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Report on the individual review of the inventory submission of the United States of America submitted in 2022*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual inventory of emissions and removals of greenhouse gases for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). This report presents the results of the individual review of the 2022 inventory submission of the United States of America, conducted by an expert review team in accordance with 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". The review took place from 12 to 17 September 2022 in Bonn.

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

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Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
2019 Refinement to the 2006 IPCC Guidelines	*2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
bbl	barrel
Btu	British thermal unit
C	carbon
CaO	calcium oxide
CCS	carbon dioxide capture and storage
CEFM	Cattle Enteric Fermentation Model
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
Convention reporting adherence	adherence to the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual greenhouse gas inventories"
CRF	common reporting format
DAYCENT	Daily Century (model)
DE	digestible energy
DOM	dead organic matter
EF	emission factor
EIA	Energy Information Administration of the United States Department of Energy
EOR	enhanced oil recovery
EPA	United States Environmental Protection Agency
ERT	expert review team
GE	gross energy intake
GHG	greenhouse gas
GHGRP	Greenhouse Gas Reporting Program of the United States Environmental Protection Agency
GREET	Greenhouse Gases, Regulated Emissions and Energy Use in Transportation (model)
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
LPG	liquefied petroleum gas
LULUCF	land use, land-use change and forestry
MMS	manure management system(s)
MOVES	Motor Vehicle Emission Simulator
MSW	municipal solid waste
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NAICS	North American Industry Classification System
NE	not estimated

NEU	non-energy use
Nex	nitrogen excretion
NF_3	nitrogen trifluoride
NH_3	ammonia
NIR	national inventory report
NO	not occurring
ODS	ozone-depleting substance(s)
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
SF_6	sulfur hexafluoride
SiC	silicon carbide
SOC	soil organic carbon
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"
USDA	United States Department of Agriculture
VS	volatile solid(s)
Wetlands Supplement	*2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*
Y_m	methane conversion rate

I. Introduction

1. This report covers the review of the 2022 inventory submission of the United States of America, organized by the secretariat in accordance with the UNFCCC review guidelines, particularly in part III thereof, namely the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (annex to decision 13/CP.20). The review took place from 12 to 17 September 2022 in Bonn and was coordinated by María José López (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for the United States.

Table 1
Composition of the expert review team that conducted the review for the United States of America

Area of expertise	*Name*	*Party*
Generalist	Agita Gancone	Latvia
	Ole-Kenneth Nielsen	Denmark
Energy	Yuriko Hayabuchi	Japan
	Ole-Kenneth Nielsen	Denmark
IPPU	Juan Luis Martin Ortega	El Salvador
	Alexander Valencia	Colombia
Agriculture	Paul Duffy	Ireland
	Braulio Pikman	Brazil
LULUCF	Markus Didion	Switzerland
	Amanda Thomson	United Kingdom
	Marina Vitullo	Italy
Waste	Violeta Hristova	Bulgaria
	Erick Wamalwa Masafu	Kenya
Lead reviewers	Paul Duffy	
	Braulio Pikman	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2022 inventory submission in accordance with the UNFCCC review guidelines.

3. The ERT has made recommendations that the United States resolve identified findings related to issues.[1] Other findings, and, if applicable, the encouragements of the ERT to the United States to resolve related issues, are also included in this report.

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

5. Annex I presents the annual GHG emissions of the United States, including totals excluding and including LULUCF, indirect CO_2 emissions, and emissions by gas and by sector.

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

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

6. Table 2 provides the assessment by the ERT of the Party's 2022 inventory submission with respect to the tasks undertaken during the review. Further information on the issues identified, as well as additional findings, may be found in tables 3 and 5.

Table 2
Summary of review results and general assessment of the 2022 inventory submission of the United States of America

Assessment			*Issue ID#(s) in table 3 or 5*[a]
Date of submission	Original submission: NIR, 15 April 2022; CRF tables (version 1), 15 April 2022		
Review format	Centralized		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	E.8, E.9, I.15, I.22, I.24, I.25, A.6, A.14, L.7, L.11
	(c) Development and selection of EFs?	Yes	E.34
	(d) Collection and selection of AD?	Yes	E.7, E.15, E.31, E.32, E.33, I.1, I.10, I.13, I.16, I.20, L.21, A.8, L.6, L.16, W.4
	(e) Reporting of recalculations?	No	
	(f) Reporting of a consistent time series?	Yes	I.17, A.2, L.5
	(g) Reporting of uncertainties, including methodologies?	Yes	G.6, A.5, A.10
	(h) QA/QC?	Yes	E.35, L.10, L.15, L.29
	(i) Missing categories, or completeness?[b]	Yes	G.1, G.8, E.13, E.18, E.21, E.29, E.36, I.3, I.9, I.19, A.1, A.17, L.1, L.2, L.13, L.14, L.17, L.24, L.26, L.31, L.32, L.33
	(j) Application of corrections to the inventory?	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	No	G.2, I.6
National inventory arrangements	Have any issues been identified with the effectiveness and reliability of the institutional, procedural and legal arrangements for estimating GHG emissions?	No	
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	Yes	
Response from the Party during the review	Has the Party provided the ERT with responses to the questions raised, including the data and information necessary for assessing conformity with the UNFCCC Annex I inventory reporting guidelines and any further guidance adopted by the Conference of the Parties?	Yes	
Recommendation for an exceptional in-country review	On the basis of the issues identified, does the ERT recommend that the next review be conducted as an in-country review?	No	

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

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

7. Table 3 compiles the recommendations from previous review reports that were included in the most recent previous review report, published on 27 August 2021,[2] and had not been resolved by the time of publication of the report on the review of the Party's 2020 inventory submission. The ERT has specified whether it believes the Party had resolved, was addressing or had not resolved each issue or problem by the time of publication of this review report and has provided the rationale for its determination, which takes into consideration the publication date of the most recent previous review report and national circumstances.

Table 3
Status of implementation of recommendations included in the previous review report for the United States of America

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
General			
G.1	Annual submission (G.1, 2020) (G.1, 2019) (G.1, 2018) (G.1, 2016) (G.1, 2015) (9, 2013) (8, 2012) Completeness	Improve the completeness of the inventory, in particular by including those categories for which there are methodologies in the 2006 IPCC Guidelines.	Addressing. The Party's inventory improvement plan includes the estimation of emissions for the missing categories as soon as the necessary data become available. The Party provided an estimate of the significance of some categories reported as "NE" in annex 5 to the NIR, however, a number of sources (categories, subcategories and carbon pools) (e.g. net carbon stock change in living biomass and DOM for the cropland and grassland categories) are not included. The ERT, while noting the continuous improvements made, considers that the recommendation has not yet been fully addressed because the Party has not yet estimated emissions for a number of categories, subcategories and carbon pools for which there are methodologies in the 2006 IPCC Guidelines (see annex II).
G.2	Annual submission (G.2, 2020) (G.2, 2019) Completeness	Provide a justification in the NIR, based on the likely level of emissions as per paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, for all sources and sinks that occur but are considered insignificant and excluded from the inventory and for which there are methodologies provided in the 2006 IPCC Guidelines, and provide in the NIR evidence that the total national aggregate of estimated emissions for all mandatory gases and categories considered insignificant remains below 0.1 per cent of national total GHG emissions.	Addressing. The Party reported in its improvement plan that NIR table A-235, which contains the reason for exclusion and estimated 2020 emissions for sources and sinks not included in the inventory, will be updated as data become available. However, the justification and evidence referred to in the recommendation are currently missing for some categories (e.g. 1.A.3.d (CO_2 emissions from domestic navigation – gaseous fuels), 2.A.4.c (CO_2 emissions from other process uses of carbonates: non-metallurgical magnesium production), 2.B.4.c (CO_2 and N_2O emissions from glyoxylic acid production), 2.B.8.d (CO_2 recovery from petrochemical and carbon black production), 2.E.2 (HFCs, PFCs, SF_6 and NF_3 emissions from electronics industry: thin-film transistor flat panel display), 4.A.1 (N_2O emissions from N mineralization/immobilization) and 4.B and 4.C (net carbon stock change in living biomass and DOM for the cropland and grassland categories)).

[2] FCCC/ARR/2020/USA. The ERT notes that the report on the review of the United States' 2021 inventory submission has not been published yet owing to insufficient funding for the review process. As a result, the latest previously published annual review report reflects the findings of the review of the Party's 2020 inventory submission.

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
			The ERT, while noting the continuous improvements made, considers that the recommendation has not yet been fully addressed because the Party has not yet provided in the NIR the justification, based on the likely level of emissions as per paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, for a number of categories, subcategories and carbon pools for which there are methodologies in the 2006 IPCC Guidelines (see annex II).
Energy			
E.1	1. General (energy sector) – gaseous fuels – CO_2 and CH_4 (E.1, 2020) (E.2, 2019) (E.18, 2018) Convention reporting adherence	Examine if the uncertainty analysis needs to be updated to reflect the findings of the research on natural gas combustion and document the findings in future inventory submissions or demonstrate that the impact of updates to the carbon content of natural gas on the uncertainty analysis is negligible.	Resolved. The Party demonstrated in its NIR (p.3-37) that the impact of updates to the carbon content of natural gas on the uncertainty analysis is negligible.
E.2	1. General (energy sector) – gaseous fuels – CO_2 and CH_4 (E.2, 2020) (E.3, 2019) (E.18, 2018) Transparency	(a) Research CO_2 EF data for fuel gas used by upstream oil and gas producers, and natural gas that has been processed and injected into downstream distribution networks, in order to determine whether a different CO_2 EF for fuel gas used in offshore oil and gas production than the CO_2 EF for the processed gas that enters the transmission, storage and distribution networks used in power and industrial plants and by other users is warranted and whether it can be determined; and (b) document the findings of the research on the CO_2 EFs in the NIR.	Addressing. The Party reported in its NIR (p.A-73) that the use of different CO_2 EFs for offshore gas use and onshore marketable gas is not warranted given that EIA reports the same calorific value for both types of natural gas. However, as indicated in the NIR (pp.A-70 and A-73), there is no reliable correlation between calorific value and the carbon content of the natural gas. Therefore, the ERT noted that the fact that the same calorific value is reported for the different types of natural gas cannot be used as the basis of an assumption that there are no differences in the carbon content. During the review, the Party reiterated that there are no data to indicate a different EF is needed for natural gas energy use in upstream oil and gas operations and provided a link to a document that explains how EIA estimates heating values (https://www.eia.gov/totalenergy/data/monthly/pdf/mer_a_doc.pdf). The document indicates that for "natural gas production, dry", the heat content has been assumed to be equal to that for natural gas consumption. The Party clarified that while there is variation in the carbon content of natural gas for any given heat content (as shown in NIR figure A-1 (p.A-72)), it is relatively small (± approximately 2 per cent) and within the range of uncertainty for this source. Furthermore, the heat content–carbon content correlation is used in determining the carbon content of natural gas used in the inventory for all natural gas combustion. Another reason that the Party deems the approach to be appropriate is that the amount of natural gas used in upstream oil and gas operations is not known (this gas is included as part of aggregated industrial sector natural gas use) but is likely to be a small portion of all natural gas use and the variation in natural gas carbon content is not considered to be large for a given heating value. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet provided in the NIR any research or other information substantiating its assumption that there is no difference between the carbon content of

