United Nations

Framework Convention on
Climate Change

FCCC/ARR/2019/UKR

Distr.: General
25 March 2020

English only

Report on the individual review of the annual submission of Ukraine submitted in 2019 *

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 inventory review of the 2019 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 16 to 21 September 2019 in Bonn.

---

* In the symbol for this document, 2019 refers to the year in which the inventory was submitted, not to the year of publication.

GE.20-04501(E)

Please recycle

Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AAU	assigned amount unit
AD	activity data
Annex A source	source category included in Annex A to the Kyoto Protocol
AR	afforestation and reforestation
Article 8 review guidelines	"Guidelines for review under Article 8 of the Kyoto Protocol"
$BCEF_R$	biomass conversion and expansion factor for conversion of removals in merchantable volume
BEF	biomass expansion factor
BEF_R	biomass expansion factor for wood and firewood removals
C	carbon
CER	certified emission reduction
CH_4	methane
CM	cropland management
Convention reporting adherence	adherence to the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CPR	commitment period reserve
CRF	common reporting format
CSC	carbon stock change
DOC_f	fraction of degradable organic carbon that decomposes
DOM	dead organic matter
EF	emission factor
ERT	expert review team
ERU	emission reduction unit
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 after application of the technical correction
$F_{NON-CON}$	fraction of non-consumed protein added to wastewater
$Frac_{GASM}$	fraction of applied organic nitrogen fertilizer materials and of urine and dung nitrogen deposited by grazing animals that volatilizes as ammonia and nitrogen oxides
$Frac_{LEACH-[H]}$	fraction of nitrogen input to managed soils that is lost through leaching and run-off
GDP	gross domestic product
GE	gross energy
GHG	greenhouse gas
GIS	geographic information system
GM	grazing land management
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor

IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
KP-LULUCF activities	activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
KP reporting adherence	adherence to the reporting guidelines under Article 7, paragraph 1, of the Kyoto Protocol
Kyoto Protocol Supplement	*2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*
LPG	liquefied petroleum gas
LULUCF	land use, land-use change and forestry
MCF	methane conversion factor
MCF_{UA}	country-specific methane conversion factor
MDMex	amount of manure excreted by animals in dry matter
MENR	Ministry of Ecology and Natural Resources
MMS	manure management system(s)
MSW	municipal solid waste
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
Nex	nitrogen excretion
NF_3	nitrogen trifluoride
NH_3	ammonia
NIR	national inventory report
NO	not occurring
NO_X	nitrogen oxides
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
RMU	removal unit
RV	revegetation
SF_6	sulfur hexafluoride
SIAR	standard independent assessment report
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"
VS	volatile solid(s)
WDR	wetland drainage and rewetting
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*

I. Introduction[1]

1. This report covers the review of the 2019 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" (decision 13/CP.20). The review took place from 16 to 21 September 2019 in Bonn and was coordinated by Jamie Howland, Nashib Kafle and Roman Payo (secretariat). Table 1 provides information on the composition of the ERT that conducted the review of Ukraine.

Table 1
Composition of the expert review team that conducted the review of Ukraine

Area of expertise	Name	Party
Generalist	Riccardo de Lauretis	Italy
	Melissa Weitz	United States of America
Energy	Vincent Camobreco	United States of America
	Sangay Dorji	Bhutan
	Brooke Elizabeth Perkins	Australia
IPPU	Thapelo Clifford Mohale Letete	South Africa
	Jacek Skoskiewicz	Poland
	Alexander Valencia	Colombia
Agriculture	Fatou Ndeye Gaye	Gambia
	Nidup Peljor	Bhutan
	Andrea Pickering	New Zealand
LULUCF and KP-LULUCF activities	Markus Didion	Switzerland
	Timothy Paul Liersch	Australia
	Marina Vitullo	Italy
Waste	Fatma Betül Demirok	Turkey
	Julius Madzore	Zimbabwe
Lead reviewers	Thapelo Clifford Mohale Letete	
	Melissa Weitz	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2019 annual submission in accordance with the UNFCCC review guidelines and the Article 8 review guidelines. The ERT notes that the individual inventory review of Ukraine's 2018 annual submission did not take place in 2018 owing to insufficient funding for the review process.

3. The ERT has made recommendations that Ukraine resolve the findings related to issues,[2] including issues designated as problems.[3] Other findings, and, if applicable, the encouragements of the ERT to Ukraine to resolve them, are also included.

---

[1] At the time of publication of this report, Ukraine had not yet submitted its instrument of ratification of the Doha Amendment, and the Amendment had not yet entered into force.

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

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

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

5.   Annex I shows annual GHG emissions for Ukraine, including totals excluding and including the LULUCF sector, indirect CO_2 emissions, and emissions by gas and by sector. Annex I also contains background data related to emissions and removals from KP-LULUCF activities, if elected by Ukraine, by gas, sector and activity.

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

II.   Summary and general assessment of the 2019 annual submission

7.   Table 2 provides the assessment by the ERT of the annual submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

Table 2
Summary of review results and general assessment of the inventory of Ukraine

Assessment			*Issue or problem ID#(s) in table 3 and/or 5[a]*
Dates of submission	Original submission: 16 May 2019 (NIR), 16 May 2019 (CRF tables) version 1, 16 May 2019 (standard electronic format tables)		
	Revised submission: 10 June 2019 (CRF tables) version 3		
	Unless otherwise specified, the values from the latest submission are used in this report		
Review format	Centralized		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and 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.18, L.15, L.19, W.4, KL.10, KL.14
	(c) Development and selection of EFs?	Yes	E.1, A.15, L.10, L.31, W.15, KL.1, KL.2
	(d) Collection and selection of AD?	Yes	A.21, L.2, L.5, L.9, L.13, L.16, L.23, L.34, L.41, KL.3, KL.6
	(e) Reporting of recalculations?	Yes	E.10
	(f) Reporting of a consistent time series?	Yes	E.11, L.6, L.7, L.35
	(g) Reporting of uncertainties, including methodologies?	Yes	L.24
	(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/completeness?[b]	Yes	E.12, L.38
	(j) Application of corrections to the inventory?	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	Yes	

Assessment			*Issue or problem ID#(s) in table 3 and/or 5[a]*
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	No	E.11
Supplementary information under the Kyoto Protocol	Have any issues been identified related to the following aspects of the national system:		
	(a) Overall organization of the national system, including the effectiveness and reliability of the institutional, procedural and legal arrangements?	No	
	(b) Performance of the national system functions?	Yes	G.2, G.7
	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 technical standards for data exchange?	Yes	G.5
	Have any issues been identified related to reporting of information on AAUs, CERs, ERUs and RMUs and on discrepancies reported 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?	Yes	G.6
	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 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 activities:		
	(a) Reporting requirements of decision 2/CMP.8, annex II, paragraphs 1–5?	Yes	KL.11, KL.13
	(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.12
	(c) Reporting requirements of decision 6/CMP.9?	Yes	KL.14
	(d) Country-specific information to support provisions for natural disturbances, in accordance with decision 2/CMP.7, annex, paragraphs 33 and 34?	No	
CPR	Was the CPR reported in accordance with the annex to decision 18/CP.7, the annex to decision 11/CMP.1 and decision 1/CMP.8, paragraph 18?	Yes	
Adjustments	Has the ERT applied an adjustment under Article 5, paragraph 2, of the Kyoto Protocol?	No	
	Did the Party submit a revised estimate to replace a previously applied adjustment?	NA	Ukraine does not have a previously applied adjustment
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for the assessment of conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	

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

[a] The ERT identified additional issues and/or problems in all sectors as well as issues and/or problems related to reporting on KP-LULUCF activities that are not listed in this table but are included in table 5.

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

III. Status of implementation of issues and/or problems raised in the previous review report

8.   Table 3 compiles all the recommendations made in previous review reports that were included in the previous review report, published on 25 May 2018.[4] For each issue and/or problem, the ERT specified whether it believes the issue and/or problem has been resolved by the conclusion of the review of the 2019 annual submission and provided the rationale for its determination, which takes into consideration the publication date of the previous review report and national circumstances.

Table 3
Status of implementation of issues and/or problems raised in the previous review report of Ukraine

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
General			
G.1	Article 3, paragraph 14, of the Kyoto Protocol (G.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. Ukraine reported on its training of specialists from developing countries in the NIR (p.323); however, it did not report whether or not this information had changed compared with the 2017 submission (i.e. whether there were changes in the training programme). During the review, the Party explained that new information is available on Article 3, paragraph 14, activities, and that the 2019 submission was updated with this information compared with the 2017 submission. The ERT considers that adding a sentence in the next NIR clearly stating either that there have been no changes or that there have been changes (and in this case, stating what the changes are) would resolve this issue.
G.2	National system (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.	Addressing. Ukraine reported on its efforts to construct land-use change matrices from GIS data (NIR, p.525). The results of these efforts determined the approach to have poor accuracy, so the Party is exploring the use of more accurate data. This work, undertaken by MENR and the National Center for GHG Emission Inventory, follows the workplan submitted by Ukraine. The data collected were compiled and processed for use for the forest land and FM land categories, as well as for the recalculation of FMRL

[4] FCCC/ARR/2017/UKR. The ERT notes that the report on the individual inventory review of Ukraine's 2018 annual submission has not been published yet. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2017 annual submission.

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			corrections. During the review, the Party further explained its efforts to identify freely available data sets for spatial analysis in order to derive better spatial data for land representation (see ID# L.5 below). The ERT notes that the issue is being addressed because, while the Party has made progress on elements of the workplan, it has not yet been fully implemented. Ukraine has involved three external organizations in improving the organization and structure of its national inventory (item (a) in the workplan). Ukraine has started to expand the spectrum of sources of information (item (b) of the workplan), and has examined the suitability of new methodologies (items (c) and (d)).
G.3	QA/QC and verification (G.7, 2017) Convention reporting adherence	Improve and implement the QC procedures as described in the QA/QC plan in order to minimize mistakes and inconsistencies, incorrectly referenced sources and inconsistent use of notation keys and to ensure better time-series consistency of the GHG inventory estimates, specifically in the agriculture and LULUCF sectors.	Resolved. Ukraine reported on tiers and EFs used in NIR table 1.2 and in CRF tables 3s1 and 3s2. The ERT did not find any discrepancies, and considers that the Party has minimized errors and inconsistencies, including in references, in all sectors, indicating improved QC procedures.

Energy

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
E.1	1.A Fuel combustion – sectoral approach – liquid fuels – CO_2 (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. Ukraine reported carbon content factors and net calorific values for various fuels in NIR table A2.4, and described the research undertaken in 2017 to improve the country-specific CO_2 EFs for liquid fuels used in the transport sector (i.e. gasoline, diesel oil and LPG) in the NIR (section A2.6.3, pp.361–362). The ERT noted that the previous review indicated residual fuel oil, petroleum coke and refinery gas as the other liquid fuel types with significant shares in stationary combustion. During the review, the Party explained that upon receipt of funding, it would develop a country-specific CO_2 EF for residual fuel. It also explained that, owing to the small quantity of petroleum coke consumed in 2017, it does not consider the development of a country-specific CO_2 EF expedient.
E.2	1.A.1 Energy industries – all fuels – CO_2, CH_4 and N_2O (E.22, 2017) Transparency	Describe in the NIR the reasons for the high level of specific fuel consumption (GHG emissions per MWh electricity produced) of power plants since 2007.	Resolved. Ukraine explained in the NIR that the high level of specific fuel consumption of power plants (1.0 t CO_2 eq/MWh and even higher in recent years) is due to ageing power plant blocks, which have high fuel consumption (section 3.2.7.1.1, p.75).
E.3	1.A.3.b Road transportation – liquid fuels – CO_2, CH_4 and N_2O (E.6, 2017) (E.16, 2016) (E.30, 2015) Transparency	Investigate the allocation of emissions from the combustion of lubricants and report the outcome of this assessment.	Resolved. Ukraine reported that 98 per cent of emissions from lubricants is accounted for in the IPPU sector whereas the remaining 2 per cent is reported under categories 1.A.1 (energy industries) and 1.A.3.b.iv (motorcycles) (NIR, section A2.4.1, p.347).
E.4	1.A.3.d Domestic navigation –	Include in the NIR documentation of the observed trends in cargo for	Not resolved. Ukraine provided a reference to the Statistical Yearbook of Ukraine for the trends in

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	liquid fuels – CO_2, CH_4 and N_2O (E.23, 2017) Transparency	national and international navigation, particularly for the years 2012 onward.	cargo for national and international navigation (NIR, p.85). However, no data or interpretation of the trends regarding water transport emissions were included in the NIR of the 2019 annual submission. During the review, the Party explained that the trends in cargo transportation can be seen in the Statistical Yearbook. The ERT noted that during the review of the 2017 submission, the Party explained that water transport plays a role in reserve infrastructure and that, because water levels in rivers in Ukraine are decreasing every year, significant fluctuations in navigation may be seen. The Party also explained that increases in 2015 were due to a substitution of railway and road transportation as a result of national circumstances and fluctuations in the national economy. The ERT considers that adding the above information to the NIR would help the Party to address the recommendation.
E.5	1.A.3.e Other transportation – biomass – CH_4 and N_2O (E.7, 2017) (E.17, 2016) (E.31, 2015) Transparency	Strive to collect data for biodiesel consumption for the period 1990–2012 and report the outcome of those efforts in the NIR and, if impossible, change the notation key for the period 1990–2012 from "NO" to "NE".	Addressing. Ukraine changed the reporting of biodiesel consumption from "NO" to "NO, NE" for 1990–2012 in CRF table 1.A(a)s3, but did not report in the NIR on its attempts to collect data for biodiesel consumption for that period. 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 (see ID# E.12 in table 5).
E.6	1.A.4 Other sectors – all fuels – CO_2, CH_4 and N_2O (E.24, 2017) Transparency	Include in the NIR clear and detailed explanations for the decreasing trends of total GHG emissions in the residential and commercial/institutional subcategories of the other sectors category.	Addressing. Ukraine reported that migration out of the country correlates with emission trends in the residential subcategory (NIR, section 3.2.10.2.2, p.89). However, only a partial explanation for the decreasing emission trend in the residential subcategory was included in the NIR 2019 compared with the explanation provided during the review of the 2017 submission (see document FCCC/ARR/2017/UKR, ID# E.24), and an explanation for the commercial/industrial subcategory emission trend was not included.
E.7	1.B.2.a Oil – CO_2, CH_4 and N_2O (E.25, 2017) Transparency	Include an explanation in the NIR for the choice of CO_2, CH_4 and N_2O EFs for estimating emissions for the oil category, including documentation of the current state of oil industry infrastructure.	Addressing. Ukraine continues to use the default values provided in the 2006 IPCC Guidelines for developing countries and countries in transition, and constant values are used across the time series. During the review, Ukraine explained that a list of the EFs used can be found in the NIR (section 3.3.2.1.2 and table 3.21). However, the ERT did not find in the NIR (specifically section 3.3.2.1, p.96) an explanation of the state of oil industry infrastructure and any changes to it since 1990 or of the choice of EFs used.

IPPU

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
I.1	2.B.3 Adipic acid production – N_2O (I.4, 2017) (I.21, 2016) (I.28, 2015) Transparency	Report consistently the information on the tier applied to estimate N_2O emissions from adipic acid production and include in the NIR the description of the number and type of abatement systems used in	Resolved. Ukraine described the tier method used (tier 2) to estimate N_2O emissions from adipic acid production as well as the type of abatement systems used in the country and the corresponding destruction and utilization factors (NIR, p.116). The destruction and utilization

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		Ukraine and the corresponding destruction and utilization factors.	factors are provided in annex 3 to the NIR (table A3.1.1.9).
I.2	2.B.4 Caprolactam, glyoxal and glyoxylic acid production – N$_2$O (I.10, 2017) Transparency	Include in the NIR methodological descriptions and QA/QC procedures regarding N$_2$O emissions from caprolactam, glyoxal and glyoxylic acid production.	Resolved. Ukraine has included a specific section in the NIR (section 4.9) on caprolactam, glyoxal and glyoxylic acid production. The Party reported that a tier 1 method, with default EFs, was used for estimating N$_2$O emissions from caprolactam production and that general QA/QC procedures were applied (NIR, p.117). As indicated in the NIR and in CRF tables 2(I)A-H, there is no glyoxal or glyoxylic acid production in the country (NIR, p.117).
I.3	2.C.3 Aluminium production – CO$_2$ and PFCs (I.7, 2017) (I.30, 2016) (I.38, 2015) Transparency	Include information on aluminium production in the NIR.	Addressing. Ukraine has included additional information in the section on aluminium production in the NIR (section 4.16), including the category description and methodological information. The Party reported that there was no aluminium production between 2010 and 2016 (NIR, section 4.16.1, p.128), but did not provide any information about aluminium production in 2017. However, NIR section 4.16.3 indicates that no aluminium has been produced since 2010. Aluminium production has been reported as "NO" in CRF table 2(I).A-Hs2 since 2011. CO$_2$ and PFC emissions have been estimated for 1990–2010 and reported as "NO" since 2011. The methodology for estimating those emissions was described (NIR, section 4.16.2).
			During the review, the Party confirmed that aluminium production has not occurred in the country since 2011 (no aluminium plants have been operational since 2011), and explained that NIR section 4.16.1 may not be clear: there was no aluminium production in Ukraine in 2017. Ukraine informed the ERT that the only aluminium plant in the country, Joint Stock Company ZALK, came under the complete control of a foreign company in 2007; it started dismantling the plant at that time, and in 2010, the dismantling led to a cessation of aluminium production in Ukraine.
			The ERT concludes that revising NIR sections 4.16.1 and 4.16.3 to explain that there have been no aluminium plants in operation in the country since 2011 would resolve this issue.
I.4	2.F.1 Refrigeration and air conditioning – HFCs (I.8, 2017) (I.37, 2016) (I.43, 2015) Accuracy	Investigate further disposal emissions, noting that the average lifetime for air-conditioning equipment according to the 2006 IPCC Guidelines is between 10 and 20 years, and document the analysis in the NIR.	Resolved. Ukraine calculated and reported HFC emissions from the disposal of domestic and mobile air-conditioning systems using a lifetime value of 15 years, which is within the average default range in the 2006 IPCC Guidelines (vol. 3, table 7.9) (NIR, pp.144 and 147).
I.5	2.F.1 Refrigeration and air conditioning – HFCs (I.11, 2017) Transparency	Correct the data in the table of the NIR presenting assumptions regarding the equipment lifetime used to estimate HFC disposal emissions from domestic equipment to ensure consistency with the assumptions used in the	Resolved. Ukraine reported the corrected data in the table of the NIR presenting assumptions regarding the equipment lifetime used to estimate HFC disposal emissions from domestic equipment (NIR table 4.28). The table shows an average lifetime of 18 years for domestic

