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Report on the individual review of the annual submission of Ukraine 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 Ukraine, 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 30 August to 4 September 2021.

* 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
Annex I Party	Party included in Annex I to the Convention
AR	afforestation and reforestation
Article 8 review guidelines	“Guidelines for review under Article 8 of the Kyoto Protocol”
BCEF _R	biomass conversion and expansion factor for conversion of removals in merchantable volume
BEF _R	biomass expansion factor for wood removals
CaO	calcium oxide
CER	certified emission reduction
CH ₄	methane
CM	cropland management
CO	carbon monoxide
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”
CP	commitment period
CPR	commitment period reserve
CRF	common reporting format
CSC	carbon stock change
DOM	dead organic matter
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	statistical database of the Food and Agriculture Organization of the United Nations
FM	forest management
FMRL	forest management reference level
FMRLcorr	forest management reference level technical correction
GDP	gross domestic product
GHG	greenhouse gas
GIS	geographic information system
GM	grazing land management
HFC	hydrofluorocarbon
HWP	harvested wood products
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
KP-LULUCF	activities under Article 3, paragraphs 3–4, of the Kyoto Protocol
LPG	liquefied petroleum gas

LULUCF	land use, land-use change and forestry
MCF _{UA}	country-specific methane conversion factor
MgO	magnesium oxide
MMS	manure management system(s)
MSW	municipal solid waste
N	nitrogen
N ₂ O	nitrous oxide
NA	not applicable
NE	not estimated
NF ₃	nitrogen trifluoride
NIR	national inventory report
NMVOC	non-methane volatile organic compound
NO	not occurring
PFC	perfluorocarbon
RMU	removal unit
RV	revegetation
SEF	standard electronic format
SF ₆	sulfur hexafluoride
SIAR	standard independent assessment report
SOC _{REF}	reference soil organic carbon stocks
SOM	soil organic matter
SSSU	State Statistics Service of Ukraine
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”
VCM	vinyl chloride monomer
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>

I. Introduction¹

1. This report covers the review of the 2021 annual submission of Ukraine, 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 30 August to 4 September 2021 and was coordinated by Jongikhaya Witi and Roman Payo (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Ukraine.

Table 1

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

<i>Area of expertise</i>	<i>Name</i>	<i>Party</i>
Generalist	Tomas Gustafsson	Sweden
	Ioannis Sempas	Greece
Energy	Lindiwe Chola Dlamini	Eswatini
	Regine Röthlisberger	Switzerland
IPPU	Pia Forsell	Finland
	Kristina Gonchar	Belarus
Agriculture	Marta Alfaro	Chile
	Andrea Pickering	New Zealand
LULUCF and KP-LULUCF	Sandro Federici	San Marino
	Heather Martindale	New Zealand
Waste	Fatma Betül Demirok	Turkey
	Excellent Hachileka	Zambia
Lead reviewers	Sandro Federici	
	Ioannis Sempas	

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

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

5. Annex I presents the annual GHG emissions of Ukraine, 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.

¹ The Doha Amendment entered into force on 31 December 2020. At the time of publication of this report, Ukraine had not accepted the Amendment.

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.

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. In accordance with paragraph 76 of the UNFCCC review guidelines and paragraphs 47 and 65 of the Article 8 review guidelines, the ERT has prioritized the review of issues and problems identified in previous review reports or in the initial assessment, recalculations that have changed the estimated emissions or removals for a category by more than 2 per cent or national total emissions by more than 0.5 per cent for any of the recalculated years, and supplementary information reported under the Kyoto Protocol. Table 2 provides the assessment by the ERT of the Party's 2021 annual submission with respect to the tasks undertaken during the desk review. Further information on the issues identified, as well as additional findings, may be found in tables 3, 5 and 6.

Table 2

Summary of review results and general assessment of the 2021 annual submission of Ukraine

Assessment		Issue/problem ID#(s) in table 3, 5 or 6 ^a	
Dates of submission	Original submission: NIR, 23 April 2021; CRF tables (version 1), 15 April 2021; SEF tables (SEF-CP2-2020), 14 April 2021		
Review format	Desk review		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	E.15, L.7, L.11, L.12, L.24, L.29, L.40, W.3, KL.9
	(c) Development and selection of EFs?	Yes	E.2, I.10, I.11, L.16
	(d) Collection and selection of AD?	Yes	G.7, I.12, A.11, L.2, L.6, L.19, L.21, L.22, L.28, L.30, L.33, L.38, KL.1, KL.2, KL.3, KL.4
	(e) Reporting of recalculations?	Yes	L.12, L.35
	(f) Reporting of a consistent time series?	Yes	E.4, L.8, L.20
	(g) Reporting of uncertainties, including methodologies?	Yes	G.10, L.5
	(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	No	
	(j) Application of corrections to the inventory?	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	No	G.8
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?		
	(b) Performance of the national system functions?	Yes	G.5, G.7, A.1

Assessment	Issue/problem ID#(s) in table 3, 5 or 6 ^a
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?	Yes G.1
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.4, KL.13, KL.14
(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.11
(c) Reporting requirements of decision 6/CMP.9?	Yes
(d) Country-specific information to support provisions for natural disturbances in accordance with decision 2/CMP.7, annex, paragraphs 33–34?	No
CPR	Was the CPR reported in accordance with decision 18/CP.7, annex; decision 11/CMP.1, annex; and decision 1/CMP.8, paragraph 18? Yes
Adjustments	Has the ERT applied any adjustments under Article 5, paragraph 2, of the Kyoto Protocol? NA Ukraine does not have a previously applied adjustment Has the Party submitted a revised estimate to replace a previously applied adjustment? No
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for assessing conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties? Yes
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review? No
Questions of implementation	Did the ERT list any questions of implementation? No

^a Further information on the issues identified, as well as additional findings, may be found in tables 3, 5 and 6.

^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 25 March 2020,⁴ and had not been resolved by the time of publication of the report on the review of the Party's 2021 annual submission. The ERT has specified whether it believes the Party had resolved, was addressing or had not resolved each issue or problem by the time of publication of this review report and has provided the rationale for its determination, which takes into consideration the publication date of the most recent previous review report and national circumstances.

Table 3

Status of implementation of recommendations included in the previous review report for Ukraine

<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	Article 3.14 (G.1, 2019) (G.9, 2017) KP reporting adherence	Report any change in the information provided under Article 3, paragraph 14, of the Kyoto Protocol, in accordance with decision 15/CMP.1 in conjunction with decision 3/CMP.11.	Not resolved. The Party reported in its NIR (chap. 15, p.307) information about the minimization of adverse impacts but did not report if there were any changes in the information provided since its previous submission, as required by decision 15/CMP.1, annex, paragraph 25. During the review, the Party clarified that there were no changes compared with the 2020 submission in relation to the information provided under Article 3, paragraph 14, of the Kyoto Protocol.
G.2	CPR (G.4, 2019) KP reporting adherence	Report in the NIR a value for the CPR without decimals, rounding it up to the nearest full unit.	Resolved. The Party reported in its NIR (p.302) a CPR value rounded to the nearest full unit (2,656,912,172 t CO ₂ eq).
G.3	National registry (G.6, 2019) KP reporting adherence	Clearly state in the NIR whether there were any changes during the reporting period related to (1) the conformance to technical standards of the national registry and (2) the results of test procedures.	Resolved. The Party reported in its NIR (chap. 14, p.306) that there were no changes during the reporting period related to the conformance to technical standards of the national registry or the results of test procedures.
G.4	National system (G.2, 2019) (G.8, 2017) KP reporting adherence	Implement the workplan in accordance with the proposed timelines and report in the NIR of the next and subsequent annual submissions on the workplan and on the progress of the implementation of the workplan, explaining in detail the ongoing activities in place to resolve all the problems identified.	Resolved. The Party described in its NIR (chaps. 6.2.2, pp.214–216, and 11.3.1.1, pp.295–296) how all items of the workplan have been implemented. Specifically, (1) all information on forest accounting in 1988, 1996 and 2002 was scanned and processed into electronic tables; (2) data required for the calculations were extracted from forest accounting databases covering 2005–2014 and processed into electronic tables; and (3) for 2014 onward, an updated database structure was used by the Ukrainian State Project Forest Inventory Production Association that allowed data to be extracted from the electronic tables.

⁴ FCCC/ARR/2019/UKR. The ERT notes that the report on the individual inventory review of Ukraine'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.5	National system (G.7, 2019) Convention reporting adherence	Submit the annual GHG inventory by 15 April each year.	Addressing. The Party submitted its 2021 CRF tables on 15 April 2021 and its 2021 NIR on 23 April 2021. In addition, Ukraine submitted its 2020 NIR and CRF tables on 25 May 2021. The submission date of the NIR is not in accordance with decision 24/CP.19, paragraph 3, which requires Annex I Parties to submit their inventories by 15 April each year. During the review, the Party clarified that an annual step-by-step planning process has been developed and followed in accordance with the 2006 IPCC Guidelines, which was reported in the NIR (chap. 1.3.2, p.49). For the 2020 submission, the plan foresaw the development and submission of Ukraine's GHG inventory submission before 15 April. However, the deadlines were not complied with owing to the optimization of the Party's central executive government bodies system and the coronavirus disease 2019 pandemic. The ERT considers that the recommendation has not yet been fully addressed because of the slightly delayed submission of the 2021 NIR (eight days after the deadline).
Energy			
E.1	Fuel combustion – reference approach – solid fuels – CO ₂ (E.8, 2019) Convention reporting adherence	Correct the unit (i.e. from TJ to kt) used to report solid fuels in CRF table 1.A(b).	Not resolved. The Party continued to use TJ as the unit in column D of CRF table 1.A(b), although the numerical values used for reporting production, import, export and stock change of solid fuels correspond to kt. During the review, the Party reported that the unit will be corrected, and explained that the GHG emission estimates are accurate.
E.2	1.A Fuel combustion – sectoral approach – liquid fuels – CO ₂ (E.1, 2019) (E.2, 2017) (E.8, 2016) (E.11, 2015) (31, 2014) Accuracy	Develop and use country-specific CO ₂ EFs for liquid fuels (i.e. residual fuel, diesel oil, LPG, petroleum coke and refinery gases), which have a significant share in the fuel mix of stationary combustion.	Addressing. The Party reported in the NIR (chap. A2.4.1, p.332) that when calculating the volume of GHG emissions from stationary combustion, motor fuels in CRF category 1.A.1 (energy industries) were not transferred to other sources of emissions, while motor fuels (gasoline, gas oil and other fuels, with the exception of liquefied propane and butane) in categories 1.A.2 (manufacturing industries and construction) and 1.A.4 (other sectors) were not accounted for 1991–2019 and were transferred to the category of mobile sources (i.e. CRF category 1.A.3 (transport)), as no information is available on the use of such fuels in stationary combustion for these years. The Party reported in its NIR (chap. A2.6.3, p.347) that methodological recommendations for determining country-specific CO ₂ EFs from motor fuels in the transport sector, developed following research undertaken in 2017, were used for the 2021 submission. According to Ukraine, the carbon content and net calorific value for gasoline, diesel oil and LPG (see NIR table A2.4) consumed were determined for 2014, while retrospective values were obtained for the entire time series. The Party reported that data for 2015–2019 were based on 2014 data. The ERT considers that the recommendation has not yet been fully addressed because country-specific CO ₂ EFs for residual fuel and petroleum coke have not been developed.

<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	1.A.1 Energy industries – all fuels – CO ₂ (E.10, 2019) Convention reporting adherence	Improve the QA/QC procedures for the energy sector in order to enhance the accuracy and consistency of the information reported on recalculations in the NIR (table 3.6) and the CRF tables.	Resolved. The Party reported in its NIR (chap. 3.2.7.5, p.78) and CRF table 8s1 that it did not conduct recalculations for energy industries. During the review, the Party reported that recalculations based on statistical forms were made following consultations with SSSU and that QC procedures were fulfilled. During the review, the Party explained that the accuracy and consistency of the information reported on recalculations were generally ensured through exact correspondence to SSSU forms and that an additional check was done.
E.4	1.A.3.b Road transportation – LPG – CO ₂ , CH ₄ and N ₂ O (E.11, 2019) Consistency	Demonstrate that the use of different data sources for 1990–2015 and 2016 onward result in consistent CO ₂ , CH ₄ and N ₂ O emission estimates across the time series.	Addressing. The Party reported in its NIR (chap. 3.2.9.2.2, p.84) that emissions for the category for the entire time series were calculated using data on energy use of fuels according to statistical form 4-MTP, taking into account the analytical study (see NIR, p.311, reference 26) using the balance sheet method and the national carbon content coefficients for gasoline, diesel and LPG, which correspond to tier 2 for CO ₂ emissions and tier 1 for other gases. However, the ERT considers that the recommendation has not yet been fully addressed because the explanation provided does not detail how consistency is maintained across the time series. During the review, the Party explained that calculations were conducted using the surrogate method presented in the 2006 IPCC Guidelines (vol. 1, chap. 5, equation 5.2) on the basis of 2015 data as stated in the NIR (chap. 3.2.9.2.2, p.84). LPG AD from IEA were used to derive a proxy used in the calculations: surrogate statistical parameters in years 0 and t (as referred to in equation 5.2).
E.5	1.A.3.d Domestic navigation – liquid fuels – CO ₂ (E.4, 2019) (E.23, 2017) Transparency	Include in the NIR documentation of the observed trends in cargo for national and international navigation, particularly for 2012 onward.	Addressing. The Party reported in its NIR (figures A.21–A.22, pp.334–335) on the observed trends in cargo for domestic and international navigation. The ERT noted the Party's explanation in the 2019 review that water transport plays a role in reserve infrastructure and, because water levels in rivers in Ukraine are decreasing every year, significant fluctuations in navigation may be seen, and that increases in 2015 were due to the substitution of railway and road transportation as a result of national circumstances and fluctuations in the national economy (see document FCCC/ARR/2019/UKR, ID# E.4). However, these explanations are not included in the NIR.
E.6	1.A.3.e Other transportation – biomass – CH ₄ and N ₂ O (E.5, 2019) (E.7, 2017) (E.17, 2016) (E.31, 2015) Transparency	Strive to collect data for biodiesel consumption for 1990–2012 and report the outcome of those efforts in the NIR and, if impossible, change the notation key for 1990–2012 from “NO” to “NE”.	Resolved. The Party changed the reporting of biodiesel consumption from “NO” to “NO, NE” for 1990–2012 in CRF table 1.A(a)s3. The Party reported in its NIR (chap. A2.4.2, p.335) that for biodiesel consumed for categories 1.A.3.b and 1.A.3.e.ii there is no opportunity to collect consumption data for 1990–2012 because SSSU included the amount of biodiesel consumed in statistical forms for data collection only from 2013 onward. The Party concluded that the amount of biodiesel consumed in 1990–2012 (222 t in 2013, 0 t in 2014 and 47 t in 2015) was negligible. The ERT noted that the likely level of emissions from biodiesel consumption is below the significance threshold established in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.