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
			the natural gas used upstream by oil and gas producers and the processed marketable gas used downstream.
E.3	Fuel combustion – reference approach – all fuels – CO_2 (E.3, 2020) (E.4, 2019) (E.3, 2018) (E.5, 2016) (E.5, 2015) (32, 2013) (41, 2012) Transparency	Provide a more transparent clarification of how the difference in emissions between the reference and the sectoral approach is determined and which fuels are subtracted as NEU and feedstocks.	Resolved. The Party provided in its NIR (p.A-464) the clarification referred to in the previous review report.
E.4	Fuel combustion – reference approach – gaseous and liquid fuels – CO_2 (E.21, 2020) Convention reporting adherence	Consistently treat still gas as liquid fuel under the sectoral and reference approaches to improve consistency between CRF tables 1.A(a), 1.A(b), 1.A(c) and the NIR table that compares fuel consumption under the two approaches.	Not resolved. The Party reported still gas under petroleum in the NIR (e.g. table A-4) but under gaseous fuels in CRF tables 1.A(a), 1.A(b) and 1.A(c). See also ID# E.9 in table 3 below. According to EIA (https://www.eia.gov/tools/glossary/index.php?id=still%20gas), the definition of still gas is "any form or mixture of gases produced in refineries by distillation, cracking, reforming, and other processes. The principal constituents are methane and ethane. May contain hydrogen and small/trace amounts of other gases. Still gas is typically consumed as refinery fuel or used as petrochemical feedstock. Still gas burned for refinery fuel may differ in composition from marketed still gas sold to other users". By this definition, the ERT considers it clear that it should be categorized as a liquid fuel in the emissions inventory. During the review, the Party explained that because still gas is physically a gas, it will continue to report it as a gaseous fuel in the CRF tables. The ERT noted that these fuel definitions are different from those in the 2006 IPCC Guidelines (vol. 2, chap. 1, table 1.1), where refinery gas is defined as "non-condensable gas obtained during distillation of crude oil or treatment of oil products (e.g. cracking) in refineries. It consists mainly of hydrogen, methane, ethane and olefins". The ERT notes that the transparency of reporting would be greatly improved if the United States were to include in the NIR a table of all fuels used in the sectoral and reference approaches and the fuel category under which the individual fuels have been reported in the CRF tables.
E.5	Fuel combustion – reference approach – all fuels – CO_2 (E.22, 2020) Comparability	Consistently categorize asphalt and road oil as liquid fuels under both the reference and the sectoral approach to improve consistency between CRF tables 1.A(b) and 1.A(d) and compliance with the 2006 IPCC Guidelines.	Resolved. The Party consistently categorized asphalt and road oil as liquid fuels.
E.6	Fuel combustion – reference approach – other fossil fuels – CO_2,	Take into account other fossil fuels under the reference approach when completing CRF table 1.A(b) or document that waste fuels are	Not resolved. The Party did not include data for other fossil fuels in CRF table 1.A(b). The comparison between the sectoral and reference approaches in this CRF table automatically includes other fossil fuels from the sectoral approach. The ERT noted that

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
	CH_4 and N_2O (E.25, 2020) Convention reporting adherence	not used in the comparison between the sectoral and reference approaches in order to improve consistency between the reference and sectoral approaches in terms of estimation coverage, and amend the reference approach column in CRF table 1.A(c), as needed.	if it is not possible to obtain data on the production, import and export of waste, then the consumption reported in the sectoral approach could be assumed to be equal to production, with import and export reported as "IE" (unless the Party knows that import and export do not occur). During the review, the Party stated that it will look into options for ensuring that the two approaches have the same coverage. The ERT considers that the recommendation has not yet been addressed because the Party has not yet improved the consistency between the reference and sectoral approaches.
E.7	Fuel combustion – reference approach – LPG – CO_2 (E.26, 2020) Comparability	Estimate natural gas liquid and LPG consistently between the reference and sectoral approaches or explain in the NIR why covering different fuels under the reference approach applying a different list of fuels than that used for the sectoral approach is the most accurate way to estimate emissions under both approaches, and change the notation key reported for LPG in CRF table 1.A(b) from "NA" to "IE".	Addressing. The Party included in its NIR (p.A-465) the explanation called for by the recommendation and changed the notation key reported in CRF table 1.A(b) from "NA" to "IE". However, the ERT noted that EIA provides import/export data for propane, propylene and total hydrocarbon gas liquids on its website (https://www.eia.gov/totalenergy/data/annual) that would allow the Party to report the reference approach in line with the UNFCCC Annex I inventory reporting guidelines. During the review, the Party stated that it is looking into ways to disaggregate the data on hydrocarbon gas liquids for reporting AD and EFs used for both the sectoral and the reference approach. The Party also clarified that currently it uses EIA data on imports and exports of LPG to report LPG data in the tables in annex 4 to the NIR (A-458). These LPG data are then reported under natural gas liquids in CRF table 1.A(b), with LPG being reported as "IE". The Party also confirmed that it could report the same data as LPG in CRF table 1.A(b) and report natural gas liquids in table 1.A(b) as "IE" in order to be more consistent with the sectoral approach (which does not have a natural gas liquids category) in future submissions. The ERT considers that the recommendation has not yet been fully addressed because import/export data are available that would allow the Party to estimate natural gas liquid and LPG consistently between the reference and sectoral approaches and report the reference approach in line with the UNFCCC Annex I inventory reporting guidelines.
E.8	Feedstocks, reductants and other NEU of fuels – all fuels – CO_2 (E.4, 2020) (E.5, 2019) (E.4, 2018) (E.7, 2016) (E.7, 2015) (38, 2013) (47, 2012) Comparability	Report only emissions from fuels combusted for the use of energy under fuel combustion, and reallocate the relevant emissions currently reported under the subcategory NEU (other) and part of the fuel used under the subcategory United States territories (other).	Not resolved. The Party has made no changes to the reporting since the previous (2020) inventory submission and continued to report emissions from NEU under fuel combustion (category 1.A.5.a). The ERT notes that the current reporting of the United States hinders comparability with the reporting of other Parties. Furthermore, the ERT agrees with the previous ERT that some emissions (e.g. from the use of lubricants) could be estimated using the data currently available and reported under the IPPU sector. If this is not feasible, the ERT notes that the Party could include in the NIR the rationale for not disaggregating these emissions and allocating them to the IPPU sector.
E.9	Feedstocks, reductants and other NEU of fuels	Continue to research the data for the emissions from the NEU of fuels reported	Addressing. The Party reported in its NIR (p.3-55) that double counting of CO_2 emissions from the NEU of fuels under the energy sector and CO_2 process emissions

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
	– all fuels – CO_2 (E.5, 2020) (E.6, 2019) (E.19, 2018) Accuracy	under the energy and IPPU sectors mass-balance method used across petrochemical production to estimate CO_2 emissions from the NEU of fuels and the method based on process emissions reported under facility-level reporting used to estimate emissions from feedstock consumption under IPPU, and further clarify the country-specific approach used in the NIR consistent with paragraph 10 of the UNFCCC Annex I inventory reporting guidelines.	from petrochemical production under the IPPU sector is not considered to be a significant issue and that further data integration is not feasible because the feedstock data from EIA used to estimate emissions from the NEU of fuels are aggregated by fuel type rather than being disaggregated by both fuel type and industry/IPPU category. The ERT considers that the Party has not yet fully addressed the recommendation, in particular the potential issue related to possible double counting, by describing how the country-specific approach is better able to reflect the national situation and how the methodologies used for estimating emissions are compatible with the 2006 IPCC Guidelines (see ID# E.4 above).
E.10	Feedstocks, reductants and other NEU of fuels – all fuels – CO_2 (E.23, 2020) Convention reporting adherence	Reconcile the emission data on the NEU of fuels reported in the NIR and CRF table 1.A(a)s4 by either reallocating NEU of lubricants and other petroleum in United States territories to NEU in CRF table 1.A(a)s4 or adding a footnote to NIR table 3-20 to explain how the data reported in that table differ from those presented in CRF table 1.A(a)s4.	Resolved. The Party added a footnote to NIR table 3-20 (p.3-50) explaining the differences in the emissions reported between that table and CRF table 1.A(a)s4.
E.11	Feedstocks, reductants and other NEU of fuels – solid fuels – CO_2 (E.24, 2020) Transparency	Include the correct reference for storage factors for industrial coking coal and distillate fuel oil to the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* rather than the 2006 IPCC Guidelines, together with a justification of their applicability.	Resolved. The Party included in its NIR (p.A-126) the correct reference for the storage factors, which is Marland and Rotty (1984) and justified the use of the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*.
E.12	International aviation – liquid fuels – CO_2, CH_4 and N_2O (E.6, 2020) (E.7, 2019) (E.5, 2018) (E.6, 2016) (E.6, 2015) (35, 2013) Transparency	Harmonize and reconcile the data between the reference and the sectoral approach for the reporting of jet kerosene consumption between CRF tables 1.A(b) and 1.D or furnish an adequate explanation of inconsistencies, where appropriate.	Addressing. Inconsistencies remain in the reporting of consumption of jet kerosene as an international bunker fuel between the two CRF tables; for example, for 2020, the Party reported 99.22 Mbbl (approximately 595,134 TJ) in CRF table 1.A(b) and 594,699 TJ in CRF table 1.D. In footnote (a) to NIR table A-228 (annex 4, p.A-468), the Party explained that jet kerosene used in international aviation has a different calorific value, based on data specific to that source, from other jet kerosene. During the review, the Party clarified that the conversion factor shown in CRF table 1.A(b) for jet fuel (5,998.02 TJ/unit) corresponds to the apparent consumption data in the table in 10^6 bbl and TJ. The apparent consumption includes imports, exports and stock change, as well as bunkers. The heating value for each use is different, as shown in NIR table A-228. To compare bunker fuel data in CRF table 1.A(b) and CRF table 1.D, the Party applied the heat equivalent for bunker fuels shown in NIR table A-228, that is, 5.68 million Btu/bbl, which results in a value of 5,993.64 TJ/10^6 bbl.

