRF table 4.A.
L.8	4.D Wetlands (L.18, 2019) (L.18, 2017) Transparency	Explain in the NIR which IPCC wetlands subcategories (flooded land and peat extraction lands) are not estimated and the reason for not estimating them (e.g. because no guidance is provided in the 2006 IPCC Guidelines or because they are not occurring); or, if subcategories are not	Resolved. The Party provided the reasons for not reporting emissions and removals from peat extraction and flooded land remaining flooded land under category 4.D.1 in the NIR (section 6.7.2, p.306) and for reporting all the emissions and removals under the subcategory 4.D.1.3 (other wetlands remaining other wetlands) (see ID# L.9 below). During the review, the Party explained that it used the correct notation key (“NA”) to report the wetlands subcategories that are not responsible for emissions or removals (e.g. peatland remaining peatland) as recommended by ERT. The ERT notes that including a

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		estimated because the Party considers that the emissions are insignificant, provide a calculation of the likely level of emissions to demonstrate that they are below the significance threshold described in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. For categories for which emissions or removals are occurring but they have not been estimated, report “NE” in the CRF tables.	table similar to that in the 2006 IPCC Guidelines (vol. 4, chap. 7, table 7.3) containing the wetlands classification and allocation of emissions and removals, or the reason for not estimating them, would help to address this issue.
L.9	4.D Wetlands (L.19, 2019) (L.18, 2017) Transparency	Explain transparently the definition or criteria applied under the cadastral subcategories used in the national definition of wetlands and the procedure for allocating these to the IPCC definitions.	Resolved. The Party provided the national definitions used for wetlands in the NIR (table 6-4, pp.276–277). According to these definitions, wetlands include land with watercourses and riverbeds, reservoirs, marshes, wetlands, swamps and land with areas that are waterlogged (by marsh, wetland or swamp). Czechia included a reference in the NIR (section 6.7.1, p.306) to the amendment to the Cadastral Decree (357/2013 Coll.), where definitions and further details on the land-use category are given. The Party also explained in the NIR that it makes no further alteration to the default categorization provided by the Czech Office for Surveying, Mapping and Cadastre and, accordingly, reports all wetlands consistent with the national definition of wetlands under the subcategories other wetlands remaining other wetlands (4.D.1.3) and land converted to other wetlands (4.D.2.3) in the CRF tables.
L.10	4.E.2 Land converted to settlements – CO ₂ (L.26, 2019) Accuracy	Correct the error detected for reference SOC for settlements and recalculate all soil CSC estimates involving land-use conversions to and from settlements in line with the 2006 IPCC Guidelines (vol. 4, chap. 8, p.8.24).	Resolved. The Party performed recalculations of all CSC estimates involving land-use conversions to and from settlements to correct the error in reference SOC used for settlements, as reported in its NIR (section 6.8.2, p.309) and CRF tables, including table 4.E.
L.11	4.G HWP – CO ₂ (L.27, 2019) Convention reporting adherence	Complete the data entry for CRF table 4.Gs2 by including the information for 1961–1989.	Not resolved. The AD on HWP for 1961–1989 are included in the NIR (section 6.10.2, table 6-12, p.312), but not in CRF table 4.Gs2. During the review, the Party indicated that the data will also be included in the CRF tables in the next annual submission.
Waste			
W.1	5.A Solid waste disposal on land – CH ₄ (W.2, 2019) (W.1, 2017) (W.2, 2016) (W.2, 2015) (78, 2014) (84, 2013) Transparency	Improve the transparency of the inventory by including in the NIR the information that, in Czechia, waste legislation was established before the EU landfill directive and that management conditions of landfills were gradually improving even	Resolved. The Party reported in its NIR (section 7.2.1.2, p.317) information on legislation before the EU landfill directive, the management conditions of landfills before 1990 and a description of national legislation on landfill management practices.

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		before 1990, together with a description of the national legislation concerning landfill management practices.	
W.2	5.A.1 Managed waste disposal sites – CH ₄ (W.5, 2019) (W.10, 2017) Transparency	Provide sufficient explanation of waste categorization AD, including information on industrial waste, in the NIR.	Resolved. The Party included sufficient explanation of waste categorization AD, including information on industrial waste, in its NIR (section 7.2.1.2, figure 7.3 and table 7.2, pp.317–319). Czechia explained that the method is based on the interpolation, extrapolation and correlation of waste production with the social product (predecessor of gross domestic product) as a test method, where constant percentages for various waste categorization streams were used. The Party uses various assumptions on factors and a categorization of different waste streams from Havránek (2007). Regarding industrial waste, the Party explained that, although ISOH AD on waste categorization include industrial waste, the AD are not disaggregated. As such, AD on industrial waste are derived from residual factors available from CZSO together with AD from ISOH.
W.3	5.A.1 Managed waste disposal sites – CH ₄ (W.6, 2019) (W.10, 2017) Accuracy	Compare the two data sources (the ISOH database and Eurostat) as a verification analysis to confirm that the AD reported in the annual submission are complete.	Addressing. The Party presented in its NIR (section 7.2.1.2, figure 7.5, p.318) a comparison of data from Eurostat and ISOH for 2010–2019 on the amounts of waste disposed of at SWDS in Czechia, which shows significant differences across the time series. However, the Party did not provide a verification analysis to confirm the completeness of the AD. During the review, Czechia provided the ERT with detailed information on AD and calculations, which confirmed that the AD are complete. The Party also explained that, although it used a hybrid approach combining data from ISOH and Eurostat to address the recommendation from the previous review, it plans to change to an approach using only the more specific ISOH data. The Party noted that CZSO has changed its methodology to make its data more consistent with the ISOH data.
W.4	5.A.1 Managed waste disposal sites – CH ₄ (W.6, 2019) (W.10, 2017) Transparency	Include the results of the verification of the data from ISOH in the NIR.	Not resolved. The Party did not include the results of the verification of the data from ISOH in the NIR following the harmonization of those data. Czechia reported in its NIR (section 7.2.1.6, p.323) that it is still planning to harmonize the ISOH and CZSO data on waste management (see ID# W.3 above).
W.5	5.A.1 Managed waste disposal sites – CH ₄ (W.7, 2019) (W.11, 2017) Accuracy	Provide in the NIR a description of the investigation of the share of sewage sludge disposal streams related to the data from ISOH, including verification by comparing with Eurostat data. If there is sewage sludge disposal to solid waste disposal sites in the country, estimate and report CH ₄ emissions from sewage sludge disposal.	Not resolved. The Party did not provide such a description in the NIR or estimate or report CH ₄ emissions from sewage sludge disposal. The Party reported in the NIR (section 7.2.1.6, p.323) that it plans to improve its reporting of the share of the sewage sludge landfilled by setting up a monitoring system following the results of a waste composition survey. During the review, the Party explained that, although sewage sludge should not be disposed to landfill as waste, it is sometimes used as technical material in landfills. The Party further explained that it will try to estimate CH ₄ emissions from sewage sludge disposal, if there are data on sludge landfilled in the ISOH database.
W.6	5.B Biological treatment of solid waste – CH ₄ and N ₂ O	Implement the improvements planned for this category (estimating emissions from composting for before 2005 and from	Addressing. The Party reported in its NIR (section 7.3.1.6, p.325) on the improvements planned to obtain data on composting for the period before 2005 and to verify the factors used in the estimation. As explained in the NIR, and subsequently during the review, the

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	(W.8, 2019) (W.12, 2017) Completeness	household compost, reviewing the data sources for emissions before 2007 and verifying the factor used for estimated leakages from digestion facilities).	project to improve the reporting on category 5.B.1 (composting) by including household composting is ongoing and due to be finalized in 2022 or 2023, but the results of the waste composition survey that began in 2019 are not yet available.
W.7	5.B Biological treatment of solid waste – CH ₄ and N ₂ O (W.8, 2019) (W.12, 2017) Transparency	Explain the recalculations (see ID# W.6 above) in the NIR.	Resolved. The Party reported in its NIR (section 7.3.1.5, p.325) that no recalculations were made for the category.
W.8	5.C.1 Waste incineration – CO ₂ , CH ₄ and N ₂ O (W.17, 2019) Transparency	Include in the NIR all recalculations made, together with detailed explanations.	Addressing. The Party reported in its NIR (section 7.4.1.5, p.331) that the whole category was recalculated to address the recommendation from the previous review. As a result, the waste category was divided into four waste streams (subcategories) as per the 2006 IPCC Guidelines (vol. 5, chap. 2, pp.2.4–2.10): municipal solid waste, clinical waste, sewage sludge and industrial waste. During the review, Czechia explained that it included recalculations with explanations in the NIR and will report all the recalculations transparently in future annual submissions. However, the ERT considers that the recommendation has not yet been fully addressed because the emissions for the four subcategories are still presented under one category in the NIR (figure 7.9, p.331) without showing disaggregated data on CO ₂ , CH ₄ and N ₂ O emissions for each subcategory. Also, the Party did not provide a detailed explanation of the recalculations made, including data and information about waste incineration prior to 2005.
W.9	5.C.1 Waste incineration – CO ₂ (W.18, 2019) Accuracy	Make an effort to report emissions for the different waste types separately. If this is not possible, provide information in the NIR on the specific types of waste incinerated and their estimated shares, including justification for using the default parameters for industrial waste instead of specific parameters for industrial, clinical and fossil liquid waste.	Addressing. The Party reported in CRF table 5.C the AD and emissions for hazardous waste using the notation key “IE”, while reporting values for other subcategories. During the review, the Party explained that it reported the different waste types separately in the NIR (section 7.4.1.2, pp.328–330). However, the ERT considers that the recommendation has not yet been resolved because the Party has not yet reported the emissions and AD separately by waste subcategory, and data for prior to 2005 have yet to be gathered. The ERT noted the Party’s acknowledgement, as mentioned in the NIR (section 7.4.1.6, p.332), that this category could be improved by a more thorough study of data and information on waste incineration prior to 2005.
W.10	5.D.1 Domestic wastewater – CH ₄ (W.13, 2019) (W.14, 2017) Transparency	Provide a more transparent and accurate explanation of the biogas reduction in the NIR (e.g. clarifying in NIR table 7-16 that the biogas reduction is a fraction of collected TOW, not treated TOW).	Resolved. The Party reported in its NIR (section 7.5.1.2, p.334) the methodological steps and an accurate explanation of the biogas reduction.
W.11	5.D.1 Domestic wastewater – CH ₄ (W.14, 2019) (W.15, 2017) Transparency	Justify in the NIR the selection of MCFs for the three streams of domestic wastewater treatment (uncollected TOW, untreated TOW and treated TOW).	Addressing. The Party included in its NIR (section 7.5.1.2, pp.333–334) a justification for the selection of the three streams of domestic wastewater treatment, including a tabular overview of the MCF values used. However, the Party did not include a justification for using the selected MCF values.