<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.7	1.A.3.e Other transportation – biomass – CO ₂ , CH ₄ and N ₂ O (E.12, 2019) Completeness	Estimate and report the entire time series for CO ₂ , CH ₄ and N ₂ O emissions from biodiesel consumption (e.g. using one of the techniques included in the 2006 IPCC Guidelines, vol. 1, section 5.3.3).	Resolved. The Party reported in its NIR (chap. A2.4.2, p.335) that the amount of biodiesel consumed in 1990–2012 was negligible (see ID# E.6 above). Considering the lack of information on biodiesel for 1990–2012, extrapolation for earlier years using the techniques provided in the 2006 IPCC Guidelines would not provide reliable estimates. Therefore, the ERT considers reporting biodiesel consumption for 1990–2012 as “NE” to be adequate.
E.8	1.A.4 Other sectors – all fuels – CO ₂ , CH ₄ and N ₂ O (E.6, 2019) (E.24, 2017) Transparency	Include in the NIR clear and detailed explanations for the decreasing trends in total GHG emissions in the residential and commercial/institutional subcategories of the other sectors category.	Resolved. The Party reported in its NIR (chaps. 3.2.10.2.1 and 3.2.10.2.2, p.87) that the significant decrease in emissions in the commercial/institutional and residential sectors in 1990–2000 is a result of the collapse of the Union of Soviet Socialist Republics in 1991, a decrease in the population and the need to save energy. The emission fluctuations relate to economic crisis, migration and decreased population. In recent years, some stabilization of emissions has been observed against the background of a constant decrease in population.
E.9	1.B.1.c Other (solid fuels) – solid fuels – CO ₂ and CH ₄ (E.13, 2019) Transparency	Improve the information on allocation of CH ₄ emissions from coal bed CH ₄ flaring.	Addressing. The Party reported in its NIR (chap. 3.3.1.4, p.93) that CH ₄ emissions associated with coal bed CH ₄ flaring (reported under CRF category 1.B.1.c) in 2012–2019 were estimated using the surrogate method from the 2006 IPCC Guidelines on the basis of equation 1.4.5 and the 2012 AD reported in NIR table 3.15 (p.94). During the review, the Party clarified that it used equation 5.2 (2006 IPCC Guidelines, vol. 2, chap. 5) and therefore the reference to equation 1.4.5 was an error. The Party committed to correcting the text in the NIR (chap. 3.3.1.4) for its next annual submission.
E.10	1.B.1.c Other (solid fuels) – solid fuels – CO ₂ and CH ₄ (E.13, 2019) Transparency	Investigate whether double counting now occurs for coal bed CH ₄ flaring between categories 1.B.1.c and 1.A.1.c (i.e. clarify whether the flaring emissions reported under category 1.A.1.c in the 2017 submission were removed from category 1.A.1.c with the reporting of flaring under category 1.B.1.c) and report in the NIR on the findings.	Not resolved. The NIR did not contain any explanation that the emissions are not covered under category 1.A.1.c. In the NIR (annex 8, p.540) the Party stated that no response is required to the recommendation from the previous review report. During the review, the Party explained that there is no double counting for coal bed CH ₄ flaring between categories 1.B.1.c and 1.A.1.c. The ERT considers that the recommendation has not yet been fully addressed and that the findings of the investigation on the possible double counting need to be reported in the next NIR.
E.11	1.B.2.a Oil – CO ₂ , CH ₄ and N ₂ O (E.7, 2019) (E.25, 2017) Transparency	Include an explanation in the NIR for the choice of CO ₂ , CH ₄ and N ₂ O EFs for estimating emissions for the oil category, including documentation of the current state of oil industry infrastructure.	Addressing. The Party reported in its NIR (chap. 3.3.2.1, p.95) that six refineries operational in Ukraine up to 2009 had stopped operations by 2012. Currently, only one refinery is working, for which the information on crude oil refined is confidential, hence the use of default EFs. The ERT considers that the recommendation has not yet been fully addressed because information on the current state of the oil industry infrastructure (technology employed) was not provided.
E.12	1.B.2.a Oil (E.14, 2019) Transparency	Include in the NIR the information that a large quantity of oil transits through the country (i.e. it is not sourced from Ukraine and not transformed or	Addressing. The Party reported in its NIR (chap. 3.3.2.1, pp.95–96) that oil transportation in Ukraine is carried out only by pipeline, whereby 13,127 kt oil transited through the country and 2,382 kt oil was transported by pipeline for the

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
		used in Ukraine) and that oil is transported only by pipeline and not by any other sources mentioned in the 2006 IPCC Guidelines.	country's own use in 2019. The oil pipeline system includes 19 pipelines up to 1,220 mm in diameter with a total length of 3,507 km, 28 oil pumping stations (176 stations units), 79 in-service tanks and an offshore oil terminal "Yuzhny". Input system capacity is 114 Mt/year, with an output of 56.3 Mt/year. The Party further reported in the NIR (chap. 3.3.2.1.2, p.96) that default EFs for transportation of oil by pipeline were used in accordance with the 2006 IPCC Guidelines (vol. 2, section 4.2.2.3). In the NIR (chap. 3.3.2.1.2, p.96) the Party stated that, since the volume of oil transited through the territory of Ukraine is considerably higher than its local production volume, the conversion of the amount of transported oil from mass units used by oil transportation enterprises into volumetric units was conducted using the average density of the Russian Urals export blend (0.865 t/m ³). During the review, the Party referred to the information reported in the NIR. The ERT considers that the recommendation has not yet been fully addressed because information on whether there are any other means of transportation of oil is not included in the NIR.
E.13	1.B.2.a.5 Distribution of oil products – CH ₄ (E.15, 2019) Transparency	Explain in CRF table 9 and the NIR that emissions from the distribution of oil products are not estimated because there is no corresponding default EF in the 2006 IPCC Guidelines.	Resolved. The Party reported "NE" for this category in CRF table 1.B.2 and reported in its NIR (chap. 3.3.2.1.2, p.96) and CRF table 9 that the products of oil refining contain only negligible amounts of CH ₄ ; therefore, CH ₄ emissions during transportation and distribution of petroleum products were not estimated.
E.14	1.B.2.b Natural gas – CO ₂ and CH ₄ (E.16, 2019) Transparency	Improve the transparency of reporting for this category by including in the NIR the explanation for the decreasing trend observed in the natural gas transmission (compared with production increases) that was provided during the review.	Not resolved. There is no information explaining the trend included in the NIR. During the review, the Party explained that the natural gas transmission and production trends are independent because of the sizeable amount of transit gas (see CRF table 1.B.2).
E.15	1.B.2.b Natural gas – CO ₂ and CH ₄ (E.18, 2019) Accuracy	Revise emission estimates for the exploration, production and processing of natural gas using a tier that is in accordance with the 2006 IPCC Guidelines (vol. 2, figure 4.2.1).	Not resolved. In the NIR (chap. 3.3.2.2, p.98), the Party indicated that it used tier 1 default CO ₂ and CH ₄ EFs to estimate emissions from exploration, production and processing of natural gas. During the review, the Party explained that no country-specific CO ₂ and CH ₄ EFs have been developed and there are no AD for applying higher-tier methods for this category.
E.16	1.B.2.b Natural gas – CO ₂ and CH ₄ (E.18, 2019) Accuracy	Develop a category-specific improvement plan, detailing the plan in the NIR.	Not resolved. In the NIR (chap. 3.3.2.7, p.100), the Party indicated that no category-specific improvements are planned. During the review, the Party reported that it will address this recommendation as soon as financing is allocated for the improvement.
E.17	1.B.2.c Venting and flaring – all gases (E.19, 2019) Transparency	Enhance the transparency of the plans to improve the national inventory by including a detailed description of the planned improvement for estimating natural gas venting emissions.	Not resolved. In the NIR (chap. 3.3.2.7, p.100), the Party indicated that no category-specific improvements are planned. During the review, the Party reported that this recommendation will be addressed as soon as financing is allocated. So far there are no State funds allocated for addressing this issue.

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IPPU			
I.1	2.B.7 Soda ash production – CO ₂ (I.12, 2019) Comparability	Report both AD and emissions for soda ash production for category 2.B.7 (soda ash production) as “NO” in CRF table 2(I).A-Hs1 and update the category description in the NIR (section 4.12.1) by removing the reference to accounting for soda ash production emissions under category 2.A.4.b (other uses of soda ash).	Resolved. The Party corrected the notation keys in CRF table 2(I).A-Hs1 from “NA” to “NO” for the entire time series. The description of emission estimates under category 2.A.4.b (other uses of soda ash) was also corrected in accordance with the recommendation.
I.2	2.B.7 Soda ash production – CO ₂ (I.13, 2019) Transparency	Report in the NIR the reasons for there being no CO ₂ emissions from the Solvay process used for soda ash production at the only soda ash plant in the country.	Resolved. The Party reported in its NIR (chap. 4.12.1, p.119) that soda ash is produced in the country using the Solvay process and that CO ₂ generated as a by-product is returned to the process. The Party clarified in the NIR that the assessment of CO ₂ emissions is in accordance with a national research study on the development of the method of calculation and determination of GHG emissions in the chemical industry with the construction of particular time series.
I.3	2.B.8.b Ethylene – CO ₂ and CH ₄ (I.14, 2019) Comparability	Correctly report in CRF table 2(I).A-Hs1 the appropriate notation key for confidential AD, the CO ₂ IEF and the CH ₄ IEF for ethylene production, and explain in the NIR that there was no production of ethylene in 2009 and 2013–2016.	Resolved. The Party reported in its NIR (chap. 4.13.1, p.119) the reasons for there being no production of ethylene in Ukraine in 2009 and 2013–2016. The Party also reported the AD, CO ₂ IEF and CH ₄ IEF for 2003–2008, 2010–2012 and 2017–2019 as confidential in CRF table 2(I).A-Hs1. The AD, CO ₂ IEF and CH ₄ IEF for 2009 and 2013–2016 were reported as “NO” in CRF table 2(I).A-Hs1.
I.4	2.C.3 Aluminium production – CO ₂ and PFCs (I.3, 2019) (I.7, 2017) (I.30, 2016) (I.38, 2015) Transparency	Include information on aluminium production in the NIR.	Resolved. The Party reported in its NIR (chap. 4.16, p.127) that aluminium production in Ukraine has not occurred since 2010. The methodology used for estimating CO ₂ , carbon tetrafluoride and hexafluoroethane emissions for 1990–2010 was described in the NIR (section 4.16.2).
I.5	2.F.1 Refrigeration and air conditioning – HFCs (I.6, 2019) (I.11, 2017) Transparency	Document in the NIR the national circumstances supporting the use of an average lifetime of 18 years for domestic refrigeration equipment.	Resolved. The Party justified in its NIR (chap. 4.25.1.1.2.1, p.142) the use of an average lifetime of 18 years for domestic refrigeration equipment, which is based on scientific research of the Cherkasy State Research Institute of Technical and Economic Information in the Chemical Industry. The lifetime factor used is within the range of 12–20 years proposed as default in the 2006 IPCC Guidelines (vol. 3, part 2, table 7.9, p.7.52).
I.6	2.F.1 Refrigeration and air conditioning – HFCs (I.11, 2019) (I.16, 2017) Transparency	Include in the NIR information justifying the late introduction (from 2000) of air-conditioned cars into the Ukrainian market.	Resolved. The Party reported in its NIR (chap. 4.25.1.2.2, p.145) that the late mass use of air-conditioned vehicles in Ukraine was caused by the low rates of car imports until 2000 and absence of domestic manufacture of vehicles equipped with air conditioning in the country, which was related to the unstable economic situation in the country after the collapse of the Union of Soviet Socialist Republics. The Party provided further details in the NIR, including references to

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			the data sources from which the year of introduction of air-conditioned cars into the Ukrainian market was obtained.
Agriculture			
A.1	3. General (agriculture) – CO ₂ , CH ₄ and N ₂ O (A.2, 2019) (A.17, 2017) Convention reporting adherence	Improve the QC checks to ensure that all tables referred to in the text of the NIR actually exist in the NIR and contain the information stated (e.g. table A3.2.3.6 should have contained data on percentage crude protein but did not, and milk production should have been presented in table A3.2.3.8 but this table does not exist).	Addressing. Regarding the errors between the tables and the text of the NIR (see ID# A.10 in table 6), the Party reported that specific QA/QC procedures were used comparing data from different sources such as other countries (NIR, chap. 5.2.4, p.173, for enteric fermentation). Thus, milk production and fat composition are reported in NIR table A.3.2.2.6 (p.415), while crude protein concentration in animal feed is reported in NIR table A3.2.3.7 (p.445). During the review, the Party clarified that the table contents were revised to ensure consistency across the text and indicated that QC is carried out by a national agriculture expert. Nevertheless, the ERT considers that the recommendation has not yet been fully addressed because errors persist in the current submission. In particular, NIR table A.3.2.2.6 does not provide information on milk protein.
A.2	3.B Manure management – N ₂ O (A.11, 2019) (A.23, 2017) Transparency	Include in the NIR information on how distribution across the MMS is estimated, together with a reference to the expert(s) or organization(s) behind the assumptions made; and an explanation regarding why it is considered valid to assume that the animal population size of an enterprise is directly correlated with the type of MMS used.	Resolved. The Party reported in its NIR (chap. 5 5.3.2.1, table 5.10, p.178) details of how MMS are classified, noting that the information is based on expert judgment from the National University of Life and Environmental Sciences of Ukraine. Ukraine provided in its NIR an explanation of the choice of cattle and swine MMS as a result of specific feasibility studies and farm specialization and capacity, with a detailed characterization by farm capacity (chap. 5, table 5.11, p.180). The ERT considers that the explanation provided, reflecting the characteristics of animal handling systems for farm types and sizes, including MMS, is adequate.
A.3	3.B.1 Cattle 3.B.3 Swine – CH ₄ (A.12, 2019) (A.10, 2017) (A.23, 2016) Transparency	Include in the NIR relevant information on the reported MMS (e.g. how manure is handled, mechanically separated and stored, and the emptying frequencies of the lagoons/manure stores and field application) (the description should include a mass balance for all handled manure based on excreted VS in each MMS and indicate whether or not the manure is covered by a crusting layer).	Addressing. The Party reported in its NIR (chap. 5.3.2.1, table 5.10, p.178) details on MMS, indicating that the storage period of all types of manure depends on the structure, humidity and technology of its storage and is 4–8 months for cattle manure and 8–12 months for swine manure. However, the ERT considers that the recommendation has not been fully addressed as no mass balance was calculated or reported by the Party, with errors in the allocation of swine manure (see ID# A.10 in table 6). During the review, Ukraine explained that national circumstances prevent the required research from being conducted and no date can be provided for when it will take place.
A.4	3.B.1 Cattle 3.B.3 Swine – CH ₄ (A.13, 2019) (A.10, 2017) (A.23, 2016) Accuracy	If the lagoons do not have a crusting layer, use the most appropriate methane conversion factor from table 10.17 of the 2006 IPCC Guidelines.	Resolved. Recalculations were carried out for category 3.B to reflect changes in the characterization of animal categories. The ERT agrees with these recalculations. The Party reported in its NIR (chap. 5.3.2.1, table 5.10, p.178) that default methane conversion factor values from table 10.16 of the 2006 IPCC Guidelines (vol. 4, chap. 10) are used to estimate emissions from MMS (see CRF table 3.B(a)s2). For lagoons with no crust layer, a methane conversion factor of 10

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			per cent was declared, which is the lower end of the default range provided in the 2006 IPCC Guidelines (vol. 4, table 10.17).
A.5	3.B.3 Swine – CH ₄ (A.15, 2019) (A.12, 2017) (A.25, 2016) Accuracy	Investigate in detail the VS excretion rates for swine, revise them as needed and report their values together with supporting information in the NIR.	Resolved. The Party reported in its NIR (chap. 5, p.177, and table A3.2.3.1, p.473) swine VS excretion in accordance with equation 5.1 of the 2006 IPCC Guidelines (vol. 4, chap. 5), providing manure excretion values, ash content and maximum methane-producing capacity of the manure. During the review, the Party clarified that total manure excretion values (dry matter basis) were updated in this submission as a result of the consideration of a new report generated by the National Academy of Agrarian Sciences of Ukraine. Recalculations were revised and the ERT agrees with the calculations.
A.6	3.G Liming – CO ₂ (A.21, 2019) (A.31, 2017) Transparency	Conduct an assessment of the proportion of inert materials in ground lime and document the results in the NIR; and, if ground lime is considered to include inert materials, revise the CO ₂ emissions for the entire time series, excluding the portion of the inert materials in ground lime.	Addressing. The CO ₂ emissions for the entire time series were recalculated for the 2018 submission (NIR, p.544) in line with the recommendation of the previous ERT. The Party reported in its NIR (chap. A3.2.6, table A3.2.6.1, p.452) the amount of ground lime applied, for both total and active matter weight. It explained that these values are based on expert judgment, considering no less than 85 per cent of the active substance. The ERT reviewed the estimations and confirmed that the proportion of inert materials considered across the time series is 15 per cent. It also confirmed that the effective lime quantities used to estimate emissions for this category exclude the inert fractions. During the review, the Party clarified that the SSSU does not carry out research on the quality of applied ground lime and there is no possibility of further updating this information at this time. The ERT considers that the recommendation has not yet been fully addressed as the Party has not yet documented in the NIR the information on the inert materials in ground lime or demonstrated that the estimated proportion of inert materials in ground lime matches that proposed in expert judgment.
LULUCF			
L.1	4. General (LULUCF) – CO ₂ (L.1, 2019) (L.2, 2017) (L.3, 2016) (L.4, 2015) (67, 2014) Convention reporting adherence	For the model used to calculate the net changes in SOM in mineral soils, verify the model's outputs with measurements annually conducted in the country.	Addressing. The Party included a comparison of the tier 3 model used to calculate CSC in SOM with IPCC tier 1 defaults in the NIR (chap. 6.3, pp.220–221), which it also included in the 2019 submission. The differences between the N content in crop residues left on fields under the tier 1 and 3 approaches are significant, particularly for grains and oil crops, with little explanation for the cause of such differences. During the review, the Party acknowledged that further verification of the model outputs is required. It included verification of the SOM pool for cropland and grassland categories in its improvement plan in the NIR (annex 8.2). The ERT considers that the recommendation has not yet been resolved because no comparison with measurements or information on actual data collection for SOM was reported. Further verification of the model outputs is required.
L.2	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O	Enhance data collection on the other land uses under which organic soils are reported and on their	Not resolved. The Party has not enhanced data collection on the land uses for which organic soils are reported. During the review, the Party explained that it has