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		calculations for 2.F.1.b (domestic refrigeration).	refrigeration equipment as used in the reported estimates.
I.6	2.F.1 Refrigeration and air conditioning – HFCs (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.	Not resolved. Ukraine did not document the national circumstances supporting the use of an average lifetime of 18 years for domestic refrigeration equipment in the NIR. During the review, the Party indicated that this information would be included in the next submission.
I.7	2.F.1 Refrigeration and air conditioning – HFCs (I.13, 2017) Transparency	Ensure correct descriptions of the actions in response to recommendations for the IPPU sector made in previous review reports, with the aim of reflecting the most updated situation, in particular with reference to the table in section A8.1 of annex 8 to the NIR on actions in response to recommendations made in the previous review report and on the improvement plan.	Resolved. Ukraine corrected in NIR table A8.2 the descriptions of the actions it has taken in response to recommendations made in previous review reports. NIR table A8.2 indicates that the Party is planning research to improve emission estimates from the manufacturing of new equipment, stocks of existing equipment and disposal of equipment containing HFCs, PFCs and SF_6 under category 2.F (product uses as substitutes for ozone-depleting substances) with implementation of the plan between the 2019 and 2021 submissions.
I.8	2.F.1 Refrigeration and air conditioning – HFCs (I.14, 2017) Transparency	Revise the table in the NIR that refers to assumptions made for subcategory 2.F.1.e (mobile air conditioning) to provide the correct global warming potential value used in calculations for HFC-134a emissions.	Resolved. Ukraine reported the correct global warming potential value (1,430) used for estimating HFC-134a emissions (NIR, p.147).
I.9	2.F.1 Refrigeration and air conditioning – HFCs (I.15, 2017) Transparency	Include in the NIR a clear justification for assuming a longer lifetime (18 years) than the IPCC default value range (9–16 years) for vehicles with mobile air conditioning in the emission estimates for subcategory 2.F.1.e (mobile air conditioning).	Resolved. Ukraine included a justification for assuming a lifetime of 18 years for vehicles with mobile air conditioning in the NIR; that is, according to national statistics, in the current unstable economic situation in Ukraine the small number of sales of new cars and the insignificant import of used cars have led to significant ageing of the vehicle fleet, resulting in an average car lifetime of 17–20 years (NIR, p.148).
I.10	2.F.1 Refrigeration and air conditioning – HFCs (I.16, 2017) Completeness	Estimate HFC emissions for 1998 and 1999 for subcategory 2.F.1.e (mobile air conditioning).	Resolved. Ukraine included estimates of HFC emissions for 1998 and 1999 for subcategory 2.F.1.e (mobile air conditioning) in NIR table A3.1.1.17 and CRF table 2(II)B-Hs2.
I.11	2.F.1 Refrigeration and air conditioning – HFCs (I.16, 2017) Transparency	Include in the NIR information justifying the late introduction (from 2000) of air-conditioned cars into the Ukrainian market.	Not resolved. Ukraine did not include in the NIR information justifying the late introduction of air-conditioned cars into the Ukrainian market. During the review, the Party clarified that national circumstances, such as the unstable economic situation after the collapse of the Union of Soviet Socialist Republics in 1991, led to automobiles being produced at only one plant in the country, which did not produce air-conditioned cars until 2000. Cars with air conditioners containing HFCs were imported from 1998.

Agriculture

A.1	3. General (agriculture) – CH_4 and N_2O	Specify accurately throughout the agriculture chapter of the NIR whether the different parameters	Resolved. Ukraine reported on the use of equations and quoted equation numbers from the 2006 IPCC Guidelines that it used for estimating

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(A.16, 2017) Transparency	and EFs used for the estimates are default values from the 2006 IPCC Guidelines or are country-specific. If country-specific values are used, include in the NIR a summary of how the country-specific value was developed, together with a reference to the study or scientific research source of the parameter.	CH_4 and N_2O emissions for the agriculture sector (NIR, p.199). The Party reported the use of default EFs from the 2006 IPCC Guidelines (vol. 4, table 11.1) for estimating N_2O emissions from organic soils and from pasture, range and paddock manure (NIR, p.199). The Party reported that the share of N in organic N fertilizers introduced and N from urine and dung left by grazing animals, which volatilized as NH_3 and NO_X, and the EF used for estimating N_2O emissions from N volatilization used, are default values from the 2006 IPCC Guidelines (vol. 4, table 11.1) (NIR, p.200).
			Regarding maximum CH_4 producing capacity, the NIR (p.182) indicates that the Party used the country-specific values presented in NIR table A3.2.3.1. These values are comparable with the default values in the 2006 IPCC Guidelines (vol. 4, tables 10A4–10A9).
			Regarding $Frac_{GASM}$ and $Frac_{LEACH-[H]}$, Ukraine used default values (0.2 and 0.3, respectively) from the 2006 IPCC Guidelines (vol. 4, table 11.3) and reported them in NIR table A3.2.8.7.
A.2	3. General (agriculture) – CO_2, CH_4 and N_2O (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. The ERT noted that the NIR (tables 5.5 and table 5.6 and text on pp.172 and 185) refers to data on milk production from "table No.15 of SSSU and analytical study [2]". However, information from those sources is not included in the NIR. During the review, the Party clarified that data from SSSU table No. 15 were reported in tables A3.2.2.6 and A3.2.2.9 of the NIR. Regarding the "Analytical study [2]", Ukraine explained that the source has confidential status and therefore the information cannot be reported in the NIR. The Party also explained that it made some changes to table structure when it implemented the tier 2 methodology for estimating CH_4 enteric emissions from cattle. For example, milk production and fat content of milk are reported in table A3.2.2.6. The Party clarified that the data on crude protein fraction in the diet of each cattle sex-age group are calculated according to the judgment of experts from the National Academy of Agrarian Sciences of Ukraine. These data were not reported in the NIR, but the Party indicated that they would be included in the NIR 2020.
A.3	3.A.1 Cattle – CH_4 (A.3, 2017) (A.20, 2016) Transparency	Investigate the reason for the fluctuation in fodder consumption as reported by SSSU and provide explanatory information in the NIR to justify the estimates.	Resolved. Ukraine reported that a tier 2 method from the 2006 IPCC Guidelines (vol. 4, chap. 10, equation 10.19) was used for estimating CH_4 emissions from cattle (NIR, p.166) and provided a description of the methodology (NIR, p.169). During the review, the Party confirmed that fodder consumption data were not used for the estimation owing to the use of the tier 2 methodology.
A.4	3.A.1 Cattle – CH_4 (A.6, 2017) (A.21,	Consider the values and trend of the CH_4 IEF for growing cattle and the assumptions and data affecting	Resolved. In CRF table 3.As1, Ukraine reported the CH_4 IEF for enteric fermentation of growing cattle (44.17 kg CH_4/head/year) in 2015. The

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	2016) Accuracy	it, and make any necessary corrections.	ERT noted that the value for 2015 has been revised compared with the 2017 submission (where 62.20 kg CH_4/head/year was reported). The ERT noted that the Party explained in the NIR that the different CH_4 IEF was a result of differences in input data and estimation approaches (p.174). The ERT did not identify any issues with the trend of the CH_4 IEF (slowly increasing from 40.41 to 45.10 kg CH_4/head/year between 1990 and 2017). Ukraine recalculated the GE intake values for each sex and age group of cattle and sheep by means of their conversion into food consumption units in dry matter (kg/head/day) and comparison with live weight values of the corresponding cattle groups. The Party compared its AD with similar FAOSTAT data and with the respective default IPCC coefficients and coefficients of countries with similar conditions (Czechia, France, Germany, Hungary and Slovakia). The relevant explanation was provided in the NIR (p.174) and the recalculated emission estimates are reported in NIR table 5.9. The ERT commends Ukraine for the initiative on this matter.
A.5	3.A.1 Cattle 3.B.1 Cattle 3.D.a.2.a Animal manure applied to soils 3.D.a.3 Urine and dung deposited by grazing animals 3.D.b Indirect N_2O emissions from managed soils – CH_4 and N_2O (A.18, 2017) Transparency	(a) Update in the NIR the description of the methods used to estimate CH_4 and N_2O emissions from subcategory 3.A.1 (cattle – growing cattle), as well as N_2O emissions from subcategories 3.B.1 (cattle – growing cattle), 3.D.2.a (animal manure applied to soils), 3.D.3 (urine and dung deposited by grazing animals) and 3.D.b (indirect N_2O emissions from managed soils), providing justification and concrete documentation for the updated or new applied feed intake values; (b) Improve QC procedures so as to identify time-series breaks before the inventory is published.	Resolved. Ukraine described in the NIR the methods used to estimate CH_4 emissions for subcategory 3.A.1 (p.169); N_2O emissions for subcategory 3.B.1 (pp.185–186); N_2O emissions for subcategory 3.D.2 (p.197); N_2O emissions for subcategory 3.D.3 (p.199); and N_2O emissions for subcategory 3.D.b (p.200). The Party presented changes in the estimation of N_2O emissions for category 3.D (agricultural soils) (NIR table 5.24), and documented the components of the GE intake calculation and the sources of AD for the GE intake estimation (NIR, pp.169–171). Regarding the trend in GE intake, Ukraine resubmitted a complete set of CRF tables for 1990–2015 with revised CH_4 and N_2O estimates for 2014 and 2015 for the listed subcategories using extrapolation of the estimated feed intake for 2013 for the Autonomous Republic of Crimea and parts of the Donetsk and Lugansk regions instead of the original values used. The revised average GE intakes for growing cattle for 2014 and 2015 are of the same magnitude, and there is no longer sudden decrease, as identified during the previous review. As a result of the revision, the estimated emissions for 2014 decreased by 0.54 kt CO_2 eq (0.0001 per cent of the national total and 0.001 per cent of the agriculture sector total emissions) and increased for 2015 by 257.14 kt CO_2 eq (0.08 per cent of the national total and 0.56 per cent of the agriculture sector total emissions). Regarding the QC procedures to identify this type of time-series break before the inventory is published, the ERT could not identify any issues

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			with the time series, so it concludes that the QC procedures have been improved.
A.6	3.A.1 Cattle 3.B.1 Cattle 3.D.a.2.a Animal manure applied to soils 3.D.a.3 Urine and dung deposited by grazing animals 3.D.b Indirect N$_2$O emissions from managed soils – CH$_4$ and N$_2$O (A.19, 2017) Transparency	(a) Describe in detail how GE intake is estimated for the different cattle groups, in particular in which unit the AD are received from SSSU and for which fodder and animal categories the data are delivered; (b) Clarify the rationale behind using equations 5.1 and 5.2 of the NIR to calculate GE intake; (c) Provide in the NIR a transparent description of the concept of fodder units and how these data are estimated by SSSU for agricultural enterprises and households holding cattle.	Resolved. (a) Ukraine described the cattle GE intake estimation with different sources of AD in NIR table 5.5 and annex 3 to the NIR; (b) Ukraine clarified that equation 10.16 from the 2006 IPCC Guidelines (vol. 4) was used to estimate GE intake, instead of equations 5.1 and 5.2, and described the rationale for its use (NIR, p.169); (c) Ukraine used equation 10.16 from the 2006 IPCC Guidelines for estimating GE intake (NIR, p.170) and applied annual GE intake of cattle sex and age groups (MJ/head/day) (NIR table A3.2.2.1, p.419) instead of mass values. Because the data from SSSU, as presented in NIR table A3.2.2.1, are in energy units, which is appropriate for equation 10.16, the ERT considers the issue to be resolved.
A.7	3.A.1 Cattle 3.B.1 Cattle 3.D.a.2.a Animal manure applied to soils 3.D.a.3 Urine and dung deposited by grazing animals 3.D.b Indirect N$_2$O emissions from managed soils – CH$_4$ and N$_2$O (A.20, 2017) Transparency	Include in the NIR information on how the amount of fodder consumed while foraging on pastures is estimated for agricultural enterprises and households holding cattle.	Resolved. Ukraine changed the methodology for estimating GE intake from equations 5.1 and 5.2 to equation 10.16 from the 2006 IPCC Guidelines (vol. 4) and, as a result, the issue of fodder is no longer relevant because the calculation of GE intake is based on energy units and not biomass units. The Party reported in NIR table 5.5 the sources of AD for estimating cattle GE intake characteristics.
A.8	3.A.1 Cattle 3.B.1 Cattle 3.D.a.2.a Animal manure applied to soils 3.D.a.3 Urine and dung deposited by grazing animals 3.D.b Indirect N$_2$O emissions from managed soils – CH$_4$ and N$_2$O (A.21, 2017) Accuracy	Allocate mature heifers to the category other mature cattle and ensure that the classification used in the inventory is in agreement with the guidance in table 10.1 of the 2006 IPCC Guidelines (vol. 4).	Resolved. Ukraine harmonized the classification of cattle with the guidance provided in table 10.1 of the 2006 IPCC Guidelines (vol. 4) and presented the classification in NIR table A3.2.1.1.1. Heifers two years of age and older (i.e. mature heifers) are now included with other mature cattle and no longer with mature dairy cattle. The estimates in the CRF tables use the same categories.
A.9	3.B Manure management – CH$_4$ and N$_2$O (A.8, 2017) (A.22, 2016) Accuracy	Reconsider the country-specific methodology used for estimating the Nex value or apply the methodology suggested in the 2006 IPCC Guidelines (vol. 4, chap. 10, equations 10.31 and 10.32) and further justify and thoroughly document in the NIR the Nex values used.	Resolved. Ukraine applied the methodology suggested in the 2006 IPCC Guidelines (vol. 4, chap. 10, equations 10.31 and 10.32) for estimating Nex (NIR, p.199).
A.10	3.B Manure management – CH$_4$	Investigate the accuracy of the VS excretion rate values used in the estimates for the amount of VS	Resolved. Ukraine recalculated its VS value for poultry across the time series in its 2018 submission. The recalculated value is 0.04 kg dry

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(A.22, 2017) Accuracy	produced by poultry for the entire time series. If errors are identified, recalculate the complete time series and revise accordingly the CH_4 estimates for category 3.B (manure management), including in the NIR clear explanations and sources for the parameters used and rationale for any recalculations made.	matter/head/day, which is still the highest of all Parties (range: 0.01–0.03). The Party explained that country-specific VS values for poultry are calculated using MDMex as a parameter (NIR p.184). The Party clarified that the source of MDMex values used for poultry (NIR table A3.2.3.1) is the judgment of experts from the National Academy of Agrarian Sciences of Ukraine.
A.11	3.B Manure management – N_2O (A.23, 2017) Transparency	(a) 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; (b) Include in the NIR 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.	Addressing. Ukraine reported that an enterprise's capacity (animal population size) and specialization are inputs to the distribution of MMS (NIR, p.192). The rationale behind MMS estimates is limited to the judgment of experts from the National University of Life and Environmental Sciences of Ukraine. During the review, the Party indicated that further work is planned to solve that limitation.
A.12	3.B.1 Cattle 3.B.3 Swine – CH_4 (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. Ukraine reported that a study has been planned by MENR in relation to anaerobic lagoons used by large animal agrienterprises, as the present source of MMS data is limited to the judgment of experts from the National University of Life and Environmental Sciences of Ukraine (NIR, p.192). During the review, Ukraine clarified that it plans to include scientific research on the environmental impact of the distribution of cattle and swine manure and the MMS determination in the 2020 budget of MENR. While the deadline for this research has not been set, its main aims are (1) cattle and swine MMS determination in accordance with the 2006 IPCC Guidelines and (2) quantitative indicators of cattle and swine manure in agricultural enterprises and households and its distribution (percentage).
A.13	3.B.1 Cattle 3.B.3 Swine – CH_4 (A.10, 2017) (A.23, 2016) Accuracy	If the lagoons do not have a crusting layer, use the most appropriate MCF from table 10.17 of the 2006 IPCC Guidelines.	Addressing. CRF table 3.B(a)s2 indicates that no anaerobic lagoons are used for cattle but they are used for swine (in cool and warm climates). However, the Party indicated limitations in the expert judgments used and the need for further research for both cattle and swine (see ID# A.12 above).
A.14	3.B.1 Cattle – N_2O (A.24, 2017) Accuracy	Further justify and thoroughly document in the NIR the Nex values used for the calculations, or reconsider the Nex values used for the different cattle categories and make necessary corrections.	Resolved. The ERT noted that Ukraine, upon revising the methodology for estimating Nex, updated the Nex values (see ID# A.9 above). The Nex reported for mature dairy cattle for 2015 is now 59.95 kg N/head/year (CRF table 3.B(b)), compared with 133.65 kg N/head/year reported in the 2017 submission. For growing cattle, the Party reported a Nex of 23.03 kg/head/year for 2015 in the 2019 submission compared with 85.55 kg/head/year in the 2017 submission.
A.15	3.B.3 Swine – CH_4 (A.12, 2017) (A.25,	Investigate in detail the VS excretion rates for swine, revise them as needed and report their	Addressing. Ukraine reported the use of equation 5.1 from the 2006 IPCC Guidelines (vol. 4, chap. 5) for estimating VS excretion rates for swine

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	2016) Accuracy	values together with supporting information in the NIR.	(NIR, p.184). The Party recalculated the VS values and reported them in NIR table A3.2.3.3. During the review, the Party explained that the variability in VS values is influenced by changing dry matter values (MDMex), which are provided by the National Academy of Agrarian Sciences of Ukraine. The Party indicated that the MDMex for swine in households is 30 per cent greater than for swine in agricultural enterprises owing to the diets of swine at these enterprises being dominated by concentrated fodder (NIR, p.184). However, Ukraine did not provide calculations showing that the degree of variation in VS excretion rate is influenced by the peculiarities of feeding.
A.16	3.B.4 Other livestock 3.D.a.2.a Animal manure applied to soils 3.D.a.3 Urine and dung deposited by grazing animals 3.D.b Indirect N_2O emissions from managed soils – N_2O (A.25, 2017) Transparency	Update in the NIR the description of the methods used to estimate N_2O emissions from categories 3.B.4 (other livestock), 3.D.2.a (animal manure applied to soils), 3.D.3 (urine and dung deposited by grazing animals) and 3.D.b (indirect N_2O emissions from managed soils), and in particular, provide information on revised Nex values calculated using equation 10.30 of the 2006 IPCC Guidelines and appropriate typical animal mass values for the different livestock categories.	Resolved. Ukraine estimated Nex per head for other livestock in accordance with tables 10.19, 10A-6 and 10A-9 and equation 10.30 of the 2006 IPCC Guidelines (vol. 4), and used the revised values for GHG estimation. The recalculation is described in the NIR (p.185), the Nex values are reported in NIR table A3.2.3.4 and the updated description of the methods is provided.
A.17	3.D.a.2.c Other organic fertilizers applied to soils – N_2O (A.27, 2017) Convention reporting adherence	Revise the NIR to reflect the reporting of AD and emissions from other organic fertilizers in agreement with the CRF tables.	Resolved. Ukraine reported on organic fertilizers in the NIR, explaining that organic fertilizers used in the country comprise only an annual amount of manure (p.197). The ERT noted that equation 11.3 for estimating N from organic N additions applied to soils (tier 1 of the 2006 IPCC Guidelines) requires estimation to be based on the annual amount of animal manure N applied (known as F_{AM}), the annual amount of total sewage N (known as F_{SEW}), the annual amount of total compost N applied (known as F_{COMP}) and the annual amount of other organic amendments used as fertilizer (known as F_{OOA}). During the review, the Party clarified that, according to SSSU data, sewage and other organic amendments are not applied on managed soils in Ukraine.
			In the NIR (p.197), Ukraine reported that the annual amount of total compost N applied (known as F_{COMP}) accounts for direct N_2O emissions from managed soils, organic N fertilizers and other organic fertilizers applied to soils. The ERT noted that the Party accounted for the contribution of other organic fertilizers in the overall estimation of N from organic N additions applied to soils, and therefore considers that the issue has been resolved.