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
			The ERT noted that it should be possible for the Party to derive a weighted average calorific value for jet kerosene on the basis of the detailed methodology used for the sectoral approach and apply this value to the reference approach to achieve the highest level of comparability between the two approaches. See also ID# E.34 in table 5. The ERT considers that the recommendation has not yet been fully addressed because the NIR does not justify the reason why different heating values are applied to jet kerosene in CRF tables 1.A(b) and 1.D.
E.13	1.A Fuel combustion – sectoral approach – biomass – CH_4 and N_2O (E.7, 2020) (E.9, 2019) (E.20, 2018) Completeness	Advance the research on CH_4 and N_2O emissions from the combustion of landfill gas, sewage gas and other biogas in order to review data sources for biogas, review the reporting of non-CO_2 emissions in the waste sector, and assess the need to add new estimates.	Not resolved. The Party did not report CH_4 and N_2O emissions from the combustion of biogas under the energy sector. The ERT noted that N_2O emissions from the combustion of biogas are not included as a missing source in annex 5 to the NIR; furthermore, some information on the amount of landfill gas combusted and the electricity generated from landfill gas, wastewater treatment gas and manure-based biogas is available from EIA (https://www.eia.gov/energyexplained/biomass/landfill-gas-and-biogas.php). During the review, the Party clarified that while EIA does have some data on landfill gas used for energy and electricity production, these data do not cover all the possible uses of biogas (e.g. to supplement the natural gas supply, in other mobile or stationary sources). Furthermore, the United States stated that non-CO_2 emissions from biogas use for energy are already captured under the waste sector and provided a reference to the NIR (p.A-447) where this is reported. While the ERT understands that CH_4 emissions from the combustion of biogas are included in the estimate for landfills and potentially wastewater handling and manure biogas, N_2O emissions should not be included under the waste sector at all. The ERT considers that the recommendation has not yet been addressed because the Party has not yet included in the energy chapter of the NIR information on emissions from biogas and whether some of the emissions are currently reported under the waste sector.
E.14	1.A.2.g Other (manufacturing industries and construction) – liquid fuels – CO_2, CH_4 and N_2O (E.8, 2020) (E.12, 2019) (E.22, 2018) Transparency	Document the impacts of the new model and the validity of the outputs and transparently document the recalculations in the NIR when the latest version of the model (MOVES 2014b) is incorporated in the inventory.	Resolved. The Party included in its NIR (on p.3-48 and in annex 3.2) explanations that fully address the recommendation.
E.15	1.A.2.g Other (manufacturing industries and construction) – liquid	Research whether data are available to accurately reallocate emissions from fuel use by agricultural mobile machinery from subcategory 1.A.2.g to 1.A.4.c.ii and fuel use	Not resolved. The Party reported AD for subcategories 1.A.4.c.ii (off-road vehicles and other machinery) and 1.A.4.c.iii (fishing) as "IE" and "NO" respectively for the whole time series, as it had done in the previous inventory submissions. The ERT noted that the majority of Parties included in Annex I to the Convention are able to report

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	fuels – CO_2, CH_4 and N_2O (E.9, 2020) (E.13, 2019) (E.23, 2018) Comparability	for fishing vessels to 1.A.4.c.iii in order to improve the comparability of the submission and ensure that emissions of all gases from a given source are reported under the same IPCC category. If data are not available to accurately reallocate emissions to the different categories, clarify, in the NIR, the country-specific approach taken consistently with paragraph 10 of the UNFCCC Annex I inventory reporting guidelines.	emissions from machinery used in agriculture, forestry and fishing in the appropriate CRF tables. During the review, the Party explained that disaggregated data are not available and that the EIA data on the "industrial sector" used for estimating CO_2 emissions include manufacturing (NAICS codes 31–33); agriculture, forestry, fishing and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); and construction (NAICS code 23). Data are received as a sum of these categories. The ERT noted that in some statistical products from EIA, fishing is included under "vessel bunkering" and there is a separate category "farm". If EIA can include fishing under one category ("vessel bunkering") in some statistical products and under another category ("industrial sector") in other products, then it should be possible for the Party to isolate the contributions of the relevant IPCC subcategories to the overall emissions. Also, the ERT noted that the International Energy Agency publishes data for the United States for "agriculture/forestry". The ERT considers that the recommendation has not yet been addressed because the Party has not yet provided a clarification on whether data are available to accurately reallocate emissions from fuel use by agricultural mobile machinery from subcategory 1.A.2.g to 1.A.4.c.ii and fuel use by fishing vessels from subcategory 1.A.2.g to 1.A.4.c.iii in order to improve the comparability of the inventory submission with those of other Parties and ensure that emissions of all gases from a given source are reported under the same IPCC category.
E.16	1.A.2.g Other (manufacturing industries and construction) – liquid fuels – CO_2, CH_4 and N_2O (E.10, 2020) (E.14, 2019) (E.24, 2018) Accuracy	Research data by non-road mobile machinery vehicle type across the different data sets, including the Federal Highway Administration and MOVES model outputs, to determine the optimum AD estimate for each subsource under non-road mobile machinery, and improve inventory accuracy, as necessary, including for CO_2, CH_4 and N_2O emissions from industrial, commercial and agricultural machinery and fishing vessels.	Resolved. The Party reported in NIR table A-83 fuel consumption data for non-road mobile machinery sources (e.g. agricultural equipment that is not reported separately in the CRF tables). The ERT noted that MOVES3 includes 88 equipment types and that the "lawn/garden" category distinguishes between residential and commercial use of gardening machinery. The ERT considers that the detailed data available from the MOVES3 model are currently not being utilized optimally in the inventory. During the review, the Party clarified that the detailed data from MOVES3 presented in the NIR and used to estimate non-CO_2 GHG emissions are not compatible with the methodology used to estimate CO_2 emissions, therefore, it was not possible to disaggregate the emissions in the relevant CRF tables. The Party also clarified that for the 2020 submission, fuel consumption estimates derived from a calculation based on MOVES and from a top-down approach were compared and it was determined that the differences between them did not allow the scaling of data: "EPA also tested an alternative approach that uses MOVES on-road fuel consumption output to define the percentage of the FHWA [Federal Highway Administration] consumption totals (from MF-21) that are attributable to on-highway transportation sources, and applying this percentage to the EIA total, thereby defining gasoline consumption from on-highway transportation sources (such that the remainder would be defined as consumption by the industrial and commercial sectors). Results from this testing revealed differences

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			between fuel consumption calculated by MOVES and fuel consumption data from FHWA. Given this inconsistency, no changes were made to the methodology for estimating motor gasoline consumption for non-road mobile sources" (2020 NIR pp.3-46–3-47).
E.17	1.A.2.g Other (manufacturing industries and construction) – all fuels – CO_2, CH_4 and N_2O (E.27, 2020) Transparency	Provide information in the NIR on the recalculation of emission estimates and clearly indicate the reason for any changes and corrections compared with previous submissions.	Resolved. The description of previous recalculations is no longer relevant. No issues with the description of recalculations for 1.A.2.g (other) were identified during this review.
E.18	1.A.3 Transport – liquid fuels – CO_2, CH_4 and N_2O (E.11, 2020) (E.15, 2019) (E.25, 2018) Accuracy	Advance the research in order to implement as soon as practicable the following improvements indicated during previous reviews: (c) Apply a consistent methodology over time to estimate vehicle miles travelled for on-road vehicles by vehicle type, defined by wheelbase; (d) Include ongoing research and documentation of minor emissions sources currently not included in the inventory, such as urea use in trucks, bio jet fuel, and compressed natural gas or LPG use in shipping.	Addressing. (c) Not resolved. The Party reported in its NIR that improvements regarding methodology application will be undertaken in stages, pending data availability, and included in future inventory submissions. (d) Addressing. The Party included urea use in trucks in the inventory and described this source in the NIR (pp.4-35–4-38). Emissions for the remaining missing sources have not yet been estimated, but the sources have been included in annex 5 to the NIR in the table of sources and sinks not included in the inventory. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet applied a consistent methodology over time to estimate vehicle miles travelled for on-road vehicles by vehicle type, defined by wheelbase.
E.19	1.A.3 Transport – all fuels – CO_2, CH_4 and N_2O (E.29, 2020) Transparency	Include in the NIR an explanation of the reasons for the inability to implement recommended methods for estimating CH_4 and N_2O emissions from off-road transport, particularly for category 1.A.3 (CH_4 and N_2O for off-road sources), which includes ships and boats, aircraft, locomotives and off-road sources (i.e. construction or agricultural equipment), in accordance with the decision trees in the 2006 IPCC Guidelines and paragraphs 11 and 50(c) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party explained in its NIR (p.3-46) that the detailed AD needed to implement the tier 2 methodology are not available for most sources of off-road transport emissions.
E.20	1.A.3.b Road transportation – liquid	Review and update the time series of diesel and gasoline CO_2 EFs, including, where	Resolved. The Party recalculated the CO_2 EFs for diesel and gasoline for the 2021 submission using information on fuel properties gathered from the North American Fuel

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	fuels – CO_2 (E.12, 2020) (E.16, 2019) (E.26, 2018) Accuracy	necessary, the data on fuel densities and carbon share by fuel grade, and report on progress, or document in the NIR that the EFs applied are accurate and representative of emissions across the time series, and update the uncertainty analysis as needed to reflect the findings of the research.	Survey conducted by the Alliance for Automotive Innovation, and described the recalculation in the NIR (p.3-40).
E.21	1.A.3.b Road transportation – liquid fuels – CO_2 (E.13, 2020) (E.17, 2019) (E.27, 2018) Completeness	Either present information in the NIR to justify the omission of any fossil carbon component in the CO_2 EF for biofuel use (e.g. fatty acid methyl ester use) or update the inventory estimates to account for emissions from the fossil carbon component of biofuels, explaining the estimations in the NIR.	Addressing. The inventory was not updated to account for possible emissions from the fossil carbon component of biofuels. The Party explained in footnote 91 of the NIR (p.3-120) that CO_2 emissions from biodiesel do not include emissions associated with the carbon contained in methanol used in the process of combustion, as emissions from methanol use in combustion are assumed to be accounted for under NEU. It also explained in footnote 85 of annex 2 to the NIR (p.A-104) that natural gas used as a petrochemical feedstock includes use in production of methanol and that, as a result, the carbon storage factor developed for natural gas as petrochemical feedstocks takes into consideration the emissions from the use of the resulting products, including methanol. Therefore, it is assumed that emissions from the combustion of methanol used in biodiesel are captured here and not reported as part of biodiesel combustion emissions. During the review, the Party clarified that it will continue to examine ways to incorporate more information into NIR table A-45 to further clarify the use of methanol as a petrochemical feedstock. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet incorporated more information into NIR table A-45 to further clarify the use of methanol as a petrochemical feedstock.
E.22	1.A.3.b Road transportation – liquid fuels – CH_4 and N_2O (E.14, 2020) (E.18, 2019) (E.28, 2018) Convention reporting adherence	Include descriptions of the MOVES model used to estimate CH_4 and N_2O emissions from road transportation and the 2016 GREET model used to generate EF inputs for alternative fuel vehicles, and information to verify that the models have been tested and calibrated to be representative of the United States fleet, fuels, driving conditions, road types and vehicle types.	Resolved. As noted by the previous ERT, the Party sufficiently described the MOVES and GREET models in the NIR (p.3-46). Information to verify that the models were tested and calibrated to the conditions of the United States fleet were also provided to the previous ERT in response to the review. The Party provided in the NIR (p.3-48) an explanation of the recalculations performed for non-CO_2 emissions from road transportation and how they better reflect United States conditions. Hence, the recommendation by the previous ERT to include references to expert reviews of EFs is no longer relevant.
E.23	1.A.5.a Stationary – other fossil fuels – CO_2, CH_4 and N_2O (E.30, 2020) Accuracy	Use updated data to estimate GHG emissions from waste incineration, including for amount of waste generated and the ratio of incineration for the latest year of the time series, and examine the applicability of data from the Organisation for Economic Co-	Resolved. The Party revised the AD, no longer assuming a constant amount of waste discarded, and recalculated the emission estimates. The Party provided in its NIR (pp.3-57–3-60) a description of the updates it made to the methodology for estimating emissions from waste incineration.