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W.12	5.D.1 Domestic wastewater – CH ₄ (W.15, 2019) (W.16, 2017) Transparency	Provide in the NIR information justifying the use of a constant ratio for biogas reduction prior to 2002.	Not resolved. The Party did not provide in the NIR information justifying the use of a constant ratio for biogas reduction prior to 2002. Czechia reported in its NIR (section 7.5.1.2, table 7.18, pp.334–335) biogas reduction fractions; however, the Party used a constant ratio for biogas reduction (fraction of treated TOW) for prior to 2002. During the review, the Party explained that no data on biogas reduction from domestic wastewater prior to 2002 are available and, as such, biogas reduction (fraction of treated TOW) is estimated on the basis of data on population from CZSO and 2006 IPCC Guidelines default values.
W.13	5.D.2 Industrial wastewater – CH ₄ (W.16, 2019) (W.17, 2017) Transparency	Provide in the NIR information on the MCFs used in the estimations (such information was provided in NIR table 7-22 of the 2016 submission).	Resolved. The Party reported in its NIR (section 7.5.1.2, table 7-18, pp.334–335) information on the MCFs used in estimating CH ₄ emissions from domestic wastewater treatment and discharge. The Party estimated CH ₄ emissions from industrial wastewater treatment and discharge together with those from domestic wastewater treatment and discharge by using a correction factor for additional industrial BOD co-discharged into sewers with domestic wastewater.
KP-LULUCF			
KL.1	AR – CO ₂ , CH ₄ and N ₂ O (KL.3, 2019) (KL.2, 2017) (KL.4, 2016) (KL.4, 2015) Accuracy	Provide information on biomass burning in AR areas and, if it occurs, report the associated emissions.	Resolved. The Party reported the AD for controlled burning of biomass as “NO” for AR areas in CRF table 4(KP-II)4 and stated in its NIR (section 12.3.1.1, p.411) that controlled burning of biomass is confined to FM land. Czechia also explained in the NIR (section 6.4.2.1, p.285) that CH ₄ and N ₂ O emissions from controlled burning were not estimated for land converted to forest land because this practice does not occur in the country. The Party explained that the available AD for biomass burning from wildfires are not spatially explicit and, although the area of biomass burning is complete (in the sense that all burned biomass is accounted for), it is not possible to allocate the AD accurately between AR and FM areas. Czechia therefore applied expert judgment to allocate all the AD and related emissions to FM land and used the notation key “IE” to report the AD and related emissions for biomass burning from wildfires for AR land in CRF table 4(KP-II)4. In response to questions from the ERT during the review on the inaccuracy that this approach may lead to, the Party explained that the project on fire prevention funded by the Ministry of the Interior was completed in 2020, but the spatially explicit data on forest fires from this project are considered confidential and the inventory can therefore only use the spatially implicit estimates.
KL.2	Deforestation – CO ₂ (KL.7, 2019) (KL.3, 2017) (KL.2, 2016) (KL.2, 2015) (87 and 89, 2014) (94, 97 and 98, 2013) Accuracy	Improve the tracking of deforested land, including information on subsequent land-use change and the management practices applied to them.	Addressing. The Party explained in its NIR (section 12.2.4, p.409) that the interim analysis shows that tracking deforested land would not result in any difference in quantified emission estimates beyond estimation error. Czechia outlined in the NIR (section 6.2.5, p.278) its plans to address this issue and highlighted the work of the Czech Office for Surveying, Mapping and Cadastre on digitalizing cadastral land-use information, which was due to be finalized in 2019. During the review, the Party explained that the available vectorized polygon layers allow comparisons of status between different years. However, the digitalization process occurred mostly for the more recent years of the reporting period, which limits the direct attribution to those parts

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			for which digitalization is available. Czechia also indicated that some tentative testing of this approach (comparing vector layers from 2002, 2007 and 2013) shows no secondary land-use change of deforested areas. The Party plans to repeat this exercise with a layer from 2020 and report on its findings in a future NIR.
KL.3	FM – CO ₂ (KL.8, 2019) (KL.1, 2017) (KL.1 and KL.3, 2016) (KL.1 and KL.3, 2015) (86, 2014) (93, 2013) Transparency	Report the correct notation key, “NR”, in CRF table NIR-1 for the deadwood pool, which is reported as “NO” in CRF table 4(KP-I)B.1.	Resolved. The Party reported the correct notation key, “R”, in CRF table NIR-1 for the deadwood pool, which is reported with estimates for the entire time series in CRF table 4(KP-I)B.1.
KL.4	FM – CO ₂ (KL.9, 2019) (KL.5, 2017) (KL.6, 2016) (KL.6, 2015) Completeness	Assess whether CSC in deadwood occurs and, if necessary, report it on the basis of the NFI.	Resolved. The Party reported CSC in the deadwood pool on the basis of the NFI in CRF table 4(KP-I)B.1.
KL.5	FM – CO ₂ and N ₂ O (KL.11, 2019) (KL.14, 2017) KP reporting adherence	Provide information to demonstrate consistency between the FMRL and the reporting of FM, for example by including in the NIR a table comparing the historical time series used in the construction of the FMRL and the reported emissions for the same historical period from the latest annual submission.	Not resolved. The Party did not provide information demonstrating consistency between the FMRL and the reporting of FM. Czechia mentioned in the NIR (section 12.5.3.3, p.415) that it has not yet applied a technical correction to the FMRL and explained that the inventory team will collaborate with the EU Joint Research Centre to calculate a technical correction so that information on it can be included in the next annual submission. During the review, the Party explained that the collaborative work with the EU Joint Research Centre, due to start in September 2021, will also address information demonstrating consistency between the FMRL and the FM reporting and its interpretation.
KL.6	FM – CO ₂ and N ₂ O (KL.12, 2019) (KL.14, 2017) Transparency	Increase the transparency of the demonstration of the methodological consistency between FM and the FMRL by providing additional information on the main drivers of the accounting quantities for FM, in accordance with the Kyoto Protocol Supplement (chap. 2.7.5.2), for example if the increased sink in 2013, 2014 and 2015 relative to the FMRL is caused by a lower harvest rate than applied in the FMRL projection or by a different driver.	Not resolved. The Party did not provide additional information on the main drivers of the accounting quantities for FM in accordance with the Kyoto Protocol Supplement (chap. 2.7.5.2) (see ID# KL.5 above).
KL.7	FM – CO ₂ , CH ₄ and N ₂ O (KL.13, 2019) (KL.16, 2017) Accuracy	Review the checklist in table 2.7.1 of the Kyoto Protocol Supplement and calculate and report a technical correction to ensure methodological consistency between the	Not resolved. The Party did not report a technical correction to ensure methodological consistency between the FMRL and the reporting on FM in the second commitment period (see ID# KL.5 above).

<i>ID#</i>	<i>Issue/problem classification^{a, b}</i>	<i>Recommendation made in previous review report</i>	<i>ERT assessment and rationale</i>
		FMRL and the reporting on FM in the second commitment period.	
KL.8	FM – CO ₂ , CH ₄ and N ₂ O (KL.17, 2019) Transparency	Increase the transparency of reporting on KP-LULUCF by including in the NIR a more detailed explanation of the changes occurring in relation to national forest resources, and in particular harvesting, to explain the large inter-annual variation in removals from FM (removals decreased from –4,387.43 kt CO ₂ eq in 2016 to –1,725.05 kt CO ₂ eq in 2017).	Resolved. The Party reported in its NIR (section 12.5.4, p.417, and section 6.4.1, pp.281–285) more information on the changes occurring in relation to national forest resources, including a table of annual harvest data by disturbance type (table 6-6, p.285) and the background to the recent insect outbreak (see ID# L.1 above).
KL.9	FM – CO ₂ , CH ₄ and N ₂ O (KL.17, 2019) Accuracy	Review all EFs and parameters associated with harvest given the large changes to the type of harvesting that are being observed.	Not resolved. The Party did not review the EFs or parameters associated with harvest emissions or revise the estimates, or transparently list the EFs or parameters associated with harvest emissions (see ID# L.2 above).
KL.10	HWP – CO ₂ (KL.14, 2019) (KL.7, 2017) (KL.8, 2016) (KL.8, 2015) Transparency	Extend the part of the NIR that describes the development of the FMRL and HWP, for increased transparency.	Addressing. The Party reported the additional AD for HWP for 1961–1989 in the NIR (section 6.10.2, pp.311–313). However, no substantial improvement has been made in the description included in the NIR (section 12.5.3.2, p.414) on the method used for constructing the FMRL. During the review, Czechia explained that the input data used by the modelling teams led by the Joint Research Centre were identical to those used for the emissions inventory (i.e. stand-wise forest inventory data nationally administered by the Forest Management Institute), and that these data have been used for all international reporting on forests by the Party. The ERT considers that this information could be included in the next annual submission to increase the transparency of the reporting.

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

^b The report on the review of the 2020 annual submission of Czechia was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2019 annual review report. For the same reason, 2020 and 2018 are excluded from the list of review years in which issues could have been identified.

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

9. In accordance with paragraph 83 of the UNFCCC review guidelines, 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 2021 annual submission of Czechia, and had not been addressed by the Party at the time of publication of this review report.

Table 4

Issues and/or problems identified in three or more successive reviews and not addressed by Czechia

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed^a</i>
General		
G.1	Improve the documentation on how qualitative information (e.g. expert judgment) on key parameters (e.g. the parameters used in the uncertainty analysis) is generated and improve the archiving of this information in order to improve transparency.	3 (2017–2021)
G.2	Provide in the NIR a key category analysis that is prepared in accordance with the 2006 IPCC Guidelines.	4 (2015/2016–2021)
G.4	Use the 2006 IPCC Guidelines as the only guidelines on QA/QC procedures and remove all outdated references to earlier IPCC guidelines from the NIR in order to improve transparency and comparability.	3 (2017–2021)
Energy		
E.3	Revise the estimates and report CO ₂ , CH ₄ and N ₂ O emissions from the biogenic fraction (CH ₄ and N ₂ O emissions reported under category 1.A.2.f; CO ₂ emissions reported as a memo item) of alternative fuels used in non-metallic industry for the whole time series.	3 (2017–2021)
E.5	Obtain more accurate data on jet kerosene consumption for domestic aviation, following the approaches set out in the 2006 IPCC Guidelines (vol. 2, chap. 3.6.1.3), by obtaining either top-down data on jet kerosene consumption from taxation authorities or bottom-up data from surveys of airline companies or air traffic control records (e.g. data from EUROCONTROL on the number of domestic and international flights by aircraft type) (the higher fuel consumption per km for domestic flights should be considered in this approach).	3 (2017–2021)
E.6	Revise the description of emissions under category 1.A.5.b.i (mobile (other)) to indicate that they are emissions from agriculture, forestry and fishing and not from aviation by the army, State institutions or private air transport.	3 (2017–2021)
E.7	Change the notation key for oil exploration to “NE” and indicate in both the NIR and the CRF completeness table why those emissions or removals have not been estimated; and provide in the NIR a justification for the exclusion in terms of the likely level of emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	4 (2015/2016–2021)
IPPU		
I.3	Collect the missing AD for 1990–2006 on mineral wool production and estimate and report CO ₂ emissions.	4 (2015/2016–2021)

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed^a</i>
I.6	Explore the possibility of obtaining additional data directly from the plant (e.g. operating conditions, AD, abatement technology) in order to increase the accuracy of the EF used and the N ₂ O emissions reported.	3 (2017–2021)
I.7	Include information in the NIR on the changes in iron and steel production processes.	6 (2013–2021)
I.8	Include a description of the different processes in iron and steel production occurring in the country, including the different mass flows and the mass balance of inputs and outputs of carbon in each process.	3 (2017–2021)
I.12	Provide in the NIR an explanation of AD, customs statistics and ISPOP data in order to prove the completeness of the estimation of F-gas emissions from imported products.	4 (2015/2016–2021)
Agriculture		
A.13	Consider swine a significant species for CH ₄ emissions from manure and apply a tier 2 method to estimate CH ₄ emissions from manure management for swine.	4 (2015/2016–2019)
A.14	Provide a rationale for the decreases in typical animal mass and Nex for swine in the NIR by explaining that they are mainly a consequence of the food market requirements for low-fat pork and by including any other relevant information.	3 (2017–2021)
A.19	Improve the reporting of indirect emissions from soils by, for example, harmonizing the reporting of ammonia emissions to different international bodies or by using well-documented national data.	6 (2013–2019)
A.21	Include the use of a higher-tier method for the estimation of indirect N ₂ O emissions from atmospheric deposition in the inventory development plan, with a corresponding timetable (harmonization with the reporting under the Convention on Long-range Transboundary Air Pollution is suggested).	3 (2017–2021)
LULUCF		
L.4	Use the auxiliary data to estimate CSC in deadwood and litter, or review and document in the NIR the likely significance of the deadwood and litter pools.	3 (2017–2021)
L.5	Review and document in the NIR the likely significance of the soils pool.	3 (2017–2021)
Waste		
W.3	Compare the two data sources (the ISOH database and Eurostat) as a verification analysis to confirm that the AD reported in the annual submission are complete.	3 (2017–2021)
W.4	Include the results of the verification of the data from ISOH in the NIR.	3 (2017–2021)
W.6	Implement the improvements planned for this category (estimating emissions from composting for before 2005 and from household compost, reviewing the data sources for emissions before 2007 and verifying the factor used for estimated leakages from digestion facilities).	3 (2017–2021)
W.12	Provide in the NIR information justifying the use of a constant ratio for biogas reduction prior to 2002.	3 (2017–2021)
KP-LULUCF		

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed^a</i>
KL.2	Improve the tracking of deforested land, including information on subsequent land-use change and the management practices applied to them.	6 (2013–2021)
KL.5	Provide information to demonstrate consistency between the FMRL and the reporting of FM, for example by including in the NIR a table comparing the historical time series used in the construction of the FMRL and the reported emissions for the same historical period from the latest annual submission.	3 (2017–2021)
KL.6	Increase the transparency of the demonstration of the methodological consistency between FM and the FMRL by providing additional information on the main drivers of the accounting quantities for FM, in accordance with the Kyoto Protocol Supplement (chap. 2.7.5.2), for example if the increased sink in 2013, 2014 and 2015 relative to the FMRL is caused by a lower harvest rate than applied in the FMRL projection or by a different driver.	3 (2017–2021)
KL.7	Review the checklist in table 2.7.1 of the Kyoto Protocol Supplement and calculate and report a technical correction to ensure methodological consistency between the FMRL and the reporting on FM in the second commitment period.	3 (2017–2021)
KL.10	Extend the part of the NIR that describes the development of the FMRL and HWP, for increased transparency.	4 (2015/2016–2021)