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	(L.2, 2019) (L.30, 2017) Accuracy	status, either drained or rewetted or, for wetlands only, natural conditions, and supplement the current data gaps with available ancillary data and expert judgment to ensure that no systematic errors affect the estimates of GHG emissions in the time series of each land-use category.	limited information on organic soils management and that improvements can be made to the data when new soil and land-use maps are developed.
L.3	4. General (LULUCF) (L.4, 2019) (L.5, 2017) (L.7, 2016) (L.18, 2015) Transparency	Enhance the information reported in the NIR to improve transparency and include, for each estimated category, the verification of outputs (i.e. GHG estimates), if any, noting that the verification of outputs is mandatory for tier 3 estimates.	Addressing. As identified in the previous review report (see document FCCC/ARR/2019/UKR, ID# L.4) the Party has taken steps to verify the model by comparing emission estimates using a tier 3 method and applying the IPCC tier 1 methodology as documented in the NIR (chap. 6.3, pp.220–221). However, differences between the calculated outputs have not been made clear (see ID# L.1 above) and further verification of outputs for tier 3 estimates is required. During the review, the Party acknowledged this as an issue and stated that it is included in its planned improvements (in NIR annex A8.2).
L.4	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O (L.23, 2019) Accuracy	Report consistent areas for organic soils in NIR table A3.2.5.4, in CRF table 3.D, and for the sum of organic soils in cropland and grassland in CRF tables 4.B and 4.C.	Resolved. The Party has corrected the error that occurred in the area of organic soils reported in the NIR (annex 3.2, table A3.2.5.4) and CRF tables 3.D, 4.B and 4.C. The area reported across these tables is now consistent.
L.5	4. General (LULUCF) (L.24, 2019) Convention reporting adherence	(1) Improve the documentation of uncertainty estimates reported in NIR table 6.10, particularly when expert judgment is involved; and (2) describe in the NIR the methodology used to calculate total uncertainty, in accordance with good practice to document any expert judgment (2006 IPCC Guidelines, vol. 1, annex 2A.1).	Not resolved. The Party reported in its NIR (chap. 6.2, p.216) that the total uncertainty of emissions for forest land is 23 per cent. The Party listed the uncertainties for the forest land category in NIR table 6.6, which includes a combination of the IPCC default and calculated and expert judgment uncertainty values. (1) The Party did not provide any further documentation of the uncertainty estimates reported in NIR table 6.6 (table 6.10 of the 2019 NIR). No documentation of how the expert judgment of uncertainty was derived has been provided. (2) Using approach 1 from the 2006 IPCC Guidelines (vol. 1, section 3.2.3.1), an uncertainty of 127 per cent is obtained from the values listed in NIR table 6.6. During the review, the Party confirmed that simple error propagation was applied to obtain the uncertainty. It is therefore unclear how an uncertainty estimate of 23 per cent for the category was obtained as no further methodologies have been described.
L.6	Land representation – CO ₂ , CH ₄ and N ₂ O (L.5, 2019) (L.7, 2017) (L.33, 2016) Accuracy	Collect sufficient data on the land area and changes in the land area, verify the conversions between land-use categories and demonstrate how the accuracy of land representation has improved, clearly documenting the AD used for the sector in the NIR.	Not resolved. The Party reported that it has not undertaken further work in investigating alternative data sources for monitoring land-area changes in the NIR (chap. 6.1.1, p.205) since the work undertaken for the 2019 submission (chap. 6.1.2). During the review and in the NIR (p.546), the Party acknowledged that it is continuing to seek funding to improve the representation of land areas. The ERT considers that the recommendation has not yet been addressed because, while the

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			Party took action to find an alternative method for identifying land representation spatially for the 2019 submission, the data from these investigated sources were found to be poor. No further information was provided in the NIR on how the Party plans to address this recommendation.
L.7	Land representation – CO ₂ , CH ₄ and N ₂ O (L.6, 2019) (L.31, 2017) Consistency	Report annual land-conversion areas in CRF table 4.1 and report cumulated 20-year conversion areas in CRF tables 4.A–4.F, which requires the calculation of annual land use and land-use change matrices for 1971–1989.	Addressing. The Party reported annual areas of land-use change in CRF table 4.1. However, CRF tables 4.A–4.F require the calculation of annual land use and land-use change matrices for 1971–1989. During the review, the Party acknowledged this as an issue and stated that work to develop land-use matrices for this period is ongoing. The ERT considers that the recommendation has not yet been fully addressed because, while annual areas of land-use change were reported in CRF table 4.1, CRF tables 4.A–4.F still require the annual land use and land-use change matrices to be calculated for 1971–1989.
L.8	Land representation – CO ₂ , CH ₄ and N ₂ O (L.7, 2019) (L.31, 2017) Consistency	Ensure that in any year X of the GHG inventory time series (1) the area (AX) of any land remaining category A is the area of A in the previous year (AX – 1) minus the area of A converted in year X to all other land-use categories (A to OLUX) plus the area converted to A from all other land-use categories 20 years before (OLU to AX – 20) (i.e. $AX = AX - 1 - A \text{ to OLUX} + OLU \text{ to AX} - 20$); and (2) the area of any land converted category B to A (B to AX) is the cumulated area converted to category A from B (B to A) in the 20-year time period from year X to year X–19 (i.e. $B \text{ to AX} = \sum_{t=X-19}^X B \text{ to A}$).	Not resolved. The Party reported the final area of forest land (managed) in CRF table 4.1 for 2018 as 10,655.12 kha. However, the initial area reported in CRF table 4.1 for forest land (managed) for 2019 is 10,654.00 kha. Similarly, the final area reported for 2018 for other land is 905.95 kha and the initial area reported for other land in CRF table 4.1 for 2019 is 905.80 kha. The ERT considers that the recommendation has not yet been addressed because the final and initial areas reported for consecutive individual years still do not always match.
L.9	Land representation – CO ₂ , CH ₄ and N ₂ O (L.27, 2019) Transparency	Ensure transparency by correctly labelling tables; that is, the title of NIR table 6.4 should indicate that the areas of conversions shown are cumulative.	Resolved. The table title was changed and the Party reported in the NIR (table 6.4, p.208) that the areas of conversion shown in that table are cumulative for the time series 1990–2019.
L.10	Land representation – CO ₂ , CH ₄ and N ₂ O (L.28, 2019) Transparency	Include in the NIR the information that donor categories are those from which land-use conversion occurs in a particular year and that they are defined on the basis of the definitions given in the country-specific forms.	Resolved. The Party reported in its NIR (annex 3.3.3, p.480) that donor categories are defined annually on the basis of a comparison of total areas for each land-use category from data collected from statistical reporting form 16-zem.
L.11	4.A Forest land – CO ₂ (L.9, 2019) (L.9, 2017) (L.14, 2016) (L.27, 2015) Accuracy	Revise the calculations of GHG emissions and removals from forest land in mineral soils following the methods presented in the 2006 IPCC Guidelines and implement sector-specific QC	Not resolved. The ERT acknowledges the ongoing efforts of Ukraine regarding stratification of land-use categories and identification of soil types on converted land. However, refinement of soil type on converted land is challenging using the current statistical approach of identifying land and land-use change distribution described in the NIR (chap. 6.1, pp.205–208). During the review, the Party

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		procedures to ensure the accuracy of the estimates reported across the time series.	clarified that the work to define land-use categories using GIS is in progress. Completion of this work would allow for soil types to be assigned to land-use conversions, and thus proper SOC _{REF} could be selected. The ERT acknowledges that this work is ongoing and is included in the improvement plan for the NIR (NIR, annex 8.2).
L.12	4.A Forest land – CO ₂ (L.10, 2019) (L.32, 2017) Accuracy	(1) Recalculate nationwide CSC factors for biomass increments and for DOM net changes, stratified by forest type, ecological region and age class, by compiling available information in the country, and, where feasible, by collecting novel data through a national forest inventory system; and (2) while new CSC factors are being calculated, and noting that Ukraine referenced the use of a 2017 Buksha et al. report in its 2017 submission, use data contained in table 3.9 of that report for biomass increments as stratified by age class and main forest species, together with an age-class distribution for the entire time series 1990–2016, and revise the DOM CSC factors and method to ensure time-series consistency.	Addressing. The ERT notes that since the submission of the 2019 NIR there have been no further recalculations for CSC factors for biomass increments and for DOM net changes in forest land. With respect to item (1) the ERT acknowledges that the Party has now stratified CSC for biomass by age class, forest species, management zone and protection status of the forest plot (as described in NIR annex 3.3.1). However, as identified in ID# L.20 below, issues remain around the methods applied to try to ensure time-series consistency with the different data sources for the stratification of the age class. Therefore, the ERT considers that the recommendation has not yet been fully addressed. With respect to item (2) the Party applied a tier 1 method for calculating CSC in DOM (see NIR chap. 6.2, p.215). During the review, the Party acknowledged that it is currently unable to apply a tier 2 methodology owing to a lack of country-specific data but has included improving its CSC estimates for DOM in its improvement plan (in NIR annex 8.2).
L.13	4.A Forest land – CO ₂ , CH ₄ and N ₂ O (L.29, 2019) Transparency	Include in the NIR or in a technical annex the information on national forest inventories that was provided to the ERT during the 2019 review.	Resolved. The Party included in NIR chapter 6.2.2 the requested information on: (1) Previous and current forest inventory compilations; (2) The agency responsible for implementing and overseeing the forest inventory; (3) The use of temporary sampling plots to produce management plans; (4) How the forest inventory data are stored and applied to the NIR. There is no specific reference in chapter 6.2.2 of the NIR to direct the reader to table A3.3.4, where information on the species in each region as well as the age class can be found. However, as the data are included in the NIR, the ERT considers that the issue has been resolved.
L.14	4.A Forest land – CO ₂ (L.30, 2019) Transparency	Explain in the NIR that, because table 4.5 in the 2006 IPCC Guidelines (vol. 4) does not contain information for softwood species in temperate zones, the Party applied further guidance from the 2006 IPCC Guidelines (below equation 2.12), which states that if BCEF _R is not available, then the equation BEF _R multiplied by wood density can be used instead; lacking country-specific values for BEF _R , Ukraine decided to use available BEF _R values for softwood species in temperate zones;	Resolved. The Party included additional information in the NIR (annex 3.3.1, p.486) to explain that BCEF _R for softwood species was estimated using the ratio of the biomass expansion factor and wood density for the softwood species in temperate zones. This is in accordance with the 2006 IPCC Guidelines (vol. 4, equation 2.12).

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		and because Ukraine did not apply a BEF _R for other species, the cells in NIR table A3.3.6 for conifers and hardwood species are empty.	
L.15	4.A Forest land – CO ₂ (L.31, 2019) Accuracy	From the data after 2014, estimate an average loss in a comparable manner to estimating the average stock and derive a correction factor based on such averaged data, to ensure the comparability of values and enhance the transparency and accuracy of estimates of losses from disturbances (in the approach used in the 2019 submission, the correction factor could result in values of more than 1 because absolute values of actual losses are compared with average values of stocks).	Resolved. The Party reported in its NIR (annex 3.3, p.486) further information on the calculation of GHG emissions from disturbances, and has applied the recommendation from the previous review report by averaging the actual data to calculate a correction factor.
L.16	4.A Forest land – CO ₂ (L.31, 2019) Transparency	Improve the explanation in the NIR regarding how the correction factors for estimating carbon loss from disturbances were derived and what the implications may be of using a constant value of the factor.	Addressing. The Party reported in its NIR (annex 3.3, p.486) further information on the calculation of GHG emissions from disturbances (see ID# L.15 above), explaining that it averaged the actual data to calculate a correction factor. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet explained what the implications of applying a constant value for the correction factor may be.
L.17	4.A Forest land – CO ₂ , CH ₄ and N ₂ O (L.32, 2019) Transparency	Improve the description in the NIR of the stratification by explaining what the subcategories of managed forest land “Total area of the category”, “Area covered by forest vegetation (managed)” and “Unstocked areas” represent.	Resolved. The Party amended the headings in NIR table A3.3.1 (p.478) to make it clear which areas of forest land remaining forest land correspond to managed forest land. The area of managed forest reported in NIR table A3.3.1 now correctly corresponds to the area reported in CRF table 4.A.
L.18	4.A.1 Forest land remaining forest land – CO ₂ , CH ₄ and N ₂ O (L.12, 2019) (L.11, 2017) (L.34, 2016) Transparency	Include clear definitions of managed and unmanaged forest land and an explanation of how unmanaged forest land is detected in the land representation and, if necessary, revise the distribution of forest land between managed and unmanaged.	Addressing. The definitions of managed and unmanaged forest land have been clarified in the NIR (chap. 6.2, p.213–214). However, it is unclear how land is detected and classified between managed and unmanaged forests. The Party reported in its NIR (p.213) that “the work to revise areas of managed and unmanaged forests is ongoing, as part of land-use transition matrix revision and revision of activity data regarding forestry on time series”. The ERT notes that the resolution of this issue is closely related to ID# L.6 above.
L.19	4.A.1 Forest land remaining forest land – CO ₂ (L.34, 2019) Accuracy	Correct the value for the area of forest land remaining forest land in 2015 reported in CRF table 4.A from 10,370.69 to 10,373.36 kha.	Not resolved. The Party has not corrected the area of forest land remaining forest land reported in CRF table 4.A for 2015, which is still reported as 10,370.69 kha instead of 10,373.36 kha. During the previous review the Party acknowledged that an error had occurred and that the area would be revised.
L.20	4.A.1 Forest land remaining forest land – CO ₂	Ensure the time-series consistency of the estimates of gains in living biomass on forest land remaining	Addressing. The Party reported in its NIR (chap. 6.2, pp.213–214) on the system in which the data collected from different forest enterprises are consolidated into a single database, noting that the data do not cover consistent information about the

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	(L.35, 2019) Consistency	forest land, including in relation to data on forest age classes and the assumptions for stand age.	age-class distribution across the time series. The Party applied a consistent approach to estimating age-class distribution across forest land; however, this resulted in a large shift in carbon gains between 2002 and 2005. During the review, as well as in its NIR (chap. 6.2.2), the Party acknowledged the issues surrounding the previous approach to ensuring time-series consistency of the age-class distribution of forest. The Party explained during the review that it intends to address this issue for its next annual submission.
L.21	4.B Cropland – CO ₂ and N ₂ O (L.13, 2019) (L.14, 2017) (L.16, 2016) (L.29, 2015) Accuracy	Enhance data collection on the use under which organic soils are reported, and supplement the current data gaps with available ancillary data and expert judgment, where needed, to ensure that no systematic errors affect the estimates of GHG emissions in the time series.	Addressing. The method applied to identify the representation of land-use categories has not been enhanced (see NIR chap. 6.1.1, p.205), which would be needed to improve the land-use category under which organic soils are reported. The Party explained during the review that work to improve the representation of land areas is ongoing (see ID# L.6 above) and, as described in ID# L.2 above, the Party has only limited information on organic soils management. Accordingly, identification of land with organic soils can be improved once improvements to land representation have been addressed.
L.22	4.B Cropland – CO ₂ (L.37, 2019) Transparency	Include the information on the land-use categories under cropland (arable land, fallow land and gardens) provided to the ERT during the review, namely that (1) the Party does not have information on the spatial distribution of lands because this information depends on the completion of the work on land representation; and (2) for fallow land, it does not have a specific methodology for estimating the effect on carbon stocks and changes of abandoning previously actively used cropland; however because on such lands natural processes of restoration of carbon stocks are occurring, it considers its assumption does not overestimate carbon removals.	Addressing. The Party reported in its NIR (chap. 6.3, p.218) that there is no information on spatial distribution of areas of cropland (arable land, orchards and fallow land), which is expected to change after introduction of GIS data (see ID# L.6 above); and calculations for fallow land cannot be performed owing to lack of input data. It is assumed that fallow land after intensive management will gain carbon in the mineral soils pool, so excluding calculation of CSC on fallow land does not lead to underestimated emissions. The ERT considers that item (1) of the recommendation has been addressed. However, with regard to item (2), the conservative approach applied for fallow land is not in line with the IPCC good practice principle of accuracy for reporting under the Convention (2006 IPCC Guidelines, vol. 1, chap. 1.4). Applying a conservative approach is relevant for reporting under the Kyoto Protocol as it ensures that emissions and removals are not under- or overestimated. The ERT recommends that the Party delete the text “Nevertheless, it is expected, that fallow lands after intensive management will gain carbon in mineral soil pool, so this assumption does not underestimate emissions” from its NIR.
L.23	4.B Cropland – CO ₂ (L.37, 2019) Transparency	Describe in NIR section 6.3 the methodology for estimating CSC for arable land or indicate there that the methodology is described in an annex to the NIR.	Resolved. The Party reported in its NIR (chap. 6.3, p.218) that cropland is subdivided into arable land, orchards and fallow land. The Party described methods for estimating CSC in biomass and SOM for the subdivisions in its NIR (annex 3.3.2).
L.24	4.C.1 Grassland remaining grassland – CO ₂	Use subdivisions of managed grassland to report those areas of grassland that are not subject to changes in management activities or for which	Not resolved. The Party has not subdivided grassland into areas of grassland that are not subject to changes in management activities or for which management activities do not result in net emissions or net removals, stating in the NIR (chap. 6.4.1, p.222) that all grassland is assumed to be managed. During the review, the Party explained that the national methodology it applies to estimate emissions