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		operation and Development website and other sources.	
E.24	1.A.5.b Mobile – solid and gaseous fuels and biomass – CO_2, CH_4 and N_2O (E.15, 2020) (E.21, 2019) (E.31, 2018) Transparency	Report AD and emissions of activities not occurring as "NO" instead of "NA".	Resolved. The Party corrected the notation key in CRF table 1.A(a) (sheet 4) for other fossil fuels.
E.25	1.B.2.c Venting and flaring – liquid and gaseous fuels – CO_2 and CH_4 (E.17, 2020) (E.23, 2019) (E.16, 2018) (E.20, 2016) (E.20, 2015) Transparency	Enhance transparency in reporting CH_4 emissions from petroleum systems from venting and flaring, in accordance with the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party reported CO_2 and CH_4 emissions from venting and flaring as "IE" in CRF table 1.B.2 and provided in the NIR transparent information on the reasons for not disaggregating flaring and venting emissions (pp.3-70 and 3-95). During the review, the Party further explained that providing an estimate of disaggregated flaring and venting emissions would involve the application of many assumptions, which would result in inconsistent reporting and, potentially, decreased transparency.
E.26	1.C CO_2 transport and storage – CO_2 (E.18, 2020) (E.25, 2019) Transparency	Report on the progress on the research to enable the estimation of emissions for category 1.C.2 and provide a description of emission pathways associated with EOR and CCS processes for all relevant categories, including how leakage from CO_2 geological storage formations is assessed for both EOR and CCS projects.	Resolved. The Party added to NIR box 3-6 (pp.3-87–3-88) more information on the progress of the research to enable the estimation of emissions for category 1.C.2 (injection and storage) and provided a description covering all the items of information outlined in the recommendation.
E.27	1.C CO_2 transport and storage – CO_2 (E.19, 2020) (E.26, 2019) Comparability	Change the total amount of CO_2 captured for storage to "IE" in line with the Party's existing approach of reporting EOR and CCS emissions in the sectors where the emissions are captured for use in EOR.	Resolved. The Party corrected the notation key to "IE" in CRF table 1.C.
E.28	1.C CO_2 transport and storage – CO_2 (E.20, 2020) (E.26, 2019) Comparability	Report the total amounts of CO_2 injected at storage sites and the total leakage from transport, injection and storage as "IE".	Resolved. The Party corrected the notation key to "IE" in the CRF table 1.C.

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IPPU			
I.1	2.A.1 Cement production – CO_2 (I.26, 2020) Accuracy	Identify the amount of non-carbonate sources of CaO used in cement production (category 2.A.1) by fully implementing the planned improvement related to the use of non-carbonate raw materials in clinker production, and revise estimates of CO_2 emissions in accordance with the tier 2 methodology from the 2006 IPCC Guidelines by correcting the amount of CaO from non-carbonate sources if data on non-carbonate CaO sources are available.	Addressing. The Party reported in its NIR (p.4-14) the planned improvements for this category (cement production), including the review of methods and data used in estimating CO_2 emissions from cement production to account for organic material contained in the raw material and to investigate the carbonation that occurs across the lifetime of the cement product. During the review, the Party clarified that it continues to review data from GHGRP and other sources on CaO content of clinker and inputs of non-carbonate CaO in order to estimate a country-specific CO_2 EF for clinker. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet identified the amount of non-carbonate sources of CaO used in cement production.
I.2	2.A.3 Glass production – CO_2 (I.27, 2020) Transparency	Explain transparently in the NIR the reasons for the dramatic reduction in reported dolomite use for glass production, from 541 kt for 2005 to 0 kt for 2014–2018, and ensure that all major carbonates (limestone, dolomite and soda ash) are estimated for the whole inventory period.	Resolved. The Party recalculated the CO_2 emissions for category 2.A.3 (glass production) using data for 2010 to 2020 from GHGRP. In the NIR (pp.4-21–4-24), the Party described the data used and the methodology followed and explained the impact of the recalculations. Further, the Party clarified that time-series consistency was ensured by using splicing techniques for 1990–2010, applying the Federal Reserve Industrial Production Index for glass production as a surrogate for the total quantity of carbonates used in glass production. During the review, the Party shared the recalculations with the ERT, which ascertained that recalculations were made for all carbonates and confirmed the time-series consistency of category 2.A.3.
I.3	2.A.4 Other process uses of carbonates – CO_2 (I.3, 2020) (I.3, 2019) (I.5, 2018) (I.17, 2016) (I.17, 2015) Completeness	Conduct further research and consultation with industry, state-level regulators and/or statistical agencies to access additional AD and EFs and/or to seek verification of the current method and assumptions for estimating emissions from ceramics and non-metallurgical magnesium production and report on progress in the NIR.	Addressing. The Party described in the NIR (p.4-30) its ongoing efforts to collect data on the production of ceramics and non-metallurgical magnesium. The Party reported in the NIR (annex 5) that the emissions from ceramics production, which are currently reported as "NE", amount to 1,160 kt CO_2 eq for 2019. These emissions were calculated using clay data as a proxy as an initial estimate to assess the significance of the ceramics subcategory. The ERT noted that, according to annex 5 (p.A-479), which also lists the raw materials not included in the proxy data, this represents an underestimation of the emissions from carbonates use in ceramics and non-metallurgical magnesium production. During the review, the Party informed the ERT that it is working on developing arrangements for regular, long-term data collection. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported emissions from ceramics and non-metallurgical magnesium production.
I.4	2.B.1 Ammonia production – CO_2	Allocate emissions from all fossil fuel uses (i.e. fuel and feedstock) for NH_3 production	Addressing. The Party continued to report emissions from NH_3 production under the energy and IPPU sectors, as described in the NIR (p.4-32).

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	(I.4, 2020) (I.4, 2019) (I.7, 2018) (I.19, 2016) (I.19, 2015) Comparability	under subcategory 2.B.1 of the IPPU sector in accordance with the 2006 IPCC Guidelines.	During the review, the Party indicated that NH_3 production facilities have recently started reporting information that will facilitate the Party's refining of its emission estimation method for consistency with the tier 3 methodology of the 2006 IPCC Guidelines and that the EPA GHGRP regulation has been updated to provide for the collection of additional data, although it will take some years to be implemented. In the meantime, data on fuel use for NH_3 production are not available in the country, and data providers do not provide data on fuel consumption broken down by industry. The ERT noted that information on NH_3 production is available and that the default EFs provided in the 2006 IPCC Guidelines could be used to estimate the emissions for category 2.B.1 (i.e. under the IPPU sector). Using the parameters provided in the 2006 IPCC Guidelines (vol. 3, chap. 3, table 3.1), the fuel requirements for NH_3 production could be estimated and then subtracted from the aggregated consumption currently reported under the energy sector. The Party highlighted that the parameters provided in table 3.1 of the 2006 IPCC Guidelines do not represent operations specific to the United States. The ERT noted that the parameters are based on the European IPPU sector, similarly to the EF used by the Party (which is from the European Fertilizer Manufacturers Association). The ERT also noted that it is not clear how the approach currently followed by the Party better represents its operations, given that it is based on European operations. During the review, the Party noted that it is not appropriate to compare the EF used with default factors that include both fuel and feedstock emissions. It also noted in the NIR (p.4-7) that the country-specific method of accounting for emissions from feedstocks and reducing agents in the IPPU chapter and emissions from energy use in the energy chapter is compatible with the 2006 IPCC Guidelines, and is well documented and based on the science, and the allocation is undertaken to avoid double counting of emissions. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported all emissions from NH_3 production under the IPPU sector or documented how the methodologies used better reflect national circumstances and are compatible with the 2006 IPCC Guidelines.
I.5	2.B.2 Nitric acid production – N_2O (I.6, 2020) (I.25, 2019) Transparency	Include in the NIR an explanation of the trends observed for N_2O emissions and AD for nitric acid production.	Resolved. The Party provided in its NIR (pp.4-40–4-41) additional information on the trends in N_2O and CH_4 emissions and AD from nitric acid production.
I.6	2.B.4 Caprolactam, glyoxal and glyoxylic acid production – N_2O (I.8, 2020) (I.7, 2019) (I.31, 2018) Transparency	Gather the necessary data and report N_2O emissions from glyoxal and glyoxylic acid production.	Addressing. The Party reported in its NIR that data on glyoxal and glyoxylic acid production are not available. The Party described its activities aimed at obtaining information on these two emissions sources from potential data providers. During the review, the Party informed the ERT that it estimated emissions from glyoxal production using limited data gathered on domestic production and import of glyoxal and found that they do not exceed the category-level threshold for significance (500 kt) in recent years as reported in the NIR (annex 5). Furthermore, ongoing research suggests that glyoxylic acid may not be produced in the United States at a level that would