^a Reports on the reviews of the 2018 and 2020 annual submissions of Czechia 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 2021 annual submission

10. Table 5 presents findings made by the ERT during the individual review of the 2021 annual submission of Czechia that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2021 annual submission of Czechia

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
General			
G.5	Annual submission	The Party reported a general assessment of completeness in its NIR (section 1.7, p.46) and included a reference to CRF table 9, which includes explanations for reporting categories as “NE”. Although the Party reported the emissions for some categories (see ID#s E.7 in table 3 and I.28 below) as “NE” on the basis of their likely insignificance as per paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, it did not include information confirming that the total national aggregate estimated emissions for all gases and categories considered insignificant remain below 0.1 per cent of the national total GHG emissions. The ERT noted that this is not in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. During the review, Czechia clarified that it considers the aggregate level of emissions from	Yes. Completeness

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		<p>insignificant categories to be under 0.1 per cent of the national total emissions on the basis of expert judgment and the reasons listed in CRF table 9, and this information will be included in the next annual submission.</p> <p>The ERT recommends that the Party provide information in the NIR and the CRF tables on the likely level of significance for categories considered insignificant in terms of the overall level of and trend in national emissions and thus reported as “NE” as per paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, and show in the NIR that the total national aggregate estimated emissions for all such gases and categories reported as “NE” remain below 0.1 per cent of the national total GHG emissions.</p>	
G.6	Key category analysis	<p>The Party reported in its NIR (section 1.5, pp.43–45) and CRF table 7 a key category analysis using approach 1, level and trend assessment, including and excluding LULUCF. The Party appears to use a similar disaggregation level in the NIR as that provided in the 2006 IPCC Guidelines (vol. 1, chap. 4, table 4.1) and CRF table 7 with very minor differences, such as disaggregating to category 1.A.5.b (other (not specified elsewhere) – liquid fuels (mobile combustion) – CO₂). While the analysis in the NIR and the CRF tables is similar, the key categories identified in the NIR differ from those identified in CRF table 7. For example, CRF table 7 identifies categories 1.A.1 (fuel combustion – energy industries – liquid fuels – CO₂) and 2.B.2 (nitric acid – N₂O) as key categories using the approach 1 trend assessment including and excluding LULUCF, yet they are not identified as key categories in the analysis presented in the NIR. Czechia did not include information on the level of category disaggregation and its rationale in the NIR and the ERT noted that this is not in accordance with paragraph 50(ii) of the UNFCCC Annex I inventory reporting guidelines. During the review, the Party explained that the levels of disaggregation used for the key category analyses presented in the NIR and CRF table 7 are the same apart from those minor differences in naming conventions. The differences in key categories identified occurred because of errors in the implementation of the key category analysis for the NIR, which, once corrected, will eliminate them.</p> <p>The ERT recommends that Czechia address errors in implementing the key category analysis using approach 1, level and trend, for the base and most recent inventory year, including and excluding LULUCF, ensure consistency in the information on key category analysis presented in the NIR and CRF table 7 (especially if continuing to use the same disaggregation level) and include information on the level of category disaggregation and the rationale for its use in the NIR.</p> <p>The ERT encourages the Party to use the good practice guidance and suggested aggregation level of analysis for approach 1 provided in the 2006 IPCC Guidelines (vol. 1, chap. 4, table 4.1), assessing and including the significance of subcategories, and to further disaggregate its inventory to improve the quality.</p>	Yes. Convention reporting adherence
G.7	QA/QC and verification	<p>The Party reported details on its QA/QC and verification plan and approach to implementing routine QC procedures and activities in its NIR (section 1.2.3, pp.24–39, and annex A5.5, pp.510–517), including descriptions of sectoral roles and specific checklists applied. The ERT noted that there are calculation errors in the key category analysis and recalculation summary in NIR tables 10-3–10-6 (pp.362–365), inconsistencies between the NIR and the CRF tables (see ID#s E.10 in table 3 and I.31 below) and some typographical errors (e.g. year of analysis identified in uncertainty tables A2-1–A2-6 in the NIR). During the review, Czechia acknowledged that there have been QC issues with recent annual submissions regarding cross-cutting issues and specific sectors, in particular where significant improvements have been implemented to move to higher methodological tiers. The Party noted that issues often arise when data or estimates are received late in the compilation process, which leaves insufficient time to carry out QC. Czechia highlighted a number of actions that it is taking to update QC planning and implementation to identify and address errors in future annual submissions, namely using the updates made during the review to address errors in the key category analysis spreadsheet for the next key category</p>	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		analysis; implementing additional automated checks, where possible; enhancing communication with sector experts to identify how QC procedures could be improved; and continuing with the ongoing multi-year capacity-building effort on sector-specific QC with national experts to ascertain the reason for and nature of each check and how and when it is conducted and, if needed, repeating the QC at different stages of the NIR development process (already completed for three of five sectors).	
		The ERT commends the Party for its efforts to update and enhance implementation of QC procedures and encourages it to continue this work and reflect significant updates to procedures in future annual submissions.	
G.8	Recalculations	The Party has improved its inventory and implemented recalculations for the agriculture and LULUCF sectors since its previous submission. However, the recalculations were either not included or insufficiently explained in the NIR (see ID#s I.29, A.23–A.26 and L.14 below). The ERT noted that this is not in accordance with paragraphs 43–45 and 50(h) of the UNFCCC Annex I inventory reporting guidelines, which state that recalculations should be reported in the NIR for all applicable years with explanatory information and justification. During the review, the Party provided additional information regarding the reasons for and impact of the recalculations (e.g. correcting errors or incorporating new AD).	Yes. Transparency
		The ERT recommends that the Party provide in the NIR information on the impact of any recalculations, as well as explanatory information on and justification for the recalculations, in accordance with paragraphs 43–45 and 50(h) of the UNFCCC Annex I inventory reporting guidelines.	
G.9	Uncertainty analysis	The Party reported in its NIR the results of its uncertainty analysis using approach 1 from the 2006 IPCC Guidelines (vol. 1, chap. 3, section 3.2.3) including and excluding LULUCF for the most recent inventory year (2019) and a description of trend uncertainty analysis (section 1.6, p.46) and detailed tables (annex 2, pp.465–477). However, the Party did not report results of the uncertainty analysis for the base year under the Convention (1990). The ERT noted that this is not in accordance with paragraph 15 of the UNFCCC Annex I inventory reporting guidelines, which requires Parties to quantitatively estimate and report uncertainties for the base year in addition to the latest inventory year and the trend uncertainty between those years. During the review, the Party explained that the uncertainty level for the base year (1990) has not been estimated but will be estimated and reported in a future NIR.	Yes. Convention reporting adherence
		The ERT recommends that the Party include in the NIR an uncertainty assessment for 1990 (the base year under the Convention).	
G.10	Uncertainty analysis	The Party reported the quantitative estimation of uncertainty for most source and sink categories included in its inventory for the most recent inventory year (2019) along with the trend uncertainty. Czechia did not quantitatively estimate uncertainty for PFCs from integrated circuits or semiconductors (category 2.E.1), CO ₂ from pulp and paper processes (category 2.H.1) or hydrofluoroolefins from use in refrigeration and air conditioning (category 2.H.3 (other)). The ERT noted that this is not in accordance with paragraph 15 of the UNFCCC Annex I inventory reporting guidelines, which states that Parties shall quantitatively estimate the uncertainty of the data used for all source and sink categories using at least approach 1 from the 2006 IPCC Guidelines. During the review, the Party explained that these uncertainties were not estimated for these categories but will be estimated for the next annual submission.	Yes. Convention reporting adherence
		The ERT recommends that the Party quantitatively estimate uncertainty for PFCs from integrated circuits or semiconductors (category 2.E.1), CO ₂ from pulp and paper processes (category 2.H.1) and hydrofluoroolefins from use in refrigeration and air conditioning (category 2.H.3 (other)).	