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	(L.15, 2019) (L.34, 2017) Accuracy	management activities do not result in net emissions or net removals of GHGs.	from mineral soils for grassland does not allow it to separate specific areas of grassland for which different management practices are applied.
L.25	4.C.2.1 Forest land converted to grassland – CO ₂ , CH ₄ and N ₂ O (L.38, 2019) Completeness	Replace the notation key “NO” with an estimated value for the conversion of forest land to grassland for 1990–1993 in CRF table 4.1 and estimate the related emissions and removals.	Resolved. The Party reported in CRF table 4.1 estimated emissions for the conversion of forest land to grassland for 1990–1993.
L.26	4.C.2.1 Forest land converted to grassland – CO ₂ , CH ₄ and N ₂ O (L.38, 2019) Transparency	Revise the labelling of NIR table A3.3.2 to indicate that the areas in the table relate to the Convention and include the 20-year transition period elected.	Resolved. The Party revised the labelling of NIR table A3.3.2 (p.479) to identify that the total areas presented are on a cumulative basis. The paragraph in the NIR which references table A3.3.2 indicates that the table is based on a 20-year transition period, making it clear why the cumulative areas under a land-use category can decrease over time.
L.27	4.D Wetlands – CO ₂ , CH ₄ and N ₂ O (L.40, 2019) Transparency	Revise NIR table 6.21 to reflect the recalculations between the previous and the current submission (i.e. in the 2020 NIR, the table should compare emissions between the 2019 and 2020 submissions).	Resolved. There were no recalculations for the wetlands category in the 2021 submission.
L.28	4.D.1 Wetlands remaining wetlands – CO ₂ and N ₂ O (L.16, 2019) (L.19, 2017) (L.18, 2016) (L.32, 2015) Accuracy	Enhance the data collection on the drainage status of peat production sites once abandoned; supplement the current data gaps with available ancillary data and expert judgment, where needed; and estimate GHG emissions in sites for peat production which, although abandoned, are still under drainage to ensure that no errors affect the GHG emission trend.	Addressing. The Party reported in its NIR (chap. 6.5, p.226) that peat extraction areas have reduced significantly since 1990. However, the Party provided no further information on the status of peat production sites once a site has been abandoned. During the review, the Party clarified that there is limited information available on the status of lands previously drained, including peat extraction sites, and that it is continuing efforts to source additional information on the status of these lands. The ERT considers that the recommendation has therefore not yet been fully addressed, but acknowledges that improvements to land representation identification (see ID# L.6 above) could help to resolve this issue.
L.29	4.D.2 Land converted to wetlands – CO ₂ , CH ₄ and N ₂ O (L.17, 2019) (L.35, 2017) Accuracy	Report all land converted to wetlands under the organic soils subdivision and discount such areas from the original land-use category area of drained organic soils.	Addressing. The Party reported in its NIR (chap. 6.5, p.226) justification for assuming that all forest land, cropland and grassland conversions to wetlands occur on organic soils. However, the ERT considers that the recommendation has not yet been fully addressed as data on land representation are required to validate this assumption (see ID# L.6 above). This is also acknowledged by the Party in its NIR (p.226).
L.30	4.F Other land – CO ₂ (L.19, 2019) (L.25, 2017) (L.22, 2016) (L.36, 2015) Comparability	Revise the classification of category 66 (“dry open lands with special vegetation cover”), noting that category 66 appears to more closely match the definition of the IPCC category grassland than other land.	Addressing. The Party revised the statistical reporting form 16-zem and category 66 is no longer used. The categories used on the form, and their descriptions, are reported in the NIR (chap. 6.1, table 6.1, p.206). During the review, the Party confirmed that category 66 is no longer applicable as the new 16-zem form has different categories. However, it is unclear what the land previously classified as category 66 has been reclassified as. The recommendation from the previous review indicates that category 66 was more aligned to the IPCC grassland category

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			than other land. However, the area of other land reported for 2017 in CRF table 4.1 is very similar in the 2019 submission (1,003.26 kha) and 2021 submissions (1,003.23 kha). Therefore, it is unclear how the updated 16-zem form has addressed the previous issues around grassland being incorrectly classified as other land throughout the time series. The ERT acknowledges that this issue is closely tied to the work needed on improving the representation of land areas (see ID# L.6 above).
L.31	4.F.2.1 Forest land converted to other land – CO ₂ and N ₂ O (L.21, 2019) (L.27, 2017) (L.24, 2016) (L.38, 2015) Transparency	Subdivide and report separately deforested areas between those that did contain trees and those that did not contain trees before deforestation; and report in the NIR a table where, for each carbon pool, the standing carbon stocks before deforestation and after deforestation are reported for those lands that did contain trees before deforestation.	Not resolved. The Party described the method used to allocate land representation in the NIR (chap. 6.1). As spatial data are not used in its approach, the Party has been unable to implement this recommendation. During the review, the Party identified improvements to data on land representation (in ID# L.6 above) that would help to address this recommendation.
L.32	4.G HWP – CO ₂ (L.41, 2019) Transparency	Explain in the NIR the methodology used for estimating emissions from HWP, including the splicing technique, the use of GDP data and the World Bank as the source of the GDP data, and the use of 2010 prices.	Not resolved. The Party reported in its NIR (chap. 6.8, p.232) that it sources data for the production of wood-based panels and paper and paperboard from FAOSTAT, which does not have information for 1990–1991 for HWP. The Party indicated that it applied a splicing technique using national GDP data to estimate HWP production for those years. However, the Party did not report any further information on the methodology used in applying the splicing technique using GDP data derived from the World Bank to calculate the production of wood-based panels, paper and paperboard for 1990–1991. Moreover, there is no longer a reference in the NIR to the use of constant 2010 prices (as reported in the 2019 NIR), so it is unclear whether this has also been applied in the 2021 NIR. The ERT considers that the recommendation has not yet been addressed because the methodology for applying the splicing technique using GDP data has not been described in the NIR.
L.33	4.G HWP – CO ₂ (L.41, 2019) Accuracy	Investigate alternative statistical sources to GDP to more accurately represent the industrial activity of the wood products industry, such as those that may be used by Ukraine's economic agencies to calculate domestic gross value added (a major component of GDP) for the wood products industry and, if the investigation results in revisions to the approach or the estimates compared with the 2019 submission, explain any recalculations, including their impact.	Resolved. The Party reported in its NIR (chap. 6.8, p.232) that it investigated alternative sources to GDP to more accurately represent the data for production of wood-based panels and paper and paperboard in 1990–1991 and included information on the impact of recalculations in section 6.8.5 of the NIR. However, no alternative source with more reliable data for the period could be found.

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L.34	4(IV).2 N leaching and run-off – CO ₂ , CH ₄ and N ₂ O (L.42, 2019) Convention reporting adherence	Use correct values and units for AD reported for emission estimates for N leaching and run-off in CRF table 4(IV).	Resolved. The Party corrected the unit error in the AD in CRF table 4(IV) relating to indirect N ₂ O emissions from N leaching and run-off. The IEF reported (0.0075 kg N ₂ O-N/kg N) is consistent with the default EF given in the 2006 IPCC Guidelines (vol. 4, chap. 11, table 11.3) that the Party reported applying.
Waste			
W.1	5. General (waste) – CO ₂ , CH ₄ and N ₂ O (W.1, 2019) (W.7, 2017) Transparency	Improve the description in the NIR of the solid waste management practices in the country, including landfilling of MSW (with and without CH ₄ recovery), composting, incineration, recycling and management of hazardous waste.	Addressing. The Party reported in its NIR information on recycling and management of hazardous waste (chap. 7.2.2.2, p.238) and sludge management (chap. 7.5.2.2.3, p.267). During the review, the Party provided additional information on solid waste management practices in the country, including recycling and management of hazardous waste. In response to a question on whether any improvement might be made to the description of other solid waste management practices in the country, including landfilling of MSW (with and without CH ₄ recovery), composting and incineration, the Party stated that at present no additional information to that already reported in the description in the NIR for those solid waste management practices in the country is available.
W.2	5. General (waste) – CO ₂ , CH ₄ and N ₂ O (W.2, 2019) (W.8, 2017) Transparency	Revise the schematic representation of waste treatment (NIR figure 7.3) by including all categories (in all relevant sectors), the sources of each type of waste, ways of treatment and final destination, particularly of sludge from wastewater treatment.	Addressing. The Party revised the schematic representation of waste treatment in its NIR (figure 7.3, p.239) by including most of the categories. During the review, the Party clarified that, although the schematic representation of waste treatment has been updated, more additions are planned. Information regarding the flow pathways for sludge from wastewater treatment and final destination of sludge is presented in the NIR (chap. 7.5.2.2.3, p.267, and figure 7.11, p.262). However, in the schematic representation, sludge treatment and its final destination are included in the position of “Other specifically designated places”. If a significant amount of sewage sludge is generated at the enterprise (water supply) and it is located on its own territory, the enterprise must have a passport for the waste disposal site, and sludge-drying beds or lagoons are considered as specifically designated places or waste disposal sites. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet revised figure 7.3 by including all categories, the sources of each type of waste, ways of treatment and final destination.
W.3	5.A Solid waste disposal on land – CH ₄ (W.4, 2019) (W.2, 2017) (W.10, 2016) Accuracy	Continue to further investigate MSW, taking into consideration the fact that the sampling should be conducted in several typical cities in each season and that the methods, frequency of sampling and implications for the time series should be documented with a view to developing a country-specific EF for the category.	Not resolved. The Party reported in the NIR (p.241) that waste composition in 2014–2019 was based on data for 2013. Regarding degradable organic carbon, the Party reported that some research on food waste was carried out but the results were significantly lower than the default values from the 2006 IPCC Guidelines (vol.5, chap. 2, table 2.4, p.2.14). Given the one-off and non-systematic nature of the research, the Party considered that additional activities are needed to develop country-specific values, and therefore it used the default IPCC values for the NIR (chap. 7.2.2.3, p.241). During the review, the Party clarified that the work on the

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			investigation of the MSW composition in Ukraine is still on the list of planned improvements to the NIR, noting that it included information on the current implementation status of the improvement in its NIR (p.556). In response to a question from the ERT on why the Party did not mention this improvement plan in chapter 7.2.6 of the NIR, “Category-specific planned improvements” (p.246), the Party stated that the information in that chapter will be updated in the next NIR.
W.4	5.A.1 Managed waste disposal sites – CH ₄ (W.12, 2019) Transparency	Increase the transparency of reporting CH ₄ utilization at landfills by including in the NIR information on the volumes of landfill gas flared, landfill gas density and CH ₄ content in the landfill gas.	Resolved. The Party reported in its NIR (chap. 7.2.2.4, p.244) that, according to the data provided by the MSW landfill operators, CH ₄ content in landfill gas ranges from 30 to 58 per cent at different landfills for different years, landfill gas density is 1.26–1.3 kg/m ³ and the volumes of landfill gas flared or recovered in 2019 amounted to 42,291,445,573 m ³ . During the review, the Party clarified that, owing to the confidentiality of the information, it was reported in general terms.
W.5	5.C.1 Waste incineration – CH ₄ and N ₂ O (W.13, 2019) Transparency	Transparently explain in the NIR the selection and values of the country-specific CH ₄ and N ₂ O EFs used for waste incineration and report the correct units for those EFs (i.e. kg/Gg waste (wet) for CH ₄ EF, g/t MSW (wet) for N ₂ O EF for MSW and g/t industrial waste (wet) for N ₂ O EF for industrial and medical waste).	Resolved. The Party transparently explained the selection and values of the CH ₄ and N ₂ O EFs used for waste incineration and reported the correct units for those EFs in its NIR (chap. 7.4.2.3, p.259). See also ID# W.7 below.
W.6	5.C.1 Waste incineration – CO ₂ , CH ₄ and N ₂ O (W.14, 2019) Transparency	Correct and enhance the description of the parameters used to estimate AD for industrial waste and medical waste incineration without energy recovery for 1990–2009 in the NIR.	Resolved. The Party corrected and enhanced the description of the parameters used to estimate AD for industrial waste and medical waste incineration without energy recovery for 1990–2009 in its NIR (chap. 7.4.2.2, p.257).
W.7	5.C.1 Waste incineration – CH ₄ and N ₂ O (W.15, 2019) Accuracy	Revise the CH ₄ and N ₂ O EFs used for waste incineration, and either use technology-specific EFs for CH ₄ and N ₂ O (2006 IPCC Guidelines, vol. 5, tables 5.3 and 5.4 for CH ₄ and N ₂ O, respectively) or follow IPCC good practice for CH ₄ (2006 IPCC Guidelines, vol. 5, section 5.4.2) and N ₂ O (section 5.4.3).	Resolved. The Party clarified the information on technology and type of waste incineration (continuous incineration) and thus revised the values of the CH ₄ and N ₂ O EFs (using stationary combustion default EFs, based on net calorific values from the 2006 IPCC Guidelines (vol. 2, table 2.2, p.2.17)). For continuous incineration of MSW and industrial waste, the approach is consistent with IPCC good practice for CH ₄ (2006 IPCC Guidelines, vol. 5, section 5.4.2) and N ₂ O (section 5.4.3). The Party reported relevant information in its NIR (chap. 7.4.2.3, p.259).
W.8	5.D.1 Domestic wastewater – CH ₄ (W.16, 2019) Transparency	Enhance the transparency of the reporting on domestic wastewater treatment and discharge by (1) clarifying what “insufficiently treated” wastewater means in relation to the IPCC classification of wastewater treatment systems (2006 IPCC Guidelines, vol. 5, table 6.3) and (2) justifying that the methane correction factor of 0.05 used to estimate CH ₄ emissions from	Resolved. The Party enhanced the transparency of its reporting on domestic wastewater treatment and discharge by (1) clarifying what “insufficiently treated” wastewater means in its NIR (chap. 7.5.2.2.2, p.263) and (2) changing the methane correction factor of 0.05 used to estimate CH ₄ emissions from insufficiently treated domestic wastewater to 0.2 and providing an explanation in the NIR (chap. 7.5.2.2.3, p.266). During the review, the Party clarified its reason for accepting the lower range (0.2) of the proposed coefficient by default. The ERT considers that the clarification is adequate and confirmed that there is no underestimation of

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		insufficiently treated domestic wastewater is more appropriate than the IPCC defaults (0.3 for centralized aerobic plants – not well managed and overloaded; and 0.1 for untreated systems) and that it does not lead to underestimation of emissions for the category.	emissions for this category as a result of using the revised methane correction factor value.
W.9	5.D.2 Industrial wastewater – CH ₄ (W.17, 2019) Transparency	Enhance the transparency of reporting on industrial wastewater treatment and discharge by providing in the NIR (1) clear information on industrial wastewater treatment methods, the relevant methane correction factor for industrial wastewater treatment and discharge and the pathway for industrial wastewater sludge after dehydration and (2) a justification for the use of an MCF _{UA} value of 0.299.	Resolved. The Party enhanced the transparency of reporting on industrial wastewater treatment and discharge by providing in the NIR (1) information on industrial wastewater treatment methods, the relevant methane correction factor for industrial wastewater treatment and discharge (chap. 7.5.4.2.3, table 7.30, p.278), and information on the pathway for industrial wastewater sludge after dehydration and (2) a justification for the use of an MCF _{UA} value of 0.299 (chap. 7.5.2.2.3, p.267). During the review, the Party clarified that the discharge and the pathway for industrial wastewater sludge are the same as for domestic wastewater because both are treated at the same central aeration stations. The Party also clarified the reason for accepting the MCF _{UA} value of 0.299 according to the input data, which is in line with the assumption that the depth of sludge-drying beds does not exceed 2 m.
KP-LULUCF			
KL.1	General (KP-LULUCF) – CO ₂ (KL.1, 2019) (KL.13, 2017) Accuracy	Implement a complete analysis of relevant information collected by and stored in the databases of the State Forest Resources Agency, which would be used to derive nationwide CSC factors for biomass increments and for DOM net changes, stratified by forest type, ecological region and age class; and while new CSC factors are being calculated by the State Forest Resources Agency databases, use data contained in table 3.9 of a 2007 Buksha et al. report for biomass increments, as stratified by age class and main forest species, together with an age-class distribution for the time series 2013–2016 and revise the DOM CSC factors and method to ensure time-series consistency.	Addressing. The Party reported applying a tier 1 approach for estimating CSC for the DOM pool for activities reported under Article 3, paragraphs 3–4, of the Kyoto Protocol in the NIR (chap. 11.3, p.295). During the review, the Party informed the ERT that the information stored in the databases was collected for management purposes and does not include any information on litter. Therefore, the Party is unable to apply a tier 2 method owing to lack of country-specific data (see also ID# L.12 above). Improving estimation of CSC in DOM is listed in the improvement plan in NIR annex 8.2. However, during the review, the Party clarified that implementing this improvement would be dependent on receiving funding. The ERT acknowledges that CSC for biomass is now stratified by age class, forest species, management zone and protection status of the forest plot. However, as identified in ID# L.20 above, issues remain with the stratification of the age class that are likely to affect the estimates of CSC in biomass and therefore the emission estimates for AR, deforestation and FM.
KL.2	General (KP-LULUCF) – CO ₂ and N ₂ O (KL.2, 2019) (KL.14, 2017) Accuracy	Add to the national forest inventory data collected through statistically sound surveys for the time series 1990–2016 on land cover and land use for the entire territory, noting that the land survey may be implemented using freely available data sets of satellite images within a time frame of a few	Not resolved. The ERT notes that the resolution of this issue requires improvements to the representation of land areas, already highlighted under a number of other issues, and specifically relates to ID# L.6 above.