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			exceed the category-level threshold for significance (500 kt). The ERT noted that evidence supporting these emissions sources not exceeding the significance threshold was reported in the NIR (annex 5, p.A-480). The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported N_2O emissions from glyoxylic acid production or demonstrated that these emissions are insignificant.
I.7	2.B.5 Carbide production – CO_2 (I.9, 2020) (I.8, 2019) (I.32, 2018) Comparability	Allocate CO_2 emissions from the production of calcium carbide to the IPPU sector in line with the 2006 IPCC Guidelines or provide clarity in the NIR as to the country-specific approach taken.	Addressing. The Party reported CO_2 emissions from calcium carbide production as "IE" in CRF table 2(I).A-Hs1. The Party reported in CRF table 9 that the CO_2 emissions are included under category 1.A.5, explaining in the NIR (p.4-52) that they are implicitly accounted for in the storage factor calculation for the NEU of petroleum coke under the energy sector. During the review, the Party highlighted that there is no way to disaggregate and report emissions specifically associated with petroleum coke used in calcium carbide production because production data are not available for calcium carbide. The ERT noted that an estimation of calcium carbide production was reported by the Party in annex 5 to the NIR, and that this information could be used to estimate the emissions for the category and allocate them to the IPPU sector in line with 2006 IPCC Guidelines. Furthermore, as there is only one producer of calcium carbide in the country, this plant could be approached for information. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet estimated and allocated CO_2 emissions from the production of calcium carbide to the IPPU sector in line with the 2006 IPCC Guidelines.
I.8	2.B.7 Soda ash production – CO_2 (I.28, 2020) Transparency	Correct the table heading for the AD from "soda ash production" to "trona consumption" in the NIR and clarify the AD description in CRF table 2(I).A-Hs1.	Resolved. The Party corrected the NIR table 4-44 heading from "Soda ash production" to "Trona ore used in soda ash consumption" and clarified that trona ore use is assumed to be equal to trona ore production. Furthermore, the Party reported in CRF table 2(I).A-Hs1 a description consistent with the information reported in the NIR.
I.9	2.B.8 Petrochemical and carbon black production – CH_4 and N_2O (I.11, 2020) (I.9, 2019) (I.10, 2018) (I.22, 2016) (I.22, 2015) Completeness	Progress with plans to analyse new data reported by facilities (i.e. GHGRP data) and include emissions from the combustion and flaring from installations not currently included in the inventory.	Not resolved. The Party reported in its NIR that CH_4 emissions for category 2.B.8 are currently included in the CO_2 estimates and reported as "IE" in the corresponding CRF tables. In the planned improvements section for this category, the Party reported that it plans to adjust CO_2 emissions for the GHGRP downward by subtracting the carbon that is also included in the reported CH_4 emissions. Regarding N_2O emissions, the Party reported in the NIR (p.4-68) that ethylene production facilities are required to report N_2O emissions from the combustion of ethylene process off-gas in both stationary combustion units and flares. Further, the Party reported that a preliminary analysis of the aggregated reported CH_4 and N_2O emissions from facilities suggests that these emissions are less than 500 kt CO_2 eq/year. The Party noted in the NIR that the inclusion of these emissions in the inventory has not been prioritized owing to their limited impact on national total emissions.

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			During the review, the Party informed the ERT that it continues to assess GHGRP data for ways to better disaggregate the data and incorporate them into the inventory, and disaggregated data will be included, as appropriate, in future inventory submissions. The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated CH_4 and N_2O emissions from ethylene production.
I.10	2.B.8 Petrochemical and carbon black production – CO_2 and CH_4 (I.12, 2020) (I.10, 2019) (I.12, 2018) (I.25, 2016) (I.25, 2015) Accuracy	Develop a methodology that is consistent with the 2006 IPCC Guidelines as soon as is practicable, allocating relevant fuel and feedstock emissions within the IPPU sector.	Addressing. The Party described in its NIR (p.4-61) the overall allocation approach followed, wherein all emissions are reported under category 2.B (chemical industry) except fuels and feedstocks transferred out of the system for energy purposes. The ERT noted that this is in line with the allocation approach set out in the 2006 IPCC Guidelines (vol. 3, chap. 3, p.3.57), which state that "fuels which are not used within the source category but are transferred out of the process for combustion elsewhere the emissions should be reported in the appropriate Energy Sector source category". The Party reported in the NIR (section 4.13) on its use of two different approaches to estimate the emissions for category 2.B.8: (1) a mass-balance (tier 2) approach for carbon black, ethylene oxide, ethylene and ethylene dichloride; and (2) a tier 1 approach for acrylonitrile and methanol. In the case of the mass-balance approach, all of the carbon input into the process is converted either into primary and secondary products or into CO_2. In the tier 1 approach, the emissions are calculated using the production of methanol and acrylonitrile as AD. During the review, the Party clarified that for acrylonitrile and methanol, combustion emissions from any energy use not associated with feedstock are accounted for as part of fossil fuel combustion in the industrial subsector emissions reported under the energy sector. The ERT confirmed that in the case of the emissions estimated by the tier 2 approach, all fuels are reported under the IPPU sector, while in the case of methanol and acrylonitrile, some fuels are considered under the energy sector. Furthermore, the ERT noted that the estimation approach followed for the energy sector (described in detail in annex 3 to the NIR) does not consider the different estimation approach followed for the IPPU sector (i.e. NIR annex 2.3 does not describe how the differences in the approaches followed for (1) acrylonitrile and methanol and (2) carbon black, ethylene oxide, ethylene and ethylene dichloride are reflected in the energy estimates for avoiding double counting), creating a potential overestimation of emissions and affecting the transparency of the national inventory and its comparability with the inventories of other Parties. The ERT considers that the recommendation has not yet been fully addressed because the Party has not implemented the IPCC methodology or transparently and specifically explained in the NIR how the country-specific approach is better able to reflect the Party's national situation and how this country-specific approach is compatible with the 2006 IPCC Guidelines.
I.11	2.B.10 Other (chemical industry) – CO_2	Clarify the emissive non-abrasive applications of SiC, document why these emissions are not	Resolved. The Party reported in its NIR (p.4-51) that, while emissions should be accounted for where they occur (in accordance with the 2006 IPCC Guidelines),

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	(I.29, 2020) Comparability	reported elsewhere (e.g. category 2.C.1) and separately report CO_2 emissions from SiC production and SiC use in the NIR.	emissions from SiC consumption are being accounted for under category 2.B.10 until additional data – on SiC consumption by end use – become available. Regarding clarification of the emissive non-abrasive applications of SiC, the Party stated in the NIR (p.4-53) that "production data for metallurgical and other non-abrasive applications of SiC are not available; therefore, both CO_2 and CH_4 estimates for SiC are based solely upon production data for SiC for industrial abrasive applications". The ERT noted that this implies that the scope of the AD used for calculating the emissions from the production of SiC does not cover all the production of SiC occurring in the country. During the review, the Party clarified that disaggregated production data for metallurgical and other non-abrasive applications of SiC are not available; only total SiC production data are available. The Party confirmed that the AD used consist of SiC used for abrasives and for metallurgical and other non-abrasive applications. The Party clarified in the NIR (p.4-52) that United States Geological Survey "production values for the United States consists of SiC used for abrasives and for metallurgical and other non-abrasive applications". Furthermore, the Party acknowledged that the scope of the AD could be clarified in the NIR. The Party also clarified in the NIR (p.4-52) the non-abrasive applications of silicon carbide ("Approximately 50 percent of SiC is used in metallurgical applications, which include primarily iron and steel production, and other non-abrasive applications, which include use in advanced or technical ceramics and refractories") and disaggregated CO_2 emissions from SiC production and SiC use (p.4-52).
I.12	2.C.1 Iron and steel production – CO_2 (I.16, 2020) (I.14, 2019) (I.17, 2018) (I.28, 2016) (I.28, 2015) Transparency	Explain the allocation of the emissions from coke production and iron and steel production across both the energy and the IPPU sectors, including the amount of carbon stored in the products of iron and steel production (this could be done, for example, through the provision of a quantitative summary of the carbon balance used to compile and quality check the inventory estimates).	Not resolved. The Party stated in the NIR (p.4-82) that "the approaches and emission estimates for both metallurgical coke production and iron and steel production…are presented in the IPPU Chapter because much of the relevant activity data is used to estimate emissions from both metallurgical coke production and iron and steel production". Furthermore, in annex 2.1, the Party stated that the consumption of coking coal, natural gas, distillate fuel and coal used in iron and steel production was adjusted under the energy sector to avoid the double counting of emissions. The ERT noted that the information reported in the NIR is confusing in terms of which emissions from iron and steel production are accounted for under the energy sector and which under the IPPU sector and because it does not specify what adjustments were made in the energy sector for each year of the time series to avoid the double counting of emissions. During the review, the Party clarified that NIR tables 4-67–4-68 (p.4-86) include a description of the flows accounted for in estimating emissions from coke production. The ERT noted that a quantitative summary of the carbon balance for iron and steel production was not provided in the NIR. The ERT considers that the recommendation has not yet been addressed because thorough information has not been included in the NIR regarding the allocation of emissions from iron and steel production between the energy and IPPU sectors.

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I.13	2.C.1 Iron and steel production – CO_2 (I.30, 2020) Accuracy	Revise estimates of CO_2 emissions from coke production taking into account national statistics on coke breeze production, for example from EIA quarterly coal reports, or demonstrate in the NIR that CO_2 emissions from coke production were not underestimated by using industry data on coke breeze production instead of EIA statistics and explain how there is a consistent approach used to track carbon throughout the calculations.	Not resolved. The Party reported in NIR table 4-67 estimates for coke breeze production of 1,220 kt for 2019 and 981 kt for 2020. However, the ERT noted that actual data on coke breeze production in the United States can be obtained from EIA quarterly coal reports. After comparing the estimated data on coke breeze production used in the GHG inventory (1,220 kt for 2019 and 981 kt for 2020) with the EIA statistics (653,000 short tons for 2019 and 507 thousand short tons for 2020), the ERT concluded that coke breeze production was potentially overestimated in the inventory. During the review, the Party clarified that the coke breeze production data used in the inventory come from iron and steel industry data from a report by the United States Department of Energy (2000), which are considered to be more representative of coke production mass balances used at steel production facilities. However, the ERT noted that the differences between this source and EIA statistics are highly significant, and no information is provided in the NIR on the rationale the Party followed for choosing AD on coke breeze production. The ERT considers that the recommendation has not yet been addressed because coke breeze production data have been updated in the inventory but information has not been included in the NIR regarding a comparison of data sources and the rationale for the selection of AD on coke breeze production.
I.14	2.C.1 Iron and steel production – CO_2 (I.31, 2020) Accuracy	Specify in the NIR the units of coke consumption and coke production (t coke or t dry coke) and provide supporting data sources, and revise estimates of CO_2 emissions, as needed, from pig iron production and coke production by applying a carbon content value for coke that corresponds to the AD for coke production or consumption.	Resolved. The Party reported in NIR table 4-69 that the source of the carbon content value for coke is table 4.3 in the 2006 IPCC Guidelines (vol. 3, chap. 4). The ERT noted that the default values provided in table 4.3 are based on the definitions provided in tables 1.2–1.3 in volume 2 of the Guidelines, where coke is defined as "the solid product obtained from the carbonisation of coal, principally coking coal, at high temperature. It is low in moisture content and volatile matter…". The ERT concludes that the coke consumption data used by the Party (from the annual statistical report of the American Iron and Steel Institute, provided in dry units) are consistent with the EF used.
I.15	2.C.1 Iron and steel production – CO_2 (I.32, 2020) Accuracy	Justify the reported carbon content value of 2 per cent for pellets, sinter and natural ore by describing the country-specific approach of assuming they have the same carbon content as direct reduced iron (2 per cent), with confirmation by references to the relevant data sources in the NIR, or otherwise revise the emission estimates for iron and steel production (category 2.C.1) by updating the carbon content value for pellets, sinter and natural ore used in pig iron production on the basis of relevant data sources.	Addressing. The Party reported in its NIR (p.86) that, in the absence of a default value from the 2006 IPCC Guidelines or the 2019 Refinement to the 2006 IPCC Guidelines for the carbon content of pellets, sinter and natural ore consumed for pig iron production, it assumed a carbon content of 2 per cent for these input materials. The ERT noted that the Party did not provide the basis for this assumption in the NIR. During the review, the Party clarified that that the carbon content values used are validated annually by industry experts, therefore, it does not plan to update these parameters. The ERT noted that the assumption made as an expert judgment regarding the carbon content of pellets, sinter and natural ore consumed for pig iron production was not documented in the NIR following the guidance on expert elicitation provided in the 2006 IPCC Guidelines (vol. 1, chap. 2).