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
A.18	3.D.a.3 Urine and dung deposited by grazing animals – N_2O (A.28, 2017) Convention reporting adherence	Report N excretion in CRF table 3.B(b) for all MMS, including pasture, range and paddock.	Resolved. Ukraine reported AD or notation keys for all MMS, including pasture, range and paddock, in CRF table 3.B(b).
A.19	3.D.a.5 Mineralization/immobilization associated with loss/gain of SOM – N_2O (A.29, 2017) Transparency	Include in the NIR a description of the method used to estimate N_2O emissions for subcategory 3.D.a.5 (mineralization/immobilization associated with loss/gain of SOM).	Resolved. Ukraine used a country-specific C/N ratio and equation 11.8 from the 2006 IPCC Guidelines to estimate N_2O emissions for subcategory 3.D.a.5 (mineralization/ immobilization associated with loss/gain of SOM) (NIR, p.199). The Party provided detailed information about the estimation of the amount of N mineralized from loss of soil organic carbon in mineral soils through land-use change or management practices (known as F_{SOM}) in the NIR (section 6.3).
A.20	3.D.b.1 Atmospheric deposition – N_2O (A.14, 2017) (A.28, 2016) Transparency	Include in the NIR information on the consumed amounts of different fertilizers (synthetic fertilizers, organic fertilizers, urine, dung and crop residues) and their related ammonia EFs.	Resolved. Ukraine reported NH_3 EFs from synthetic fertilizers, organic fertilizers, urine, dung and crop residues in the NIR (table A3.2.8.7) as well the amounts of fertilizers used, including inorganic and organic fertilizers (animal manure applied to soil, other organic fertilizers applied to soil), urine and dung deposited by grazing animals and crop residues, in CRF table 3.D.
A.21	3.G Liming – CO_2 (A.31, 2017) Accuracy	(a) Conduct an assessment of the proportion of inert materials in ground lime and document the results in the NIR; (b) 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.	Not resolved. (a) Ukraine reported the annual amount of ground lime used (NIR, p.452, table A3.2.6.10), the share of active substances in ground lime (NIR, p.204) and the CO_2 EF (NIR, p.203) for estimating emissions in accordance with equation 11.12 of the 2006 IPCC Guidelines (tier 1 methodology). The Party reported that ground lime with different proportions of inert materials is used for the liming of soils but the national statistics do not include information on the quality of the ground lime applied (NIR, p.204). The Party also reported that industrial limestone fertilizers contain no less than 85 per cent of active substances (NIR, p.204); (b) Ukraine used an EF of 0.12 CO_2-C per unit in both the 2019 submission (NIR, p.204) and the 2017 submission, which was based on national circumstances. National statistics do not include information on the quality of the ground lime applied.

LULUCF

L.1	4. General (LULUCF) – CO_2 (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. Ukraine provided additional information on verification of the national methodology for estimating CSCs in mineral soils, which is based on a tier 1 approach, in the NIR (section 6.3.4). The Party compared estimates of N content; the comparison showed large differences between calculations in the tier 1 and the national methodologies (NIR table 6.14). The Party did not indicate any further steps

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			it would take to verify annual carbon balances. The ERT noted that no information was provided in the NIR demonstrating consistency between the N budget in the LULUCF and agriculture sectors, which a previous ERT mentioned as an option for verifying the model's outputs (see document FCCC/ARR/2016/UKR, ID# L.2).
			During the review, the Party explained that the differences between the tier 1 and the national methodologies, while large, are reasonable when the overall N content in crop residues left on fields is considered; for example, the values for national methodologies for above-ground and below-ground biomass residues are 20 and 41 per cent higher, respectively. The ERT noted that the differences in the totals are to a large extent determined by the two main crop types: grain crops and oil crops. The Party indicated that the differences in the totals are reasonable, considering the uncertainty in default EFs. The ERT noted that the uncertainties in default EFs for grains presented in table 11.2 of the 2006 IPCC Guidelines (vol. 4) (i.e. 2 per cent for slope, ±6 per cent for intercept to estimate above-ground residue and ±16 per cent for ratio of below-ground residues to above-ground biomass) are small compared with the 37 per cent and 48 per cent uncertainties for above- and below-ground biomass presented in NIR table 6.14, even when considering that the combination of uncertainties for slope and intercept result in a higher total uncertainty than the individual uncertainties. Because it is not clear which crops the Party includes under oil crops, the ERT cannot make a similar evaluation for those crops. Based on the evaluation for crops, the ERT notes that further verification is needed.
			During the review, the Party confirmed errors in the calculations of totals for groups of crops. Ukraine uses major crop types (e.g. winter wheat, spring wheat, rice, maize) according to national statistics, which are then aggregated into major crop groups (e.g. grains). Ukraine reported on these major groups in the NIR (section 6.3.4), but with errors. This supports the ERT assessment of further verification being needed.
L.2	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.30, 2017) Accuracy	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.	Addressing. In table A8.1 of the NIR, Ukraine reported that limited information is available on the status of lands previously drained, including peat extraction sites, and that work on collecting information on the status of these lands is ongoing.

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
L.3	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.30, 2017) Accuracy	Use methods and factors contained in the Wetlands Supplement for estimating CO_2 emissions and removals, as well as CH_4 and N_2O emissions, from organic soils (see ID# L.35 in document FCCC/ARR/2017/UKR).	Resolved. The Party applied the Wetlands Supplement for the estimations (NIR, section 6.5.2, p.242) (see ID# L.18 below).
L.4	4. General (LULUCF) (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. The ERT noted that Ukraine took steps to verify the model used for estimating the carbon balance in SOM for cropland and grassland, and presented this work in the NIR (section 6.3.4). However, the ERT also noted that the verification presented lacks important additional steps (e.g. demonstrating consistency between the N budgets in the LULUCF and agriculture sectors) and is lacking in transparency (see ID# L.1 above).
L.5	Land representation – CO_2, CH_4 and N_2O (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.	Addressing. Ukraine reported on its progress in improving AD, including for the representation of land and for land-use conversion, in the NIR (section 6.1.2). The ERT noted that the issue is being addressed according to the workplan agreed with the ERT of the review of the 2017 submission (see ID# G.2 above): Ukraine has involved three external organizations to improve the organization and structure of its national inventory (item (a) in the workplan). Ukraine has also started to expand the spectrum of sources of information (item (b) of the workplan), and the Party has examined the suitability of new methodologies (items (c) and (d)). The Party reported that the required methodology and data are still being developed (NIR, section 6.1.2). During the review, the Party explained that an evaluation of the collected data indicated them to be poor in quality and insufficient in number to be used in the national inventory (see also ID# L.26 in table 5).
L.6	Land representation – CO_2, CH_4 and N_2O (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 the years 1971–1989.	Addressing. The ERT noted that CRF table 4.1 presents annual land-conversion values. However, Ukraine has not calculated annual land use and land-use change matrices for the years 1971–1989 and, as a result, it has not been able to report cumulated 20-year conversion areas in CRF tables 4.A–4.F. The ERT acknowledges that the preparation of the land-use change matrices requires that the limitations of the land representation are resolved (see ID# L.5 above).
L.7	Land representation – CO_2, CH_4 and N_2O (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 to	Not resolved. The ERT noted that for individual years, areas do not always match. For example, the final area of forest land (managed) in 2016 was 10,662.53 kha, while the initial area in 2017 was 10,662.56 kha; and the final area of other land in 2016 was 1,011.82, while the initial area in 2017 was 1,011.79 kha. In the years after 1990, the differences between final area in year t and initial area in year t + 1 are even greater.

During the review, the Party explained that the differences result from the fact that work on land |

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		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 to AX = $\sum_{X-19}^{X}$ B to A).	representation is ongoing and land-use matrices for 1971–1989 have not yet been developed. The ERT understands that, owing to the ongoing nature of the work, areas reported in CRF table 4.1 can be inconsistent for 20 years from 1990 onward as areas of converted lands before 1990 are not available yet. The ERT noted that the inconsistencies in the final area in year t and initial area in year t + 1 in the land-use matrices are not considered to be one of the limitations of the land representation.
L.8	4.A Forest land – CO_2 and N_2O (L.8, 2017) (L.11, 2016) (L.24, 2015) Comparability	Report all areas included under forest land that are unstocked because of management activities (e.g. firebreaks, forest roads) under the category managed forest land, possibly under a subdivision such as "unstocked managed forest land", or alternatively, according to their dominant use (e.g. firebreaks as grassland and forest roads as settlements).	Resolved. Ukraine stratified managed forest land into stocked and unstocked areas, as recommended by the previous ERTs.
L.9	4.A Forest land – CO_2 (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 procedures to ensure the accuracy of the estimates reported across the time series.	Not resolved. The ERT acknowledges the ongoing efforts of Ukraine regarding stratification of land-use categories and identification of soil types on converted land. During the review, the Party explained that the definition of land-use categories using GIS is in progress, and that the correct assignment of soil types depends on the completion of this work.
L.10	4.A Forest land – CO_2 (L.32, 2017) Accuracy	(a) 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; (b) While new CSC factors are being calculated, and noting that Ukraine referenced the use of a Buksha et al. (2007) report in its 2017 annual submission, use data contained in table 3.9 of Buksha et al. (2007) 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 noted that EFs for gains in living biomass and for DOM were revised following the recommendation of the previous ERT (NIR, section 6.2.5 and annex 3.3.1). With regard to the recalculations of DOM, the ERT noted that Ukraine now uses a tier 1 approach consistently over the time series (NIR, sections 6.2.2 and 6.2.5) instead of a tier 2 approach, as was used in the 2017 submission. The ERT also noted that forest land remaining forest land is a key category by level and trend. While the UNFCCC Annex I inventory reporting guidelines allow the use of a tier 1 approach for key categories under certain circumstances, a Party should explain why category-specific guidance cannot be followed (2006 IPCC Guidelines, vol. 4, figure 4.1), and that is the reason the ERT considers that this issue has not yet been resolved. During the review, the Party explained that it recognizes the need for improving the methodology and EFs for forest land (see also NIR table A8.2, which has an anticipated completion date for this work in the 2019–2020 review cycle).
L.11	4.A.1 Forest land remaining forest land – CO_2	Revise the estimates of DOM and establish sector-specific QC procedures to check the time-series	Resolved. Ukraine recalculated estimates from DOM since the 2017 submission and applied a tier 1 approach for estimating litter and

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(L.10, 2017) (L.15, 2016) (L.8, 2015) (68, 2014) Consistency	consistency of the estimates and their coherence among carbon pools and categories.	deadwood, assuming no change to the entire time series (NIR, sections 6.2.2 and 6.2.5). Regarding the QC for this category, the ERT noted that the recommendation does not apply to the tier 1 approach Ukraine is currently using. During the review, the Party explained that it ensured consistency in lands converted to and from forest land. The ERT confirmed this was the case and has been documented by the Party in relevant sections on category-specific recalculations (NIR, sections 6.3.5, 6.4.5, 6.6.5 and 6.7.5). Further, Ukraine explained in the NIR (section 6.2.2) and confirmed during the review that it plans to implement a higher tier method for estimating litter and deadwood once country-specific EFs are available.
L.12	4.A.1 Forest land remaining forest land – CO_2, CH_4 and N_2O (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. Ukraine improved its definition and stratification of forest land remaining forest land in the NIR (section A3.3.1). The ERT noted, however, that in NIR table A3.3.1, the "Area covered by forest vegetation (managed)" does not correspond to the area of managed forest reported under forest land remaining forest land in CRF table 4.A, suggesting that the definition has not been correctly implemented. The ERT also noted, as explained by the Party in the NIR (section 6.2.1), the limitations of the land representation (see ID# L.5 above).
L.13	4.B Cropland – CO_2 and N_2O (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 ERT acknowledged the ongoing efforts of Ukraine to improve data on land representation, which are presented in the NIR (section 6.2.1). During the review, the Party explained that the identification of land with organic soils will be possible once the limitations of the land representation are resolved (see ID# L.5 above).
L.14	4.C.1 Grassland remaining grassland – CO_2 (L.34, 2017) Accuracy	Report under unmanaged grassland only those areas that have never been subject to human activities; document in the NIR why the reported unmanaged grassland areas are respectively considered unmanaged.	Resolved. Ukraine considered all grassland as managed and reported relevant AD and EFs consistently (NIR, section 6.4.1).
L.15	4.C.1 Grassland remaining grassland – CO_2 (L.34, 2017) Accuracy	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.	Not resolved. During the review, the Party explained that it will consider the definition of unmanaged grassland and the subdivision of managed grassland in the next submission.
L.16	4.D.1 Wetlands remaining wetlands – CO_2 and N_2O (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	Addressing. The ERT noted the ongoing efforts of Ukraine to improve AD, as described in the NIR (section 6.1.2) (see also ID# L.5 above), which are needed to resolve this issue. During the review, the Party explained that limited information is available on the status of lands previously drained, including peat extraction

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		abandoned, are still under drainage to ensure that no errors affect the GHG emission trend.	sites, and that work on collecting information on the status of these lands is ongoing.
L.17	4.D.2 Land converted to wetlands – CO_2, CH_4 and N_2O (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. Ukraine reported all areas of land converted to wetlands as occurring on mineral soils in CRF table 4.D. The ERT noted that the Party, in response to the recommendation, justified doing so in the NIR (L.35 in table A8.1), the justification being that the area of organic soils on forest land, cropland and grazing land is relatively constant and therefore the conversions occurred on mineral soils. The ERT also noted that it would be valuable for Ukraine to include this information in the explanatory information in the body of the NIR. During the review, the Party explained that this issue would be resolved once the work on land representation is completed (see ID# L.5 above).
L.18	4.D.2 Land converted to wetlands – CO_2, CH_4 and N_2O (L.35, 2017) Accuracy	Apply methods and factors contained in the Wetlands Supplement to estimate GHG emissions and removals from organic soils in land converted to wetlands.	Resolved. The Party applied the Wetlands Supplement for the estimations (NIR, section 6.5.2) (see ID# L.3 above).
L.19	4.F Other land – CO_2 (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.	Not resolved. The ERT noted that the resolution of this issue depends on completion of the work on improving the land representation (see ID# L.5 above). During the review, the Party agreed with the assessment of the ERT.
L.20	4.F Other land – CO_2 and N_2O (L.26, 2017) (L.23, 2016) (L.37, 2015) Convention reporting adherence	Strengthen the QC procedures for the LULUCF sector (correct the 1990 value for the SOM CSC factor for mineral soils) and report on the improvements implemented.	Resolved. The ERT noted that the original issue (FCCC/ARR/2015/UKR, ID# L.37) related to the 1990 value of the SOM CSC factor in mineral soils (–0.37 t C/ha in the 2015 submission) being the same for any forest land conversion to other land uses (cropland, grassland, settlements and other land). The ERT reviewing the 2015 submission considered that such an SOM CSC factor was not justifiable, because the land-use soil organic carbon at equilibrium differs according to the use of land. The current ERT noted that the Party reported different values for net CSC in mineral soils for 1990 in the CRF tables. The value for "total other land", –0.33 t C/ha, is different from the values for the conversions of forest land to cropland (–43 t C/ha), grassland (–0.24 t C/ha), wetlands ("NA") and settlements (–0.95 t C/ha). The changes suggest strengthened QC procedures.
L.21	4.F.2.1 Forest land converted to other land uses – CO_2 and N_2O (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	Addressing. The ERT noted that this issue can only be resolved once the work on land representation is completed (see ID# L.5 above). During the review, the Party confirmed this assessment of the ERT.