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
Energy			
E.13	1.A.1.a Public electricity and heat production – solid fuels – CO ₂ , CH ₄ and N ₂ O	<p>The inter-annual change in the AD on fuel consumption for category 1.A.1.a.i (electricity generation – solid fuels) between 2009 and 2010 (305.9 per cent) is considered significant both across the time series and among other reporting Parties. During the review, the Party explained that this was because the reporting of consumption of solid fuels in electricity cogeneration was historically performed on the basis of CZSO reports at company level, which did not allow for a more detailed breakdown for possible analyses. Czechia further explained that, following a change in the statistical methodology of the Energy Regulatory Office that enabled the monitoring of cogeneration at the level of individual sources for 2014 onward, it has adopted a new methodology for reporting cogeneration and revised the methodology used back to 2010. The Party acknowledged the inconsistency and explained that it will reallocate the AD on fuel consumption for electricity cogeneration to category 1.A.1.a.ii (combined heat and power generation) in its next annual submission.</p> <p>The ERT recommends that the Party recalculate emissions from electricity generation for solid fuels for 1990–2009 by reallocating the AD on fuel consumption to category 1.A.1.a.ii (combined heat and power generation) and ensure consistent reporting of subcategories 1.A.1.a.i (electricity generation – solid fuels) and 1.A.1.a.ii (combined heat and power generation) across the time series.</p>	Yes. Comparability
E.14	1.A.1.a Public electricity and heat production – gaseous fuels – CO ₂	<p>The inter-annual changes in the AD on fuel consumption for category 1.A.1.a.ii (combined heat and power generation – gaseous fuels) are significant across the time series: 1994–1995 (53.28 per cent), 2006–2007 (–20.48 per cent), 2007–2008 (–30.25 per cent) and 2009–2010 (31.13 per cent). During the review, the Party explained that the share of gaseous fuels in total consumption in 1994 and 1995 was 1.8 and 2.4 per cent, respectively, which corresponds to a fluctuation of 0.6 per cent in terms of all fuels in the sector. Czechia further explained that such fluctuations are common and are based on the fuel market and legislative requirements, and noted that the explanation provided during the review will be included in its next annual submission.</p> <p>The ERT recommends that the Party include in the NIR an explanation of the trend in fuel consumption for combined heat and power generation.</p>	Yes. Transparency
E.15	1.A.1.a Public electricity and heat production – other fossil fuels and biomass – CH ₄ and N ₂ O	<p>The Party reported the recalculated estimates of CH₄ and N₂O emissions for other fossil fuels and biomass in category 1.A.1.a (public electricity and heat production), which differ significantly from the previously reported estimates for emissions from other fossil fuels (CH₄ 150.0 per cent and N₂O 150.0 per cent for 1990–2018) and biomass (CH₄ –95.3 per cent and N₂O –17.3 per cent for 2018). During the review, the Party explained that this difference was caused by an error in the calculation files for subcategories and that it will report the correct data in its next annual submission. After the correction, the estimates of emissions will be same as in the 2020 submission. The ERT noted that the underestimations stemming from this error are below the threshold of significance for Czechia and therefore do not lead to a potential problem. For example, this error results in an underestimation of emissions amounting to 17 kt CO₂ eq for 2019, which is below the threshold of significance for Czechia (61 kt CO₂ eq).</p> <p>The ERT recommends that the Party correct the error identified and recalculate CH₄ and N₂O emissions (other fossil fuels and biomass) for category 1.A.1.a (public electricity and heat production) for the entire time series.</p>	Yes. Accuracy
E.16	1.A.1.b Petroleum refining – liquid	<p>The inter-annual changes in CO₂ emissions for category 1.A.1.b (petroleum refining – liquid fuels) between the following years of the time series were noted as significant compared with other Parties: 1993–1994 (103.67 per cent), 1994–1995 (–61.26 per cent), 1995–1996 (67.07 per cent), 1998–1999 (49.65 per cent), 2000–2001 (53.76 per cent), 2014–2015 (–39.97 per cent) and 2016–2017 (42.70 per cent). During the review, the Party explained that the annual increases until 2008 were</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
	fuels – CO ₂ , CH ₄ and N ₂ O	<p>the result of a global trend of growth in petroleum refining. On the basis of information received from ORLEN Unipetrol, the biggest oil processing company in Czechia, the decline in 2015–2016 was because of an accident at its ethylene unit, which caused the shutdown of the refining industry until 2016. Czechia noted that it explained the decrease in ethylene production in the NIR in the relevant section of the IPPU chapter (section 4.3.8, p.190). However, the ERT noted that including in the NIR information on the trend in CO₂ emissions for category 1.A.1.b (petroleum refining – liquid fuels), including by adding cross references to the IPPU chapter, would enhance the transparency of the reporting.</p> <p>The ERT recommends that the Party explain the trend in CO₂ emissions for category 1.A.1.b (petroleum refining – liquid fuels) by describing the growth of petroleum refining until 2008 as a global trend, and the factors that caused the decline in 2015–2016 (i.e. the accident at the ethylene unit, which caused the shutdown of the refining industry), including by adding cross references to the IPPU chapter, in its next NIR.</p>	
E.17	1.A.2.c Chemicals – liquid and solid fuels – CO ₂ , CH ₄ and N ₂ O	<p>The inter-annual changes in the AD on fuel consumption for category 1.A.2.c (chemicals – liquid fuels) between the following years are considered significant across the time series: 1999–2000 (–63.89 per cent), 2003–2004 (1,163.64 per cent), 2005–2006 (–54.77 per cent) and 2009–2010 (173.47 per cent), while the inter-annual changes in the AD for the consumption of solid fuels for that category between the following years are considered significant across the time series: 1999–2000 (93.30 per cent), 2006–2007 (–42.19 per cent) and 2009–2010 (–67.23 per cent). The ERT noted that the consumption of solid fuels increased from 23,312 TJ to 45,063 TJ (21,751 TJ) between 1999 and 2000, while the consumption of liquid fuels decreased from 6,694 TJ to 2,417 TJ (4,277 TJ). The decrease in the consumption of liquid fuels is not entirely explained by the increase in the consumption of solid fuels because there is still an increase of 17,474 TJ in total consumption for chemical manufacture between those years. During the review, the Party explained that decreases and increases in the consumption of liquid fuels are offset in individual years by corresponding decreases and increases in the consumption of other fuels, especially solid fuels. Between 1999 and 2000 the increase in solid fuel consumption was partially offset by a decrease in liquid fuel consumption. However, between 2006 and 2007 there was an overall decrease in the consumption of solid, liquid and gaseous fuels. Czechia explained that fluctuations in fuel consumption are influenced by many factors, including economic development, the production plan of companies and their stocks, meteorological conditions and efforts to reduce the energy intensity of processes in the chemical industry.</p> <p>The ERT recommends that the Party explain the reason for the significant fluctuation in AD on fuel consumption for category 1.A.2.c (chemicals – liquid fuels) across the time series in the NIR in line with the explanation provided to the ERT during the review.</p>	Yes. Transparency
E.18	1.A.2.f Non-metallic minerals – other fossil fuels – CO ₂	<p>The inter-annual changes in CO₂ emissions for category 1.A.2.f (non-metallic minerals – other fossil fuels) are considered significant across the time series between 2009–2010 (–28.25 per cent), 2012–2013 (–39.13 per cent) and 2018–2019 (57.90 per cent). During the review, the Party explained that the error stems from the incorrect inclusion of biocomponents (e.g. paper sludge) under other fossil liquid fuels (e.g. for 2016). Czechia further explained that, when it compared the data used for the inventory with those available from another source (https://www.svcement.cz/data/data-2020/), the other data set does not show the same inter-annual fluctuations, even though other fossil fuel consumption only has a limited share in total fossil fuel consumption. Further consultations on the recently obtained data on the consumption of other fossil fuels (solid and liquid) with Czech Cement Association representatives confirmed that the new data are more representative of the real situation. The Party explained that a recalculation will be performed to address this issue in its next annual submission.</p>	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
E.19	1.A.4.a Commercial/ institutional – gaseous fuels – CO ₂ , CH ₄ and N ₂ O	<p>The ERT recommends that the Party revise the AD and recalculate the CO₂ emissions for other fossil fuels for category 1.A.2.f (non-metallic minerals), making sure that other fossil fuels include only the relevant fuels (non-biomass fraction of municipal waste, industrial waste and waste oils) as per the 2006 IPCC Guidelines (vol. 2, chap. 1, table 1.1), also considering the new data set available from the Czech Cement Association (https://www.svcement.cz/data/data-2020/).</p> <p>The inter-annual changes in the AD on fuel consumption for category 1.A.4.a (commercial/institutional – gaseous fuels) are considered significant across the time series between 1991–1992 (–64.81 per cent) and 1993–1994 (577.94 per cent). During the review, the Party explained that the AD are obtained from official CZSO/Eurostat/International Energy Agency/Organisation for Economic Co-operation and Development questionnaires and there are no data on natural gas consumption between 1992 and 1994 in the commercial and public services. Czechia also explained that it can add gas consumption based on approximation from other years close to 1992–1994 in the next annual submission. The Party further explained that the AD on natural gas vary between the above-mentioned years because between 1990 and 1992 Czechia was part of Czechoslovakia but in 1993 Czechoslovakia was split to form Czechia and Slovakia. Estimating the missing AD using interpolation of data for other years close to 1992–1994 may therefore not be appropriate.</p> <p>The ERT recommends that the Party recalculate the emissions for 1992–1994 by making efforts to obtain data on natural gas consumption or, if that is not possible, by deriving the data using appropriate data splicing techniques provided in the 2006 IPCC Guidelines (vol. 1, chap. 5, section 5.3.3).</p>	Yes. Consistency
E.20	1.B.2.a Oil – liquid fuels – CH ₄	<p>The IEF values for CH₄ emissions for category 1.B.2.a.4 oil (refining/storage) are 2,800 kg/PJ for 1990–1995, 1,150 kg/PJ for 2002–2012 and 584.5 kg/PJ for 2013–2019. During the review, the Party clarified that the decrease in the IEF is based on the assumption that there is ongoing “ecologization” of the refineries and oil storage facilities, whereby oil companies invest a significant amount of money in upgrading their equipment to minimize environmental damage. In the past these investments were mainly aimed at reducing the usual pollutants, including non-methane volatile organic compounds. The equipment upgrades also led to a decrease in CH₄ emissions for category 1.B.2.iv (refining/storage). The operators in Czechia are legally required to estimate and report emissions of non-methane volatile organic compounds in the integrated central system, and the data are used for national environmental policy decision-making as well as for international reporting (e.g. under the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe). The Party provided a graph to the ERT that demonstrated the correlation between the EF for CH₄ emissions for category 1.B.2.iv (refining/storage) and that for non-methane volatile organic compounds. The graph clearly showed that the decrease in the EF for the latter, which is based on direct reporting by operators (i.e. tier 3), is even more significant than the decrease in the CH₄ EF used for the GHG inventory.</p> <p>The ERT recommends that the Party include the explanation for the significant decrease in the CH₄ IEF for category 1.B.2.a.4 oil (refining/storage) provided during the review in the NIR.</p>	Yes. Transparency
E.21	1.B.2.b Natural gas – gaseous fuels – CH ₄	<p>The ERT noted that the CH₄ IEF for category 1.B.2.b.2 (natural gas production) is almost stable at around 39,000 kg/PJ for 1990–2019, with the exception of 2005 (29,500 kg/PJ). During the review, the Party explained that the reason for the sudden decline was that a different EF was used for that year and that this error will be corrected in the next annual submission.</p> <p>The ERT recommends that the Party recalculate the CH₄ emissions for category 1.B.2.b.2 (natural gas production) for 2005 using the correct EF.</p>	Yes. Accuracy