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
			The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet justified in the NIR the basis for the assumption made regarding the carbon content of pellets, sinter and natural ore consumed for pig iron production.
I.16	2.C.1 Iron and steel production – CO_2 (I.33, 2020) Accuracy	Describe in the NIR the type of fluxes used in iron and steel production and ensure that only CO_2 emissions from the emissive sources of fluxes are reported under category 2.C.1 and that consumption of carbonates under category 2.A.4 is adjusted to subtract emissive sources accounted for elsewhere in the GHG inventory.	Addressing. The Party reported in its NIR (p.89) the amount of flux stone used in iron and steel production for electric arc furnace and basic oxygen furnace steel production. The source of these data is the American Iron and Steel Institute. On page 4-27 of the NIR, the Party clarified that flux stone used during the production of iron and steel was deducted from category 2.A.4 (other process uses of carbonates) and attributed to category 2.C.1 (iron and steel production). However, the ERT noted that during the previous (2020) review, the Party clarified that the information provided by the American Iron and Steel Institute includes all flux types, including limestone, lime and fluorspar, but that the Party only accounts for the use of fluxes containing carbon (limestone and dolomite) in iron and steel production emissions because the emissions associated with other fluxes are reported under their individual categories (e.g. 2.A.2 (lime production)). The ERT could not find any other reference in the 2022 NIR to these other fluxes used in iron and steel production. During the review, the Party clarified that emissions associated with the use of the other fluxes in iron and steel production (if CO_2 emissions are released) are considered under those sources (e.g. emissions from lime production, emissions from other process uses of carbonates) in the inventory. The ERT noted that the scope of the information provided by the American Iron and Steel Institute is the production of iron and steel and there is no mention in the NIR about the consumption of carbonates in iron and steel production except category 2.A.2. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet demonstrated that all uses of carbonates as fluxes are included in the emission estimates for iron and steel reported in CRF table 2(I).A-Hs1.
I.17	2.C.4 Magnesium production – SF_6 (I.17, 2020) (I.15, 2019) (I.35, 2018) Consistency	Investigate the reasons for the SF_6 IEF increase between 2009 and 2011 and report in the NIR on the outcome of the investigation and on any recalculations of AD, EFs or emissions resulting from those investigations.	Not resolved. The Party reported in its NIR (p.4-109) on the recalculations made for SF_6 emissions for category 2.C.4 for 2016–2019. Furthermore, the Party included in the NIR a more detailed description of the trends in magnesium production AD, EFs and emissions, including the reasons for the high emissions reported for 2009–2011 but not the reasons for the SF_6 IEF increase between 2009 and 2011. During the review, the Party clarified that the large increase in the SF_6 IEF from 2010 to 2011 is due to both a single facility reporting anomalously high emissions for 2011 and increased production. The ERT noted that increased production levels alone are not likely to be the reason for the increased IEF between 2010 and 2011. The ERT asked the Party to share the AD and calculations made to ascertain the consistency of the time series. However, the Party could not provide this information to the ERT owing to confidentiality constraints. Therefore, the ERT could not confirm the time-series consistency of SF_6 emissions for category 2.C.4.

ID#	Issue classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			The ERT considers that the recommendation has not yet been addressed because the Party has not yet provided evidence for the SF_6 IEF increase between 2009 and 2011 for category 2.C.4.
I.18	2.D Non-energy products from fuels and solvent use – CO_2 (I.18, 2020) (I.16, 2019) (I.36, 2018) Comparability	Estimate separately CO_2 emissions from lubricants and paraffin wax use and report them under category 2.D.	Not resolved. The Party reported CO_2 emissions from lubricants and paraffin wax as "IE" under category 2.D (non-energy products from fuels and solvent use) in CRF table 2(I).A-Hs1. The Party reported in its NIR (p.4-7) that CO_2 emissions from the NEU of fuels are reported under the energy sector owing to national circumstances. The Party reported non-energy fuel consumption for different sectors and fuel types in NIR table A-20 (annex 2). During the review, the Party clarified that it uses a country-specific approach to determining carbon storage from NEU fuels. This approach includes calculating carbon inputs from statistics on the NEU of fuels from EIA and adjusting for imports/exports of major petrochemicals used for industrial processes (e.g. reductants used in metallurgy, feedstocks used in carbon black production). The Party also clarified that wherever possible, feedstocks are separated and reported separately. The ERT noted that the data available on the NEU of fuels can be used to estimate the AD for category 2.D and can then be subtracted from the energy sector AD. The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated and reported separately the CO_2 emissions from lubricants and paraffin wax for reporting under category 2.D.
I.19	2.G.2 SF_6 and PFCs from other product use – SF_6 (I.23, 2020) (I.22, 2019) (I.37, 2018) Completeness	Investigate possible SF_6 emissions from airborne warning and control systems, particle accelerators and radars and include them in the next inventory submission, providing a description of the identified sources, the SF_6 emissions from them for the entire time series, a methodology description and an uncertainty analysis, in accordance with the 2006 IPCC Guidelines (vol. 2, chap. 8, pp.8.23–8.25 and 8.26–8.30).	Not resolved. The Party reported SF_6 emissions for category 2.G.2 as "NE" in CRF table 2(II). During the review, the Party clarified that emissions of SF_6 and PFCs from other product use (i.e. from airborne warning and control systems, particle accelerators and radars) are not included in the national GHG inventory. Estimates of fugitive and process SF_6 emissions, which are based on data obtained in 2018 from relevant government agencies (e.g. United States Department of Energy, United States Department of Defense), were provided in annex 5 to the NIR as an indication of the expected scale of emissions to demonstrate they are likely below the significance threshold. Furthermore, the Party clarified that there is potentially some overlap between the emissions based on government agency data reported in annex 5 and emissions reported elsewhere in the NIR (e.g. fugitive emissions from electrical transmission and distribution). The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated and reported SF_6 and PFC emissions from other product use.
Agriculture			
A.1	3. General (agriculture) – CH_4 and N_2O	Include in the NIR (e.g. in annex 5) an indication of the sources and categories not estimated for Alaska and Hawaii, or, if the	Addressing. The Party did not provide in NIR table A-235 (annex 5, p.A-476) an update in relation to agriculture sector sources and categories not estimated for Alaska and Hawaii.

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
	(A.1, 2020) (A.25, 2019) Completeness	emissions are insignificant, justify their exclusion on the basis of the likely level of emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	During the review, the Party clarified that work on collecting these data for Alaska and Hawaii is ongoing. The Party indicated that the data will be included in the 2024 submission at the earliest. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported an indication of the sources and categories not estimated for Alaska and Hawaii.
A.2	3. General (agriculture) – CH_4 and N_2O (A.2, 2020) (A.26, 2019) Consistency	Explore the use of alternative data sources to derive AD for the years of the time series where no DAYCENT data are available (2013–2017), and if alternative data sets are not available, use proxy data or extrapolation methods to derive AD.	Addressing. The Party reported in its NIR that surrogate data, trend analysis and statistical approaches were used to estimate CH_4 emissions from rice cultivation for 2015–2020 (p.5-21), N_2O emissions from the cultivation of organic soils for 2018–2020 (p.5-37) and GHG emissions from the field burning of agricultural residues for 2014–2020 (p.5-54). However, the ERT noted that the AD reported in CRF table 3.C for 2015–2020, the area of cultivated organic soils for 2018–2020 and CRF table 3.F for 2014–2020 are held constant. During the review, the Party clarified that it continues to work with relevant government agencies to assess alternative data sources and also the possibility of reducing the time lag in availability of AD for the GHG inventory. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet provided AD for the years of the time series where no DAYCENT data are available.
A.3	3. General (agriculture) – CH_4 and N_2O (A.25, 2020) Transparency	Correct the unit in the title of NIR table A-174 from “MJ/1,000 head” to “MJ/head”.	Resolved. The Party corrected the table heading in its 2021 NIR, in which the relevant table is table A-157, to “Calculated annual GE by animal type and state, for 2017 (MJ)”. In the 2022 NIR, the relevant table is table A-148 and it has the heading “Calculated annual GE by animal type and state, for 2020 (GJ)”.
A.4	3. General (agriculture) – N_2O (A.26, 2020) Convention reporting adherence	Report the same values for Nex on pasture, range and paddock in CRF tables 3.B(b) and 3.D.	Resolved. The Party reported the same Nex values for pasture, range and paddock in CRF tables 3.B(b) and 3.D.
A.5	3.A Enteric fermentation – CH_4 (A.3, 2020) (A.2, 2019) (A.16, 2018) Convention reporting adherence	Undertake a quantitative uncertainty assessment in conjunction with future planned methodological updates.	Not resolved. The Party reported in its NIR (p.5-9) the same uncertainty range as in previous inventory submissions (i.e. 11 per cent below to 18 per cent above the 2020 emission estimates). The ERT noted that the most recent quantitative uncertainty analysis for CH_4 emissions from enteric fermentation was undertaken for the 2003 submission. During the review, the Party clarified, as it had done in previous reviews, that updates to the uncertainty assessment will be considered in conjunction with the methodological refinements that are planned or under way and will be implemented for future inventory submissions.