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		lands that did contain trees before deforestation.	
L.22	4(IV) Indirect N_2O emissions from managed soils – N_2O (L.36, 2017) Completeness	Report estimates of indirect N_2O emissions in CRF table 4(IV) to ensure consistency among GHG estimates reported under the Convention and the Kyoto Protocol.	Resolved. Ukraine reported indirect N_2O emissions for N leaching and run-off in CRF table 4(IV), while it continued to use the notation key "NO" for atmospheric deposition in the same table. During the review, the Party confirmed that indirect N_2O emissions from N leaching and run-off reported in CRF table 4(IV) comprise only indirect N_2O emissions from N mineralization of soils associated with the loss of carbon in the event of land-use changes, in accordance with the 2006 IPCC Guidelines (vol. 4, equation 11.10). Ukraine explained that indirect N_2O emissions from N mineralization of soils associated with the loss of carbon due to management changes on cropland remaining cropland are reported under the agriculture sector (CRF table 3.D). Regarding the use of the notation key "NO", the Party confirmed that indirect N_2O emissions due to atmospheric deposition do not occur on land other than cropland, for which the emissions are included in CRF table 3.D.

Waste

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
W.1	5. General (waste) – CO_2, CH_4 and N_2O (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. Ukraine included a limited description of solid waste management practices in the NIR (p.253). The ERT noted that clarity is lacking regarding practices occurring in the country; for example, the management of hazardous waste and wastewater sludge, and waste recycling are not described in section 7.2.1 of the NIR (p.253). During the review, the Party explained that it has taken this recommendation into account by referencing the schematic diagram shown in figure 7.3 of the NIR for waste management practices in 2017. However, the figure does not show all the management practices; for example, for open burning and for sludge from wastewater treatment. It also does not show the complete pathway for illegally dumped solid waste, whether this is illegally open-burned or aerobically degrades at the illegal dump site.
W.2	5. General (waste) – CO_2, CH_4 and N_2O (W.8, 2017) Transparency	Revise the schematic representation of waste treatment (figure 7.3 in the NIR) 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. Ukraine reported a revised schematic diagram on waste flows in its NIR (p.257). The ERT noted that all pathways were included except the flow pathways for sludge from wastewater treatment, hazardous waste and illegally dumped solid waste. During the review, the Party explained that it would try to include all the sources (wastewater sludge and hazardous waste) of solid waste in figure 7.3 of the NIR for the next submission.
W.3	5. General (waste) – CO_2, CH_4 and N_2O (W.9, 2017) Convention reporting adherence	Apply notation keys consistent with the definitions provided in decision 24/CP.19, annex I, paragraph 37, and ensure consistency between the NIR and CRF tables, in particular for	Resolved. Ukraine correctly reported AD, parameters and emissions as "NO" for subcategories 5.A.1.b (managed waste disposal sites – semi-aerobic) and 5.A.3 (uncategorized waste disposal sites) (these activities are not occurring), and as "NE" for subcategory 5.C.2

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		subcategories 5.A.1.b (managed waste disposal sites – semi-aerobic), 5.A.3 (uncategorized waste disposal sites) and 5.C.2 (open burning of waste), as well as in the additional information box of CRF table 5.D.	(open burning of waste) (except for specially designed equipment, this practice is outlawed). The Party provided the information that sporadic activities do occur but demonstrated that their likely level of emissions are below the threshold of significance (NIR, p.272). Ukraine also correctly reported numerical values for all parameters in the additional information box for CRF table 5.D, and those values are consistent with those reported in the NIR (p.286).
W.4	5.A Solid waste disposal on land – CH_4 (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. Ukraine reported that waste composition in 2014–2017 was based on the data for 2013 (NIR, p.259). Regarding degradable organic carbon, Ukraine reported that there was some research for food waste but the results were significantly lower than the default values from the 2006 IPCC Guidelines and, given the one-off and non-systematic nature of the research, Ukraine considered that additional activities are needed to develop country-specific values and therefore it used the default IPCC values in the submission (NIR section 7.2.2.3, p.259).

During the review, the Party explained that work on improving country-specific factors is listed as a priority in its list of areas for which work should start as soon as possible. |
W.5	5.A Solid waste disposal on land – CH_4 (W.3, 2017) (W.12, 2016) Convention reporting adherence	Strengthen QA/QC checks for the waste sector and ensure that the DOC_f value is corrected in the CRF tables and consistently reported between the NIR and the CRF tables.	Resolved. Ukraine reported a consistent default DOC_f value of 0.5 in the NIR (p.259) and CRF table 5.A, suggesting that the Party has strengthened its QA/QC procedures.
W.6	5.A.1 Managed waste disposal sites – CH_4 (W.10, 2017) Transparency	Enhance the transparency of reporting by providing in the NIR additional information on CH_4 recovery and flaring practices (e.g. documentation that outlines the procedures and certifications on the amount of CH_4 flared and the amount recovered for delivery to the end users), as well as relevant evidence on how and where recovered CH_4 is used in the energy sector.	Resolved. Ukraine reported that CH_4 recovered in the energy sector is used for electricity generation and is sold with a green tariff (NIR, p.261).
W.7	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.5, 2017) (W.11, 2016) Transparency	Include in the NIR information on the waste management practices in rural areas, together with the justification that emissions from open burning are insignificant, in accordance with decision 24/CP.19, annex I, paragraph 37(b).	Resolved. Ukraine reported CO_2, CH_4 and N_2O emissions from the open burning of waste as "NE" in CRF table 5.C and justified that the likely level of emissions from open burning (40.27 kt CO_2 eq) is below the significance threshold of 0.05 per cent of the total GHG emissions (NIR, p.272).
W.8	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.6., 2017) (W.13,	Further investigate the issue of inconsistency in the reporting of emissions from open burning of waste and quantify the CO_2, CH_4 and N_2O emissions from open	Resolved. See ID# W.7 above.

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	2016) Transparency	burning if considered to be significant.	
W.9	5.C.1 Waste incineration – CH_4 and N_2O (W.12, 2017) Transparency	Provide in the NIR and CRF table 9 information clarifying under which category it has included CH_4 and N_2O emissions, if these are reported as "IE" (e.g. emissions from incinerated non-biogenic waste).	Resolved. Ukraine reported CH_4 and N_2O emissions for category 5.C.1, subcategory non-biogenic, as "IE" in CRF table 5.C. CRF table 9 indicates that these emissions are reported under category 5.C.1, subcategory biogenic (i.e. together with the biogenic emissions). The Party also reported that incineration with and without energy recovery occurs in the country and that non-energy emissions are reported under the waste sector (NIR, pp.270–271).
W.10	5.D Wastewater treatment and discharge – CH_4 (W.13, 2017) Transparency	Enhance the transparency of the reporting in the NIR of CH_4 emissions from subcategories 5.D.1 (domestic wastewater) and 5.D.2 (industrial wastewater), by providing additional information, explanations and relevant descriptions to ensure a better understanding of the country-specific approach applied for estimating the emissions from wastewater treatment and discharge, including those from removed sludge processing depending on its final destination.	Resolved. Ukraine improved the reporting of the country-specific approach applied for estimating the emissions from wastewater treatment and discharge in section 7.5.4.2 of the NIR. The Party reported information on its selection of an MCF for category 5.D.1 (domestic wastewater) in the NIR (p.284). The ERT noted that information on wastewater sources and selection of biochemical oxygen demand values for the category is included in the NIR (pp.278 and 283). For remaining transparency issues in reporting subcategories 5.D.1 (domestic wastewater) and 5.D.2 (industrial wastewater), see ID#s W.16 and W.17, respectively, in table 5.
W.11	5.D Wastewater treatment and discharge – N_2O (W.14, 2017) Accuracy	Provide in the NIR all relevant information on the methodological approaches, EFs and AD used for reporting N_2O emissions from domestic and industrial wastewater (subcategories 5.D.1 and 5.D.2), including reflecting the $F_{NON-CON}$ value selected (1.1) and direct N_2O emissions from centralized wastewater treatment plants in the estimation of (indirect) N_2O emissions from domestic wastewater, as recommended in the 2006 IPCC Guidelines.	Resolved. Ukraine reported information on the methodological approaches, EFs and AD used for estimating N_2O emissions for categories 5.D.1 (domestic wastewater) and 5.D.2 (industrial wastewater) in the NIR (pp.285–286 and 291–292). The ERT noted that the Party used the $F_{NON-CON}$ value of 1.1 from the 2016 IPCC Guidelines (vol. 5, table 6.11), recommended in the previous review.
KP-LULUCF activities			
KL.1	General (KP-LULUCF activities) – CO_2 (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 Buksha et al. (2007) for biomass increments, as stratified by age class and main forest species, together with an age-class	Addressing. The ERT noted that EFs for gains in living biomass and for DOM were revised following the recommendation. The ERT also noted that the Party now uses a tier 1 approach to estimate DOM. The ERT further noted that the application of a tier 1 approach for DOM is considered temporary by the Party. During the review, Ukraine explained that a higher tier method would be implemented once country-specific EFs are available (see ID# L.10 above).

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		distribution for the time series 2013–2016 and revise the DOM CSC factors and method to ensure time-series consistency.	
KL.2	General (KP-LULUCF activities) – CO_2 and N_2O (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 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.	Not resolved. The ERT noted that, given the limitations in land representation (see ID# L.5 above), errors and inconsistencies still affect the KP-LULUCF activities AR, deforestation and FM (see ID# KL.11 in table 5). The Party has not elected further activities. During the review, the Party explained that the methodology and data required to resolve this issue are still being developed.
KL.3	General (KP-LULUCF activities) – CO_2, CH_4 and N_2O (KL.15, 2017) Accuracy	(a) 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; (b) 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 2019 annual submission.	Addressing. The ERT noted the efforts of Ukraine to improve the AD, as described in the NIR (section 6.1.2) (see ID# L.5 above). During the review, the Party explained its efforts to identify freely available data sets for spatial analysis in order to derive better spatial data for land representation. The Party confirmed the conclusion it presented in the NIR (section 6.1.2) that the examined data have low accuracy and there is a high probability that their use would result in misallocation or misinterpretation of land-use categories.
KL.4	Afforestation and reforestation – CO_2 and N_2O (KL.1, 2017) (KL.2, 2016) (90, 2014) Transparency	Report in the NIR additional information on the model applied to estimate the SOM CSCs in land converted to forest land, as well as a table for reporting the areas converted to forest land and the CSCs in each carbon pool, stratified by land-use conversion type, climatic zone and year of conversion.	Addressing. Ukraine reported more details on the model used in NIR table A8.1. During the review, the Party explained that the existing limitations of land representation affect this issue (see ID# L.5 above). The Party also explained that resolving the limitations of land representation will enable proper soil types to be assigned to land-use conversions, and thus the selection of proper reference soil organic carbon stocks (known as SOC_{REF}). The ERT concurs with the Party's preliminary analysis, which supports the current assumption that soil conversions occur on high-activity clay soils, for which calculations are performed.
KL.5	Deforestation – CO_2 and N_2O (KL.2, 2017) (KL.3, 2016) (94, 2014) Transparency	Report in the NIR additional information on how the CSC factors applied to estimate the CSCs in forest land converted to other land use are calculated, as well as a table for reporting the areas converted to forest land and	Resolved. Ukraine applied a tier 1 approach for estimating litter and deadwood, assuming no change to the entire time series (see ID# L.11 above).

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		the CSCs in each carbon pool, stratified by land-use conversion type, climatic zone and year of conversion.	
KL.6	FM – CO_2, CH_4 and N_2O (KL.3, 2017) (KL.4, 2016) Accuracy	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 ERT noted that the information on how unmanaged forest land is defined and identified, which was provided by the Party in the NIR (section 11.1.1), is not transparent and that NIR table A3.3.1 does not explain whether areas under the Convention and under the Kyoto Protocol are consistent; the inconsistencies identified by the previous ERT regarding the area of managed forest reported under the Convention (managed forest land remaining forest land and land converted to forest land) and under the Kyoto Protocol (forest land under FM and afforested land) remain. In particular, the "Area covered by forest vegetation (managed)" of 9,477.22 kha for 2017 reported in NIR table A3.3.1 does not correspond to the area of managed forest land of 10,424 kha for 2017 reported in CRF table 4.A. Further, in table A3.3.1, the "Area covered by forest vegetation (managed)" reported for 2017 (under the Convention) is less than the total area of FM land of 9,569.68 kha reported for 2017 (under the Kyoto Protocol). The opposite should be the case and supports the assessment (also made in the previous review) that some forest areas reported as unmanaged under the Convention are reported as managed under management activities under the Kyoto Protocol. Such inconsistency remains to be addressed. The Party could address it by showing the relationship between land-use reporting under the Convention and under the Kyoto Protocol.

The ERT noted that Ukraine did not demonstrate that emissions are not underestimated when areas considered as unmanaged are, in reality, subject to management activities (i.e. managed). The ERT also noted that the Party's efforts to revise areas of managed and unmanaged forests is ongoing, as explained in the NIR (section 6.2.1). The ERT further noted that inconsistencies occur owing to the limitations of land representation (see also ID#s L.5 and KL.2 above and KL.11 in table 5). During the review, the Party explained that forest land was stratified into managed and unmanaged land, and that CSCs for FM were estimated on the basis of the area of managed forest land only. |
| KL.7 | FM – CO_2, CH_4 and N_2O (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 | Addressing. Ukraine provided information on FMRL in the NIR (section 11.5.5). The ERT noted, however, that the information provided by the Party on its FMRL estimation in the NIR does not transparently identify how the technical correction of the FMRL was implemented as required by decision 2/CMP.7. Further, the NIR lacks the information recommended by the previous ERT, in particular on the methods for |

ID#	Issue and/or problem classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		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 Kyoto Protocol Supplement); and (4) that demonstrates consistency between the FMRLcorr value and the FM GHG estimates.	estimating the areas reported in NIR table 11.3, and on consistency between the FMRL and KP-LULUCF activities, including on areas of mineral and organic soils, stratification of the forest (managed, unmanaged, stocked, unstocked), estimation of carbon pools and consideration of disturbances. During the review, the Party explained that the information in the NIR (section 11.5.5) was revised. The ERT noted that further revision, adding more information, would enhance the transparency of reporting on FM.
KL.8	FM – CO_2 (KL.6, 2017) (KL.7, 2016) Accuracy	Either calculate the biomass carbon stock gains in forest land, applying the forest age-class structure and age-class dependent increment rates, or take this inconsistency into consideration when calculating the technical correction to the FMRL.	Resolved. Ukraine revised its methodology and based its estimation on forest age structure and age-class dependent increment rates, as documented in the NIR (sections 6.2.5, 11.3.1.1, 11.3.14, 11.5.5 and A3.3.1).
KL.9	FM – CO_2, CH_4 and N_2O (KL.7, 2017) (KL.8, 2016) Accuracy	Implement a technical correction to the FMRL in order to ensure consistency among areas of forest land included in the FMRL and areas reported under FM during the commitment period.	Resolved. The ERT noted that a technical correction to the FMRL was implemented (NIR, section 11.5.5) and reported in the CRF accounting table. The ERT also noted, however, that the historical forest area used in the FMRL calculations shown in NIR table 11.3 is not presented transparently (see ID#s KL.6 and KL.7 above).
KL.10	FM – CO_2 (KL.16, 2017) Accuracy	Remove HWP produced during the first commitment period from the calculation of the contribution of HWP.	Not resolved. The ERT noted that Ukraine did not change its approach and continues including the contribution of HWP produced during the first commitment period (and which had already been accounted for during the first commitment period as instantaneously oxidized) in the reported HWP estimates, the FMRL and in the GHG estimates. During the review, the Party explained that "the separation may be implemented just excluding all HWP produced in the first commitment period from the calculation of the HWP carbon stocks. However, this would cause an inconsistency in the time series of the HWP contribution. Considering that the inclusion of the HWP produced in the first commitment period in the calculation of the HWP contribution in the second commitment period has not any impact on the accounting. The inclusion in the FMRL and in the HWP contribution reported for the second commitment period of the emissions originated in the second commitment period from HWP produced in the first commitment period has no impact on the accounted quantities for FM". The ERT considers that it is important to include this information in the NIR. The ERT noted that the issue of the approach deviating from reporting requirements (decision 2/CMP.7, annex, para. 16) remains; that is,

ID#	*Issue and/or problem classification[a, b]*	*Recommendation made in previous review report*	*ERT assessment and rationale*
			emissions from HWP already accounted for during the first commitment period of the Kyoto Protocol on the basis of instantaneous oxidation shall be excluded.

[a] References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) in which the issue and/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 2018 annual submission of Ukraine was not available at the time of the 2019 review. Therefore, the previous recommendations reflected in table 3 are taken from the 2017 annual review report. For the same reason, 2018 is excluded from the list of review years in which the issue could have been identified.

IV. Issues identified in three 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 included in table 4 have been identified in three successive reviews, including the review of the 2019 annual submission of Ukraine, and have not been addressed by the Party.

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

ID#	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed[a]*
General	No issues identified	
Energy		
E.1	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	5 (2014–2019)
E.5	Strive to collect data for biodiesel consumption for the period 1990–2012 and report the outcome of those efforts in the NIR and, if impossible, change the notation key for the period 1990–2012 from "NO" to "NE"	4 (2015–2019)
IPPU		
I.3	Include information on aluminium production in the NIR	4 (2015–2019)
Agriculture		
A.12	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)	3 (2016–2019)
A.13	If the lagoons do not have a crusting layer, use the most appropriate MCF from table 10.17 of the 2006 IPCC Guidelines	3 (2016–2019)
A.15	Investigate in detail the VS excretion rates for swine, revise them as needed and report their values together with supporting information in the NIR	3 (2016–2019)

ID#	Previous recommendation for the issue identified	Number of successive reviews issue not addressed[a]
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	5 (2014–2019)
L.4	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	4 (2015–2019)
L.5	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	3 (2016–2019)
L.9	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	4 (2015–2019)
L.12	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	3 (2016–2019)
L.13	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	4 (2015–2019)
L.16	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	4 (2015–2019)
L.19	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	4 (2015–2019)
L.21	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	4 (2015–2019)
Waste		
W.4	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	3 (2016–2019)
KP-LULUCF activities		

ID#	Previous recommendation for the issue identified	Number of successive reviews issue not addressed[a]
KL.4	Report in the NIR additional information on the model applied to estimate the SOM CSCs in land converted to forest land, as well as a table for reporting the areas converted to forest land and the CSCs in each carbon pool, stratified by land-use conversion type, climatic zone and year of conversion	5 (2014–2019)
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	3 (2016–2019)
KL.7	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 Kyoto Protocol Supplement; and (4) that demonstrates consistency between the FMRLcorr value and the FM GHG estimates	3 (2016–2019)

[a] The report on the review of the 2018 annual submission of Ukraine has not yet been published. Therefore, 2018 was not included when counting the number of successive years in table 4.