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
E.22	1.B.2.b Natural gas – gaseous fuels – CH ₄	<p>The ERT noted that, although AD for category 1.B.2.b.5 (natural gas distribution) have fluctuated across the time series, the estimated CH₄ emissions for the category have remained relatively stable since 2012 (16.24–16.30 kt). The Party briefly explained the methodology used to estimate emissions from natural gas distribution in the NIR (section 3.3.2.2.2, pp.161–162), but did not explain the reasons for the large inter-annual variations in the CH₄ emissions before 2012. During the review, the Party explained that the large fluctuations in AD for 1990–2011 are because, for that period, AD were collected from individual gas companies, which led to inaccuracies, and this issue was addressed following the availability of updated official statistics from the Energy Regulatory Office for 2012 onward. The IEF is expected to fluctuate because, although the emissions remain fairly constant, the AD used in the estimation (e.g. length of pipeline, number of customers and regulation stations, and the natural gas consumption in individual years (obtained from CZSO questionnaire)) vary across the time series. Czechia further explained that the methodology used for calculating emissions from the distribution of natural gas will be described in more detail in the next annual submission.</p> <p>The ERT recommends that the Party improve the description in the NIR of the methodology for calculating emissions from gas distribution, including the evolution of the AD (on the length of distribution network, the number of gas pressure regulation stations and number of customers) to explain the trend in AD for category 1.B.2.b.5 (natural gas distribution).</p>	Yes. Transparency
E.23	1.B.2.b Natural gas – gaseous fuels – CH ₄	<p>AD for subcategory 1.B.2.b.6 (other) were reported, while CO₂ and CH₄ emissions were reported as “IE” in CRF table 1.B.2. The Party reported in the documentation box to CRF table 1.B.2 and in CRF table 9 that the emissions for subcategory 1.B.2.b.6 (other) are included in subcategories 1.B.2.b.4 (transmission and storage) and 1.B.2.b.5 (distribution). During the review, Czechia explained that the emissions for subcategory 1.B.2.b.6 (other) are not included in subcategory 1.B.2.b.5 (distribution) but CH₄ emissions for subcategory 1.B.2.b.6 (other) are reported together with emissions for subcategory 1.B.2.b.4 (transmission and storage). The Party further explained that the text in the documentation box to CRF table 1.B.2 will be corrected in the next annual submission to state that CH₄ emissions for subcategory 1.B.2.b.6 (other) are included in subcategory 1.B.2.b.4 (transmission and storage).</p> <p>The ERT recommends that the Party correctly describe both in the documentation box to CRF table 1.B.2 and the NIR where the emissions for subcategory 1.B.2.b.6 are included.</p>	Yes. Transparency
IPPU			
I.14	2.A.2 Lime production – CO ₂	<p>To justify the selection of country-specific EFs for lime production, the Party included two graphs in annex 3 to its NIR (section A3-5, p.494) to illustrate the linear relationship between lime production EFs derived from input feedstocks and magnesium carbonate input (annex 3, figure A3-6, p.494) and magnesium oxide output (annex 3, figure A3-7, p.494). The ERT noted that figure A3-6 is a duplicate of figure A3-7, and data on the relationship between lime production and magnesium carbonate input were not supplied. During the review, Czechia clarified that this duplication was an oversight that will be corrected in the next annual submission.</p> <p>The ERT recommends that the Party update the graphs to improve transparency on the choice of country-specific EFs for lime production and implement QC practices to reduce the likelihood of drafting errors in future NIRs.</p>	Yes. Convention reporting adherence
I.15	2.A.4 Other process uses of carbonates – CO ₂	<p>The Party reported in its NIR (section 4.2.4.2, p.178) that hydrated lime is used in a recarbonation process at one paper mill. An annual net removal of CO₂ from this activity is claimed based on data from the facility operators, occurring from 2010 onward, with “NO” reported for this category for 1990–2009. The ERT noted that the 2006 IPCC Guidelines (vol. 3, chap. 2, p.2.19) state that recarbonation may be reported only where proven and validated methods are used to calculate CO₂ removals, that both emissions and removals should be reported separately, and that this activity may be reported under</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		<p>category 2.H (other). The ERT asked Czechia to provide further information on the estimation method for the recarbonation activity to determine adherence to the 2006 IPCC Guidelines. During the review, the Party explained that CO₂ removal estimates are calculated using EU ETS data, but no further details on the estimation process were available. Czechia further explained that no relevant data were available for prior to 2010.</p> <p>The ERT recommends that the Party investigate the methods used to estimate emissions and removals from recarbonation and clearly document the process, for example through reference and citation of EU ETS methods and data. The ERT also recommends that the Party report emissions and removals from recarbonation under category 2.H (other) in line with the 2006 IPCC Guidelines.</p> <p>The ERT encourages the Party to review the commencement date of recarbonation activities in the country and document its findings in the NIR.</p>	
I.16	2.A.4 Other process uses of carbonates – CO ₂	<p>The Party reported in its NIR (table 4-8, pp.178–179) the emissions from urea use in denitrification in category 2.A.4.d (other process uses of carbonates – other) as “NO” for 1990–2015 and “NE” for 2016, while reporting emission estimates for 2017–2019. The Party did not explain the use of notation keys in the NIR or CRF table 9. Emissions from mineral wool production, flue-gas desulphurization, denitrification and recarbonation were reported at an aggregated level in CRF table 2(I).A-Hs1 under category 2.A.4.d (other process uses of carbonates – other), so no further information on notation key use was reported in CRF table 9. During the review, the Party explained that urea use in denitrification began in the country following new legislation that came into force in 2016, based on EU industrial emissions directive 2010/75/EU. Because companies were granted a transitional period, the emissions in 2016 were negligible and thus reported as “NE”. Widespread use of urea in denitrification has increased since 2017. Prior to 2016, urea was not used for denitrification, so emissions from this source were reported as “NO”.</p> <p>The ERT recommends that the Party explain the use of notation keys for reporting emissions from urea use in denitrification in its next annual submission.</p>	Yes. Transparency
I.17	2.A.4 Other process uses of carbonates – CO ₂	<p>The Party reported in its NIR (table 4-8, p.178–179) and CRF table 2(I).A-Hs1 emissions from urea use in denitrification in category 2.A.4.d (other process uses of carbonates – other). The ERT noted that the reporting of emissions from urea used in denitrification under category 2.A.4.d is not in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 8, p.8.19), as urea used in denitrification does not constitute a process use of carbonate. The ERT considers that a more appropriate category under which to report emissions from this source is category 2.D.3 (non-energy products from fuels and solvent use – other) under urea used as a catalyst. During the review, Czechia explained that denitrification was included in category 2.A.4.d because the type of activity was similar to others reported under that category, such as desulphurization, and noted that the denitrification activity reported in this category relates to industrial heat, electricity and chemical facilities, whereas urea catalyst emissions reported under category 2.D.3 arise from urea catalysts used in diesel engines, constituting different activity types.</p> <p>The ERT recommends that the Party report emissions arising from urea used in denitrification under a separate subcategory under category 2.D.3 (non-energy products from fuels and solvent use – other) to improve comparability.</p>	Yes. Comparability
I.18	2.B.1 Ammonia production – CO ₂	<p>Following a previous recommendation (see ID# I.5 in table 3), the Party reported in the NIR that for 1990–2013, when urea production was occurring and corresponding CO₂ removals were included in net emission estimates for ammonia production, urea application emissions from the urea produced were allocated under the agriculture sector.</p>	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
I.19	2.B.1 Ammonia production – CO ₂	<p>The ERT encourages the Party to provide in the NIR specific cross references to the relevant NIR and CRF tables in which urea application emissions are reported.</p> <p>The Party reported in its NIR (section 4.3.1.2, p.183, and section 3.2.3, pp.66–67) that, in addition to being reported in category 2.B.1 ammonia production, the CO₂ emissions from non-energy use of fuels in ammonia production are presented in CRF table 1.A(d) (other oil). The ERT noted that this is consistent with the 2006 IPCC Guidelines (vol. 3, chap. 3, section 3.2.2). However, while the CRF tables note the use of other oil as feedstock in the ammonia production process, the NIR indicates that residual fuel oil is used (section 4.3.1.4, pp.184). Non-energy use of residual fuel oil is reported as “NO” in CRF table 1.A(d). The ERT noted that, according to the 2006 IPCC Guidelines (vol. 3, chap. 1, box 1.1, and vol. 3, chap. 3, section 3.2.2 and box 3.2), for ammonia production no distinction is made between fuel and feedstock emissions and all fuel and feedstock emissions are to be accounted for in the IPPU sector. It is not clear if all relevant liquid fuels used in the process are accounted under the IPPU sector.</p> <p>The ERT recommends that the Party review reporting arrangements for emissions from ammonia production and ensure all emissions arising from both fuel and feedstock consumption of residual fuel oil and other oils are reported under category 2.B.1 (ammonia production) to improve comparability in line with the 2006 IPCC Guidelines. The ERT also recommends that the Party improve the consistency of the reporting on the feedstock use for ammonia production reported in the NIR and CRF table 1.A(d).</p>	Yes. Comparability
I.20	2.B.1 Ammonia production – CO ₂	<p>The Party reported in its NIR (section 4.3, p.182) that ammonia production emissions are estimated using a tier 1 method on the basis of default EFs. The ERT noted that category 2.B.1 ammonia production is consistently assessed as a key category by level assessment. Czechia reported in its NIR (table 4-13, p.182) that there is a single ammonia production facility in the country. The ERT noted that use of a tier 1 estimation method for ammonia production when it is a key category is not in accordance with the 2006 IPCC Guidelines decision tree (vol. 3, chap. 3, figure 3.1), according to which it is good practice to use a tier 2 or 3 method. During the review, Czechia clarified that data were not available to apply a higher-tier estimation method. In its response to the provisional main findings, the Party explained that feedstock for ammonia production is a complex mixture of different kinds of hydrocarbon, which also varies depending on the actual hydrocarbon content of natural oil (petroleum) flowing into the facility at a given time. It is therefore not possible to obtain exact data on the current carbon content of the feedstock because the facility cannot measure it. As a result, it is not possible for the Party to move to a higher-tier method.</p> <p>The ERT recommends that the Party explore the possibility of obtaining additional data directly from the plant (e.g. ammonia production fuel requirements) to support applying a higher-tier method for estimating ammonia production emissions consistently with the 2006 IPCC Guidelines, or otherwise justify transparently the use of a tier 1 method for estimating ammonia production emissions, given that it is a key category.</p>	Yes. Accuracy
I.21	2.B.2 Nitric acid production – N ₂ O	<p>The Party reported in CRF table 7 and its NIR (section 4.1.1, p.167) that nitric acid production is a key category. However, nitric acid was not identified as a key category in the summary table of IPPU key categories in the NIR (table 4-1, p.167). During the review, Czechia explained that nitric acid is no longer a key category and that the corresponding references in CRF table 7 and the NIR are erroneous and will be corrected in the next annual submission.</p> <p>The ERT recommends that the Party ensure that the reporting of key categories is consistent between the data reported in the CRF tables and the NIR by implementing QC procedures.</p>	Yes. Convention reporting adherence