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		months and with a budget limited to the time of the operators that need to collect data by visual interpretation of satellite images and to analyse data collected to derive a complete time series of consistent land representation for the entire national territory.	
KL.3	General (KP-LULUCF) – CO ₂ , CH ₄ and N ₂ O (KL.3, 2019) (KL.15, 2017) Accuracy	Explore alternative data sets of spatial information (e.g. Landsat free imagery) and consider applying survey methods instead of wall-to-wall mapping, because they require significantly less resources than wall-to-wall mapping and are proven to be easier to implement and provide more accurate data for a given level of resources allocated; and report in the NIR on data sets and methods planned to be used to ensure that a complete time series of land representation will be available for the next annual submission.	Addressing. The Party reported in its NIR (chaps. 6.1.1, p.205, and 11.2.2, p.292) that it investigated alternative data sources for monitoring land area changes but the data from these sources were found to be poor. During the review, the Party acknowledged that it is continuing to seek funding to use GIS for land-use matrix development.
KL.4	General (KP-LULUCF) – CO ₂ , CH ₄ and N ₂ O (KL.11, 2019) Accuracy	Ensure accuracy and consistency of the data of the land-use transition matrix reported in the NIR and in the CRF tables, including by correcting the following errors: the area of AR at the end of 2016 (308.95 kha) plus the area converted to AR in 2017 (1.44 kha), 310.39 kha, is not equal to the area at the end of inventory year 2017 (310.67 kha); the area presented in row “Other” of NIR table 11.1 (i.e. area that has never been subject to any KP-LULUCF) is converted to deforestation (e.g. 1.71 kha, as presented in NIR table 11.1); and the area of FM at the beginning of the inventory year does not agree with the area of FM in CRF table 4(KP-I)B.1 for 2016.	Addressing. CRF table NIR-2 for 2017 has been corrected in that the area at the end of the reporting year for AR is now equal to the total from the previous year plus the area converted to AR in 2017. The ERT considers that this issue has been resolved. However, the ERT considers that the recommendation has not yet been fully addressed because NIR table 11.1 still reports the area being converted from other to deforestation. The total area of other reported at the end of the reporting year in table 11.1 does not correspond to the area of land of other that has been converted to AR and deforestation. Furthermore, the area of FM at the beginning of the inventory year for 2017 (9,543.38 kha) still does not agree with the area of FM in CRF table 4(KP-I)B.1 for 2016 (9,543.77 kha), as noted by the previous ERT, and the area of FM at the beginning of the inventory year for 2019 (9,601.38 kha) still does not agree with the area of FM in CRF table 4(KP-I)B.1 for 2018 (9,599.63 kha).
KL.5	Article 3.3 activities – CO ₂ and N ₂ O (KL.4, 2019) (KL.1, 2017) (KL.2, 2016) (90, 2014) Transparency	Report in the NIR additional information on the model applied to estimate SOM CSC in land converted to forest land, as well as a table for reporting the areas converted to forest land and the CSC in each carbon pool, stratified by land-use conversion type, climatic zone and year of conversion.	Addressing. The Party reported in its NIR (chap. 11.3, p.296) that it applies a tier 1 method for estimating CSC in SOM in forest land. During the review, the Party clarified that it is seeking the additional funding required to implement a tier 2 method, which would enable the CSC in each carbon pool to be stratified by land-use conversion type, climatic zone and year of conversion. Improving the estimation of CSC in the soils pool during conversions between land-use categories is also included in the improvement plan in annex 8.2 to the NIR. The ERT notes that the resolution of this issue is also related to ID#s L.6 and KL.2 above.

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KL.6	FM – CO ₂ , CH ₄ and N ₂ O (KL.6, 2019) (KL.3, 2017) (KL.4, 2016) Transparency	Report information on how unmanaged forest land is defined and identified and document, if unmanaged forest land is subject to the impact of any human activity, how any possible unbalanced accounting is avoided.	Addressing. The Party clarified the definitions of managed and unmanaged forest under the LULUCF sector in its NIR (chap. 6.2, pp.213–214). During the review, the Party explained that the same definitions are applied for reporting under the Kyoto Protocol. The Party reported in its NIR (chap. 6.2.1, p.213) that “the work to revise areas of managed and unmanaged forests is ongoing, as part of land-use transition matrix revision and revision of activity data regarding forestry on time series” (see also ID# L.6 above). The previous ERT noted that the areas reported as managed under the Kyoto Protocol and the Convention were inconsistent. To address this, the Party has revised the headings in NIR table A3.3.1 to provide clarity. However, it remains unclear how unbalanced accounting has been avoided. For example, NIR table A3.3.1 reports a total area of managed forest land under forest land remaining forest land as 10,397.04 kha (9,452.51 kha + 944.53 kha). However, the total managed forest land remaining forest land in CRF table 4.A is reported as 10,366.59 kha. The inconsistencies in the areas reported therefore continue to make the relationship between the areas reported for forest land under the Convention and those reported under FM and AR under the Kyoto Protocol unclear.
KL.7	FM – CO ₂ , CH ₄ and N ₂ O (KL.7, 2019) (KL.5, 2017) (KL.6, 2016) Transparency	To ensure the transparency of each technical correction to the FMRL, report complete and clear information (1) on the rationale for calculating the FMRLcorr value; (2) on the methods used to calculate the FMRLcorr value (including all background data and parameters used); (3) on the results for FMRLcorr and the technical correction value, including a discussion of the differences between the FMRLcorr and the FMRL values (i.e. the causes and, where possible, the percentage impact for each cause); in particular, for this purpose, it is good practice to report a comparison of the recalculated estimates with the previous estimates (see table 2.7.2 of the <i>2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol</i>); and (4) that demonstrates consistency between the FMRLcorr value and the FM GHG estimates.	Resolved. The Party included additional information in its NIR (chap. 11.5.5).
KL.8	FM – CO ₂ (KL.10, 2019) (KL.16, 2017) Accuracy	Remove HWP produced during the first commitment period from the calculation of the contribution of HWP.	Resolved. The Party reported in its NIR (chap. 11.3, p.295) that HWP reported in the first commitment period, based on the instant oxidation approach, were excluded from the calculations for HWP emissions. A technical correction was also made to the FMRL to exclude these emissions.

ID#	Issue/problem classification ^{a, b}	Recommendation made in previous review report	ERT assessment and rationale
KL.9	FM – CO ₂ (KL.12, 2019) Accuracy	Justify the use of the tier 1 approach to estimate the carbon balance of DOM on FM land and demonstrate that the deadwood and litter pools are not a net source.	Not resolved. The Party reported in its NIR (chap. 11.3, p.296) that a tier 1 approach for DOM was applied because there is a lack of country-specific data. However, the Party has not yet provided information to demonstrate that the deadwood and litter pools are not a net source.
KL.10	FM (KL.13, 2019) KP reporting adherence	Report, for the FM cap, the value inscribed in the report on the review of the report to facilitate the calculation of the assigned amount for the second commitment period of the Kyoto Protocol of Ukraine (262,627.177 kt CO ₂ eq) in the CRF accounting table and in the NIR.	Resolved. The Party reported in its NIR (p.303) and in the CRF accounting table the FM cap value of 262,627.177 kt CO ₂ eq.
KL.11	Deforestation (KL.14, 2019) Transparency	Explain in more detail, in the NIR, how the data on biomass carbon stocks gains and losses are estimated.	Resolved. The Party reported in its NIR (chap. 11.3, p.295) a description of how data on losses in biomass carbon stocks are derived from SSSU data. It indicated that estimates for gains in biomass carbon stocks require extrapolation of existing data to cover the entire national forest area. The extrapolation process is described in the NIR (chap. A3.3.1, p.480).

^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 Ukraine 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 Ukraine, 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 Ukraine

ID#	Previous recommendation for issue	Number of successive reviews issue not addressed ^a
General		
G.1	Report any change in the information provided under Article 3, paragraph 14, of the Kyoto Protocol, in accordance with decision 15/CMP.1 in conjunction with decision 3/CMP.11.	3 (2017–2021)
Energy		

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed^a</i>
E.2	Develop and use country-specific CO ₂ EFs for liquid fuels (i.e. residual fuel, diesel oil, LPG, petroleum coke and refinery gases), which have a significant share in the fuel mix of stationary combustion.	6 (2014–2020)
E.5	Include in the NIR documentation of the observed trends in cargo for national and international navigation, particularly for 2012 onward.	3 (2017–2021)
E.11	Include an explanation in the NIR for the choice of CO ₂ , CH ₄ and N ₂ O EFs for estimating emissions for the oil category, including documentation of the current state of oil industry infrastructure.	3 (2017–2021)
IPPU	No issues identified.	
Agriculture		
A.1	Improve the QC checks to ensure that all tables referred to in the text of the NIR actually exist in the NIR and contain the information stated (e.g. table A3.2.3.6 should have contained data on percentage crude protein but did not, and milk production should have been presented in table A3.2.3.8 but this table does not exist).	3 (2017–2021)
A.3	Include in the NIR relevant information on the reported MMS (e.g. how manure is handled, mechanically separated and stored, and the emptying frequencies of the lagoons/manure stores and field application) (the description should include a mass balance for all handled manure based on excreted VS in each MMS and indicate whether or not the manure is covered by a crusting layer).	4 (2016–2021)
A.6	Conduct an assessment of the proportion of inert materials in ground lime and document the results in the NIR; and if ground lime is considered to include inert materials, revise the CO ₂ emissions for the entire time series, excluding the portion of the inert materials in ground lime.	3 (2017–2021)
LULUCF		
L.1	For the model used to calculate the net changes in SOM in mineral soils, verify the model's outputs with measurements annually conducted in the country.	6 (2014–2021)
L.2	Enhance data collection on the other land uses under which organic soils are reported and on their status, either drained or rewetted or, for wetlands only, natural conditions, and supplement the current data gaps with available ancillary data and expert judgment to ensure that no systematic errors affect the estimates of GHG emissions in the time series of each land-use category.	3 (2017–2021)
L.3	Enhance the information reported in the NIR to improve transparency and include, for each estimated category, the verification of outputs (i.e. GHG estimates), if any, noting that the verification of outputs is mandatory for tier 3 estimates.	5 (2015–2021)
L.6	Collect sufficient data on the land area and changes in the land area, verify the conversions between land-use categories and demonstrate how the accuracy of land representation has improved, clearly documenting the AD used for the sector in the NIR.	4 (2016–2021)
L.7	Report annual land-conversion areas in CRF table 4.1 and report cumulated 20-year conversion areas in CRF tables 4.A–4.F, which requires the calculation of annual land use and land-use change matrices for 1971–1989.	3 (2017–2021)

ID#	Previous recommendation for issue	Number of successive reviews issue not addressed ^a
L.8	Ensure that in any year X of the GHG inventory time series (1) the area (AX) of any land remaining category A is the area of A in the previous year (AX – 1) minus the area of A converted in year X to all other land-use categories (A to OLUX) plus the area converted to A from all other land-use categories 20 years before (OLU to AX – 20) (i.e. $AX = AX - 1 - A + OLUX + OLU$ to AX – 20); and (2) the area of any land converted category B to A (B to AX) is the cumulated area converted to category A from B (B to A) in the 20-year time period from year X to year X–19 (i.e. $B \text{ to } AX = \sum_{t=X-19}^X B \text{ to } A$).	3 (2017–2021)
L.11	Revise the calculations of GHG emissions and removals from forest land in mineral soils following the methods presented in the 2006 IPCC Guidelines and implement sector-specific QC procedures to ensure the accuracy of the estimates reported across the time series.	5 (2015–2021)
L.12	(1) Recalculate nationwide CSC factors for biomass increments and for DOM net changes, stratified by forest type, ecological region and age class, by compiling available information in the country, and, where feasible, by collecting novel data through a national forest inventory system; and (2) while new CSC factors are being calculated, and noting that Ukraine referenced the use of a 2017 Buksha et al. report in its 2017 submission, use data contained in table 3.9 of that report for biomass increments as stratified by age class and main forest species, together with an age-class distribution for the entire time series 1990–2016 and revise the DOM CSC factors and method to ensure time-series consistency.	3 (2017–2021)
L.18	Include clear definitions of managed and unmanaged forest land and an explanation of how unmanaged forest land is detected in the land representation and, if necessary, revise the distribution of forest land between managed and unmanaged.	4 (2016–2021)
L.21	Enhance data collection on the use under which organic soils are reported, and supplement the current data gaps with available ancillary data and expert judgment, where needed, to ensure that no systematic errors affect the estimates of GHG emissions in the time series.	5 (2015–2021)
L.24	Use subdivisions of managed grassland to report those areas of grassland that are not subject to changes in management activities or for which management activities do not result in net emissions or net removals of GHGs.	3 (2017–2021)
L.28	Enhance the data collection on the drainage status of peat production sites once abandoned; supplement the current data gaps with available ancillary data and expert judgment, where needed; and estimate GHG emissions in sites for peat production which, although abandoned, are still under drainage to ensure that no errors affect the GHG emission trend.	5 (2015–2021)
L.29	Report all land converted to wetlands under the organic soils subdivision and discount such areas from the original land-use category area of drained organic soils.	3 (2017–2021)
L.30	Revise the classification of category 66 (“dry open lands with special vegetation cover”), noting that category 66 appears to more closely match the definition of the IPCC category grassland than other land.	5 (2015–2021)
L.31	Subdivide and report separately deforested areas between those that did contain trees and those that did not contain trees before deforestation; and report in the NIR a table where, for each carbon pool, the standing carbon stocks before deforestation and after deforestation are reported for those lands that did contain trees before deforestation.	5 (2015–2021)
Waste		

<i>ID#</i>	<i>Previous recommendation for issue</i>	<i>Number of successive reviews issue not addressed^a</i>
W.1	Improve the description in the NIR of the solid waste management practices in the country, including landfilling of MSW (with and without CH ₄ recovery), composting, incineration, recycling and management of hazardous waste.	3 (2017–2021)
W.2	Revise the schematic representation of waste treatment (NIR figure 7.3) by including all categories (in all relevant sectors), the sources of each type of waste, ways of treatment and final destination, particularly of sludge from wastewater treatment.	3 (2017–2021)
W.3	Continue to further investigate MSW, taking into consideration the fact that the sampling should be conducted in several typical cities in each season and that the methods, frequency of sampling and implications for the time series should be documented with a view to developing a country-specific EF for the category.	4 (2016–2021)
KP-LULUCF		
KL.1	Implement a complete analysis of relevant information collected by and stored in the databases of the State Forest Resources Agency, which would be used to derive nationwide CSC factors for biomass increments and for DOM net changes, stratified by forest type, ecological region and age class; and while new CSC factors are being calculated by the State Forest Resources Agency databases, use data contained in table 3.9 of a 2007 Buksha et al. report for biomass increments, as stratified by age class and main forest species, together with an age-class distribution for the time series 2013–2016 and revise the DOM CSC factors and method to ensure time-series consistency.	3 (2017–2021)
KL.2	Add to the national forest inventory data collected through statistically sound surveys for the time series 1990–2016 on land cover and land-use for the entire territory, noting that the land survey may be implemented using freely available data sets of satellite images within a time frame of a few months and with a budget limited to the time of the operators that need to collect data by visual interpretation of satellite images and to analyse data collected to derive a complete time series of consistent land representation for the entire national territory.	3 (2017–2021)
KL.3	Explore alternative data sets of spatial information (e.g. Landsat free imagery) and consider applying survey methods instead of wall-to-wall mapping, because they require significantly less resources than wall-to-wall mapping and are proven to be easier to implement and provide more accurate data for a given level of resources allocated; and report in the NIR on data sets and methods planned to be used to ensure that a complete time series of land representation will be available for the next annual submission.	3 (2017–2021)
KL.5	Report in the NIR additional information on the model applied to estimate SOM CSC in land converted to forest land, as well as a table for reporting the areas converted to forest land and the CSC in each carbon pool, stratified by land-use conversion type, climatic zone and year of conversion.	6 (2014–2021)
KL.6	Report information on how unmanaged forest land is defined and identified and document, if unmanaged forest land is subject to the impact of any human activity, how any possible unbalanced accounting is avoided.	4 (2016–2021)

^a Reports on the reviews of the 2018 and 2020 annual submissions of Ukraine have not yet been published. Therefore, 2018 and 2020 were not included when counting the number of successive years for this table.

V. Additional findings made during the individual review of the Party's 2021 annual submission

10. Tables 5–6 present findings made by the ERT during the individual review of the 2021 annual submission of Ukraine that are additional to those identified in table 3. In accordance with paragraph 76(b) of the UNFCCC review guidelines, the ERT has prioritized in table 5 recalculations that changed the estimated total emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent for any of the recalculated years.