V. Additional findings made during the individual review of the 2019 annual submission

10.   Table 5 contains findings made by the ERT during the individual review of the 2019 annual submission of Ukraine that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2019 annual submission of Ukraine

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
General			
G.4	CPR	The Party reported that its CPR is 2,565,006,563.36 t CO_2 eq (NIR, p.318). However, the ERT, noting that the CPR should not have decimals because it refers to an amount of Kyoto Protocol units, considers that the value should be 2,565,006,564 t CO_2 eq (i.e. rounding up the decimals).	Yes. KP reporting adherence
		The ERT recommends that Ukraine report in the NIR a value for the CPR without decimals, rounding it up to the nearest full unit.	
G.5	National registry	The Party reported that it makes information publicly accessible on the official website of the national registry (http://www.carbonunitsregistry.gov.ua/en/) (NIR, p.318). The website publishes reports on holdings and transactions in the registry. The website is hosted at the ".gov" domain. However, the website's software has not been updated for more than 10 years, and in September 2018 the website lost visibility owing to software incompatibility with the programming language of the new ".gov" domain. The ERT noted that this lack of public accessibility is not in accordance with the reporting requirements under Article 7, paragraph 1, of the Kyoto Protocol (decision 15/CMP.1, annex, para. 32(g–h)). During the review, Ukraine explained that the website was operational again in November 2019.	Not an issue/problem
G.6	National registry	The Party reported changes in its national registry compared with its previous annual submission (NIR, chap. 14). However, in the SIAR 2019, changes in the national registry not fully reported by Ukraine were identified (pp.8–9); specifically, changes relating to the conformance to technical standards of its national registry and to the results of its test procedures.	Yes. KP reporting adherence
		The ERT recommends, as was noted in the SIAR, that Ukraine 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.	
G.7	National system	The Party submitted its NIR and CRF tables on 16 May 2019, and submitted revised CRF tables on 10 June 2019. The ERT noted that these dates are not in accordance with decision 24/CP.19, paragraph 3, which requests Parties included in Annex I to the Convention to submit their inventories by 15 April each year. During the review, Ukraine explained that the delay in the 2019 submission was related to difficulties in data collection and processing due to the temporary occupation by the Russian Federation of the Autonomous Republic of Crimea, the city of Sevastopol, and certain districts of the Donetsk and Luhansk regions.	Yes. Convention reporting adherence
		The ERT recommends that Ukraine submit the annual GHG inventory by 15 April each year.	
Energy			
E.8	Fuel combustion – reference approach – solid fuels – CO_2	In CRF table 1.A(b), the Party reported all solid fuels (including other solid fuels) in the unit TJ. Based on the reported values, the ERT noted that the unit used should probably be kt. During the review, Ukraine explained that "TJ" was a misprint, and that the unit used for all solid fuels was in fact kt. The Party indicated that the error would be corrected in the next submission, and confirmed that the error does not impact the estimates reported.	Yes. Convention reporting adherence

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
		The ERT recommends that Ukraine correct the unit (i.e. from TJ to kt) used to report solid fuels in CRF table 1.A(b).	
E.9	Fuel combustion – reference approach – all fuels – CO_2	The ERT noted differences between IEA data and annual submission data (reference approach). Explanations for these differences were not documented in the NIR, and were not provided in sufficient detail during the review week. The differences are as follows:	Not an issue/problem

(a) The apparent consumption Ukraine reported to the UNFCCC is lower than that reported to IEA for all years up to 2014, with the largest differences occurring in 1993–2005 and in 2010, when the apparent consumption reported in the CRF tables is up to 13 per cent lower than that reported to IEA. For other years, the apparent consumption reported in the CRF tables is within 5 per cent of that in the data reported to IEA. During the review, the Party explained that IEA methodologies caused the differences but did not elaborate on why the methodology differences result in large anomalies in some years rather than consistent variations across the time series;

(b) The CRF values for apparent consumption in solid fuel combustion are 20 per cent lower than IEA data for 1990, with other years matching more closely. During the review, the Party explained the IEA data are consistent and based on statistical forms, but did not elaborate on why the comparison for 1990 was a significant outlier;

(c) Imports of crude oil are 17 per cent higher in the CRF tables than those reported to IEA. Furthermore, the apparent consumption of crude oil in the CRF tables is 20 per cent higher than that in the IEA data;

(d) The differences in apparent consumption between CRF table 1.A(b) and IEA data are not consistent throughout the time series, particularly in 1993–2005 and 2010, where CRF data are 13 per cent lower than IEA data. During the review, the Party explained that this difference in consumption arose owing to differences in AD between CRF and IEA calculations; however, it did not elaborate on what was different in the AD or why. Increases can also be observed in CRF data compared with IEA data; the Party explained that these resulted from geographical coverage differences, as outlined in annex A2.10 to the NIR;

(e) Imports of natural gas reported in the CRF tables are 11 per cent higher than those reported to IEA, while exports of natural gas (175,663 TJ) are reported in the CRF tables but not to IEA. In addition, the CRF tables show a larger stock build of natural gas than that reported to IEA (CRF, 297,635 TJ; IEA, 176,983 TJ). During the review, the Party explained that the differences were caused by methodological differences in data collection for the GHG inventory compared with data collection for IEA; however, this explanation does not clarify why the two data sets differ significantly and variably throughout the time series;

(f) Natural gas production is 4 to 18 per cent higher from 2007 onward in the CRF tables compared with IEA data, and systematically lower by about 5 per cent for 1995–2006. During the review, the Party explained that the observed differences were due to geographical coverage differences (outlined in annex A2.10 to the NIR) and the differences in standard temperature used (IEA data, 15 °C; CRF data, 20 °C);

(g) Consumption in international aviation differed in the CRF tables from that reported to IEA. For 1990–2006, CRF data are up to 77 per cent lower than those reported to IEA, while from 2007 onward CRF data are up to two times higher. During the review, the Party explained that the methodological differences between the IEA and CRF data are not known as there is not enough contact among IEA, SSSU and GHG inventory specialists;

| --- | --- | --- | --- |
		(h) For all years, data on coking coal production reported to IEA are included under other bituminous coal in the CRF tables. However, the total solid fuel production figures vary by 10 per cent or more for most years, with the CRF data consistently lower than data reported to IEA. The largest discrepancies occur for 2003 (CRF values 32 per cent lower than IEA) and 1999–2000 (CRF values 25 per cent lower than IEA). In the NIR 2017, the Party acknowledged the differences in its comments on the UNFCCC–IEA data comparison made by IEA, and attributed them to different calorific values. During the 2019 review, Ukraine explained that the differences were due to varying geographical coverage (as outlined in annex A2.10 to the NIR) and that different methods were used, including different net calorific values.	
		Although IEA data are not necessarily 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. Furthermore, 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 emission 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.	
		The ERT encourages Ukraine 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 overestimations or underestimations.	
		The ERT encourages Ukraine to connect inventory, SSSU and IEA specialists in order to gain a better understanding of methodological differences among them thereby enabling the Party to improve its QC procedures and transparency.	
E.10	1.A.1 Energy industries – all fuels – CO_2	The Party provided an explanation for a number of recalculations made under category 1.A.1 (energy industries) (NIR, section 3.2.7.5). The ERT noted that the CO_2 emission value provided in recalculation table 3.6 (NIR, pp.77–78) for 2016 differs from the value reported in CRF table 1s1 (101,585.08 kt in the NIR compared with 100,988.04 kt in CRF table 1s1). During the review, Ukraine explained that the CO_2 emission value in the NIR is incorrect and that the value in CRF table 1s1 is correct.	Yes. Convention reporting adherence
		The ERT recommends that Ukraine improve the QA/QC procedures for the energy sector in order enhance the accuracy and consistency of the information reported on recalculations in the NIR (table 3.6) and the CRF tables.	
E.11	1.A.3.b Road transportation – LPG – CO_2, CH_4 and N_2O	The ERT noted that CO_2, CH_4 and N_2O emissions increased significantly between 2015 and 2017 (from 2,500 to 4,853 kt, a 94.1 per cent increase over two years). However, this trend was not discussed in the NIR. During the review, Ukraine explained that it used IEA data to estimate these emissions for 2016 and 2017.	Yes. Consistency
		The ERT recommends that Ukraine demonstrate that the use of different data sources for 1990–2015 and 2016 onwards result in consistent CO_2, CH_4 and N_2O emission estimates across the time series.	
		The ERT encourages Ukraine to connect with IEA experts in order to gain a better understanding of the recalculations and trends in the IEA data.	
E.12	1.A.3.e Other transportation –	In response to a previous recommendation (see ID# E.5 in table 3), the Party changed the notation key for reporting emissions from biodiesel consumption for 1990–2012 from "NO" to "NO, NE" and reported emissions since 2013.	Yes. Completeness

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
	biomass – CO_2, CH_4 and N_2O	The ERT noted that the 2006 IPCC Guidelines do include a method to estimate emissions from biodiesel consumption (vol. 2, section 3.3). During the review, Ukraine explained that the quantity of biodiesel consumed was not reported by SSSU until 2013. It also explained that the emissions in 1990–2012 would be lower than in 2013 (0.5 kt CO_2 eq) because the fuel was not commonly used in Ukraine until 2013.	
		The ERT recommends that Ukraine estimate and report the entire time series for CO_2, CH_4 and N_2O emissions from biodiesel consumption (e.g. using one of the techniques included in the 2006 IPCC Guidelines, vol. 1, section 5.3.3).	
E.13	1.B.1.c Other (solid fuels) – CO_2 and CH_4	The ERT noted the inclusion of emissions for category 1.B.1.c (other (flaring) under fugitive emissions from solid fuels) since the 2018 submission. The recalculation is explained in the 2018 NIR (section 3.3.1.6, p.92). The ERT noted that the explanation for these recalculations was not specific, referring only to being carried out because of errors in the previous inventories regarding the calculation of coal bed CH_4. This source was previously reported as "NA" but it was noted in the 2016 review report (ID# E.32) (also mentioned in ID# E.14 of the 2017 review report) that flaring of coal bed CH_4 with no energy recovery was reported under category 1.A.1.c (manufacture of solid fuels and other energy industries). As there were no recalculations between the 2017 and 2018 submissions for category 1.A.1.c, the ERT noted that a small overestimation of emissions may result from double counting (if coal bed CH_4 flaring is reported under both categories 1.B.1.c and 1.A.1.c). During the review, Ukraine explained that (1) there was an error in calculating this source arising from an error in converting kg to t; (2) table 3.17 of the NIR had an error (the column labels for CH_4 and CO_2 needed to be swapped); and (3) emissions were reallocated from category 1.B.1.a to 1.B.1.c for the entire time series, following the example of the inventories of some other Parties.	Yes. Transparency
		The ERT recommends that Ukraine improve the information on allocation of CH_4 emissions from coal bed CH_4 flaring. The ERT also recommends that the Party 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 its findings.	
E.14	1.B.2.a Oil	The Party described the trends in oil transport in Ukraine in the NIR (section 3.3.2.1.1, p.96). As indicated in the 2006 IPCC Guidelines, oil transport can include emissions from a variety of sources, including pipelines, tankers, trucks and rail cars (vol. 2, table 4.2.2). The ERT noted that the description provided for oil transport did not specifically mention the sources of oil transport emissions. During the review, Ukraine explained that a large quantity of oil transits through the country (i.e. it is not sourced from Ukraine and not transformed or used in Ukraine). The Party clarified that oil is transported only by pipelines and not by any other sources mentioned in the 2006 IPCC Guidelines. The ERT considers that this information on the national circumstances of Ukraine is needed for assessing the completeness and accuracy of emissions estimated for this category (1.B.2.a (oil)).	Yes. Transparency
		The ERT recommends that Ukraine 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 used in Ukraine) and that oil is transported only by pipelines and not by any other sources mentioned in the 2006 IPCC Guidelines.	
E.15	1.B.2.a.5 Distribution of oil products – CH_4	The Party reported emissions for category 1.B.2.a.5 (distribution of oil products) as "NE" in CRF table 1.B.2, and explained in CRF table 9 that this source was reported as "NE" because estimates are negligible. During the review,	Yes. Transparency

		Ukraine explained that the 2006 IPCC Guidelines (vol. 2, table 4.2.5) do not provide a default EF (it is reported as "NA" in that IPCC table).	
		The ERT recommends that Ukraine 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.	
E.16	1.B.2.b Natural gas – CO_2 and CH_4	The Party reported data on the quantity of natural gas produced; as reported in CRF table 1.B.2, the quantity has increased 21.7 per cent since 2000 (from 17,884.00 m^3 in 2000 to 21,761.00 m^3 in 2017). However, the volume of gas transmitted, as reported in CRF table 1.B.2, has decreased by 33.3 per cent since 2000 (from 150.00 Mt in 2000 to 100.00 Mt in 2017). During the review, Ukraine explained that the quantity of natural gas transmitted includes production and imports (including European imports from the Russian Federation). The Party described the cause of the decrease as being the decreasing volumes of natural gas being transmitted.	Yes. Transparency
		The ERT recommends that Ukraine improve the transparency of its 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.	
E.17	1.B.2.b Natural gas – CO_2 and CH_4	The Party described in the NIR Ukraine's gas distribution network, the quantity of natural gas produced and recent data trends (section 3.3.2.2.1, p.99). The ERT noted that the Party did not provide any specific information on the national circumstances and the natural gas exploration, production and processing industries beyond the quantity produced in the two most recent years. Without transparent descriptions of the national circumstances, it was difficult for the ERT to assess the methodologies. 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 CH_4 and 99.74 per cent was conventional natural gas. The ERT considers that this information on the national circumstances of Ukraine is needed for assessing the completeness and accuracy of fugitive emissions estimated for this category (1.B.2.b (natural gas)).	Yes. Transparency
		The ERT recommends that Ukraine enhance the transparency of its reporting for this category by explaining in the NIR that the majority of natural gas produced in the country is from conventional onshore sources and reporting the shares of natural gas produced (1) onshore and offshore in the Black Sea and (2) from coal seam and from conventional natural gas.	
		The ERT encourages Ukraine to consider what other contextual information on Ukraine's natural gas exploration, production and processing industries should be included in the NIR.	
E.18	1.B.2.b Natural gas – CO_2 and CH_4	The Party reported that a tier 1 method and default EFs were used for estimating fugitive emissions from the exploration, production and processing of natural gas (NIR, section 3.3.2.2, pp.96–98). The ERT noted that CH_4 emissions from category 1.B.2.b (natural gas) were identified as key by the Party in its key category analysis (NIR, table A1.2). The ERT also noted that the 2006 IPCC Guidelines (vol. 2, figure 4.2.1) indicate that it is good practice to obtain country-specific data and use the tier 2 or 3 approach for key categories. The ERT further noted that the Party indicated no category-specific planned improvements in the NIR (section 3.3.2.7). During the review, Ukraine explained that it does not have any plans to refine the methods for estimating emissions from natural gas exploration, production and processing, but that it would consider investigating additional data.	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
		The ERT recommends that Ukraine revise its emission estimates from 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). The ERT also recommends that the Party develop a category-specific improvement plan for this issue, detailing the plan in the NIR.	
E.19	1.B.2.c Venting and flaring – all gases	The Party reported that there are no planned improvements for estimating fugitive emissions from category 1.B.2.c (venting and flaring) (NIR, section 3.3.2.7, p.101). During the review, Ukraine explained that it intends to develop a method for obtaining more accurate data on natural gas venting.	Yes. Transparency
		The ERT recommends that Ukraine enhance the transparency of its plans to improve the national inventory by including a detailed description of the planned improvement for estimating natural gas venting emissions.	
IPPU			
I.12	2.B.7 Soda ash production – CO_2	The Party reported that "since the data of fuel use (coke, anthracite, coal) are not available, the estimate of CO_2 emissions was calculated on the basis of data of soda ash use, not those on production, and it is accounted for in category 2.A.4.b – Other Uses of Soda Ash" (NIR, section 4.12.1, p.120). However, the Party reported AD and CO_2 emissions for category 2.B.7 (soda ash production) as "NA" and "NO", respectively, in CRF table 2(I).A-Hs1. The ERT noted that this reporting is not in accordance with the 2006 IPCC Guidelines (vol. 1, table 8.1); the Guidelines require that whenever emissions and/or removals for an activity or category are estimated and included in the inventory but not presented separately for that category, the notation key "IE" is to be used. Thus, the notation "IE" should be used by the Party for AD and CO_2 emissions from category 2.B.7 (soda ash production) given that, as reported in the NIR, they have been included and accounted for under category 2.A.4.b (other uses of soda ash). During the review, Ukraine explained that the CO_2 emissions from soda ash production have not been accounted for under category 2.A.4.b. A study assessing CO_2 emissions at the only soda ash plant in the country found that all the CO_2 released during side reactions in the Solvay process is captured and recycled in the plant (and in the process, because CO_2 is a feedstock for the Solvay process), hence there are no CO_2 emissions. The Party indicated that as a result of the findings of this study, the notation key "NO" would be used for AD and emissions in the next submission.	Yes. Comparability
		The ERT recommends that Ukraine 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).	
I.13	2.B.7 Soda ash production – CO_2	The Party reported that "in Ukraine, soda ash production takes place at one plant with Solvay process (the synthesis process) … since the data of fuel use (coke, anthracite, coal) are not available, the estimate of CO_2 emissions was calculated on the basis of data of soda ash use, not those on production, and it is accounted for in category 2.A.4.b – Other Uses of Soda Ash" (NIR, section 4.12.1, p.120). However, in section 4.5.2.2 of the NIR, where a methodological description of category 2.A.4.b (other uses of soda ash) is presented, the Party reported that a default CO_2 EF of 0.415 t CO_2/t soda ash use has been applied to kt soda ash use, which takes into account exports, imports and production of soda ash and excludes soda ash used for glass production. The ERT noted that this is not consistent with the statement that CO_2 emissions from soda ash production have been accounted for under category 2.A.4.b, because the default EF (0.415 t CO_2/t soda ash use) only accounts for emissions from calcination of soda	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
		ash and does not account for emissions during the production of soda ash in the Solvay process (2006 IPCC Guidelines, vol. 3, table 2.1). During the review, Ukraine explained that the CO_2 emissions from soda production have not been accounted for under category 2.A.4.b. A study assessing CO_2 emissions at the only soda ash plant in the country found that all the CO_2 released during side reactions in the Solvay process is captured and recycled in the plant, hence there are no CO_2 emissions.	
		The ERT recommends that Ukraine 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.	
I.14	2.B.8.b Ethylene – CO_2 and CH_4	The Party reported AD for the production of ethylene in 2017 and CO_2 and CH_4 EFs in 2017 as "NO" in CRF table 2(I).A-Hs1. However, in the same CRF table, CO_2 emissions and CH_4 emissions related to the production of ethylene in 2017 were reported as 185.06 and 0.29 kt, respectively. The ERT noted that GHG emission estimates for ethylene production were reported for 1990–2008, 2010–2012 and 2017, but no emission estimates were reported for 2009 and 2013–2016. In the NIR (p.120), the Party reported that, since 2013, ethylene has not been produced in Ukraine, which was confirmed with data provided by Cherkasky State Scientific Research Institute of Technical and Economic Information in the Chemical Industry, but there are no reasons reported for why ethylene production did not occur in 2009 and 2013–2016. The ERT also noted that this reporting is not in accordance with the 2006 IPCC Guidelines (vol. 1, table 8.1); the notation key "NO" cannot be used for AD and IEFs for a category or activity that is occurring and emitting GHGs. During the review, Ukraine explained that while there was no production of ethylene in the country between 2013 and 2016, production resumed in 2017; hence the "NO" notation key used in the CRF tables and the statement in the NIR were errors that the Party will correct in the next submission. The Party also explained that information related to the AD and EFs for the production of ethylene is confidential; hence the appropriate notation key will be used in the CRF tables in the next submission.	Yes. Comparability
		The ERT recommends that Ukraine correctly report in CRF table 2(I).A-Hs1 the appropriate notation key for confidential AD, the CO_2 IEF and the CH_4 EF for ethylene production, and explain in the NIR that there was no production of ethylene in 2009 and 2013–2016.	
Agriculture			
A.22	3.B Manure management – CH_4	The ERT noted ID# A.12 in table 3.	Not an issue/problem
		The ERT encourages the Party to report in its NIR on the outcomes of the study on distribution of cattle and swine manure and the MMS determination and the consequent improvements in transparency, and to include the study timeline in the NIR, in the section on category-specific planned improvements.	
LULUCF			
L.23	4. General (LULUCF) – CO_2, CH_4 and N_2O	The ERT noted that the area of organic soils reported in NIR table A3.2.5.4 and CRF table 3.D for 2017 (478,400.0 ha) does not match the value reported in CRF tables 4.B and 4.C (478,350.00 ha, which is the sum of 108,522.38 ha in cropland and 369,827.62 ha in grassland). The ERT also noted that the Party did not provide any further information regarding the finding of the previous ERT that the areas presented by the Party differ from those obtained from FAOSTAT (see http://www.fao.org/faostat/en/#home) (for 2017, 669 kha organic soils under cropland and 127 kha organic soils under managed grassland). During the review, Ukraine explained that an error in rounding had occurred in NIR table A3.2.5.4 and CRF table 3.D. Regarding the use of FAOSTAT data, the Party	Yes. Accuracy