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
I.22	2.B.2 Nitric acid production – N ₂ O	<p>The Party reported in its NIR (section 4.3.2.2, p.186) that a tier 1 method was used to estimate nitric acid production emissions for 1990–2012. Czechia reported that nitric acid is produced at three facilities in the country and provided information on different mitigation technologies employed and changes in production technology and pressure over time. The ERT noted that the reported emission estimation methodology is not in accordance with the tier 1 estimation approach in the 2006 IPCC Guidelines (vol. 3, chap. 3, p.3.21), which involves multiplying nitric acid production AD by a production EF, and that it is good practice to assume no abatement of N₂O emissions. The ERT was not able to reconstruct the estimation method used by the Party to estimate emissions for 1990–2012. A range of EFs were provided for different combinations of mitigation technology and production process pressure (NIR pp.185–186), but no information was provided on how many production units used each of the technologies and pressures. The proportion of nitric acid production AD for each production unit was not reported, as only aggregate production AD were provided (NIR table 4-19, pp.186–187). Czechia additionally reported in its NIR (p.186) that N₂O emissions for 1990–2012 were based on a mean value of nitric acid production capacity, with NSCR technology corresponding to 110 kt nitric acid/year with emissions of 1 kg N₂O/t nitric acid. The corresponding annual emission value of 110 t N₂O/year was then subtracted from the “native NSCR emission value”. Further information on the data sources for mean nitric acid production capacity, corresponding EFs and the definition of the native NSCR emission value was not provided. During the review, the Party clarified that the EF for nitric acid production varied during the time series and all emission calculations were reduced by 110 t N₂O/year. Czechia noted that EFs for different mitigation technologies and operating conditions were determined in a series of country-specific studies. Some details on the timing of changes to operational conditions and equipment were identified as uncertain owing to the simultaneous introduction of new technology and phase-out of older units.</p> <p>The ERT recommends that the Party review and revise in its NIR the reporting on the estimation methods used for nitric acid production emissions for 1990–2012 to clarify whether estimation techniques are in line with the tier 1 method set out in the 2006 IPCC Guidelines, clearly report on how emission estimates were derived for each year, taking into account different operating conditions and mitigation technologies, where applicable, and describe transparently the source of all values and terms referred to in the calculation of emission estimates.</p>	Yes. Accuracy
I.23	2.C.1 Iron and steel production – CO ₂	<p>The Party reported in its NIR (section 4.4.1.2, p.195) that approximately 25 per cent of iron ore charge used in blast furnaces is provided from pellets, lump ores and other secondary materials. The ERT noted that AD and emissions for subcategory 2.C.1.e (pellets) were reported as “NO” in CRF table 2(I).A-Hs2 but no further explanation was provided in the NIR on the source of the pellets or secondary materials, making completeness difficult to verify. During the review, the Party explained that it is in the process of upgrading the methodological tier used for estimating iron and steel production, and more detailed information on the sources of pellets and other secondary materials will be available when a higher methodological tier is used. The Party further explained that it is not aware of any evidence that primary production of pellets is occurring.</p> <p>The ERT recommends that the Party investigate whether pellet production is occurring in the country and reflect the findings in the reporting of pellet production emissions in the NIR and CRF table 2(I).A-Hs2, as appropriate.</p>	Yes. Accuracy
I.24	2.C.1 Iron and steel production – CO ₂	<p>The Party reported in its NIR (section 4.4.1.2, p.196) that, in the total production of iron and steel in Czechia, electric furnaces cover less than 5 per cent and, from the total amount of CO₂ emissions, about 6 per cent is recycled in the process. The ERT noted that the meaning of “about 6 per cent [of the total amount of CO₂ emissions] is recycled in the process” is not clear. It could describe the proportion of emissions from recycled iron and steel or may relate to the proportion of CO₂ emissions recycled for use in another process. Further, it is unclear whether the 6 per cent relates to total emissions for the</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		<p>iron and steel production category, or only to electric furnaces. This adversely impacts the transparency of the emission estimates for this category. During the review, Czechia stated that it is in the process of upgrading the methodological tier used for estimating iron and steel production, and that more detailed information on the use of electric arc furnaces and scrap recycling based on EU ETS data will be available when the upgrade has been completed. The Party clarified that the statement that electric furnaces cover less than 5 per cent refers to the proportion of steel produced at electric furnaces, which was 4.7 per cent of the total steel production in 2019, according to CZSO records. The Party further clarified that the 6 per cent of recycled emissions refers to treatment of waste gas from iron and steel-making processes, and that further work is being undertaken to investigate the link between these waste gases and the energy sector, which may result in the refinement of this statement in the NIR.</p> <p>The ERT recommends that the Party clearly explain in the NIR how electric furnaces and emissions from recycled iron and steel are accounted for in the emission estimates.</p>	
I.25	2.D.3 Other (non-energy products from fuels and solvent use) – CO ₂	<p>The Party reported in its NIR (section 4.5.3.2, p.203) that emissions from urea used as a catalyst are estimated in accordance with the 2006 IPCC Guidelines (vol. 2, chap. 3, equation 3.2.2). The ERT noted that emissions were estimated for 1998–2019 as the appropriate time series for the process, but no further elaboration was provided. The ERT further noted that the purity factor for urea used in equation 3.2.2 was not stated. During the review, Czechia clarified that the purity factor used in estimating emissions for this application was 32.5 per cent. This is consistent with the default value provided in the 2006 IPCC Guidelines.</p> <p>The ERT recommends that the Party explain in the NIR why 1998 has been chosen as the first year for which emissions from urea used as a catalyst are estimated for category 2.D.3 (other). The ERT also recommends that the Party specify in the NIR the purity factor used in estimating emissions for this source.</p>	Yes. Transparency
I.26	2.E Electronics industry – F-gases	<p>The Party reported in its NIR (section 4.6, p.205) that SF₆ and other fluorinated compounds are not used in photovoltaics industry under category 2.E.3. Emissions for this category were reported as “NO” in CRF table 2(II)B-Hs1, but no further information on the photovoltaics industry was provided in the NIR. During the review, Czechia explained that only one company in the country could be involved in photovoltaics production, and the company has declared that no technologies are employed that would result in F-gas emissions. As such, emissions for category 2.E.3 were reported as “NO”.</p> <p>The ERT recommends that the Party provide information on the photovoltaics industry in Czechia in the NIR explaining why this industry does not produce any emissions.</p>	Yes. Transparency
I.27	2.E.1 Integrated circuit or semiconductor – F-gases	<p>The Party reported in its NIR (section 4.6.2, p.206) that emissions from integrated circuits and semiconductors are estimated using a tier 2a method in line with the 2006 IPCC Guidelines (vol. 3, chap. 6, pp.6.9–6.11). It also reported in the NIR that the F-gases carbon tetrafluoride, hexafluoroethane, fluoroform, NF₃ and SF₆ are used in semiconductor manufacturing, and by-product emissions of carbon tetrafluoride are estimated using equation 6.3 from the 2006 IPCC Guidelines (vol. 3, chap. 6). The ERT noted that no information on by-product emissions of hexafluoroethane or fluoroform was provided in the NIR. The ERT acknowledged that by-product EFs for these F-gases are listed as “NA” for semiconductor manufacturing under the tier 2a methodology in the 2006 IPCC Guidelines (vol. 3, chap. 6, table 6.3). During the review, Czechia clarified that estimation of by-product emissions of hexafluoroethane and fluoroform will be included in future annual submissions.</p> <p>The ERT encourages the Party to review the estimation of by-product emissions arising from the use of F-gases in the electronics industry and clearly explain whether by-product emissions sources are occurring.</p>	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
I.28	2.E.4 Heat transfer fluid – F-gases	<p>The Party reported emissions of an unspecified mix of HFCs and PFCs in subcategory 2.E.4 (heat transfer fluid) in CRF tables 2(II) and 2(II).B-Hs1 as “NE” for 1990–2019. Czechia reported in CRF table 9 that reliable data are not available and emissions are expected to be very low. The Party did not provide in its NIR information on the use of heat transfer fluid or justify the use of “NE” on the basis of likely insignificance as per paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. During the review, Czechia explained that further investigation on heat transfer fluid use in the country is planned and the findings of the investigation will be reported in subsequent annual submissions.</p> <p>The ERT recommends that the Party complete the investigation into the use of heat transfer fluid in the electronics industry and report on emissions associated with this source, and, if emissions for this category are reported as “NE”, justify this in line with the UNFCCC Annex I inventory reporting guidelines.</p>	Yes. Completeness
I.29	2.F Product uses as substitutes for ozone-depleting substances – F-gases	<p>The Party reported in its NIR (section 4.7.8, p.220) that refrigeration and air conditioning subcategories 2.F.1.a–2.F.1.f were recalculated owing to minor modifications to the Phoenix model resulting from QA/QC processes, with recalculations affecting the estimates for 2005–2018. Czechia further reported that AD for subcategories 2.F.1.a–2.F.1.f and 2.F.3 (fire protection) were updated for 2016–2018 as a result of a new data verification system. The effect that these recalculations had on the time series for these subcategories was not explained in the NIR. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 5, p.5.14), which state that recalculations should be accompanied by clear documentation on the reason for the recalculation and the effect on the time series. The ERT acknowledged the difficulties that can arise when revising complex models, but recognized that clear documentation is necessary to ensure transparency and time-series consistency. During the review, the Party provided additional data on the effect of the recalculations on the subcategories, noting that they were mainly minor. Information on the updated data verification system was also provided. Czechia further stated during the review that the Phoenix model was subsequently modified to assume that recovered gases are used after decommissioning in other equipment, changing emission estimates from stocks and disposal.</p> <p>The ERT recommends that the Party clearly report the recalculations applied for the relevant emission estimate time series in accordance with paragraphs 43–45 of the UNFCCC Annex I inventory reporting guidelines. The ERT also recommends that the Party clearly explain in the NIR the changes to the Phoenix model for estimating F-gas emissions, in particular changes relating to the assumption that recovered gases are reused.</p>	Yes. Transparency
I.30	2.F.1 Refrigeration and air conditioning – HFC-134a	<p>The ERT noted that emissions and removals of HFC-134a for subcategory 2.F.1.b (domestic refrigeration) were recalculated for 1997–2019. The recalculations were significant, with an average decrease in estimated annual emissions of 23.7 per cent and an average decrease in estimated annual removals of 93.0 per cent for 1997–2018 compared with the emissions and removals reported in the Party’s 2020 submission in CRF table 2(II).B-Hs2. Czechia reported information in its NIR (section 4.7.8, p.220) on recalculations for category 2.F.1 (refrigeration and air conditioning) resulting from QA/QC processes but did not provide any reasoning for the significant recalculations observed for subcategory 2.F.1.b (domestic refrigeration). During the review, the Party clarified that the significant difference in reported emissions and removals was because of a mistake in the Phoenix calculation model used to estimate emissions and removals for category 2.F.1. Czechia explained that this mistake will be corrected for the next annual submission.</p> <p>The ERT recommends that the Party review the reported emissions and removals of HFC-134a for subcategory 2.F.1.b (domestic refrigeration) to ensure the accuracy of the reported values, review QC procedures to reduce the risk of future reporting errors and transparently document in the NIR any recalculations applied.</p>	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
I.31	2.F.4 Aerosols – HFC-134a and HFC-227ea	<p>The Party reported in its NIR (section 4.7.8, p.220) that additional research conducted in 2020 on metered dose inhaler supply in the country found propellant in sold metered dose inhalers included HFC-227ea in addition to HFC-134a. Previously Czechia has reported only HFC-134a emissions under category 2.F.4 (aerosols). The Party reported that emissions for category 2.F.4 (aerosols) were recalculated to account for the newly identified HFC-227ea emissions from metered dose inhalers and that emissions reported under category 2.F.4 (aerosols) would be split, with emissions from metered dose inhalers reported under subcategory 2.F.4.a (metered dose inhalers) and all other emissions previously reported under category 2.F.4 (aerosols), such as general aerosol use emissions, reported under subcategory 2.F.4.b (other). The ERT noted that CRF table 2(II).B-Hs2 includes HFC-134a and HFC-227ea emissions under subcategory 2.F.4.a (metered dose inhalers), but no data were reported under subcategory 2.F.4.b (other). The sum of emissions of HFC-134a and HFC-227ea reported under the subcategories of category 2.F.4 (aerosols) in CRF table 2(II).B-Hs2 does not match the total emissions of each F-gas reported for category 2.F.4 (aerosols) in CRF table 2(II). During the review, the Party clarified that, when using CRF Reporter, no node was created for HFC-134a in subcategory 2.F.4.b (other), resulting in emissions for that subcategory not being individually reported in CRF table 2(II).B-Hs2. Czechia confirmed that emissions for subcategory 2.F.4.b (other) were included in the total emissions reported in category 2.F.4 (aerosols), and that emissions for subcategory 2.F.4.b (other) will be reported in CRF table 2(II).B-Hs2 in future annual submissions.</p> <p>The ERT recommends that the Party review and revise the CRF table reporting arrangements for categories 2.F.4 (aerosols), 2.F.4.a (metered dose inhalers) and 2.F.4.b (other) and ensure emissions and removals are accurately and transparently reported consistently with the reporting in the NIR.</p>	Yes. Convention reporting adherence
I.32	2.H Other (IPPU) – CO ₂	<p>The Party reported in its NIR (section 4.9.1, p.228) that CO₂ emissions from pulp and paper processes, arising from sodium sulphate reduction to sodium sulfide, have been introduced for the first time under category 2.H.1 (pulp and paper). The ERT commends the expansion in coverage of reported emissions sources. Emissions from this source are reported for 2001–2019, with emissions for 1990–2000 reported as “NO”. Czechia reported that emission data for 2010–2019 were obtained from the facility operator, while emissions for 2001–2009 were estimated on the basis of soda ash consumption data from the facility operator. Detailed explanation of calculation methodologies for this category was not provided in the NIR. The time series of emissions for this category shows a significant increase between 2010 and 2011, which is not explained in the NIR. The reported emissions for 2010 appear consistent with the emission trend for 2001–2009, but are significantly lower than the reported emissions for 2011–2019. During the review, the Party clarified that data obtained from the producer were sourced from EU ETS data. Czechia stated that the same company produces calcium carbonate and sodium carbonate, and that emissions from these production sources were reported under categories 2.A.4.d (desulfurization) and 2.A.4.b (other uses of soda ash).</p> <p>The ERT recommends that the Party review and transparently document the calculation methodologies used to determine pulp and paper emissions, including how emissions have been determined in accordance with a methodology for other process uses of carbonates from the 2006 IPCC Guidelines (vol. 3, chap. 2, pp.2.32–2.35). The ERT also recommends that the Party explain how time-series consistency is maintained, noting the different AD sources for 2001–2009 and 2010–2019, and clearly document how emissions from the producer have been reported under multiple categories to demonstrate that no over- or under-reporting has occurred.</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
Agriculture			
A.23	3.B.1 Cattle – N ₂ O	<p>The recalculated estimates of direct N₂O emissions for MMS (liquid systems) for category 3.B.1 (cattle) differ significantly from the previously reported estimates for 2016 (–28.48 per cent), 2017 (–29.09 per cent) and 2018 (28.08 per cent). The NIR (section 5.2.2.5, pp.255–258) does not transparently describe the recalculations performed at the subcategory level, in particular their impact. During the review, Czechia explained that nitrogen emissions from manure management have been calculated using a tier 2 methodology for all animal categories for the first time. The country-specific value of Nex has been newly derived from national legislation (implementing decree 377/2013 Coll.), while the revised data on MMS usage since 2016 (cattle, swine and poultry) and 2014 (horses, goats and sheep) are provided by CRI experts. Revisions of the nitrogen losses (fraction of total nitrogen loss), recommended by the ERT in the previous review report, by animal category and MMS improved the accuracy of the estimates. While the changes in data on MMS usage and fractions of nitrogen loss caused an insignificant increase in the estimated N₂O emissions (less than 30 kt CO₂ eq), the use of a country-specific value of Nex decreased the estimate of total emissions by about 100 kt CO₂ eq (1.2 per cent of the total emissions from the sector).</p> <p>The ERT encourages the Party to improve the transparency of its reporting on the recalculations made in 2021 of direct N₂O emissions for MMS (liquid systems) by providing in the NIR specific information on the recalculations at the subcategory level, including the type of recalculation (e.g. correcting an error or updated AD or EF) and its impact on the emission estimates for the subcategory.</p>	Not an issue/problem
A.24	3.D.a.3 Urine and dung deposited by grazing animals – N ₂ O	<p>The recalculated estimates of direct N₂O emissions from urine and dung deposited by grazing animals for the subcategory differ significantly from the previously reported estimates for 2016 (–7.93 per cent), 2017 (–6.93 per cent) and 2018 (–7.75 per cent). The recalculations made for the subcategory were not specifically explained in the NIR (section 5.4.5, pp.265–266). During the review, the Party explained that the recalculation was performed to correct a technical error found during the earlier expert review, which led to a change in the estimated amount of nitrogen excreted in pasture, range and paddock for other animal categories. The calculation of the Nex rate for individual categories of livestock was derived by means of coefficients (excretion kg nitrogen/head/year) specified in implementing decree 377/2013 Coll. Further, the data on MMS usage were updated on the basis of a long-term statistical survey of agricultural farms in Czechia.</p> <p>The ERT encourages the Party to improve the transparency of its reporting by providing in the NIR specific information on the recalculations made in 2021 of direct N₂O emissions from urine and dung deposited by grazing animals at the subcategory level, including the type of recalculation (e.g. correcting an error or incorporating updated AD) and its impact on the emission estimates for the subcategory.</p>	Not an issue/problem
A.25	3.D.b.1 Atmospheric deposition – N ₂ O	<p>The recalculated estimates of indirect N₂O emissions from atmospheric deposition for the subcategory differ significantly from the previously reported estimates for the entire time series, by 2.3 to 11.1 per cent. The recalculations made were not clearly explained in the NIR (section 5.4.5, p.265–266). During the review, the Party explained that this stems from removing the double counting of nitrogen input from digestate for 2016 onward. As a result, the corresponding reported amount of nitrogen from organic nitrogen fertilizers applied to soils has been reduced, leading to a reduction in the estimated N₂O emissions for 2016 onward. In addition, the decrease in the estimated N₂O emissions for 2019 was caused by the use of country-specific Nex values for all livestock categories.</p> <p>The ERT encourages the Party to improve the transparency of its reporting by providing in the NIR specific information on the recalculations made in 2021 of indirect N₂O emissions from atmospheric deposition at the subcategory level, including</p>	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		the type of recalculation (e.g. correcting an error or incorporating updated AD) and its impact on the emission estimates for the subcategory.	
A.26	3.D.b.2 Nitrogen leaching and run-off – N ₂ O	<p>The recalculated estimates of indirect N₂O emissions from nitrogen leaching and run-off for the subcategory differ significantly from the previously reported estimates for 2016 (–4.93 per cent), 2017 (–4.82) and 2018 (–5.50 per cent). The recalculations made for the subcategory were not clearly explained in the NIR (section 5.4.5, p.265–266). During the review, the Party explained that this stems from removing the double counting of nitrogen input from digestate for 2016 onward. As a result, the corresponding reported amount of nitrogen from organic nitrogen fertilizers applied to soils has been reduced, leading to a decrease in the estimated indirect N₂O emissions for 2016 onward. In addition, the decrease in the estimated N₂O emissions for 2019 was caused by the use of country-specific Nex values for all livestock categories.</p> <p>The ERT encourages the Party to improve the transparency of its reporting by providing in the NIR specific information on the recalculations made in 2021 of indirect N₂O emissions from nitrogen leaching and run-off at the subcategory level, including the type of recalculation (e.g. correcting an error or incorporating updated AD) and its impact on the emission estimates for the subcategory.</p>	Not an issue/problem
LULUCF			
L.12	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O	<p>As described in its NIR (section 6.4.5, p.295), the Party performed recalculations of CSC in living biomass in forest land by using a rectified fraction of additional harvest of 50 per cent. However, Czechia did not transparently describe in the NIR the basis for this value and how this fraction of additional harvest was used in the calculation of total carbon loss from harvests. During the review, the Party explained that the total harvest volume (NIR section 6.4.2.1, p.288) includes:</p> <p>(a) The harvest removals reported by CZSO for individual species expressed in m³ merchantable volume (minimum diameter 7 cm, volume under bark);</p> <p>(b) Associated harvest loss expressed in m³ woody biomass, as reported by CZSO since 2009 but actually used for 2011 (NIR section 6.4.2.1, p.287) until 2019 (most recent inventory year). The Party considered the early CZSO estimates for 2009–2010 as not fully reconciled;</p> <p>(c) An approximation of additional loss for 1990–2010 based on the assumption of 5 per cent for planned harvest and 15 per cent for salvage logging, calculated using the amount for the harvest removals as in (a) above, expressed in m³ woody biomass.</p> <p>Because the complete time series of extra loss (see (b–c) above) is expressed in m³ biomass volume of unknown composition in terms of merchantable (parts over 7 cm in diameter) and non-merchantable (parts under 7 cm in diameter) wood volume, Czechia assumes a 50 per cent fraction for each of the two components. This has an impact on further calculations, because merchantable volume is expanded to total biomass using biomass conversion and expansion factors. Only 50 per cent of biomass volume is therefore included in the calculation, because the rest of the volume (non-merchantable) is already accounted for when applying biomass conversion and expansion factors to total merchantable volumes. The reduction to 50 per cent therefore prevents double counting of some emissions originating from treatment of non-merchantable, small-size woody parts (mostly branches).</p> <p>The ERT recommends that the Party transparently describe in the NIR the EFs and parameters associated with harvest emissions, including the assumptions and calculations underlying the rectified fraction of additional harvest, and how these components are calculated to obtain the total carbon loss from harvests. The ERT also recommends that the Party</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		demonstrate the consistency of the estimates of carbon loss from harvest over the entire time series by reporting the time-series data for harvest losses, and provide the basis for the assumed values of the parameters (i.e. 5 per cent for planned harvest, 15 per cent for salvage logging and 50 per cent for partitioning between merchantable and non-merchantable wood volume).	
L.13	4.A.1 Forest land remaining forest land – CO ₂	<p>As reported in its NIR (section 6.4.5, p.295), the Party recalculated CSC in deadwood in forest land using a revised trend line constructed on the basis of the two NFIs. The ERT noted that the estimates of CSC in deadwood changed from the consistently negative values in Czechia's 2020 submission to positive values in the 2021 submission, partly because the Party used the average from the second CzechTerra cycle and second NFI to represent 2015 and obtain the trend line for the 2020 submission (2020 NIR, section 6.4.2.1, p.277). During the review, Czechia explained that for the 2021 submission it used only NFI data to obtain methodologically consistent estimates for the entire time series, since the data collection for CzechTerra and the NFI differ substantially in terms of sampling frequency (the sampling for the NFI is more intensive than that for CzechTerra). The Party indicated that that this inconsistency can be avoided by using only the NFI as a source of AD for estimating deadwood. Czechia also explained that using the stock change method with data from two points in time (represented by the sampling dates for the first and second NFIs) produces the current trend line, which is extrapolated over the entire reporting period.</p> <p>The ERT recommends that the Party transparently describe the recalculations of CSC in deadwood, including the differences in the methodologies and data used, in order to explain the changes.</p>	Yes. Transparency
L.14	4.A.1 Forest land remaining forest land – CO ₂	<p>The Party reported in its NIR (section 6.4.2.1, p.288) that it used data from both NFIs to estimate CSC in dead organic matter. However, Czechia did not include a sufficiently detailed description of the NFI in the NIR for the ERT to assess whether the NFIs produce accurate and reliable data for the estimation, such as information on plot size and the number of sampling plots. During the review, the Party explained that the sampling for both the NFI and CzechTerra used a plot size of 0.05 ha, in which lying deadwood and standing dead trees of merchantable dimensions are recorded, together with the decay category, and that wood dimension, decay category and species-specific wood density is used for the estimation of carbon stock, which in turn is used to calculate CSC in deadwood between the first and second NFIs.</p> <p>The ERT recommends that the Party provide information on its NFIs in the NIR, including the plot size and number of sample plots, to allow for an assessment of the reliability of the data gathered on CSC in deadwood.</p>	Yes. Transparency
Waste			
W.14	5.A Solid waste disposal on land – CH ₄	<p>The Party reported in its NIR (table 7-3, p.319) the share of different waste streams used in the first-order decay model to calculate CH₄ emissions for 1950 onward. For 1950–1995 the Party used a constant percentage for all waste streams, which gives the same calculated value of degradable organic carbon for the entire 45-year period. The Party followed a similar approach for 2009–2019 using the data for 2009 for the entire period. The ERT noted that, as per the 2006 IPCC Guidelines (vol. 5, chap. 2, tables 2.4–2.5, p.2.14–2.15), national waste composition should be based on appropriate sampling methods and be repeated periodically to cover changes in waste generation and management. The ERT further noted that, if no country-specific data are available, the Party could use the default method and values provided in the 2006 IPCC Guidelines (vol. 5, chap. 2, tables 2-3–2-5 and 2A.1). During the review, the Party explained that the preliminary results from a new waste composition survey project are now available. The Party provided the ERT with a calculation sheet for category 5.A.1 (IPCC waste model) and the working paper on the IPCC waste model (Havránek, 2007), including some of the data</p>	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		<p>on waste amount, degradable organic carbon and MCF from the survey, and noted that more data will become available soon and will be incorporated into the next annual submission.</p> <p>The ERT recommends that the Party use the data from the new waste composition survey project to obtain data (e.g. using extrapolation) on historical changes in solid waste disposal and waste streams for the entire time series, while using the first-order decay method together with default data from the 2006 IPCC Guidelines to estimate the CH₄ emissions from MSW.</p>	
W.15	5.A Solid waste disposal on land – CH ₄	<p>According to the NIR (section 7.2.1.2, p.317), in order to calculate CH₄ emissions, the Party used the waste model provided in the 2006 IPCC Guidelines (vol. 5, chap. 3, pp.3.10–3.12) together with amounts of industrial waste disposed at SWDS. The Party reported a constant value for the amount of industrial waste disposed at SWDS for 1990–2002 and did not report any values for 2017 onward. For 2003–2016 the Party used data on industrial waste disposed at SWDS from ISOH, increasing them by a residual factor obtained from CZSO, which is based on their industrial waste statistics. During the review, Czechia explained that it used an average value for the amount of industrial waste disposed at SWDS for 1990–2003 and did not provide figures for 2017 onward because of a lack of data. The Party explained that it will change its approach and explain the data sources used in its next annual submission. The ERT noted that this does not lead to an underestimation of emissions because Czechia included the amount of industrial waste in the total amount of solid waste disposal on land.</p> <p>The ERT recommends that the Party obtain data on industrial waste for the entire time series or, if that is not possible, use the appropriate data splicing techniques from the 2006 IPCC Guidelines (vol. 1, chap. 5, pp.5.8–5.14), such as the extrapolation method from the non-linear trend line, to obtain the data for the entire time series (1990–2003 and 2017 onward) and transparently present this information in the next annual submission.</p>	Yes. Transparency
W.16	5.B Biological treatment of solid waste – CH ₄ and N ₂ O	<p>The Party reported in its NIR (section 7.3.1 and table 7-9, pp.324–325) emissions from composting and the parameters used to estimate the emissions for 2005–2019. However, the Party did not report emissions for 1990–2004. During the review, the Party explained that this was because of a lack of data and that it is making efforts to collect data to report the emissions in the next annual submission. The ERT noted that the 2006 IPCC Guidelines (vol. 5, chap. 2, table 2.1) provide regional default data on composting that could enable the Party to estimate the emissions for 1990–2004.</p> <p>The ERT recommends that the Party make efforts to obtain data on waste composting for 1990–2004; or, if that is not possible, use the appropriate data splicing techniques from the 2006 IPCC Guidelines (vol. 1, chap. 5) (e.g. extrapolation method from the non-linear trend line) to obtain the data for 1990–2004; or estimate the emissions on the basis of the regional default data on composting provided in the 2006 IPCC Guidelines (vol. 5, chap. 2, table 2.1).</p>	Yes. Completeness
KP-LULUCF			
KL.11	FM – CO ₂ , CH ₄ and N ₂ O	<p>The Party reported in its NIR (section 12.5.3.3, p.415) that it is planning to issue a technical correction of the FMRL to include the use of a modelling tool (tier 3) to address some of the issues identified. Another model (European Forest Information Scenario) provides projections on basic forest inventory data, as well as carbon in forest biomass and soils for the FMRL. Further, as explained above (see ID# L.12 in table 3), Czechia performed recalculations of CSC estimates in living biomass in forest land by using a rectified fraction of additional harvest of 50 per cent and provided an explanation during the review of the assumptions and calculations underlying this value. During the review, the Party explained that it intends to use the Carbon Budget Model of the Canadian Forest Sector for a complete assessment of deadwood, litter and input to soil carbon pools for its next annual submission. The ERT noted that, since these pools are not included in the</p>	Yes. KP reporting adherence