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
			The ERT considers that the recommendation has not yet been addressed because the Party has not yet updated its quantitative uncertainty assessment for this category.
A.6	3.A.1 Cattle – CH_4 (A.4, 2020) (A.6, 2019) (A.20, 2018) Accuracy	Update regional diet characterization data used in the estimation of CH_4 emissions from cattle in order to more accurately reflect the differences in diets across farms and states.	Addressing. The Party reported in its NIR (annex 3, pp.A-281–A-284) additional information relating to cattle DE, Y_m and GE values for animal type and region, including supplemental diet in NIR tables A-145–A-148. During the review, the Party clarified that an evaluation of the results of two ruminant nutrition models (one for beef and one for dairy cattle), run using recent national and state-level feed data along with corresponding default/average animal characteristics consistent with CEFM inputs, is under way but not yet complete. Model outputs include Y_m and DE values for dairy feedlot cattle in seven regions of the United States. The Party informed the ERT that the results of this work will be included in the 2024 submission at the earliest. The ERT considers that the recommendation has not yet been fully addressed because work on updating the cattle nutrition models in order to better reflect differences in diets across farms and states is still under way.
A.7	3.A.1 Cattle – CH_4 (A.7, 2020) (A.4, 2019) (A.18, 2018) Accuracy	Improve the accuracy of the milk fat percentage, for example by investigating the possibility of using additional data sources for information on milk fat percentage values, such as creameries and agricultural extension services.	Resolved. The Party reported in its NIR updated milk fat percentages (p.5-10). These values range from 3.7 to 4.1 per cent across the time series and are more representative of the United States' livestock industry than the previous values. Recalculations made owing to this change are described on pages 5-10 and 5-19 (in the recalculations discussion sections) of the NIR.
A.8	3.A.1 Cattle – CH_4 (A.8, 2020) (A.5, 2019) (A.19, 2018) Accuracy	Investigate the possibility of using additional data sources (e.g. farm extension services) to derive country-specific information on calf births from dairy cows throughout the year and report on the results of this investigation in the NIR.	Addressing. The Party reported in its NIR (annex 3.10, p.A-271) that the number of calf births from dairy cows is assumed to be distributed equally throughout the year, but noted in the planned improvements section (p.5-10) that it is seeking data for births by month. During the review, the Party informed the ERT that an assumption is applied to country-specific data on calf births from USDA, which are for annual births, to distribute the data equally throughout the year in order to ensure consistency with the CEFM calculations. The primary data source does not provide monthly data on calf births, but work is under way to identify other sources of data. The Party stated that improving data collection is a long-term process starting at USDA and improved data will be included in the 2024 submission at the earliest. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet managed to collect data on calf births by month and report them in its NIR.
A.9	3.A.2 Sheep – CH_4 (A.9, 2020) (A.7, 2019)	Update the sheep population distribution as data availability allows, focusing resources,	Resolved. The Party reported in its NIR (p.A-301) that animal population data for sheep are from the agricultural statistics database of the USDA National Agricultural Statistics Service (USDA, 2021a). The United States estimated enteric fermentation CH_4

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	(A.21, 2018) Accuracy	as appropriate, in line with the 2006 IPCC Guidelines.	emissions for sheep using the default EF of 9 kg/CH_4/head/year from the 2019 Refinement to the 2006 IPCC Guidelines.
A.10	3.B Manure management – CH_4 (A.10, 2020) (A.11, 2019) (A.25, 2018) Convention reporting adherence	Update the quantitative uncertainty assessment for CH_4 emissions from manure management.	Not resolved. The Party reported in its NIR (p.5-17) that the quantitative uncertainty analysis for CH_4 and N_2O emissions from manure management was performed in 2002 using a method consistent with approach 2 from the 2006 IPCC Guidelines, and that the uncertainty estimates were applied directly to the values for 2020. During the review, the Party clarified, as it had done in previous reviews, that updates to the uncertainty assessment will be considered in conjunction with the methodological refinements that are planned or under way and will be implemented for future inventory submissions. The ERT considers that the recommendation has not yet been addressed because the Party has not yet updated its quantitative uncertainty assessment for this category.
A.11	3.B Manure management – CH_4 and N_2O (A.11 and A.12, 2020) (A.12, 2019) (A.5, 2018) (A.14, 2016) (A.14, 2015) Accuracy	Obtain updated MMS data and estimate emissions using the updated MMS usage data; if this is not possible, report on progress in the effort to update the MMS data.	Resolved. The previous ERT noted that the Party updated MMS data for dairy cows, swine and poultry; however, data for other livestock types, such as sheep, had not been updated since 2001. In the 2022 submission, the Party reported in its NIR (annex 3.11, pp.A-305–A-307) information on MMS usage data. MMS data for sheep for 1990–1993 were obtained from the USDA National Agricultural Statistics Service sheep report (USDA, 1994). Data for 2001 were obtained from the USDA Animal and Plant Health Inspection Service national sheep report (USDA APHIS, 2003); these data are based on a statistical sample of farms in the 22 states with the most sheep. Data for 1994–2000 were calculated assuming a linear progression from 1993 to 2001. Owing to the lack of additional data, MMS values for 2002 onward were assumed to be the same as those for 2001. On the basis of expert opinion, the Party assumed that all sheep manure not deposited in feedlots was deposited on pasture, range or paddock (Anderson, 2000). The ERT considers that the MMS usage reported for sheep – approximately 50 per cent pasture, range and paddock and 50 per cent solid storage and dry lot – is reasonable for this livestock species, the emissions for which are not significant, contributing less than 1 per cent to the total emissions for the category. The ERT did not identify any issues with the MMS data reported for other livestock species.
A.12	3.B Manure management – N_2O (A.12, 2020) (A.14, 2019) (A.26, 2018) Accuracy	Investigate other potential data sources of animal MMS data, such as extension services (i.e. agricultural advisory services).	Resolved. The previous ERT noted that the Party had updated the MMS data for dairy cows, swine and poultry in the 2020 submission, but that the MMS data for sheep had not been updated. The current ERT considers this issue is resolved on the basis of the approach used by the Party for a livestock species with non-significant emissions (i.e. sheep) (see ID# A.11 above).
A.13	3.B.1 Cattle – CH_4 (A.13, 2020) (A.16, 2019) (A.7, 2018) (A.15, 2016) (A.15, 2015) Transparency	If not using a more disaggregated livestock categorization in estimating emissions, use option A for reporting data and emissions for cattle in the CRF tables; if applying option C, report the values for population size,	Resolved. The Party reported in CRF table 3.B(a)s2 disaggregated climatic parameters for all cattle subcategories. The cattle livestock characterization between CRF table 3.B(a)s1 and table 3.B(a)s2 is fully aligned in terms of allocation by climatic region and MMS type.

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		allocation by climatic region to cool and temperate regions, typical animal mass, VS daily excretion and CH_4 producing potential for all other cattle subcategories of option C in CRF tables 3.B(a)s1 and 3.B(a)s2.	
A.14	3.B.1 Cattle – N_2O (A.15, 2020) (A.29, 2019) Accuracy	Report the correct Nex values for beef cattle calves, dairy cattle calves and beef replacement heifers in CRF table 3.B(b) so that they reflect the true average Nex rate.	Not resolved. The ERT noted that some discrepancies remain in the reported total N excreted and the Nex values calculated by multiplying population by Nex rate for beef cattle calves and dairy cattle calves in CRF table 3.B(b). During the review, the Party clarified that it calculates Nex values for each state using a state-specific Nex rate factor and then adds the totals for all states to determine the national total Nex value, which is reported in CRF table 3.B(b). Therefore, the values will not be the same as if the average Nex rate reported for each animal class were used to calculate the total Nex. The Party noted that using different values for the Nex rate (i.e. other than the weighted values currently reported) would not accurately reflect the information used in estimating emissions and that it is not appropriate to report an average value only to ensure that Nex values align. The Party indicated that it plans to further review the typical animal mass values used in the calculations for enteric fermentation (using CEFM) and for manure management to ensure that reported N and Nex values are correct. The ERT considers that the recommendation has not yet been addressed because the Party has not yet ensured that the correct values of N and Nex, based on typical animal mass values, are used in the calculations for enteric fermentation (using CEFM) and for manure management.
A.15	3.B.1 Cattle – N_2O (A.16, 2020) (A.30, 2019) Transparency	Replace "IE" for the Nex rate for heifer stockers and beef replacement heifers with the actual Nex rates applied for those animal classes in CRF table 3.B(b); and replace the Nex rates for dairy cattle and non-dairy cattle with "IE" and explain in the documentation box of CRF table 3.B(b) that the Nex rates are reported for individual livestock classes.	Not resolved. The Party continued to report the Nex rate for heifer stockers and beef replacement heifers as "IE" in CRF table 3.B(b). During the review, the Party clarified that it is currently investigating the possibility of providing disaggregated Nex rates for these cattle types in future inventory submissions (at the earliest in the 2024 submission). The ERT considers that the recommendation has not yet been addressed because the Party has not yet provided disaggregated Nex rates for different cattle classes.
A.16	3.B.2 Sheep – CH_4 and N_2O (A.17, 2020) (A.31, 2019) Transparency	Include information on MMS distribution for sheep in NIR table A-189.	Resolved. The Party reported in NIR table A-166 (annex 3, pp.A-321–A-322) data on the MMS distribution of sheep by state.
A.17	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O	Include all N_2O emissions for Alaska and Hawaii in the emissions reported under this category or clearly outline in the	Not resolved. The Party reported in its NIR (p.5-46) that emissions for Alaska and Hawaii are not included for any sources in the inventory for agricultural soils, with the exception of (1) N_2O emissions from drained organic soils in cropland and grassland