ID#	Finding classification	Description of the finding with recommendation or encouragement	*Is finding an issue and/or a problem?*[a]
		explained that FAOSTAT uses its own methodology and assumptions to define areas of drained organic soils of cropland and grassland. For inventory purposes, official information was obtained from the State Agency of Water Resources of Ukraine on the status of the drainage of organic soils in agriculture. In this case, the national source is considered to be more reliable.	
		The ERT recommends that Ukraine 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. The ERT encourages the Party to explain the differences in the areas of organic soils in FAOSTAT data and the inventory (i.e. FAOSTAT for 2017 indicates 669 kha organic soils under cropland and 127 kha under managed grassland, while CRF tables 4.B and 4.C report 108,520 ha organic soils in cropland and 369,830 ha in grassland).	
L.24	4. General (LULUCF)	The ERT noted the Party's description of how it estimated uncertainty in the forest land category and the estimate of 15 per cent total uncertainty of emissions and removals for forest land (NIR, section 6.2.3). This value is lower than the value presented in the NIR 2018 (17 per cent). The uncertainty associated with biomass growth presented in table 6.10 of the NIR 2019 is 20 per cent, whereas it was 25 per cent in table 6.6 of the NIR 2018. The majority of uncertainty estimates presented in both of those tables are based on expert judgment, including the uncertainty for data on biomass growth. The ERT also noted that the expert judgments presented in NIR table 6.10 are not documented as required by good practice (2006 IPCC Guidelines, vol. 1, annex 2A.1). The value of 15 per cent total uncertainty for forest land in the NIR 2019 is low considering the contributing uncertainties presented in NIR table 6.10. Based on a simple error propagation corresponding to approach 1 of the 2006 IPCC Guidelines (vol. 1, section 3.2.3.1), the ERT obtained a value for total uncertainty of 125 per cent.	Yes. Convention reporting adherence
		During the review, Ukraine explained that it applied EFs for biomass growth based on age and species instead of EFs averaged for species as had been applied in earlier submissions to reduce uncertainty, and that some uncertainties were derived on the basis of statistical error calculations and some 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.	
		The ERT recommends that Ukraine (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). The ERT encourages the Party to discuss qualitatively in the NIR the uncertainties in a transparent manner, in accordance with paragraph 15 of the UNFCCC Annex I inventory reporting guidelines.	
L.25	4. General (LULUCF) – CO_2, CH_4 and N_2O	The ERT noted ID# L.2 in table 3.	Not an issue/problem
		The ERT encourages Ukraine to provide an update on the progress of collecting further information on the other land uses under which organic soils are reported and on their status, and present a justification for the reliability and accuracy of the national data.	
L.26	Land representation – CO_2, CH_4 and N_2O	The ERT noted the Party's report on progress of the work on developing a land representation system that ensures that land areas and conversions are identified accurately and consistently over time (NIR, section 6.1.2). Several of the problems identified in the review of the 2017 submission that remain unresolved or are being addressed (e.g. ID#s L.5, L.12, L.16, L.17, L.19, KL.2, KL.3, KL.4 and KL.6 in table 3), as well as new problems identified in the current review (see ID#s L.23 above and L.34 and KL.11 below), depend on the completion of the land	Not an issue/problem

representation work. The ERT also noted that land representation has implications for the accounting of KP-LULUCF activities and that, because of this, the Party has prioritized work on improving land representation to address the problems related to KP-LULUCF. Despite these efforts, KP-LULUCF activities are still affected by the limitations of the land representation (see ID# KL.11 below). This affects the need for data before 1990, regarding which the Party explained during the review that land-use matrices for 1971–1989 were not yet developed but would be delivered after work on land representation based on spatial analysis is finished. This limitation results in inaccurate allocations of land conversions in the LULUCF sector and for KP-LULUCF activities and consequently in inaccurate estimates of related emissions and removals. The ERT commends Ukraine for its efforts but notes that the workplan developed with the ERT of the 2017 review includes neither dates on which the Party expects the work regarding land representation to be completed nor specific development steps.

During the review, the ERT asked Ukraine whether it could indicate an expected date of completion. The Party replied that it is currently impossible to give a specific date of completion of this work, mainly because of the lack of funding for scientific research in the GHG inventory field, and that unfortunately no central budget funds or technical assistance have been assigned for this work yet. The ERT noted that the Party may wish to reconsider its approach for identifying and evaluating alternative data sources for developing a land representation system. The evaluation presented in the NIR (section 6.1.2) is based on a comparison with the currently used data. This is appropriate in general; however, the ERT considers that if it is known that the currently used data are not correct (e.g. biased owing to the fact that land uses are identified on the basis of the legal status of the land rather than on actual use, as identified by the ERT in 2017 (see ID# L.5 in table 3)), then the application of current data in the evaluation of alternative data sources is of limited use.

The ERT encourages Ukraine to complete this work well in advance of the end of the second commitment period of the Kyoto Protocol.

| L.27 | Land representation – CO_2, CH_4 and N_2O | The ERT noted that the land-use matrices reported by the Party in NIR table 6.4 and CRF table 4.1 are not consistent as areas for individual categories do not match between the two tables. For example, NIR table 6.4 reports a total area of cropland prior to conversion in 2017 of 35,292.21 kha but CRF table 4.1 reports that area as 34,875.27 kha. The ERT also noted the Party's response to the recommendation of the previous ERT regarding improvements to its land representation (see ID# L.5 in table 3). The ERT further noted that the Party did not include in the NIR information on the revision applied to the areas of different categories and their annual changes. | Yes. Transparency |

During the review, Ukraine explained that NIR table 6.4 reflects areas of conversions on a cumulative basis, taking into account a 20-year transition period, and that CRF table 4.1 was revised in accordance with the recommendation of the previous ERT (ID# L.31 in the 2017 annual review report). The current ERT considers this explanation acceptable as the data in CRF table 4.1 were indeed revised to annual values (see ID# L.5 in table 3).

The ERT recommends that Ukraine 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. The ERT encourages the Party to use the same format for the land-use change matrices presented in the NIR as in CRF table 4.1 and CRF table NIR-2, in order to enhance transparency.

ID#	Finding classification	Description of the finding with recommendation or encouragement	*Is finding an issue and/or a problem?[a]*
L.28	Land representation – CO_2, CH_4 and N_2O	The ERT noted the information regarding the methodology for deriving AD to determine land-use changes, particularly land converted to forest land (NIR, section A3.3.1). Regarding the limitations on data for land representation (see ID#s L.5 and KL.3 in table 3), the Party states that "information about the area of land converted to forest land from the land-use change matrix was used to determine proportional ratios among donor categories for the land-use category Forest Land" (NIR, p.465). However, no additional information was reported by the Party. During the review, Ukraine explained that, currently, the land-use categories that are recognized to be a donor category (i.e. a category from which land-use conversion occurs in a particular year) are defined on the basis of the country-specific definition. For example, if in any particular year the total area of cropland decreases, it is seen as a donor category for conversions to forest land.	Yes. Transparency
		The ERT recommends that Ukraine 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.	
L.29	4.A Forest land – CO_2, CH_4 and N_2O	The ERT noted that Ukrainian forest inventories are used by the Party as a source for estimating emissions and removals on forest land (NIR, section 11.3.1.1). The ERT also noted that very little information on the data that are collected in the inventories is presented in the NIR, such as type of sampling (e.g. permanent or temporary plots), sampling design (e.g. number and density of plots, size of plots) or specific data collected (e.g. diameter at breast height threshold). The ERT further noted that the Party reported on the progress of the implementation of a national forest inventory system in its NIR 2018 (section 11.3.1.1). There, the Party explained that consistent data for the entire time series was expected to be included in its 2019 submission. The Party did not report on the further development of a consistent time series in its NIR 2019, or provide information on individual inventories that would allow the ERT to evaluate the consistency of individual inventories.	Yes. Transparency
		During the review, Ukraine provided to the ERT additional information that was important for understanding its national circumstances.	
		The ERT recommends that Ukraine include in the NIR or in a technical annex the information on national forest inventories that was provided to the ERT during the review, namely:	
		(a) Previously, the forest inventory was compiled for the entire area of managed forest when the owner (State or private) requested a forest inventory to be performed. Currently, inventories are made for all the forests managed by the State Forest Resources Agency of Ukraine and for forests managed by some private enterprises (in total around 75 per cent of the forest area in the country). Other forest enterprises are not obliged to perform a forest inventory, but are encouraged to;	
		(b) Ukrainian State Forest Design is responsible for performing forest inventories and regulates all the technical aspects through "instructions" that it develops, which are adopted by the State Forest Resources Agency;	
		(c) Temporary sampling plots are usually used to collect data for forest managers (including species, diameter at breast height, height of stands, volume and merchantable wood). These data are used by the forest agencies to provide enterprises with a management plan. Ukrainian State Forest Design contributes to data processing and storage by maintaining databases with information on every area of every enterprise that has undergone a forest	

		inventory (e.g. every plot on a map is measured and the information is stored in the databases). Usually, every region has a forest inventory every 10 years;	
		(d) Ukrainian State Forest Design stores the databases as well as paper copies of previous forest inventories (i.e. for 1988, 1996 and 2002). For the purpose of the GHG inventory, data on areas of every species in every region were exported from the databases to be used together with the EFs in NIR table A3.3.4.	
L.30	4.A Forest land – CO_2	The ERT noted that the Party used the 2006 IPCC Guidelines (vol. 4, equation 2.12) to estimate the annual carbon loss in biomass of wood removals (NIR, annex 3.3.1). The Party explained that in the absence of default $BCEF_R$ values for some species, it estimated them on the basis of BEF and wood density. In NIR table A3.3.6, the Party presented the estimated $BCEF_R$ values and the wood densities, but not the BEFs. During the review, Ukraine explained that because the 2006 IPCC Guidelines (vol. 4, table 4.5) does not contain information for softwood species in temperate zones, it 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. 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. The ERT considers this explanation sufficient.	Yes. Transparency
		The ERT recommends that Ukraine 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, it 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; 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.31	4.A Forest land – CO_2	The ERT noted that the Party used the 2006 IPCC Guidelines (vol. 4, equation 2.14) to estimate carbon loss from disturbances, and that it modified that equation to account for national circumstances. In particular, the Party estimated a correction factor (NIR table A3.3.7) that corresponds to the fraction of biomass lost in disturbances. The values of the correction factor for conifers correspond to the values obtained by dividing the values in the column "Actual losses of wood according to statistical reporting 3-LG" of NIR table A3.3.7 with the values in the column "Estimated loss of wood with average values of growing stock", whereas the values of the correction factor for broadleaf species do not agree with the values obtained by division of the values in the two columns. The ERT also noted that, in a few cases, the value of the correction factor was more than 1, which would result in a biomass loss after disturbance that is greater than the biomass before the disturbance and therefore may indicate that the losses are overestimated.	Yes. Accuracy
		During the review, Ukraine explained that NIR table A3.3.7 contains an error in the values of the correction factor for broadleaf species. The Party also explained that correction factors of more than 1 occur when the actual loss of wood is higher than the average wood volume by area, and that factors applied for the time series 1990–2013 were based on data for 2014 because, since 2014, SSSU has been collecting data on actual wood loss volumes during disturbance events. The ERT raised further questions regarding (1) the accuracy of a correction factor that can take on values of more than 1 although a value of 1 indicates total biomass loss (see also the note to equation 2.14 in the 2006 IPCC Guidelines, vol. 4) and (2) the suitability of applying a constant correction factor to the years 1990–2013 despite annual variability of disturbance events. In response to the further questions raised, the Party	

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
		explained that it would consider the cases of correction factor values of more than 1 and provide more information in the next submission. Currently, disturbances consist of all damage due to extreme weather events, pests, diseases and other causes, except fires. Fires are estimated separately (NIR, annex 3.3.1, pp.476–477). Regarding (2), the Party explained that it is still investigating how the correction factor might be estimated for 1990–2013 on the basis of only areas of disturbances available, taking into account that severity of wood damage might change from year to year.	
		The ERT recommends that from the data after 2014 the Party 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). The ERT also recommends that Ukraine improve its 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.	
L.32	4.A Forest land – CO_2, CH_4 and N_2O	The ERT noted ID# L.8 in table 3. The ERT also noted that the explanation of the stratification in the NIR along with NIR table A3.3.1 is not transparent because it is not clear that the column "Area of Forest land remaining Forest land" refers to managed forest land only, as explained by the Party during the review. The ERT also noted that the area reported as "Area covered by forest vegetation (managed)" does not correspond to the area of managed forest reported under forest land remaining forest land in CRF table 4.A.	Yes. Transparency
		The ERT recommends that the Party 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.	
L.33	4.A Forest land – CO_2, CH_4 and N_2O	The ERT noted ID# L.9 in table 3.	Not an issue/problem
		The ERT encourages the Party to make more visible, in the NIR (e.g. under planned improvements), the additional information on the work to define land-use categories and on the analysis of World Reference Base soil types that was provided during the 2017 review (and which is currently included in the NIR in table A8.1).	
L.34	4.A.1 Forest land remaining forest land – CO_2	The ERT noted that the total area of forest land remaining forest land in 2015 reported in CRF table 4.A in the 2019 submission is 10,370.69 kha whereas the corresponding areas in 2015 reported in CRF table 4.A in the 2017 and 2018 submissions were 10,373.36 kha. The Party explained in its 2018 and 2019 NIRs that the "current NIR was prepared using approach and data sources as in 2017 submission" (section 6.1.1). The ERT also noted the revisions regarding the stratification of forest land into managed and unmanaged land (NIR, section 6.2.1) and that there is no indication whether this revision affected the total area of forest land remaining forest land, and if so, how. During the review, Ukraine explained that an error in data entry had occurred because, in the calculation files for the 2019 submission, the area of 10,373.36 kha should have been used. The Party confirmed that the revision of the definition of unmanaged and managed forests did not affect the total area of the forest land category.	Yes. Accuracy
		The ERT recommends that Ukraine 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.	