Table 5

Additional findings made during the individual review of the 2021 annual submission of Ukraine related to recalculations

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
Energy			
		Recalculations made for the energy sector changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	Not an issue/problem
IPPU			
		Recalculations made for the IPPU sector changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	Not an issue/problem
Agriculture			
		Recalculations made for the agriculture sector changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations. Recalculations were made for categories 3.A, 3.B, 3.D and 3.H.	Not an issue/problem
LULUCF			
L.35	4.A Forest land – CO ₂	<p>The Party reported in the NIR (table 6.7, p.217) recalculations for forest land emissions, which resulted in an increase in estimated emissions for 1990–1996 and a decrease for 1997–2018. Notably, the recalculations resulted in a decrease in estimated emissions for 2003–2006, ranging from 4.0 per cent to 7.6 per cent, and much smaller changes for the rest of the time series. This inconsistency was not explained in the NIR. During the review, the Party clarified that the changes to estimated emissions due to the recalculations are largely driven by (1) an error correction of the total harvested wood allocated to different wood species by share of total harvesting and (2) the correction of an incorrect BCEF_R value (1.17) being applied to hardwoods for 1997 onward. This was corrected to the default value from the 2006 IPCC Guidelines (vol. 4, chap. 4, table 4.5) for hardwoods with a growing stock of >200 m³ (0.89). While the corrections explain the change in estimated emissions for the majority of the time series, it is unclear how these two corrections justify the large change in the emission profile for 2003–2006.</p> <p>The ERT recommends that the Party transparently describe in the next NIR the additional causes for the large change in the estimated emissions for 2003–2006 relative to the other years in the time series.</p>	Yes. Transparency

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
Waste			
		Recalculations made for the waste sector changed the estimated emissions for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations. Recalculations were made for categories 5.C–5.D.	Not an issue/problem
KP-LULUCF			
		Recalculations made for KP-LULUCF changed the estimated emissions or removals for a category by more than 2 per cent and/or national total emissions by more than 0.5 per cent; however, the ERT did not identify any issues or problems with these recalculations.	Not an issue/problem

^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.

11. Table 6 contains additional findings made by the ERT during the individual review of the 2021 annual submission that are not covered in table 3 or 5, but are within the scope of the desk review as specified in paragraph 76 of the UNFCCC review guidelines or paragraph 65 of the Article 8 review guidelines and are findings that the ERT wishes to convey to the Party.

Table 6

Additional findings made during the individual review of the 2021 annual submission of Ukraine

<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.6	Methods	<p>The Party did not include in its NIR a summary table to indicate the method (tier level) and type of EF (IPCC default, country-specific or plant-specific) applied for each key category. The ERT noted that a summary table would facilitate it in determining whether recommended methods from the appropriate decision tree in the 2006 IPCC Guidelines were used for estimating emissions and removals for key categories, in line with paragraph 50(c) of the UNFCCC Annex I inventory reporting guidelines. During the review, the Party clarified that it could not provide this table because a “significant amount of time” is required to prepare it. Ukraine explained that every category has many smaller subcategories, some of which have been calculated using tier 1 and default EFs. The provision of substantial information on country-specific circumstances, data availability and restrictions, as well as a reference in the NIR, for each of these subcategories required much more time than was available before the end of the review week. More detailed information on these categories is provided in relevant sections of the NIR.</p> <p>The ERT encourages Ukraine to improve the transparency of its reporting by including a summary table with the method (tier level) and type of EF (IPCC default, country-specific or plant-specific) applied for each key category, with a brief explanation or a reference to the specific section of the NIR that provides a justification for the cases where the 2006 IPCC Guidelines decision trees for the selection of a methodology were not followed.</p>	Not an issue/problem
G.7	National system	The ERT noted that a significant number of recommendations from previous UNFCCC reviews, which are associated with the LULUCF and KP-LULUCF sectors, have not been addressed by Ukraine in its 2020 and 2021 submissions. Table 3	Yes. KP reporting adherence

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
		<p>above contains more than 20 recurring issues concerning these sectors, the majority of which are associated with fundamental elements of the sectors, such as land representation. The ERT is of the view that the accumulation of recurring issues for the LULUCF and KP-LULUCF sectors is linked to a potential problem in the national system, which appears to not be capable of collecting all the data needed to support the national LULUCF experts with the preparation of accurate and consistent time series, and significantly affects the quality of the estimated and reported emissions and removals. During the review, the Party identified lack of data and resources as the main reasons for the recurring issues.</p> <p>The ERT recommends that the Party prepare and report in its next annual submission an action plan detailing the steps, time frames, responsibilities, and human and financial resources required to address the issues identified in the LULUCF and KP-LULUCF sectors. The ERT also recommends that the Party report on the progress of implementation of the action plan on the LULUCF and KP-LULUCF sectors in subsequent annual submissions.</p>	
G.8	Notation keys	<p>Ukraine reported as “NE” some categories it considered insignificant in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, but it did not provide information demonstrating that the total national aggregate of estimated emissions for all gases and categories considered insignificant remains below 0.1 per cent of the national total GHG emissions. During the review, the Party explained that there were only two categories where the provision of paragraph 37(b) was used, namely category 5.C.2 open burning of waste (CO₂, CH₄ and N₂O) and category 3.B.2.5 leaching and run-off from MMS (N₂O). The justification relating to aggregated insignificant emissions being less than 0.1 per cent of total emissions will be added in the next annual submission.</p> <p>The ERT recommends that the Party ensure that the total national aggregate of estimated emissions for all gases and categories considered insignificant remains below 0.1 per cent of national total GHG emissions, in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, and include that information in the NIR.</p>	Yes. Convention reporting adherence
G.9	Notation keys	<p>The Party reported in CRF table 6 indirect CO₂ emissions from atmospheric oxidation of CH₄, CO and NMVOCs as “NO” or “NA”, although CH₄, CO and NMVOCs were reported for the energy, IPPU and LULUCF sectors. The ERT noted that the notation keys “NO” and “NA” are not suitable for reporting indirect CO₂ emissions because these emissions occur from the atmospheric oxidation of CH₄, CO and NMVOCs. During the review, the Party stated that the 2006 IPCC Guidelines do not provide a methodology for estimating indirect CO₂ emissions and there are no such national methodologies. For that reason, indirect CO₂ emissions are considered as not occurring in Ukraine. The ERT noted that a methodology for estimating indirect CO₂ emissions is provided in the 2006 IPCC Guidelines (vol. 1, chap. 7.2.1.5, p.7.6). In addition, according to the UNFCCC Annex I inventory reporting guidelines, Annex I Parties may report indirect CO₂ emissions from the atmospheric oxidation of CH₄, CO and NMVOCs.</p> <p>The ERT recommends that the Party either estimate and report indirect CO₂ emissions in CRF table 6 or update the reporting of indirect CO₂ emissions in CRF table 6 by using the correct notation key (e.g. “NE”) in accordance with paragraph 37 of the UNFCCC Annex I inventory reporting guidelines.</p>	Yes. Accuracy
G.10	Uncertainty analysis	<p>The Party did not include in the NIR an uncertainty analysis for its base year under the Convention (1990). The ERT noted that, in accordance with paragraph 15 of the UNFCCC Annex I inventory reporting guidelines, Parties shall report uncertainties for at least the base year and the latest inventory year. During the review, the Party replied that the uncertainty analysis for the base year will be reflected in the next NIR.</p> <p>The ERT recommends that the Party include in the NIR an uncertainty analysis for its base year under the Convention (1990).</p>	Yes. Convention reporting adherence

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
Energy			
E.18	Fuel combustion – reference approach – all fuels – CO ₂	<p>The ERT noted that differences between IEA data and annual submission data (reference approach) persist. For example, the percentage difference in total apparent consumption of liquid fuels fluctuates significantly across the time series from 0 per cent for 2001 to 20 per cent for 1990. For 2017, 2018 and 2019, total apparent consumption of liquid fuels according to IEA data is higher than the total apparent consumption reported in the CRF tables by 9.5, 7.6 and 3.8 per cent, respectively. For 2019 in particular, IEA reports apparent consumption of 30,992 TJ natural gas liquids in Ukraine, based largely on domestic production, while the CRF tables report consumption of 27,706 TJ natural gas liquids for the same year, equating to a 10.6 per cent difference between the two data sets. Explanations for these differences were not documented in the NIR or provided in sufficient detail during the review week. Although IEA data are not used to compile GHG inventory estimates, comparisons between the reference approach and IEA data are an important part of the QC process for inventory estimates. The 2006 IPCC Guidelines (vol. 1, p.6.11) specify that, in applying QC procedures, particular attention should be paid to parts of the inventory development that rely on external and shared databases. This requirement covers confidential data. Where a national database is used for compiling information on a large number of point emissions sources, the inventory compiler needs to confirm that QC of data coming from integrated databases has taken place, and, if protocols from the data providers are not adequate, QC should be conducted by the inventory compiler. During the review, the Party reported that there are differences between the methodologies applied by IEA and those used in compiling the GHG inventory.</p> <p>The ERT encourages the Party to analyse the significant differences between the IEA and CRF energy estimates and explain in the NIR the reasons for the differences in order to demonstrate that there are no inherent over- or underestimations.</p>	Not an issue/problem
E.19	1.A.2.f Non-metallic minerals – liquid fuels – CO ₂	<p>The Party reported in CRF table 1.A(a)s2 that the CO₂ IEF for 2017 was 73.50 t/TJ while for 2018 it was 66.43 t/TJ, resulting in an inter-annual change of 9.6 per cent between 2017 and 2018, which the ERT noted is significant. The ERT also noted that the AD increased from 144.21 TJ in 2017 to 483.57 TJ in 2018. During the review, the Party clarified that this is due to the increased use of LPG under liquid fuels in the category since 2018.</p> <p>The ERT recommends that the Party investigate and provide in the NIR a detailed explanation of the sector-specific drivers behind these significant inter-annual changes in AD across the time series.</p>	Yes. Transparency
E.20	1.B.2.b Natural gas – CO ₂ and CH ₄	<p>The Party described in its NIR (chap. 3.3.2.2.1, p.98) its gas distribution network, the quantity of natural gas produced and recent data trends. The Party reported that, to estimate emissions in this category, it used the average tier 1 default EFs for CO₂ and CH₄ presented in NIR table 3.19 (p.99). The Party did not provide any specific information on national circumstances or natural gas exploration, production and processing industries beyond the quantity of gas produced for 2018 and 2019. Without a transparent description of national circumstances, it was difficult for the ERT to assess the appropriateness of the use of tier 1 default EFs for CO₂ and CH₄. During the review, Ukraine explained that in 2017 the majority of natural gas produced in the country was from conventional onshore sources (0.02 per cent from offshore sources in the Black Sea and 99.8 per cent sourced onshore) and that, of the natural gas produced, 0.26 per cent was coal seam CH₄ and 99.74 per cent was conventional natural gas. The ERT considers that this information on national circumstances is needed for assessing the transparency and accuracy of the fugitive emissions estimated for this category.</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
<p>The ERT recommends that the Party improve the transparency of the information in its NIR by including all relevant contextual information on its natural gas exploration, production and processing industries, which should justify the choice of method for estimating emissions.</p>			
IPPU			
I.7	2. General (IPPU)	<p>The Party reported “NO” in CRF tables 2(I)s1, 2(I)s2, 2(II), 2(II)B-Hs1 and 2(II)B-Hs2 for AD and emissions for all relevant gases under categories 2.B.9 fluorochemical production and 2.G.2 SF₆ and PFCs from other product uses, but did not provide any explanation in the NIR for the absence of these AD and emissions. During the review, the Party clarified that the activities under categories 2.B.9 and 2.G.2 do not occur in the country and that it will include this information in the next NIR.</p> <p>The ERT recommends that the Party improve the transparency of the information reported by including in its NIR a dedicated section on categories 2.B.9 fluorochemical production and 2.G.2 SF₆ and PFCs from other product uses, documenting the absence of the AD and emissions for these categories.</p>	Yes. Transparency
I.8	2. General (IPPU)	<p>The Party reported in its NIR (tables A.3.1.1.3 and A.3.1.1.8, pp.369–370 and 375) the AD for categories 2.A.2 and 2.B.2 for the entire time series. The ERT noted that the inter-annual changes in AD for 2.B.2 nitric acid production are significant for 2006/2007 (30.3 per cent), 2008/2009 (31.6 per cent), 2010/2011 (28.6 per cent), 2012/2013 (23.4 per cent), 2017/2018 (9.6 per cent) and 2018/2019 (52.8 per cent); and the inter-annual changes in AD for category 2.A.2 lime production are significant for 1990/1991 (11.9 per cent), 2010/2011 (18.5 per cent) and 2013/2014 (20.6 per cent). During the review, the Party clarified that the inter-annual changes in AD were due mainly to economic factors (increase in consumption of feedstock, global financial and economic crisis, etc.). The ERT agreed that the explanation provided could clarify the trend in the production of lime and nitric acid in the country.</p> <p>The ERT recommends that the Party provide in the NIR an explanation of the observed trends in AD and the drivers behind the significant inter-annual changes for key categories 2.B.2 nitric acid production and 2.A.2 lime production.</p>	Yes. Transparency
I.9	2.A.1 Cement production – CO ₂	<p>The Party reported in its NIR (chap. 4.2, p.104) that the tier 2 method was used to calculate CO₂ emissions for category 2.A.2 cement production. The Party also reported in the NIR (chap. 4.2, pp.103–105) that the CO₂ EF was calculated taking into account the plant-specific data on the content of CaO in clinker. The Party clarified in the NIR that in 2012–2019 the share of CaO derived from a non-carbonate source decreased but no information on the share of CaO from a non-carbonate source (e.g. steel slag or fly ash) or the MgO content in clinker was provided in the NIR. In the NIR (chap. 4.2.5, p.105) Ukraine reported that the recalculations of CO₂ emissions were made for 2018 because of updates to the data for the CaO and MgO content in clinker. However, from the explanation in the NIR it is not clear how the CO₂ EFs were derived. According to the 2006 IPCC Guidelines (vol. 3, chap. 2.2.1.2, p.2.12) the derivation of a CO₂ EF for clinker requires the CaO content of the clinker to be known, as well as the fraction of CaO that was derived from a carbonate source (generally calcium carbonate). During the review, the Party provided the ERT with the annual plant-specific CaO content (66.1 per cent) for 2019. It explained that the non-carbonate sources for clinker production were not used in 2019 and that the MgO content in clinker was taken into account to determine the EF.</p> <p>The ERT recommends that the Party include in the NIR information on the annual plant-specific CaO content for the whole time series and an explanation of how the national CO₂ EF for clinker was derived, including information on the MgO content in clinker and the share of CaO derived from a non-carbonate source.</p>	Yes. Transparency