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		<p>current FMRL, attention should be paid to the consistency between the FMRL and the reporting of FM in the technical correction (see ID# KL.5 in table 3). The ERT also noted that these methodological changes will have an impact on the reporting of FM in the commitment period and therefore the Party will need to incorporate them into the FMRL in order to ensure consistency with the reporting in the commitment period. The ERT further noted that the Party has not yet performed a technical correction for the FMRL in this commitment period.</p> <p>The ERT recommends that the Party demonstrate the consistency between the FMRL and the reporting of FM in the commitment period by performing a technical correction to the FMRL to address the methodological changes made in the reporting in the commitment period, including in the treatment of the deadwood, litter and soil carbon pools.</p>	

^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 2021 annual submission of Czechia.

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

12. Czechia elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF is not applicable to the 2021 review.

VIII. Questions of implementation

13. No questions of implementation were identified by the ERT during the individual review of the Party's 2021 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 Czechia in its 2021 annual submission

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

Table I.1
Total greenhouse gas emissions and removals for Czechia, base year–2019
 (kt CO₂ eq)

	<i>Total GHG emissions excluding indirect CO₂ emissions</i>		<i>Total GHG emissions and removals including indirect CO₂ emissions^a</i>		<i>Land-use change (Article 3.7 bis as contained in the Doha Amendment)^b</i>	<i>KP-LULUCF (Article 3.3 of the Kyoto Protocol)^c</i>	<i>KP-LULUCF (Article 3.4 of the Kyoto Protocol)</i>	
	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>	<i>Total including LULUCF</i>	<i>Total excluding LULUCF</i>			<i>CM, GM, RV, WDR</i>	<i>FM</i>
FMRL								–4 686.00
Base year ^d	190 129.53	192 006.98	192 006.98	198 967.74	NA		NA	
1990	190 111.06	197 071.82	191 988.50	198 949.27				
1995	147 772.71	156 329.52	149 222.72	157 779.54				
2000	140 514.74	149 272.31	141 705.34	150 462.91				
2010	132 196.04	139 605.90	133 183.23	140 593.09				
2011	129 478.15	138 068.89	130 446.15	139 036.89				
2012	125 261.06	134 138.67	126 186.80	135 064.41				
2013	120 514.93	128 691.89	121 342.11	129 519.07		–241.69	NA	–7 703.15
2014	118 488.59	126 563.24	119 315.25	127 389.90		–277.04	NA	–7 595.95
2015	120 629.31	127 972.21	121 428.17	128 771.06		–346.68	NA	–6 809.66
2016	123 421.03	129 584.95	124 184.39	130 348.31		–312.47	NA	–5 700.67
2017	126 581.03	130 460.08	127 302.73	131 181.78		–298.99	NA	–3 429.89
2018	132 673.45	128 554.62	133 370.07	129 251.24		–387.50	NA	4 663.38
2019	136 203.02	122 638.51	136 862.08	123 297.56		–327.08	NA	14 060.97