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
L.35	4.A.1 Forest land remaining forest land – CO_2	The ERT noted that the trend of gains in living biomass on forest land remaining forest land since 1990 changed significantly in the 2019 submission compared with the 2017 and 2018 submissions. Particularly notable is the sharp decrease in gains between 2002 and 2005: CRF table 4.A of the 2019 submission shows gains decreased from 19,066.86 kt C (2002) to 18,522.38 kt C (2003), 17,977.89 kt C (2004) and 17,433.41 kt C (2005) before levelling off again, whereas CRF table 4.A in the 2017 and 2018 submissions shows gains remained relative stable between 2002 and 2005 (17,431.98 kt C (2002), 17,461.69 kt C (2003), 17,476.55 kt C (2004) and 17,505.72 kt C (2005). The ERT also noted that the Party had performed recalculations for biomass increment on forest land remaining forest land between the 2018 and 2019 submissions (NIR 2019, section 6.2.5), but that the NIR 2019 does not explain the decrease in gains between 2002 and 2005.

During the review, Ukraine explained that the sharp decrease in gains between 2002 and 2005 is due to the data on forest age classes that were obtained from Ukrainian State Forest Design (the compiled results of forest inventories in 1988, 1996 and 2002; see G.8 in NIR 2019 table A.8.1). The age-class data before 2005 were summarized in 20-year periods (for most species) or 10-year periods (for softwood and some other species), while in the data after 2005, forests were stratified by 10-year age classes. Furthermore, assumptions on stand age needed to be applied to the data before 2005 as the actual age was not known; it was approximated on the basis of the stage of maturity of the stand (young, middle-aged, pre-mature, mature and over-mature stands) (NIR 2019, section 11.3.1.1). The ERT considers this a potential time-series inconsistency.

The ERT recommends that Ukraine ensure the time-series consistency of the estimates of gains in living biomass on forest land remaining forest land, including in relation to data on forest age classes and the assumptions for stand age. | Yes. Consistency |
| L.36 | 4.A.2 Land converted to forest land – CO_2, CH_4 and N_2O | The ERT noted that the area of managed grassland that was converted to forest land in 2015 differs in CRF table 4.1 of the 2017, 2018 and 2019 submissions. The 2017 table reports an area of 14.08 kha, the 2018 table reports the conversion as "NO" and the 2019 table reports an area of 2.70 kha. During the review, Ukraine explained that the areas in CRF table 4.1 of the 2017 submission were incorrectly reported using a cumulative approach. Based on a recommendation from the 2017 review, in the 2018 submission, the Party used an annual conversion reporting approach. Owing to the definition of unmanaged lands applied in the 2018 submission, an area of 2.70 kha was reported for grassland converted to forest land (unmanaged). In the 2019 submission, Ukraine revised the definition of unmanaged forests on the basis of a recommendation from the 2017 review (see ID# L.12 in table 3); the area of 2.70 kha was thus reported to be grassland converted to forest land (managed). The ERT notes that the justification is sound because the revisions mentioned were indeed made. | Not an issue/problem |
| L.37 | 4.B Cropland – CO_2 | The ERT noted that the Party (1) reported in NIR table 6.1 three land-use categories under the cropland category: arable land, fallow land and gardens; (2) provided information only on areas with perennial woody vegetation in the NIR (section 6.3 and annex 3.3.2); (3) did not stratify the data in CRF table 4.B by the three cropland land-use categories; and (4) reported in NIR table A3.3.11 a total area of orchards in 1990 that amounts to only 863.1 kha (i.e. 30 times 38.37 kha) of a total of 35,847.26 kha for cropland remaining cropland reported in CRF table 4.B for 1990.

During the review, Ukraine explained that it does not have information on the spatial distribution of lands; this information depends on the completion of the work on land representation (see ID# L.5 in table 3). With regard to | Yes. Transparency |

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
		the methodology for estimating CSCs, the methodology for arable land is described in the NIR (annex A3.3.2), but for fallow land, the Party 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, the Party considers that the assumption does not overestimate carbon removals.	
		The ERT recommends that Ukraine 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) it 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. The ERT also recommends that Ukraine describe in NIR section 6.3 the methodology for estimating CSCs for arable land or indicate there that the methodology is described in an annex to the NIR.	
L.38	4.C.2.1 Forest land converted to grassland – CO_2, CH_4 and N_2O	The ERT noted that the information on conversion to and from forest land presented in NIR table A3.3.2 is in several instances not consistent with the corresponding information presented in the annual land transition matrices in CRF table 4.1. For example, according to NIR table A3.3.2, there are annual conversions of forest land to grassland from 1990 to 1993. However, in CRF table 4.1, for 1990–1993, the conversion from forest land to grassland is reported as "NO". The ERT also noted that the total cumulative area of land conversions from forest land to other land categories decreases after 2010. Based on the information on the data presented in the table, the data are based on the database of AR and deforestation; the ERT notes that land cannot shift from deforestation (decisions 15/CMP.1, annex, para. 6, and 16/CMP.1, annex, para. 19) and, as a result, the areas for AR and deforestation cannot decrease over time. During the review, Ukraine explained that (1) CRF table 4.1 contains errors in the reporting of conversions of forest land to grassland. CRF table 4.C and NIR table A3.3.2 are consistent with each other. CRF table 4.1 will be revised in the next submission; (2) NIR table A3.3.2 presents data relevant to the Convention rather than to KP-LULUCF activities, therefore areas revert to the category land remaining land after the transition period; and (3) the same areas of deforestation are used for the Convention and the Kyoto Protocol, however, for the Convention, reporting a cumulative approach includes the 20-year transition rule. The ERT agrees with the Party's explanations.	Yes. Completeness
		The ERT recommends that Ukraine 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. The ERT also recommends that the Party 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 by Ukraine.	
L.39	4.C Grassland – CO_2, CH_4 and N_2O	The impacts of the recalculations shown in the NIR 2018 were generally very large (NIR 2018, table 6.11). For example, for 2015, Ukraine reported net CO_2 emissions of 2,036.15 kt in the 2017 but net CO_2 removals of 939.13 kt in the 2018 submission. The ERT also noted that the Party did not transparently explain the individual effects on the estimates of the three processes that triggered the recalculations, namely estimation of CSC in settlements converted to grassland, revision of N inputs from organic fertilizers, and recalculations in cropland. During the review, Ukraine explained that during the in-country review in 2017, an error in the calculation spreadsheets was	Not an issue/problem

ID#	Finding classification	Description of the finding with recommendation or encouragement	*Is finding an issue and/or a problem?[a]*
		identified by the ERT, which led to significant erroneous values of SOM in settlements. In the 2018 submission, that error was eliminated, which led to a revision of all the conversions from and to settlements.	
		The ERT encourages Ukraine to describe more transparently in the NIR the individual drivers triggering a recalculation that affects estimates.	
L.40	4.D Wetlands – CO_2, CH_4 and N_2O	Ukraine presented recalculations in the wetlands category in NIR table 6.21. The ERT noted that the table presents the results of the recalculation between the 2017 and 2018 submissions rather than between the 2018 and 2019 submissions, as would be expected in the NIR 2019.	Yes. Transparency
		The ERT recommends that Ukraine revise NIR table 6.21 to reflect the recalculations between the previous and the current submission (i.e. in the NIR 2020, the table should compare emissions between the 2019 and 2020 submissions).	
L.41	4.G HWP – CO_2	The ERT noted that the Party performed recalculations for the HWP category between the 2018 and 2019 submissions, justifying them because of "a number of changes in activity data" (NIR, section 6.8.5). The ERT also noted that the Party refers to this justification when it justifies the recalculations for HWP under the Kyoto Protocol in the NIR (section 11.3.1.4). The ERT further noted that the recalculations resulted in differences of up to 90 per cent from the values in the 2018 submission, as shown in NIR 2019 table 6.28. During the review, Ukraine explained that for the calculation of HWP, a splicing technique based on GDP was used to calculate the missing information, and that for the 2019 submission, the GDP was obtained from World Bank data (in 2010 prices). The Party also explained that, as a result, values of the production of wood-based panels and paper and paperboard for 1990–1991 changed (see tables A3.3.27 in NIR 2018 and A3.3.26 in NIR 2019).	Yes. Accuracy
		The ERT recommends that Ukraine explain in the NIR the methodology it 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. The ERT also recommends that the Party 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, that the Party explain any recalculations, including their impact.	
L.42	4(IV).2 N leaching and run-off – CO_2, CH_4 and N_2O	The ERT noted that the Party applies the tier 1 approach, using default EFs, to estimate indirect N_2O emissions from managed soils (NIR table 6.12). The ERT also noted that in CRF table 4(IV), an IEF of 7,500.00 kg N_2O-N/kg N is reported. However, the default factor from the 2006 IPCC Guidelines (vol. 4, table 11.3) is 0.0075 kg N_2O-N/kg N, which Ukraine used in CRF table 3.D for reporting N leaching and run-off in the agriculture sector. During the review, Ukraine explained that it uses a default EF from the 2006 IPCC Guidelines: 0.0075 kg N_2O-N/kg N. The error is in the AD, which are provided in kt rather than kg. The ERT noted that this error affects all years since 1990. However, the ERT noted that the error has no impact on the emission estimates.	Yes. Convention reporting adherence
		The ERT recommends that Ukraine use correct values and units for AD reported for emission estimates for N leaching and run-off in CRF table 4(IV).	

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
Waste			
W.12	5.A.1 Managed waste disposal sites – CH$_4$	The Party reported that CH$_4$ utilization in MSW is quantified by MSW landfill operators on a monthly basis according to equation 7.5 in its NIR (p.261). The ERT noted that no numerical values for the parameters used in NIR equation 7.5 (namely, volume of landfill gas flared, landfill gas density and CH$_4$ content in landfill gas) are reported in the NIR to help the ERT better understand how CH$_4$ utilization at MSW dumps is estimated (NIR section 7.2.2.4). During the review, Ukraine provided additional information on parameters such as the amount of collected biogas, landfill gas density, CH$_4$ content in landfill gas, and the amount of biogas used to produce heat and electricity and the amount of energy thus produced (as provided by one of the operators). The Party clarified that the chemical composition of biogas was obtained from direct measurements, and provided models of measuring equipment and the international standards to which they are certified.	Yes. Transparency
		The ERT recommends that Ukraine 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.	
W.13	5.C.1 Waste incineration – CH$_4$ and N$_2$O	The Party described the emissions, methodological approach, AD and EFs for incinerated waste in the NIR (section 7.4, pp.270–279). The EFs reported are 118.5 g/kt waste for CH$_4$ (all waste types), 100 g/kt industrial waste for N$_2$O and 55,100 g/kt MSW for N$_2$O (NIR, section 7.4.2.3); however, clarity on whether these EFs are based on wet or dry weight and how they are derived is lacking. The Party reported that limited information is available on the technologies used in Ukraine for waste incineration, therefore, the specific technology or management practice used in the incineration of waste is not given in the NIR. The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 5, tables 5.3–5.5).	Yes. Transparency
		During the review, Ukraine provided more information on how the EFs were derived and explained that they were based on wet weight. The Party stated that owing to limited information on waste incineration technologies and management practices, average EFs were taken from tables 5.3 and 5.6 (which is based on tables 5.4 and 5.5) of the 2006 IPCC Guidelines (vol. 5) as follows: (1) CH$_4$ EF for all types of waste: 118.5 g/kt waste (average range, assuming that 0 is the minimum value for EFs and 237 is the maximum ((0 + 237)/2 = 118.5)) (wet weight); (2) N$_2$O EF for industrial and medical waste: 100 g/kt waste (table 5.6) (all types of incineration) (wet weight); and (3) N$_2$O EF for MSW: 55 g/kt MSW (as the average value between continuous and semi-continuous incinerators (50 g/kt waste) and batch-type incinerators (60 g/kt waste) ((50 + 60)/2 = 55)) (wet weight). The ERT noted that the units for these EFs are different (1,000 times lower) from the default EFs provided in the 2006 IPCC Guidelines (kg/Gg waste (wet) for CH$_4$ (table 5.3), g/t MSW (wet) for N$_2$O (table 5.4) and g/t industrial waste (wet) for N$_2$O (table 5.5)) and that the use of these low EFs could lead to an underestimation of emissions for this category. In response, Ukraine stated that the units reported in the NIR (section 7.4.2.3) are wrong but noted that this did not affect the results of the emission estimates.	
		The ERT recommends that Ukraine 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.	

ID#	Finding classification	Description of the finding with recommendation or encouragement	*Is finding an issue and/or a problem?[a]*
W.14	5.C.1 Waste incineration – CO_2, CH_4 and N_2O	The Party reported that in estimating the 1990–2009 time-series data for waste incineration without energy recovery, it used the indicators for 2010 (NIR, p.276). The ERT considers that the indicators used for estimating the emissions for the period 1990–2009 are not transparently reported. During the review, Ukraine explained that the average industrial waste incinerated per capita for 2009–2010 and the Index of Industrial Production of Ukraine were used for estimating the 1990–2009 time series data for industrial waste incineration without energy recovery. For medical waste incineration without energy recovery, the Party explained that the average value of medical waste incinerated (without energy recovery) per capita for 2010–2013 was calculated and then this value was multiplied by the value of the population in each year for 1990–2009. The ERT noted that average values for 2010–2013 were used and not 2010 parameters, as reported in the NIR (p.276).

The ERT recommends that Ukraine 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 its NIR. | Yes. Transparency |
| W.15 | 5.C.1 Waste incineration – CH_4 and N_2O | The Party reported that limited information is available on waste incineration parameters (NIR, p.278) and that average default values were taken from the 2006 IPCC Guidelines (vol. 5, tables 5.3, 5.4 and 5.6). The ERT noted that the average values used were derived from IPCC default EFs for a wide range of technologies. For example, Ukraine averaged the IPCC default EFs for CH_4 for fluidized bed batch-type incinerators (237 kg CH_4/Gg waste) and for fluidized bed continuous incinerators (0 kg CH_4/Gg waste) to come up with an average CH_4 EF of 118.5 g CH_4/t waste (wet basis). According to the 2006 IPCC Guidelines (vol. 5, section 5.4.2), using stationary combustion default EFs (from the 2006 IPCC Guidelines, vol. 2, table 2.2) is good practice for continuous incineration of MSW and industrial waste where there is no technology information specific to the country. The ERT also noted the average values used by Ukraine are much higher than the default factors under stationary combustion (e.g. 30 kg CH_4/TJ municipal waste and 4 kg N_2O/TJ municipal waste, based on net calorific values), which might lead to an overestimation of emissions for this category. During the review, Ukraine acknowledged that obtaining its CH_4 and N_2O EFs by averaging default EFs from a wide range of technologies could be incorrect. The Party explained that it would try to find out the type and technology of incineration for the next submission and justify the choice of EFs.

The ERT recommends that Ukraine revise the CH_4 and N_2O EFs used for waste incineration and either use technology-specific EFs for CH_4 and N_2O (2006 IPCC Guidelines, vol. 5, tables 5.3 and 5.4 for CH_4 and N_2O, respectively) or follow IPCC good practice for CH_4 (2006 IPCC Guidelines, vol. 5, section 5.4.2) and N_2O (section 5.4.3). | Yes. Accuracy |
| W.16 | 5.D.1 Domestic wastewater – CH_4 | The Party estimated CH_4 emissions for category 5.D.1 (domestic wastewater) using country-specific AD and the tier 2 methodology. The ERT noted that the Party used an MCF of 0.05 for insufficiently treated wastewater for both domestic and industrial wastewater treatment plants (NIR table 7.21), which is not in accordance with the 2006 IPCC Guidelines (vol. 5, table 6.8) because the MCF of 0.05 is much lower than the default values of 0.3 (range 0.2–0.4) for domestic wastewater treatment (not well managed, overloaded) and 0.1 (range 0–0.2) for untreated systems.

During the review, Ukraine explained that it used an MCF for the wastewater treatment plants of 0 based on the assumption that all aeration stations are well managed and non-overloaded (from table 6.8 of the 2006 IPCC Guidelines, vol. 5, which corresponds to well-managed aerobic treatment plants, range 0–0.1). Further, domestic | Yes. Transparency |

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
		wastewater classified as "insufficiently treated" in the NIR is also treated at centralized aeration stations that are well managed and non-overloaded. In some cases, however, wastewater treatment at treatment plants is restricted to mechanical removal of large debris, sand and suspended matter/sludge. The untreated or insufficiently treated wastewater is directed to surface water bodies. Incomplete treatment occurs mainly in small towns, urban settlements and rural settlements. Ukraine also explained that, as a rule, these are insignificant excesses of maximum admissible concentrations from insufficiently treated domestic wastewater; therefore, an MCF of 0.05 was used. The ERT noted that according to NIR table 7.19, the percentage of insufficiently treated domestic wastewater increased from 8.37 per cent in 2016 to 17.88 per cent in 2017, but there is no explanation for this increase in the NIR. The ERT could not find clarity in what "insufficiently treated" wastewater treatment approximates to in the 2006 IPCC Guidelines classifications (vol. 5, table 6.3) or in the justification for the choice of an MCF value of 0.05. It was also not clear if "untreated" refers to "insufficient" or there are two streams, untreated and insufficiently treated. The ERT also noted that the previous ERT (for the 2017 review) recommended that Ukraine enhance transparency by providing additional information and explanations for country-specific factors used to estimate emissions from domestic wastewater treatment and discharge. The ERT recommends that Ukraine enhance the transparency of its 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 MCF of 0.05 used to estimate CH_4 emissions from 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. The ERT believes that future ERTs should consider this issue further to ensure that there is not an underestimation of emissions from this category.	
W.17	5.D.2 Industrial wastewater – CH_4	The Party estimated CH_4 emissions for category 5.D.2 (industrial wastewater) using country-specific AD and the tier 2 methodology. The ERT noted that the Party used 0.05 as the MCF for insufficiently treated wastewater for both domestic and industrial wastewater treatment plants and 0.299 as the MCF for sludge (NIR tables 7.21 and 7.28). However, the values are not justified in the NIR. During the review, Ukraine explained that the MCF for industrial wastewater used is the default MCF from the 2006 IPCC Guidelines (vol. 5, table 6.8). The MCF for the wastewater treatment plants is 0 based on the assumption that all aeration stations are well managed and non-overloaded (from table 6.8 of the 2006 IPCC Guidelines, vol. 5, which corresponds to well-managed aerobic treatment plants, range 0–0.1). The MCF for dehydrated industrial sewage sludge was taken as similar to the MCF for domestic sludge dehydration in sludge fields, MCF_{UA}, and MCF_{UA} was calculated on the basis of the assumption that the depth of the sludge fields is 1–5 m. The Party stated that the MCF_{UA} value could be an underestimate owing to the lack of reliable data on the depth of sludge fields at all sewage treatment plants in Ukraine, and in some cases, conversion of sludge fields into sludge storage. Ukraine also stated that it hopes to provide a more convincing justification for this coefficient in the next submission; otherwise, it will revert to using the default coefficient recommended by the 2006 IPCC Guidelines. The ERT agrees with the Party that the default MCF for well-managed industrial wastewater is 0 (2006 IPCC Guidelines, vol. 5, table 6 .8). However, the Party's assumption that all aeration stations are well managed and non-overloaded for industrial wastewater treatment and discharge is not reported in the NIR and the MCF for category 5.D.2 is reported as 0.05.	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
		The ERT recommends that Ukraine enhance the transparency of its reporting on industrial wastewater treatment and discharge by providing in the NIR (1) clear information on industrial wastewater treatment methods, the relevant MCF 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.	