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
I.10	2.B.2 Nitric acid production – N ₂ O	<p>The Party reported in its NIR (chap. 4.7, pp.113–114) that N₂O emissions for category 2.B.2 nitric acid production were estimated using tier 2 and 3 methods. The ERT agreed with the estimation of emissions for enterprises with low-pressure units using tier 2. At the same time, the Party reported in its NIR (table 4.11, p.114) that the emissions for medium-pressure units were estimated using tier 3 for the whole time series, while the default N₂O EF (7 kg/t) (2006 IPCC Guidelines, vol. 3, part 1, table 3.3, p.3.23) was used for 1990–2008. Moreover, in NIR table A3.1.1.8, the default N₂O EF (7 kg/t) for 1990–2008 was defined as country-specific. During the review, the Party clarified that in 2009 direct test measurements were performed on the recommendation of the Ukrainian Chemists Union to define the country-specific N₂O EF for units of medium pressure. However, the justification that the applied default N₂O EF for 1990–2008 is country-specific was not provided. This is not in accordance with the 2006 IPCC Guidelines (vol. 3, chap. 3.3.2) because the tier 3 method requires real measurement data and plant-level EFs obtained from direct measurement of emissions. It was not explained in the NIR how the N₂O EF value for 1990–2008 was derived and how time-series consistency was ensured.</p> <p>The ERT recommends that Ukraine ensure the time-series consistency of the estimates of N₂O emissions from nitric acid production for medium-pressure units by using the methods suggested in the 2006 IPCC Guidelines (vol. 1, chap. 2.2.4, pp.2.12–2.16). The ERT also recommends that the Party report the N₂O EFs used across the time series for estimated emissions for medium-pressure units if they are not all based on measured data.</p>	Yes. Consistency
I.11	2.B.8 Petrochemical and carbon black production – CO ₂ and CH ₄	<p>The Party reported in its NIR (annex 3, table A3.1.1.10, pp.377–378) the EFs used to estimate CO₂ and CH₄ emissions and corresponding emissions for category 2.B.8. The Party applied a CH₄ EF of 28.7 kg/t carbon black produced to estimate emissions for category 2.B.8.f carbon black, while in the NIR (chap. 4.13.2, p.121) it is stated that the default parameters were used. The ERT noted that whereas the value used is the default CH₄ EF for carbon black production without thermal treatment in the 2006 IPCC Guidelines (vol. 3, table 3.24, p.3.80), the default process is thermal treatment, so the default CH₄ EF of 0.06 kg/t carbon black produced should be used. Moreover, there was not enough information on the production processes of carbon black, methanol and VCM to justify the EF used. In addition, the Party reported in the NIR (p.119) that methanol is obtained from CO and hydrogen in the presence of catalysts, and in dry distillation of wood. At the same time, the Party used the IPCC default CO₂ EF of 0.67 t CO₂/t methanol produced, which is used for natural gas as a feedstock and conventional steam reforming without primary reformer as a default process (2006 IPCC Guidelines, vol. 3, part 1, table 3.12, p.3.73). During the review, the Party clarified that, according to the data obtained from enterprises, carbon black was produced using the furnace black process, methanol was produced using conventional steam reforming without primary reformer and VCM was produced using a balanced process for ethylene dichloride production integrated with VCM production plant. A tier 1 methodology and default EFs were used to calculate CO₂ and CH₄ emissions from carbon black, methanol and VCM processes.</p> <p>The ERT recommends that the Party use the CH₄ EF of 0.06 kg/t carbon black produced that is provided in the 2006 IPCC Guidelines (vol. 3, table 3.24, p.3.80) for the default process or justify the use of the CH₄ EF of 28.7 kg/t carbon black produced for estimating CH₄ emissions for category 2.B.8.f carbon black. The ERT also recommends that the Party provide a transparent description of the production processes and feedstock used for the production of carbon black, methanol and VCM and, if necessary, correct the parameters used in accordance with the 2006 IPCC Guidelines (vol. 3, chap. 3.9.2.2).</p>	Yes. Accuracy
I.12	2.D.1 Lubricant use – CO ₂	<p>The Party reported in the NIR (chap. 4.20.1, p.130) that it used AD from IEA for 1990–1997, data from SSSU for 1998–2017 and data from national research for 2014–2019 to estimate CO₂ emissions. The ERT noted that these data sets are by no means consistent as each uses a different set of assumptions to derive the data. The ERT also noted that the inter-annual</p>	Yes. Consistency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
<p>changes in AD values for 1995/1996 (119.9 per cent), 1996/1997 (17.9 per cent), 1997/1998 (–28.8 per cent) and 2006/2007 (22.7 per cent) seem to be outliers and need to be checked by the Party.</p> <p>During the review, the Party clarified that a misprint occurred and that the data obtained from SSSU (form 4-MTP) for lubricant non-energy consumption were used for 1998–2019 and the data from IEA questionnaires were used for 1990–1997; and that IEA also uses data sources from form 4-MTP. National research data for 2014–2019 were used only for the revision carried out to account for amounts of lubricant consumption in temporarily occupied territories of the Autonomous Republic of Crimea, the city of Sevastopol and parts of the Donetsk and Luhansk regions. The Party explained that the significant changes in lubricant use for 1996, 1997 and 1998 are a result of lubricants being imported to Ukraine since 1996, and the changes in 2007 are due to a sharp growth in the production and importation of lubricants in Ukraine.</p> <p>The ERT recommends that the Party ensure the time-series consistency of its emission estimates by applying the same data source for the entire time series, or, if this is not possible, apply a splicing technique from the 2006 IPCC Guidelines (vol. 1, chap. 5.3.3) or provide the supporting information that the IEA and SSSU data sets use the same source. The ERT also recommends that the Party include the information provided during the review to explain the significant inter-annual changes in lubricant use over the time series (e.g. for 1996, 1997, 1998 and 2007) in the next NIR.</p>			
Agriculture			
A.7	3.B Manure management – CH ₄	<p>In the NIR (pp.543–544) and during the review, the Party explained that its national circumstances prevented it from further improving data on the distribution of cattle and swine manure and MMS distribution, and that it cannot currently provide any further information in this regard.</p> <p>The ERT encourages the Party to report in its NIR, in the section on category-specific planned improvements, the timeline for a study on distribution of cattle and swine manure and MMS distribution.</p>	Not an issue/problem
A.8	3.B.3 Swine – CH ₄	<p>The Party reported in CRF table 3.B(a)s2 the distribution of MMS per climate type for swine, whereby 166 per cent of manure is allocated to MMS. This is not in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 10, equation 10.23, p.10.44) as the allocation of manure to MMS is greater than 100 per cent. During the review, the Party clarified that this mistake occurred only at the stage of importing data into CRF Reporter and had no effect on the GHG emission estimates, and this will be corrected in its next annual submission.</p> <p>The ERT recommends that the Party revise the allocation per MMS for swine in CRF table 3.B(a)s2.</p>	Yes. Convention reporting adherence
A.9	3.D.a.2.b Sewage sludge applied to soils – N ₂ O	<p>The Party reported in its NIR (chap. 5, p.192) that sewage sludge and other organic amendments are not applied to managed soils and that the amount of N in sewage that is introduced to soils is not recorded by SSSU. Ukraine reported this subcategory as “NA” in CRF table 3.D. In response to a question from the ERT, the Party clarified during the review that use of sewage sludge as organic fertilizer is not typical in Ukraine and that there is no clear information on sewage sludge application to agricultural soils in the country. It indicated that further analysis and research on the data on sewage sludge applied to agricultural soils is needed (see ID# W.10 below). The ERT considers that emissions from the use of sewage sludge as organic fertilizer are likely to be below the threshold of significance in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.</p> <p>The ERT noted that the reporting of “NA” in this case is not in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines because the activity occurs in the country, although specifics on the AD are not available and emissions are not accounted for.</p>	Yes. Transparency

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
		<p>The ERT recommends that the Party clearly justify in the NIR why the emissions from the use of sewage sludge as organic fertilizer are considered to be insignificant and use notation key “NE” in CRF table 3.D in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.</p>	
A.10	3.G Liming – CO ₂	<p>The Party reported in its NIR (chap. 5, p.198) that no AD on dolomite application to agricultural soils are available but reported it as “NO” in CRF table 3.G-I. During the review, the Party clarified that natural liming materials and industrial waste (shale and peat ash, cement kiln dust and other) are used for liming of agricultural soils, and that these natural liming materials are classified as hard (limestone, dolomite, chalk) or soft (calcareous sinter, marl, clay marl and others) rocks, acknowledging that dolomite is actually being applied to agricultural soils in the country. It indicated that there are limitations on estimating the associated emissions given that the amount of dolomite used is potentially insignificant. The ERT noted that the reporting of “NO” in this case is not in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, as the activity occurs in the country. The ERT considers that emissions from dolomite application to agricultural soils for liming are likely to be below the threshold of significance in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.</p> <p>The ERT recommends that the Party include information in the NIR in order to justify the decision not to estimate emissions from this source, and report emissions for this category as “NE” in CRF table 3.G-I in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.</p>	Yes. Transparency
A.11	3.H Urea application – CO ₂	<p>The Party reported in its NIR (chap. 5.9.2, p.200) that it uses a tier 1 methodology to estimate emissions for this category, and in CRF table 3.G-I that a total amount of 284,787.73 t/year urea was applied to agricultural soils in 2019. FAOSTAT data are used as AD only for 2002–2004 and 2008–2011. For 1990–2001 and 2005–2007, AD for applied urea were calculated as a share of the total annual values of the applied N fertilizers, estimated as a conservative coefficient in accordance with country-specific practices and data for 2018 onward from the Statistical Yearbook of Ukraine on the application of synthetic and organic fertilizers for harvest of agricultural crops. During the review, the Party confirmed that for 2018 onward the Statistical Yearbook of Ukraine was used as an official reference for the application of synthetic and organic fertilizers to agricultural crops and as a data source. However, it could not explain the significant difference in data generated from the Statistical Yearbook of Ukraine, which amounted to 46 per cent of the reported FAOSTAT values for 2018–2019. The ERT considered that Ukraine could not justify the use of a conservative approach to estimating the quantity of urea used in the country in the years for which neither national nor FAOSTAT information is available, and that this may lead to an underestimation of emissions for 1990–2001 and 2005–2007. The use of national information on agricultural crops only may lead to an underestimation of emissions if the information does not include the use of urea fertilizer on grassland used for livestock production.</p> <p>The ERT recommends that the Party revise the AD used for the estimation of emissions for this category to ensure consistency across the time series, in particular the approach used to fill the gaps for the years for which no information is available from national sources or FAOSTAT, to ensure that there is no underestimation of emissions. The ERT also recommends that the Party make sure that national data sources cover all uses of urea on soils under the agriculture sector, in particular for uncultivated grassland, and update the emission estimates for categories 3.H and 3.D accordingly.</p>	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
LULUCF			
L.36	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O	<p>The Party did not provide any further information regarding the finding from the previous review report that the areas of organic soils presented by the Party differ from those obtained from FAOSTAT (see ID# L.23 in document FCCC/ARR/2019/UKR). During the review, the Party stated that it had not yet taken this encouragement into account.</p> <p>The ERT encourages the Party to explain the differences between the areas of organic soils according to FAOSTAT data (available at www.fao.org/faostat/en/#search/organic%20soils) and those reported in the CRF tables (i.e. for 2017 FAOSTAT indicates 562 kha organic soils under cropland and 94.58 kha under managed grassland, while CRF tables 4.B and 4.C report 108.53 kha organic soils under cropland and 369.87 kha under grassland).</p>	Not an issue/problem
L.37	4. General (LULUCF) – CO ₂ , CH ₄ and N ₂ O	<p>The Party reported in its NIR that the uncertainty of the AD for grassland and cropland areas is 6 per cent and is based on expert judgment. However, the expert judgment presented in NIR tables 6.9 and 6.13 is not documented in line with good practice (2006 IPCC Guidelines, vol. 1, annex 2A.1). Furthermore, the uncertainty of 6 per cent seems low compared with the uncertainty reported in NIR table 6.6 for land converted to forest land (50 per cent), which was also estimated on the basis of expert judgment. No further clarification was provided by the Party during the review.</p> <p>The ERT recommends that the Party describe in the NIR the methodology used to calculate total uncertainty for grassland and cropland, in accordance with good practice on documenting any expert judgment (2006 IPCC Guidelines, vol. 1, annex 2A.1).</p>	Yes. Transparency
L.38	Land representation – CO ₂ , CH ₄ and N ₂ O	<p>The Party reported in CRF table 4.1 land-use change from other land to forest land and cropland. CRF tables 4.A, 4.B and 4.C also identify land-use changes from other land to forest land, cropland and grassland. The Party reported in its NIR (p.206) that the other land category is classified by the statistical reporting form 16-zem as “open land without vegetation or with little vegetation” and is described as land not included in other categories (rocks, sand, solonchaks and other land). Given the Party’s definition, it is unlikely that other land could be converted to forest land, cropland and grassland, and that areas of other land have been incorrectly classified. During the review, the Party explained that it is not possible to monitor the dynamic of vegetation on these lands, since the data are collected by use of the statistical reporting form 16-zem, without use of GIS technologies. The Party noted the limitations of using the data source to report land transitions and explained that this issue will be resolved once a GIS-based system of land representation has been implemented.</p> <p>The ERT recommends that the Party reclassify the areas of other land to a land use that is more representative of the land category, where land-use conversion from other land to forest land, cropland and grassland has taken place. The ERT notes that this recommendation is closely aligned with ID# L.6 above and that, as acknowledged by the Party during the review, resolution of that issue would be likely to help to resolve this issue.</p>	Yes. Accuracy
L.39	4.A Forest land	<p>The ERT noted that issues remain since the previous review regarding the calculation of uncertainty for forest land (see ID# L.5 above; see also ID# L.24 in document FCCC/ARR/2019/UKR). During the 2019 and 2021 reviews, the Party explained that it applied EFs for biomass growth based on age and species instead of EFs averaged for species as had been applied for earlier submissions to reduce uncertainty, and that some uncertainties were derived on the basis of statistical error calculations and others were obtained from expert judgment (scientists’ estimations or assumptions). The total uncertainty of the category is based on calculated and estimated values of uncertainties for pools.</p> <p>The ERT encourages the Party to qualitatively discuss the uncertainties for forest land in a transparent manner in the NIR, in accordance with paragraph 15 of the UNFCCC Annex I inventory reporting guidelines.</p>	Not an issue/problem

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
L.40	4.A Forest land – CO ₂ , CH ₄ and N ₂ O	<p>The Party reported in its NIR (annex A3.3.1, p.486) that the calculation of biomass losses reported in CRF table 4.A excludes emissions from harvesting associated with industrial wood that is transferred to the HWP pool. The reported values for biomass gains and losses in CRF table 4.A also result in an unusually high implied CSC factor for net change. For example, the reported value for 2018 (1.32 t carbon/ha) is the highest of all reporting Parties (–0.64–1.32 t carbon/ha). Moreover, for other years (1998, 2001, 2003, 2004, 2005, 2015 and 2017), the reported values (1.33–1.76 t carbon/ha) are also the highest of all reporting Parties for each year (–0.59–1.76 t carbon/ha). The method used to report biomass losses in forest land is not in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 2, equation 2.11), which does not exclude biomass losses associated with HWP. Excluding biomass losses associated with HWP from CRF table 4.A would result in a double reporting of gains associated with this industrial wood. This is because the biomass growth associated with this timber is reported in CRF table 4.A and this carbon stock is again reported as a gain in the HWP pool. The exclusion of these biomass losses could explain why the Party's implied CSC factors are relatively high in comparison with those of other reporting Parties. During the review, the Party explained that the losses are excluded from CRF table 4.A to prevent double counting of the emissions from industrial wood. However, no further information was received as to how the carbon stocks for industrial wood are transferred between the biomass pool from forest land to the HWP pool to prevent the double counting of removals.</p> <p>The ERT recommends that the Party follow equation 2.11 of the 2006 IPCC Guidelines (vol. 4, chap. 2) and report all losses for biomass in CRF table 4.A, regardless of whether or not the losses are associated with timber for HWP production.</p>	Yes. Accuracy
L.41	4.B Cropland – CO ₂ , CH ₄ and N ₂ O	<p>The Party reported large inter-annual variations in the emissions reported for cropland remaining cropland in CRF table 4.B across the time series. The inter-annual changes for 2007/2008 (117.3 per cent), 2010/2011 (68.4 per cent) and 2012/2013 (38.3 per cent) are particularly significant. The IEF for mineral soils for the same periods are also significantly different: 2007/2008 (153.3 per cent), 2010/2011 (78.7 per cent) and 2012/2013 (42.4 per cent). During the review, the Party explained that the changes are driven by crop harvesting volumes and amounts of fertilizers applied to soils. Change in the structure of crop types also influences the emission profile across the time series. The Party informed the ERT that data on crop harvesting areas and volumes as well as N fertilizer application are collected and published annually by SSSU. The Party provided the ERT with links to the statistical data. The Party also noted that the methodology of data collection publication is sometimes changed by SSSU so the GHG inventory team makes an adjustment in order to ensure time-series consistency.</p> <p>The ERT recommends that the Party:</p> <p>(a) Describe in more detail in the NIR the changes to crop structure, harvest volumes of specific crop types and volume of fertilizer application to transparently justify the large inter-annual changes in emissions, and provide information on the drivers behind these changes in comments beneath a figure presenting the time series (e.g. revised figure 6.2). NIR figure 6.2 (p.203) does not cover the years with the greatest inter-annual variability. The changes would be more transparently explained if the data provided in figure 6.2 were expanded to show the years where these large inter-annual variations in emissions occur;</p> <p>(b) Report in the NIR the years where SSSU alters its methodology for data collection and describe the methods that the inventory team applies to ensure time-series consistency when these data collection methods are changed.</p>	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue/problem? ^a
Waste			
W.10	5.D Wastewater treatment and discharge – CH ₄	<p>The Party reported in CRF table 5.D the AD related to sludge removal from both domestic wastewater (category 5.D.1) and industrial wastewater (category 5.D.2). Since sludge removal is reported in the wastewater inventory, it should be consistent with the estimates for sludge applied to agricultural soils, sludge incinerated, sludge composted and sludge deposited in solid waste disposal sites. However, no clear information regarding sludge emissions for categories 5.A, 5.B and 5.C is available in the NIR. The Party stated in its NIR (chap. 7.5.2.2.3, p.267) that in some cases dried sludge is removed at MSW landfills, and insignificant amounts of sludge are used as organic and mineral fertilizers in agriculture or incinerated; and that there is no precise data on the amount of sludge used in agriculture, incinerated and disposed of at MSW landfills. Furthermore, the Party reported in CRF table 3.D the AD and N₂O emissions related to sewage sludge applied to soils as “NA”.</p> <p>In response to a question raised by the ERT, the Party clarified during the review that (1) it estimates CH₄ emissions from sewage sludge treatment under category 5.D, namely from sludge dehydration/drying on sludge-drying beds/lagoons; (2) the amount of composted sludge was included in the other waste category (NIR table 7.7, p.249), the total emissions of which were estimated and reported under category 5.B.1; (3) the emissions from incinerated industrial sludge and domestic sludge were estimated and reported under category 5.C.1; (4) the information on the sludge deposited in solid waste disposal sites was presented in aggregate form in the statistics form “1- waste”; however, the form does not separate landfilling and storage on the sludge-drying beds because both are considered as waste disposal sites in Ukraine. Thus, the emissions from sludge deposited at solid waste disposal sites are not estimated under category 5.A; and (5) currently in Ukraine, there is no clear information on the sewage sludge applied to agricultural soils, thus no emissions were estimated and reported under category 3.D (notation key “NA” used in CRF table 3.D). The Party indicated that there is a need for further analysis of and research on the data on sludge deposited at solid waste disposal sites and on sewage sludge applied to agricultural soils.</p> <p>The ERT recommends that the Party improve the transparency of the NIR by reporting a complete sludge balance, including the total amount produced (from domestic and industrial wastewater) and the amount sent to each of the different treatments (landfill, composting, incineration and agriculture), specifying under which categories the related emissions are accounted for.</p>	Yes. Transparency
W.11	5.D Wastewater treatment and discharge – N ₂ O	<p>The Party reported data on population (in thousands) and protein consumption (kg/person/year) under additional information in CRF table 5.D. The Party also reported data on protein consumed (kt) and population (in thousands) in NIR table 7.26 (p.270). The ERT calculated protein consumption values by using the data presented in NIR table 7.26 and identified inconsistencies between the values reported in the CRF table and the NIR for 2014 onward (e.g. while the protein consumption value for 2019 is calculated as 30.02 kg/person/year from NIR table 7.26, it is reported as 28.42 kg/person/year in the CRF table). During the review, the Party confirmed the inconsistencies between the values reported in CRF table 5.D and the NIR for 2014–2019. The ERT asked the Party whether there were any calculation errors due to these inconsistencies; that is, whether emission calculations were affected by these inconsistencies and therefore consistent time series were used in the calculations for 1990–2019. The Party clarified that there are no inconsistencies in the time series of data used in the calculations of the GHG emissions. The original data on protein consumption derived from national statistics were used for both. The values for population were mistakenly presented in NIR table 7.26 excluding the share of the population of the temporarily occupied territories of Ukraine, while the values reported in the CRF table included the share of the population of those territories. This caused the difference between the values of protein consumption reported</p>	Yes. Convention reporting adherence