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

^a The Party reported indirect CO₂ 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 CO₂, CH₄ and N₂O, and 1995 for HFCs, PFCs, SF₆ and NF₃. Czechia 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 Czechia, excluding land use, land-use change and forestry, 1990–2019(kt CO₂ eq)

	<i>CO₂^a</i>	<i>CH₄</i>	<i>N₂O</i>	<i>HFCs</i>	<i>PFCs</i>	<i>Unspecified mix of HFCs and PFCs</i>	<i>SF₆</i>	<i>NF₃</i>
1990	166 080.16	23 489.06	9 295.81	NO	NO	NE, NO	84.24	NO
1995	133 050.53	18 033.35	6 592.94	14.02	0.01	NE, NO	88.68	NO
2000	128 318.02	15 170.50	6 441.91	419.40	4.69	NE, NO	108.40	NO
2010	118 590.62	14 096.20	5 353.91	2 421.38	48.06	NE, NO	82.76	0.15
2011	116 135.62	14 124.00	5 994.65	2 685.07	8.31	NE, NO	88.64	0.59
2012	112 215.10	14 102.12	5 851.18	2 796.37	6.31	NE, NO	92.44	0.89
2013	107 352.98	13 527.88	5 624.27	2 925.26	4.22	NE, NO	83.04	1.41
2014	104 921.56	13 565.76	5 732.91	3 084.23	3.17	NE, NO	79.90	2.37
2015	105 663.45	13 590.21	6 129.83	3 304.99	2.15	NE, NO	78.27	2.15
2016	107 448.80	12 997.18	6 278.52	3 541.21	1.82	NO, NE	78.63	2.15
2017	108 334.49	12 831.20	6 206.83	3 729.86	2.03	NO, NE	74.03	3.33
2018	106 828.22	12 734.60	5 850.48	3 762.15	2.13	NO, NE	70.56	3.11
2019	101 471.39	12 447.63	5 555.13	3 751.32	1.62	NO, NE	67.93	2.52
Percentage change 1990–2019	–38.9	–47.0	–40.2	NA	NA	NA	–19.4	NA

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

^a Including indirect CO₂ emissions as reported in CRF table 6.

Table I.3

Greenhouse gas emissions and removals by sector for Czechia, 1990–2019(kt CO₂ eq)

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
1990	162 615.26	17 573.22	15 712.38	–6960.77	3 048.42	NO
1995	130 411.64	14 502.65	9 479.75	–8 556.81	3 385.50	NO
2000	122 946.32	15 197.24	8 642.65	–8 757.57	3 676.71	NO
2010	113 148.91	15 305.24	7 557.92	–7 409.86	4 581.02	NO
2011	110 675.53	15 529.14	8 206.84	–8 590.74	4 625.38	NO
2012	106 888.59	15 281.70	8 115.00	–8 877.61	4 779.12	NO

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
2013	101 228.04	15 132.84	8 086.37	-8 176.96	5 071.82	NO
2014	98 201.30	15 928.97	8 159.29	-8 074.65	5 100.34	NO
2015	99 246.32	15 572.66	8 741.21	-7 342.90	5 210.88	NO
2016	100 454.15	15 845.89	8 781.53	-6 163.93	5 266.75	NO
2017	101 190.22	15 918.00	8 726.13	-3 879.05	5 347.43	NO
2018	98 846.92	16 507.47	8 490.15	4 118.82	5 406.70	NO
2019	93 923.98	15 743.45	8 198.66	13 564.52	5 431.47	NO
Percentage change 1990–2019	-42.2	-10.4	-47.8	-294.9	78.2	NA

Notes: (1) Czechia did not report emissions or removals in the sector other (sector 6); (2) totals include indirect CO₂ emissions reported 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–2019, for Czechia
(kt CO₂ eq)

	<i>Article 3.7 bis as contained in the Doha Amendment^a</i>	<i>Activities under Article 3.3 of the Kyoto Protocol</i>		<i>FM and elected activities under Article 3.4 of the Kyoto Protocol</i>				
	<i>Land-use change</i>	<i>AR</i>	<i>Deforestation</i>	<i>FM</i>	<i>CM</i>	<i>GM</i>	<i>RV</i>	<i>WDR</i>
FMRL				-4 686.00				
Technical correction				NA				
Base year ^b	NA				NA	NA	NA	NA
2013		-494.66	252.97	-7 703.15	NA	NA	NA	NA
2014		-527.48	250.44	-7 595.95	NA	NA	NA	NA
2015		-543.96	197.28	-6 809.66	NA	NA	NA	NA
2016		-550.21	237.74	-5 700.67	NA	NA	NA	NA
2017		-562.31	263.32	-3 429.89	NA	NA	NA	NA
2018		-537.31	149.81	4 663.38	NA	NA	NA	NA
2019		-504.64	177.56	14 060.97	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 Czechia 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 an overview of key relevant data from Czechia's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5

Key relevant data for Czechia under Article 3, paragraphs 3–4, of the Kyoto Protocol from its 2021 annual submission

<i>Parameter</i>	<i>Data values</i>
Periodicity of accounting	(a) AR: commitment period accounting (b) Deforestation: commitment period accounting (c) FM: commitment period accounting (d) CM: not elected (e) GM: not elected (f) RV: not elected (g) WDR: not elected
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 and including indirect CO ₂ emissions	6 941.074 kt CO ₂ eq (55 528.593 kt CO ₂ eq for the duration of the commitment period)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	NA
2. Deforestation	NA
3. FM	NA
4. CM	NA
5. GM	NA
6. RV	NA
7. WDR	NA

Annex II

Information to be included in the compilation and accounting database

Tables II.1–II.7 include the information to be included in the compilation and accounting database for Czechia. 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 2019, including on the commitment period reserve, for Czechia (t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
CPR	468 463 683	–	–	468 463 683
Annex A emissions				
CO ₂	101 471 401	–	–	101 471 401
CH ₄	12 447 634	–	–	12 447 634
N ₂ O	5 555 126	–	–	5 555 126
HFCs	3 751 324	–	–	3 751 324
PFCs	1 620	–	–	1 620
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF ₆	67 934	–	–	67 934
NF ₃	2 523	–	–	2 523
Total Annex A sources	123 297 562	–	–	123 297 562
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–504 640	–	–	–504 640
Deforestation	1 77 561	–	–	1 77 561
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	14 060 973	–	–	14 060 973

Table II.2

Information to be included in the compilation and accounting database for 2018 for Czechia (t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	106 828 217	–	–	106 828 217
CH ₄	12 734 597	–	–	12 734 597
N ₂ O	5 850 481	–	–	5 850 481
HFCs	3 762 147	–	–	3 762 147
PFCs	2 130	–	–	2 130
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF ₆	70 557	–	–	70 557
NF ₃	3 111	–	–	3 111
Total Annex A sources	129 251 241	–	–	129 251 241
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–537 309	–	–	–537 309
Deforestation	149 813	–	–	149 813
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	4 663 378	–	–	4 663 378

Table II.3

Information to be included in the compilation and accounting database for 2017 for Czechia(t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	108 334 493	–	–	108 334 493
CH ₄	12 831 196	–	–	12 831 196
N ₂ O	6 206 834	–	–	6 206 834
HFCs	3 729 864	–	–	3 729 864
PFCs	2 033	–	–	2 033
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF ₆	74 025	–	–	74 025
NF ₃	3 333	–	–	3 333
Total Annex A sources	131 181 779	–	–	131 181 779
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–562 309	–	–	–562 309
Deforestation	263 316	–	–	263 316
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–3 429 886	–	–	–3 429 886

Table II.4

Information to be included in the compilation and accounting database for 2016 for Czechia(t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	107 448 800	–	–	107 448 800
CH ₄	12 997 182	–	–	12 997 182
N ₂ O	6 278 519	–	–	6 278 519
HFCs	3 541 215	–	–	3 541 215
PFCs	1 818	–	–	1 818
Unspecified mix of HFCs and PFCs	NO, NE	–	–	NO, NE
SF ₆	78 629	–	–	78 629
NF ₃	2 150	–	–	2 150
Total Annex A sources	130 348 314	–	–	130 348 314
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–550 208	–	–	–550 208
Deforestation	237 741	–	–	237 741
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–5 700 672	–	–	–5 700 672

Table II.5

Information to be included in the compilation and accounting database for 2015 for Czechia(t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	105 663 461	–	–	105 663 461
CH ₄	13 590 206	–	–	13 590 206
N ₂ O	6 129 834	–	–	6 129 834
HFCs	3 304 993	–	–	3 304 993
PFCs	2 152	–	–	2 152
Unspecified mix of HFCs and PFCs	NE, NO	–	–	NE, NO

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
SF ₆	78 267	–	–	78 267
NF ₃	2 150	–	–	2 150
Total Annex A sources	128 771 063	–	–	128 771 063
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–543 956	–	–	–543 956
Deforestation	197 276	–	–	197 276
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–6 809 662	–	–	–6 809 662

Table II.6

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	104 921 562	–	–	104 921 562
CH ₄	13 565 755	–	–	13 565 755
N ₂ O	5 732 910	–	–	5 732 910
HFCs	3 084 231	–	–	3 084 231
PFCs	3 168	–	–	3 168
Unspecified mix of HFCs and PFCs	NE, NO	–	–	NE, NO
SF ₆	79 904	–	–	79 904
NF ₃	2 373	–	–	2 373
Total Annex A sources	127 389 902	–	–	127 389 902
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–527 478	–	–	–527 478
Deforestation	250 442	–	–	250 442
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–7 595 947	–	–	–7 595 947

Table II.7

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	107 352 979	–	–	107 352 979
CH ₄	13 527 881	–	–	13 527 881
N ₂ O	5 624 275	–	–	5 624 275
HFCs	2 925 261	–	–	2 925 261
PFCs	4 222	–	–	4 222
Unspecified mix of HFCs and PFCs	NE, NO	–	–	NE, NO
SF ₆	83 041	–	–	83 041
NF ₃	1 409	–	–	1 409
Total Annex A sources	129 519 066	–	–	129 519 066
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–494 662	–	–	–494 662
Deforestation	252 972	–	–	252 972
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–7 703 145	–	–	–7 703 145

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

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

- (a) 1.B.2.a.1 oil – exploration (CO₂, CH₄ and N₂O) (see ID# E.7 in table 3);
- (b) 2.A.4.d other process use of carbonates – other – mineral wood production (CO₂) (1990–1999) (see ID# I.3 in table 3);
- (c) 2.E.4 heat transfer fluid (unspecified mix of HFCs and PFCs) (see ID# I.28 in table 5);
- (d) 5.B.1 composting (CH₄ and N₂O) (1990–2004) (see ID# W.6 in table 3).

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

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

IPCC. 2014. *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Hayama, Japan: Institute for Global Environmental Strategies. Available at <https://www.ipcc.ch/publication/2013-revised-supplementary-methods-and-good-practice-guidance-arising-from-the-kyoto-protocol/>.

IPCC. 2014. *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Geneva: IPCC. Available at <https://www.ipcc.ch/publication/2013-supplement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories-wetlands/>.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2012, 2013, 2014, 2015, 2016, 2017 and 2019 annual submissions of Czechia, contained in documents FCCC/ARR/2012/CZE, FCCC/ARR/2013/CZE, FCCC/ARR/2014/CZE, FCCC/ARR/2015/CZE, FCCC/ARR/2016/CZE, FCCC/ARR/2017/CZE and FCCC/ARR/2019/CZE, 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. https://unfccc.int/sites/default/files/resource/AGI%202020_final.pdf.

Annual status report for Czechia for 2021. Available at https://unfccc.int/sites/default/files/resource/asr2021_CZE.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Risto Saarikivi (CHMI), including additional material on the methodology and assumptions used. The following references may not conform to UNFCCC editorial style as some have been reproduced as received:

Havránek M. 2007. Emissions of methane from solid waste disposal sites in the Czech Republic during 1990-2005: Application of first order decay model. *Charles University Environment Center Working Paper WP2007/02, Prague*.

Kull S, Rampley G, Morken S, et al. 2016. *Operational-scale carbon budget model of the Canadian forest sector (CBM-CFS3): version 1.2, user's guide*.

Zaňát J, Dorda P and Grézl T. 1997. *Leaks of methane and higher hydrocarbons during oil extraction, Moravské naftové doly, a.s. Hodonín*. In: Conference natural gas emissions - economic and ecological impacts, Prague.