KP-LULUCF activities

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
KL.11	General (KP-LULUCF activities) – CO_2, CH_4 and N_2O	The ERT noted that the areas presented in the land-use transition matrix in NIR table 11.1 are not accurate for the total area of individual categories at the beginning of inventory year 2017, and that the total area of individual categories at the end of inventory year 2017 does not follow from the area changes presented in the table. For example, the area of AR at the beginning of 2017 (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). Furthermore, it is not plausible that the area presented in the row "Other" (i.e. area that has never been subject to any KP-LULUCF activity) is converted to deforestation (e.g. 1.71 kha, as presented in NIR table 11.1). The ERT also noted that the areas at the end of inventory year 2017 reported in NIR table 11.1 agree with the areas presented in CRF tables 4(KP-I)A.1, 4(KP-I)A.2 and 4(KP-I)B.1, respectively, but that the area of the activity FM at the beginning of inventory year 2017 in NIR table 11.1 (9,569.68 kha) does not agree with the area in the CRF table 4(KP-I)B.1 for the end of inventory year 2016 (9,570.11 kha). Furthermore, the ERT noted that the information presented in NIR table 11.1 is not consistent with the data in CRF table NIR-2; for example, CRF table NIR-2 does not suggest a conversion from other to deforestation, and reports this with the notation key "NA".

During the review, Ukraine explained that areas of AR and deforestation correspond between years in CRF table NIR-2 and CRF tables 4(KP-I)A.1 and 4(KP-I)A.2. The differences in areas for FM result from the current methodology for deriving the matrix of land uses. The Party is aware of this and has made efforts to develop a more consistent methodology (NIR, section 6.1.2). The discrepancies and inconsistencies will be eliminated when planned work on developing a land-use change matrix based on GIS data is fully implemented.

The ERT recommends that Ukraine 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 activity) 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.

The ERT encourages Ukraine to subdivide the area of AR into areas less than or equal to 20 years and areas greater than 20 years since afforestation for more transparent tracking of the areas. | Yes. Accuracy |
| KL.12 | FM – CO_2 | The ERT noted that Ukraine now uses the tier 1 approach instead of the tier 2 approach used in the 2017 submission to estimate CSCs in DOM on forest land (see ID# L.10 in table 3). The ERT also noted that CO_2 emissions and removals from forest land remaining forest land is a key category by level and trend (NIR, p.53, and CRF table 7). While the UNFCCC Annex I inventory reporting guidelines allow the use of the tier 1 approach for key categories under certain circumstances, a Party should explain why category-specific guidance cannot be followed (UNFCCC Annex I inventory reporting guidelines, para. 11). Furthermore, decision 16/CMP.1, annex, | Yes. Accuracy |

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue and/or a problem?[a]
		paragraph 21, indicates that a Party should provide transparent and verifiable information that the pool is not a net source; Ukraine has not demonstrated this for the deadwood and litter pools. During the review, Ukraine explained that a lack of data prevent the implementation of the tier 2 approach. The Party is aware of the need for improving the methodology and EFs for forest land; this is listed in the improvement plan (NIR, annex A8.2). However, owing to the challenges Ukraine has faced in recent years, this work has not been done yet.	
		The ERT recommends that Ukraine 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.	
KL.13	FM	The ERT noted that the FM cap reported in the CRF table accounting is 262,808.86 kt CO_2 eq, but in the 2018 submission is 262,671.18 kt CO_2 eq. The ERT also noted that the value of the FM cap presented 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 is 262,627.177 kt CO_2 eq. During the review, Ukraine explained that the FM cap was revised in accordance with the revision of GHG emissions in the base year. However, the ERT noted that the FM cap cannot be changed following decision 6/CMP.9, paragraph 12.	Yes. KP reporting adherence
		The ERT recommends that Ukraine report, for its 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 table accounting and in the NIR.	
KL.14	Deforestation	For biomass carbon stocks, the ERT noted that the Party extrapolated from data from the State Forest Resources Agency of Ukraine, which cover 73 per cent of the managed forest area, to the entire managed forest area (NIR, section A3.3.1, p.465). During the review, in response to a question raised by the ERT regarding the accuracy of the extrapolation approach, the Party explained that extrapolation is needed only to estimate carbon gains, which are based on available areas of species composition at the regional level obtained from the State Forest Resources Agency. Extrapolation is not needed to estimate carbon losses, for which more comprehensive data are available, including data from SSSU and from different ministries and agencies. The ERT appreciates this information and notes that the Party needs to improve the accuracy and transparency of the extrapolation approach. The Party also explained that the method for estimating CSCs in forest land converted to other land use would be improved after the GIS-based methods of land-use identification and matrix construction are introduced. The efforts and improvements planned with the use of GIS are described in the NIR (section 6.1.2) (see ID# L.5 in table 3).	Yes. Transparency
		The ERT recommends that the Party explain in more detail, in the NIR, how the data on biomass carbon stocks gains and losses are estimated.	

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

VI. Application of adjustments

11.   The ERT did not identify the need to apply any adjustments to the 2019 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

12.   Ukraine has elected commitment period accounting and therefore the issuance and cancellation of units for KP-LULUCF activities is not applicable to the 2019 review.

VIII. Questions of implementation

13.   No questions of implementation were identified by the ERT during the individual review of the Party's 2019 annual submission.

Annex I

Overview of greenhouse gas emissions and removals for Ukraine for submission year 2019 and data and information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, as submitted by Ukraine in its 2019 annual submission

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

Table 1
Total greenhouse gas emissions for Ukraine, base year[a]–2017
(kt CO_2 eq)

| | Total GHG emissions excluding indirect CO_2 emissions | | Total GHG emissions including indirect CO_2 emissions[b] | | Land-use change (Article 3.7 bis as contained in the Doha Amendment)[c] | KP-LULUCF activities (Article 3.3 of the Kyoto Protocol)[d] | KP-LULUCF activities (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	879 311.15	938 603.07	NA	NA	NA		NA	
1990	879 311.15	938 603.07	NA	NA				
1995	505 075.60	558 897.72	NA	NA				
2000	379 880.51	425 535.74	NA	NA				
2010	375 758.24	405 103.28	NA	NA				
2011	412 734.96	426 079.81	NA	NA				
2012	396 562.35	415 232.24	NA	NA				
2013	400 703.27	406 506.77	NA	NA		–2 146.86	NA	–55 157.65
2014	356 350.21	360 266.92	NA	NA		–2 133.35	NA	–54 251.12
2015	310 489.87	316 771.06	NA	NA		–2 112.05	NA	–52 209.28
2016	333 283.57	335 115.70	NA	NA		–2 448.61	NA	–50 829.59
2017	310 271.40	320 625.82	NA	NA		–2 461.40	NA	–50 639.91

Note: Emissions/removals reported in the sector other (sector 6) are not included in the total GHG emissions.
[a] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. 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.
[b] The Party did not report indirect CO_2 emissions in CRF table 6.
[c] The value reported in this column refers to 1990.
[d] Activities under Article 3, para. 3, of the Kyoto Protocol, namely AR and deforestation.

Table 2
Greenhouse gas emissions by gas for Ukraine, excluding land use, land-use change and forestry, 1990–2017
(kt CO$_2$ eq)

	CO$_2$^{a}	CH$_4$	N$_2$O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF$_6$	NF$_3$
1990	705 832.23	182 442.44	50 092.58	NO	235.82	NO	0.01	NO
1995	389 865.79	138 539.28	30 314.53	NO	178.06	NO	0.07	NO
2000	285 338.50	117 891.87	22 173.49	15.73	115.74	NO	0.42	NO
2010	294 078.88	84 497.22	25 746.96	743.83	26.67	NO	9.71	NO
2011	307 958.46	85 942.51	31 350.46	819.97	NO	NO	8.41	NO
2012	303 964.74	80 414.60	30 001.17	840.73	NO	NO	10.99	NO
2013	297 295.00	75 123.70	33 194.32	881.22	NO	NO	12.54	NO
2014	257 587.95	68 721.33	33 093.09	847.82	NO	NO	16.73	NO
2015	223 910.09	61 185.18	30 881.09	775.24	NO	NO	19.46	NO
2016	234 203.75	65 967.23	34 031.30	889.13	NO	NO	24.30	NO
2017	223 220.04	63 637.54	32 730.36	1 009.46	NO	NO	28.42	NO
Per cent change 1990–2017	**−68.4**	**−65.1**	**−34.7**	**NA**	**NA**	**NA**	**372 318.4**	**NA**

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

^{a} Ukraine did not report indirect CO$_2$ emissions in CRF table 6.

Table 3
Greenhouse gas emissions by sector for Ukraine, 1990–2017
(kt CO$_2$ eq)

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
1990	725 319.33	117 988.08	83 371.85	−59 291.93	11 923.82	NO
1995	431 377.13	57 985.68	57 986.85	−53 822.12	11 548.06	NO
2000	311 340.84	67 146.85	35 658.69	−45 655.23	11 389.36	NO
2010	286 384.30	74 481.67	31 817.27	−29 345.04	12 420.04	NO
2011	296 451.67	80 847.38	36 288.42	−13 344.85	12 492.34	NO
2012	290 288.85	77 306.56	35 234.86	−18 669.89	12 401.97	NO
2013	282 153.85	72 419.52	39 412.58	−5 803.50	12 520.82	NO
2014	246 739.48	61 864.55	39 264.65	−3 916.72	12 398.24	NO
2015	210 824.99	56 458.31	37 277.75	−6 281.19	12 210.01	NO
2016	224 764.59	58 149.08	39 857.44	−1 832.14	12 344.59	NO

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
2017	217 752.63	51 746.15	38 907.79	−10 354.42	12 219.25	NO
Per cent change 1990–2017	**−70.0**	**−56.1**	**−53.3**	**−82.5**	**2.5**	**NA**

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

Table 4
Greenhouse gas emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol by activity, base year[a]–2017, for Ukraine
(kt CO_2 eq)

	Article 3.7 bis as contained in the Doha Amendment[b]	*Activities under Article 3, paragraph 3, of the Kyoto Protocol*		*FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol*				
	Land-use change	*AR*	*Deforestation*	*FM*	*CM*	*GM*	*RV*	*WDR*
FMRL				−48 700.00				
Technical correction				−2 900.00				
Base year	NA				NA	NA	NA	NA
2013		−2 286.65	139.79	−55 157.65	NA	NA	NA	NA
2014		−2 268.97	135.62	−54 251.12	NA	NA	NA	NA
2015		−2 246.46	134.40	−52 209.28	NA	NA	NA	NA
2016		−2 576.12	127.51	−50 829.59	NA	NA	NA	NA
2017		−2 595.23	133.84	−50 639.91	NA	NA	NA	NA
Per cent change base year–2017					**NA**	**NA**	**NA**	**NA**

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

[a] 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.

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

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

Table 5
Key relevant data for Ukraine under Article 3, paragraphs 3 and 4, of the Kyoto Protocol in the 2019 annual submission

Key parameters	Values
Periodicity of accounting	(a) AR: commitment period accounting
	(b) Deforestation: commitment period accounting
	(c) FM: commitment period accounting
	(d) CM: not elected
	(e) GM: not elected
	(f) RV: not elected
	(g) WDR: not elected
Election of activities under Article 3, paragraph 4	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 (262 627.177 kt CO_2 eq for the duration of the commitment period)
Cancellation of AAUs, CERs and ERUs and/or issuance of RMUs in the national registry for:	
1. AR	NA
2. Deforestation	NA
3. FM	NA
4. CM	NA
5. GM	NA
6. RV	NA
7. WDR	NA

Annex II

Information to be included in the compilation and accounting database

Tables 1–5 include the information to be included in the compilation and accounting database for Ukraine. Data shown are from the original annual submission of the Party, including the latest revised estimates submitted, adjustments (if applicable) and the final data to be included in the compilation and accounting database.

Table 1
Information to be included in the compilation and accounting database for 2017, including on the commitment period reserve, for Ukraine
(t CO_2 eq)

	Original submission	Revised estimate	Adjustment	Final
CPR	2 565 006 563	2 565 006 564	–	2 565 006 564
Annex A emissions for 2017	–	–	–	–
CO_2[a]	223 220 038	–	–	223 220 038
CH_4	63 637 540	–	–	63 637 540
N_2O	32 730 356	–	–	32 730 356
HFCs	1 009 464	–	–	1 009 464
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	28 422	–	–	28 422
NF_3	NO	–	–	NO
Total Annex A sources	**320 625 820**	–	–	**320 625 820**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2017	–	–	–	–
AR	–2 595 232	–	–	–2 595 232
Deforestation	133 835	–	–	133 835
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2017	–	–	–	–
FM	–50 639 908	–	–	–50 639 908

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

Table 2
Information to be included in the compilation and accounting database for 2016 for Ukraine
(t CO_2 eq)

	Original submission	Revised estimate	Adjustment	Final
Annex A emissions for 2016	–	–	–	–
CO_2[a]	234 203 748	–	–	234 203 748
CH_4	65 967 233	–	–	65 967 233
N_2O	34 031 297	–	–	34 031 297
HFCs	889 127	–	–	889 127
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	24 298	–	–	24 298
NF_3	NO	–	–	NO
Total Annex A sources	**335 115 702**	–	–	**335 115 702**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2016	–	–	–	–

	Original submission	Revised estimate	Adjustment	Final
AR	–2 576 125	–	–	–2 576 125
Deforestation	127 514	–	–	127 514
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2016	–	–	–	–
FM	–50 829 587	–	–	–50 829 587

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

Table 3
Information to be included in the compilation and accounting database for 2015 for Ukraine
(t CO_2 eq)

	Original submission	Revised estimate	Adjustment	Final
Annex A emissions for 2015	–	–	–	–
CO_2[a]	223 910 091	–	–	223 910 091
CH_4	61 185 180	–	–	61 185 180
N_2O	30 881 085	–	–	30 881 085
HFCs	775 243	–	–	775 243
PFCs	NO	–	–	NO
Unspecified mix of HFCs and PFCs	NO	–	–	NO
SF_6	19 462	–	–	19 462
NF_3	NO	–	–	NO
Total Annex A sources	**316 771 062**	–	–	**316 771 062**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2015	–	–	–	–
AR	–2 246 456	–	–	–2 246 456
Deforestation	134 404	–	–	134 404
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2015	–	–	–	–
FM	–52 209 281	–	–	–52 209 281

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

Table 4
Information to be included in the compilation and accounting database for 2014 for Ukraine
(t CO_2 eq)

	Original submission	Revised estimate	Adjustment	Final
Annex A emissions for 2014	–	–	–	–
CO_2[a]	257 587 952	–	–	257 587 952
CH_4	68 721 329	–	–	68 721 329
N_2O	33 093 093	–	–	33 093 093
HFCs	847 825	–	–	847 825
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	**360 266 924**	–	–	**360 266 924**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2014	–	–	–	–
AR	–2 268 971	–	–	–2 268 971
Deforestation	135 617	–	–	135 617
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2014	–	–	–	–

	Original submission	Revised estimate	Adjustment	Final
FM	–54 251 124	–	–	–54 251 124

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

Table 5
Information to be included in the compilation and accounting database for 2013 for Ukraine
(t CO_2 eq)

	Original submission	Revised estimate	Adjustment	Final
Annex A emissions for 2013	–	–	–	–
CO_2[a]	297 294 996	–	–	297 294 996
CH_4	75 123 696	–	–	75 123 696
N_2O	33 194 322	–	–	33 194 322
HFCs	881 217	–	–	881 217
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	**406 506 773**	–	–	**406 506 773**
Activities under Article 3, paragraph 3, of the Kyoto Protocol for 2013	–	–	–	–
AR	–2 286 646	–	–	–2 286 646
Deforestation	139 789	–	–	139 789
FM and elected activities under Article 3, paragraph 4, of the Kyoto Protocol for 2013	–	–	–	–
FM	–55 157 652	–	–	–55 157 652

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

Annex III

Additional information to support findings in table 2 in this report

Missing categories that may affect completeness

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

(a)   1.A.3.e other transportation (CO_2, CH_4 and N_2O emissions from biodiesel consumption) (see ID# E.12 in table 5 in this report);

(b)   4.C.2.1 forest land converted to grassland (CO_2, CH_4 and N_2O emissions and removals from the conversion of forest land to grassland for 1990–1993) (see ID# L.38 in table 5 in this report).

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 http://www.ipcc-nggip.iges.or.jp/public/kpsg.

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 http://www.ipcc-nggip.iges.or.jp/public/wetlands/.

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2014, 2015, 2016 and 2017 annual submissions of Ukraine, contained in documents FCCC/ARR/2014/UKR, FCCC/ARR/2015/UKR, FCCC/ARR/2016/UKR and FCCC/ARR/2017/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%202019.pdf.

Annual status report for Ukraine for 2019. Available at https://unfccc.int/sites/default/files/resource/asr2019_UKR.pdf.

C. Other documents used during the review

Responses to questions during the review were received from Mykhailo Chyzhenko (Climate Policy and Reporting Division, Climate Change and Ozone Layer Protection Department, MENR), including additional material on the methodology and assumptions used.