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
		<p>in CRF table 5.D and NIR table 7.26. However, the protein consumption and corresponding GHG emissions were reported correctly. The Party further clarified that the original data on protein consumption derived from national statistics were corrected in order to take into account the share of protein consumption by the population of the temporarily occupied territories of Ukraine and the share of dumped food components that were not actually eaten.</p> <p>The ERT recommends that the Party report consistent data on population and protein consumption under additional information in CRF table 5.D and NIR table 7.26.</p>	
KP-LULUCF			
KL.12	General (KP-LULUCF) – CO ₂ , CH ₄ and N ₂ O	<p>The ERT noted an inconsistency in the column “Activities under Article 3.3”/“Deforestation”, in NIR table 11.1 (p.294). The numbers in the column do not add up to 50.41 kha, the total area at the end of the inventory year reported. Likewise, the row “Other” does not add up to the total area of the beginning of the inventory year 2019 of 50,393.68. This inconsistency is caused by 2.63 kha of other land being converted to deforestation land. The ERT also noted that NIR table 11.1 reports an area of 9,601.09 kha for cropland management in the total area row at the end of inventory year 2019. However, the Party has not elected to account for cropland management under Article 3, paragraph 4, of the Kyoto Protocol. During the review, the Party acknowledged these issues and explained that both the area for cropland management and the area of other land being converted to deforestation land were recorded in error. The ERT noted that the incorrectly reported area values do not affect the total areas reported or the estimates provided.</p> <p>The ERT recommends that the Party replace the erroneous values for cropland management and other with the notation key “NA”.</p>	Yes. Convention reporting adherence
KL.13	General (KP-LULUCF) – CO ₂ , CH ₄ and N ₂ O	<p>In CRF table NIR-2 reported by the Party, the value reported in the column “Total area at the end of the previous inventory year” is not equal to the value reported in row “Total area at the end of the current inventory year” for the previous year for FM and “other” for 2013–2019 or the values reported in CRF tables 4(KP-I)B.1 and 4(KP-I)A.2; for example, the reported area for FM at the end of the previous inventory year for 2019 is 9,601.38 kha, whereas the total area reported for FM for the end of 2018 is 9,599.63 kha. There is also misalignment between the areas reported for deforestation in 2016 (50.05 kha) and 2015 (50.07 kha). During the review, the Party explained that the differences in the reported FM areas are due to the differences in the data reported by different government bodies, which do not track changes, and those used to compile all the data for the annual NIR submission. The differences arise from reporting differences between AR, deforestation and FM, so while the area used to calculate CSC is not affected, the allocation between land-use activities is. The Party also clarified that there was an error in the calculation sheets for deforestation when applying cumulative methods and filling CRF table NIR-2. The area of deforestation at the beginning of 2016 should be 50.07 kha and at the end of the year 50.10 kha. The CSC are not affected by this error because the calculations are based on annual deforestation areas and not estimated using a cumulative approach.</p> <p>The ERT recommends that the Party ensure the accuracy and consistency of the land-use transition matrix data reported in the CRF tables by aligning the area reported for FM and deforestation at the end of the previous inventory year (CRF tables 4(KP-I)B.1 and 4(KP-I)A.2) with the area reported for the subsequent year in CRF table NIR-2 column “Total area at the end of the previous inventory year”. The ERT also recommends that the Party provide further explanation in the NIR as to how the differences in the data reported by the different government bodies are accounted for in the matrix.</p>	Yes. Consistency

<i>ID#</i>	<i>Finding classification</i>	<i>Description of finding with recommendation or encouragement</i>	<i>Is finding an issue/problem?^a</i>
KL.14	General (KP-LULUCF) – CO ₂ , CH ₄ and N ₂ O	<p>The Party reported in its NIR (chap. 11.3.1, p.295) that the estimation of CSC for activities under Article 3, paragraphs 3–4, of the Kyoto Protocol followed methods similar to those used for estimating carbon stocks reported under the forest land category under the Convention. As described in ID# L.41 above, biomass losses reported in CRF table 4.A for forest land exclude emissions from harvesting associated with industrial wood that is transferred to the HWP pool. Following the same methodology, the reported CSC in biomass for both AR and FM activities reported in CRF tables 4(KP-1)A.1 and 4(KP-1)B.1 are not consistent with the 2006 IPCC Guidelines (vol. 4, chap. 2, p.16) and result in an underestimation of biomass losses, such that the emissions for these reported activities are underestimated.</p> <p>The ERT recommends that the Party follow equation 2.11 of the 2006 IPCC Guidelines (vol. 4, chap. 2, p.16) and report all losses for biomass in CRF tables 4(KP-1)A.1 and 4(KP-1)B.1, regardless of whether or not the losses are associated with timber for HWP production. The ERT also recommends that the Party ensure that the same approach, consistent with IPCC good practice, is applied for the calculation of the FMRLcorr.</p>	Yes. Accuracy

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

VI. Application of adjustments

12. The ERT did not identify the need to apply any adjustments for the 2021 annual submission of Ukraine.

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

13. Ukraine 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

14. 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 Ukraine in its 2021 annual submission

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

Table I.1

Total greenhouse gas emissions and removals for Ukraine, base year–2019

(kt CO₂ eq)

	Total GHG emissions excluding indirect CO ₂ emissions		Total GHG emissions and removals including indirect CO ₂ emissions ^a		Land-use change (Article 3.7 bis as contained in the Doha Amendment) ^b	KP-LULUCF (Article 3.3 of the Kyoto Protocol) ^c	KP-LULUCF (Article 3.4 of the Kyoto Protocol)	
	Total including LULUCF	Total excluding LULUCF	Total including LULUCF	Total excluding LULUCF			CM, GM, RV, WDR	FM
FMRL								–48 700.00
Base year ^d	884 223.01	942 574.07	NA	NA	NA		NA	
1990	884 223.01	942 574.07	NA	NA				
1995	509 020.75	561 925.72	NA	NA				
2000	381 481.76	427 602.79	NA	NA				
2010	375 067.83	407 123.69	NA	NA				
2011	412 193.02	428 395.17	NA	NA				
2012	397 366.28	417 435.21	NA	NA				
2013	401 886.04	409 042.06	NA	NA		–2 127.99	NA	–52 460.48
2014	357 991.37	362 608.94	NA	NA		–2 116.31	NA	–51 284.27
2015	312 356.77	319 141.19	NA	NA		–2 095.27	NA	–49 333.93
2016	335 142.78	337 456.51	NA	NA		–2 367.23	NA	–48 515.68
2017	312 563.90	323 045.06	NA	NA		–2 386.81	NA	–49 198.68
2018	340 673.90	339 797.89	NA	NA		–2 488.03	NA	–47 256.86
2019	332 163.16	332 114.02	NA	NA		–2 378.26	NA	–46 985.84

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

^a The Party did not report 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 all gases. Ukraine 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 Ukraine, 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	705 829.99	183 074.29	53 433.96	NO	235.82	NO	0.01	NO
1995	389 864.61	139 063.41	32 819.57	NO	178.06	NO	0.07	NO
2000	285 337.20	118 352.61	23 781.09	15.73	115.74	NO	0.42	NO
2010	294 078.32	84 892.36	27 372.77	743.86	26.67	NO	9.71	NO
2011	307 952.84	86 279.76	33 334.16	820.00	NO	NO	8.42	NO
2012	303 976.43	80 724.30	31 882.74	840.76	NO	NO	10.99	NO
2013	297 249.64	75 503.66	35 394.98	881.24	NO	NO	12.54	NO
2014	257 508.61	68 943.05	35 292.71	847.84	NO	NO	16.73	NO
2015	223 822.12	61 527.23	32 996.83	775.37	NO	NO	19.64	NO
2016	234 005.95	66 229.26	36 309.63	887.36	NO	NO	24.31	NO
2017	223 084.98	63 938.32	34 983.76	1 009.54	NO	NO	28.46	NO
2018	232 032.93	67 739.85	38 641.79	1 350.04	NO	NO	33.29	NO
2019	222 579.32	69 778.64	38 091.75	1 625.79	NO	NO	38.52	NO
Percentage change 1990–2019	–68.5	–61.9	–28.7	NA	NA	NA	504 605.1	NA

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

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

Table I.3

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

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
1990	725 319.33	117 988.08	86 842.92	–58 351.06	12 423.74	NO
1995	431 377.13	57 985.68	60 607.71	–52 904.97	11 955.20	NO
2000	311 340.84	67 146.85	37 334.68	–46 121.03	11 780.42	NO
2010	286 384.30	74 481.70	33 520.89	–32 055.85	12 736.81	NO
2011	296 451.67	80 847.40	38 351.53	–16 202.15	12 744.56	NO
2012	290 288.85	77 306.58	37 207.73	–20 068.94	12 632.06	NO
2013	282 153.85	72 419.55	41 642.84	–7 156.02	12 825.83	NO
2014	246 739.48	61 864.57	41 431.02	–4 617.57	12 573.87	NO
2015	210 824.99	56 462.83	39 378.00	–6 784.42	12 475.36	NO

	<i>Energy</i>	<i>IPPU</i>	<i>Agriculture</i>	<i>LULUCF</i>	<i>Waste</i>	<i>Other</i>
2016	224 764.59	58 149.44	42 030.05	–2 313.74	12 512.42	NO
2017	217 752.63	51 898.60	40 996.56	–10 481.16	12 397.26	NO
2018	226 285.47	56 865.17	44 303.73	876.01	12 343.52	NO
2019	219 173.09	58 238.71	42 477.21	49.14	12 225.02	NO
Percentage change 1990–2019	–69.8	–80.6	–51.1	–100.1	–1.6	NO

Notes: (1) Ukraine did not report emissions or removals in the sector other (sector 6); the corresponding cells in the CRF tables were left blank; (2) Ukraine did not report indirect CO₂ emissions in CRF table 6.

Table I.4

Greenhouse gas emissions and removals from activities under Article 3, paragraphs 3–4, of the Kyoto Protocol by activity, base year–2019, for Ukraine
(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				–48 700				
Technical correction				–4 600				
Base year ^b	NA				NA	NA	NA	NA
2013		–2 286.65	158.66	–52 460.48	NA	NA	NA	NA
2014		–2 268.97	152.66	–51 284.27	NA	NA	NA	NA
2015		–2 247.24	151.97	–49 333.93	NA	NA	NA	NA
2016		–2 503.27	136.04	–48 515.68	NA	NA	NA	NA
2017		–2 528.85	142.03	–49 198.68	NA	NA	NA	NA
2018		–2 538.75	50.72	–47 256.86	NA	NA	NA	NA
2019		–2 530.29	152.03	–46 985.84	NA	NA	NA	NA
Percentage change base year–2019					NA	NA	NA	NA

Notes: 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 Ukraine 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 Ukraine's reporting under Article 3, paragraphs 3–4, of the Kyoto Protocol.

Table I.5

Key relevant data for Ukraine 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	32 828.397 kt CO ₂ eq (262 627 kt CO ₂ eq for the duration of the commitment period)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	NA
2. Deforestation	NA
3. FM	NA

Annex II

Information to be included in the compilation and accounting database¹

Tables II.1–II.7 include the information to be included in the compilation and accounting database for Ukraine. 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 Ukraine
(t CO₂ eq)

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
CPR	2 656 912 172	–	–	2 656 912 172
Annex A emissions				
CO ₂	222 579 323	–	–	222 579 323
CH ₄	69 778 638	–	–	69 778 638
N ₂ O	38 091 754	–	–	38 091 754
HFCs	1 625 788	–	–	1 625 788
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF ₆	38 518	–	–	38 518
NF ₃	NO	–	–	NO
Total Annex A sources	332 114 021	–	–	332 114 021
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 530 294	–	–	–2 530 294
Deforestation	152 032	–	–	152 032
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–46 985 839	–	–	–46 985 839

Table II.2

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	232 032 926	–	–	232 032 926
CH ₄	67 736 851	–	–	67 736 851
N ₂ O	38 641 788	–	–	38 641 788
HFCs	1 350 037	–	–	1 350 037
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF ₆	33 291	–	–	33 291
NF ₃	NO	–	–	NO
Total Annex A sources	339 797 892	–	–	339 797 892
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 538 751	–	–	–2 538 751
Deforestation	50 720	–	–	50 720
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–47 256 859	–	–	–47 256 859

¹ The Doha Amendment entered into force on 31 December 2020. At the time of publication of this report, Ukraine had not accepted the Amendment.

Table II.3

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	223 084 976	–	–	223 084 976
CH ₄	63 938 317	–	–	63 938 317
N ₂ O	34 983 764	–	–	34 983 764
HFCs	1 009 537	–	–	1 009 537
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF ₆	28 461	–	–	28 461
NF ₃	NO	–	–	NO
Total Annex A sources	323 045 056	–	–	323 045 056
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 528 846	–	–	–2 528 846
Deforestation	142 032	–	–	142 032
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–49 198 679	–	–	–49 198 679

Table II.4

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	234 005 955	–	–	234 005 955
CH ₄	66 229 256	–	–	66 229 256
N ₂ O	36 309 630	–	–	36 309 630
HFCs	887 357	–	–	887 357
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF ₆	24 312	–	–	24 312
NF ₃	NO	–	–	NO
Total Annex A sources	337 456 511	–	–	337 456 511
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 503 268	–	–	–2 503 268
Deforestation	136 041	–	–	136 041
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–48 515 680	–	–	–48 515 680

Table II.5

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	223 822 115	–	–	223 822 115
CH ₄	61 527 225	–	–	61 527 225
N ₂ O	32 996 830	–	–	32 996 830
HFCs	775 372	–	–	775 372
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
SF ₆	19 642	–	–	19 642
NF ₃	NO	–	–	NO
Total Annex A sources	319 141 185	–	–	319 141 185
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 247 242	–	–	–2 247 242
Deforestation	151 974	–	–	151 974
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–49 333 927	–	–	–49 333 927

Table II.6

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	257 508 606	–	–	257 508 606
CH ₄	68 943 054	–	–	68 943 054
N ₂ O	35 292 709	–	–	35 292 709
HFCs	847 844	–	–	847 844
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF ₆	16 726	–	–	16 726
NF ₃	NO	–	–	NO
Total Annex A sources	362 608 939	–	–	362 608 939
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 268 971	–	–	2 268 971
Deforestation	152 661	–	–	152 661
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–51 284 269	–	–	–51 284 269

Table II.7

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

	<i>Original submission</i>	<i>Revised submission</i>	<i>Adjustment</i>	<i>Final value</i>
Annex A emissions				
CO ₂	297 249 639	–	–	297 249 639
CH ₄	75 503 655	–	–	75 503 655
N ₂ O	35 394 983	–	–	35 394 983
HFCs	881 240	–	–	881 240
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF ₆	12 543	–	–	12 543
NF ₃	NO	–	–	NO
Total Annex A sources	409 042 060	–	–	409 042 060
Activities under Article 3, paragraph 3, of the Kyoto Protocol				
AR	–2 286 646	–	–	–2 286 646
Deforestation	158 661	–	–	158 661
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol				
FM	–52 460 481	–	–	–52 460 481

Annex III

Additional information to support findings in table 2

Missing categories that may affect completeness

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

Annex IV

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

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

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

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

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2014, 2015, 2016, 2017 and 2019 annual submissions of Ukraine, contained in documents FCCC/ARR/2013/UKR, FCCC/ARR/2014/UKR, FCCC/ARR/2015/UKR, FCCC/ARR/2016/UKR, FCCC/ARR/2017/UKR and FCCC/ARR/2019/UKR, respectively.

Other

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at https://unfccc.int/sites/default/files/resource/AGI%202020_final.pdf.

Annual status report for Ukraine for 2021. Available at https://unfccc.int/sites/default/files/resource/asr2021_UKR.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Igor Onopchuk (National Center for GHG Emission Inventory of Ukraine), including additional material on the methodology and assumptions used.