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	(A.18, 2020) (A.19, 2019) (A.30, 2018) Completeness	improvement plan steps for including those emissions in the inventory.	(Hawaii) and (2) managed manure N and pasture, range and paddock N additions for grassland (Alaska and Hawaii). During the review, the Party clarified that the collection of data on Alaska and Hawaii to allow their inclusion in the agricultural soils N_2O estimates is under way and that this improvement will be included in the 2024 submission at the earliest. The ERT considers that the recommendation has not yet been addressed because the Party has not yet included N_2O emissions for Alaska and Hawaii in the emissions reported under this category.
A.18	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O (A.19, 2020) (A.20, 2019) (A.32, 2018) Transparency	Provide additional information in the NIR on the quantities and N contents of commercial organic amendments (e.g. biosolids, dried blood and compost) applied to agricultural soils.	Resolved. The Party reported in NIR table A-184 (annex 3.12, pp.A-357–A-358) information on the quantities of N and the N contents of commercial organic amendments. The Party reported in its NIR (annex 3.12, p.A-356, footnote 155) that while the amounts of dried manure and biosolids are provided in each report of the Tennessee Valley Authority (1991 to 1994) and Association of American Plant Food Control Officials (1995 to 2017), the N contents of dried manure and biosolids are only provided in one report of the Association of American Plant Food Control Officials (2000). The values are 0.5 and 6.0 per cent respectively for dried manure and biosolids. The N content of biosolids used in estimating the total N applied from biosolids is assumed to be 3.9 per cent (Association of American Plant Food Control Officials, 2000).
A.19	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O (A.20, 2020) (A.32, 2019) Convention reporting adherence	Correct the text in the NIR to reflect the actual method applied, namely that N_2O emissions from tobacco crops are estimated using the DAYCENT model (tier 3 method).	Resolved. The Party corrected the relevant text in both its 2021 NIR (p.5-36) and its 2022 NIR (p.5-37). The Party reported that the DAYCENT model is used to estimate N_2O emissions associated with the production of alfalfa hay, barley, corn, cotton, grass hay, grass-clover hay, oats, peanuts, potatoes, rice, sorghum, soybeans, sugar beets, sunflowers, tobacco and wheat, but is not applied to estimate N_2O emissions from other crops or rotations with other crops, such as sugarcane, some vegetables, and perennial/horticultural crops.
A.20	3.D.a.2 Organic N fertilizers – N_2O (A.27, 2020) Convention reporting adherence	Correct the reported percentage for the average N content of biosolids (the high value of 69 per cent reported in the 2020 NIR is a clerical error without any impacts on estimated emissions).	Resolved. The Party corrected the clerical error in its NIR (p.A-357). The United States now reports that total sludge generation estimates are converted to units of N by applying an average N content (the N content of biosolids used in estimating the total N applied from biosolids is assumed to be 3.9 per cent (Association of American Plant Food Control Officials, 2000) and then the estimates are disaggregated by use and by disposal practice on the basis of historical data (EPA, 1993).
A.21	3.D.a.3 Urine and dung deposited by grazing animals – N_2O (A.23, 2020) (A.34, 2019) Transparency	Include in the NIR the information provided to the ERT explaining the approach used to allocate N deposited in urine and dung to each county and how the DAYCENT model uses these data in the estimation of N_2O emissions.	Resolved. The Party reported in its NIR (annex 3.12, p.A-353) information on the approach used for allocating N deposited on pasture, range and paddock to each county. N from animal waste deposited on pasture, range and paddock in non-federal grassland in a county is generated by multiplying the total pasture, range and paddock N (based on animal type and population data in a county) by the fraction of non-federal grassland area in the county. Pasture, range and paddock manure N input rates for the DAYCENT (tier 3) model simulations are estimated by dividing the total pasture, range and paddock

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			manure N amount by the land area associated with non-federal grassland in the county from the USDA National Resources Inventory. During the simulations, the pasture, range and paddock N input is divided equally between urine and solid manure (i.e. a 50:50 split) and carbon is also added with the solids on the basis of C/N ratios estimated from livestock-specific data on manure chemical content in the *Agricultural Waste Management Field Handbook* (USDA, 1996).
A.22	3.D.b Indirect N_2O emissions from managed soils – N_2O (A.24, 2020) (A.24, 2019) (A.12, 2018) (A.18, 2016) (A.18, 2015) Transparency	Provide an explanation of how the methodology and the DAYCENT model used to estimate N volatilized and N loss are both compatible with the 2006 IPCC Guidelines and based on science.	Resolved. The Party reported in its NIR (chap. 5 (p.5-43) and annex 3.1) information on the DAYCENT model used for estimating indirect N_2O emissions from managed soils. The Party uses both the DAYCENT (tier 3) model and the tier 1 methodology from the 2006 IPCC Guidelines to estimate the amount of N that is subject to leaching and surface run-off into water bodies and is eventually emitted as N_2O. The DAYCENT model is used to simulate the amount of N transported from land. N transport from all other areas is estimated using the tier 1 methodology and the 2006 IPCC Guidelines default factor for the proportion of N subject to leaching and run-off associated with N applications on cropland that are not simulated by DAYCENT, applications of biosolids on grassland, and pasture, range and paddock manure N excreted on federal grassland. Also, for both the DAYCENT (tier 3) model and the 2006 IPCC Guidelines tier 1 methodology, nitrate leaching is assumed to be an insignificant source of indirect N_2O emissions in cropland and grassland systems in arid regions, as discussed in the 2006 IPCC Guidelines. During the review, the Party clarified that peer-reviewed publications on the use of the DAYCENT model for estimating soil N_2O emissions that elaborate the scientific basis of the model are referenced in the NIR (chap. 10 and annex 3.12) and in annex III.C.
A.23	3.F Field burning of agricultural residues – CH_4 and N_2O (A.29, 2020) Transparency	Correct the typographical error in the equation used to calculate carbon or N released from biomass burning.	Resolved. The Party corrected the error in its 2021 NIR (pp.5-53–5-54) and now reports the correct equations 5-1 and 5-2 (2022 NIR pp.5-54–5-55).
A.24	3.H Urea application – CO_2 (A.30, 2020) Accuracy	Demonstrate that the country-specific EFs are appropriate for specific national circumstances and are more accurate than the default data provided in the 2006 IPCC Guidelines, or otherwise apply the IPCC default value (0.2 t CO_2-C/t urea) for this category.	Resolved. The Party reported in its NIR that it estimates CO_2 emissions from urea application using the 2006 IPCC Guidelines tier 1 methodology. The method assumes that the carbon in the urea is released after application to soils and converted to CO_2. During the review, the Party clarified that the IPCC default CO_2 EF was used, which has a value of 0.2 (calculation workbooks use a factor of 0.73, which accounts for the EFs in addition to the 44/12 carbon to CO_2 conversion). Emissions are first calculated at the state level and then aggregated to obtain the national estimate. The Party indicated that it plans to revise the text on the methodology in the NIR to avoid confusion with the discussion of the Monte Carlo simulation.

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LULUCF			
L.1	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.1, 2020) (L.1, 2019) (L.2, 2018) (L.2, 2016) (L.2, 2015) (81, 2013) Completeness	Conclude the technical work under way to be able to provide estimates for the carbon stock changes in the living biomass and DOM pools for each conversion category from forest land to any other land use for each year based on a reliable land-use change matrix, and report on the achievements made.	Not resolved. The United States reported carbon losses in the living biomass and DOM pools for categories 4.B.2.1 (forest land converted to cropland), 4.C.2.1 (forest land converted to grassland) and 4.E.2.1 (forest land converted to settlements) and in the living biomass pool only for category 4.D.2.3.1 (forest land converted to other wetlands) for the first time for 2018. The Party reported as "NE" categories 4.D.2.2.1 (forest land converted to peat extraction) in CRF table 4.D and 4.F.2.1 (forest land converted to other land) in CRF table 4.F. During the review, the Party clarified that it does not currently include estimates for forest land converted to peat extraction or other land. These categories will be included in future inventory submissions and will contain the estimates of carbon stock loss as a result of converting forest to the respective land use. The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated and reported the carbon stock changes in the living biomass and DOM pools for each conversion category from forest land to any other land use.
L.2	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.2, 2020) (L.2, 2019) (L.3, 2018) (L.3, 2016) (L.3, 2015) (82, 2013) (97, 2012) Completeness	Include all managed United States lands in the inventory; improve the consistency of the time series of national areas; and report on the achievements made.	Not resolved. The land-use matrix of CRF table 4.1 and the land representation tables in the NIR (tables 6-4 and 6-5, pp.6-10–6-11) include all areas of managed and unmanaged land in the United States except for United States territories. During the review, the Party noted that the following tables are included in the NIR: (a) Table 6-31: Area of managed land in cropland remaining cropland that is not included in the current inventory; (b) Table 6-35: Area of managed land in land converted to cropland that is not included in the current inventory; (c) Table 6-39: Area of managed land in grassland remaining grassland in Alaska that is not included in the current inventory; (d) Table 6-47: Area of managed land in land converted to grassland in Alaska that is not included in the current inventory; (e) Table A-212: Forest land area estimates and differences between estimates in NIR sections 6.1 ("Representation of the US land base") (CRF category 4.1) and 6.2 ("Forest land remaining forest land") (CRF category 4.A.1); (f) Table A-216: Land converted to forest land area estimates and differences between estimates in NIR section 6.1 ("Representation of the US land base") (CRF category 4.1) and land converted to forest land (CRF category 4.A.1). The Party indicated that efforts are under way to improve land representation and ensure consistency with the area data used to develop the estimates for individual land use and land-use conversion categories and that it will continue to make efforts to include all

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			managed land in the territories of the United States, as well as grassland in Alaska, in the inventory but doing so will take some time as AD are lacking. The ERT considers that the recommendation has not yet been addressed because the Party has not yet included all managed land in the inventory, improved the time-series consistency of national areas and reported the achievements made.
L.3	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.3, 2020) (L.3, 2019) (L.36, 2018) Convention reporting adherence	Until the Party is able to report anthropogenic emissions and removals from the entire national managed land area, report non-estimated managed land as a subdivision in the relevant CRF tables (i.e. tables 4.A–4.E) so that the managed land area for each land category reported in CRF table 4.1 corresponds with that reported for the same category in CRF tables 4.A–4.E.	Not resolved. The Party did not report the entire national land area, managed and unmanaged, or include the non-estimated area as a subdivision in the relevant CRF tables, and did not estimate emissions and removals from the entire national managed land area. During the review, the Party clarified that it will consider implementing this recommendation (i.e. using the notation key "NE" in the relevant CRF tables) for the 2023 or 2024 submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet reported as a subdivision in the relevant CRF tables the area of non-estimated managed land until which time it can estimate emissions and removals from the entire national managed land area.
L.4	4. General (LULUCF) – CO_2, CH_4 and N_2O (L.4, 2020) (L.41, 2019) Transparency	Report in the NIR preliminary emission or removal estimates for the land areas of the United States territories reported as a preliminary result of the planned improvement carried out for the inventory.	Not resolved. The Party did not include in the NIR the preliminary emission or removal estimates for the land areas of the territories of the United States reported as a preliminary result of the planned improvement carried out for the inventory. The ERT acknowledges that the Party reported preliminary estimates of land use in United States territories in the NIR (box 6-2). During the review, the Party clarified that work on developing the AD needed to estimate emissions and removals for the territories of the United States is still under way. The ERT considers that the recommendation has not yet been addressed because the Party has not yet included in the NIR the preliminary emission or removal estimates for the land areas of the territories of the United States reported as a preliminary result of the planned improvement carried out for the inventory.
L.5	Land representation – CO_2, CH_4 and N_2O (L.5, 2020) (L.4, 2019) (L.7, 2018) (L.21, 2016) Consistency	Resolve the inconsistencies in land-use areas in the time series reported in the CRF tables.	Addressing. The Party included in its NIR (p.6-9) a description of the national land-use representation system and in the documentation boxes in CRF tables 4.A–4.E. During the review, the Party clarified that a splicing method was applied to calculate soil carbon stock changes from 2016 to 2019 for land converted to forest land because mineral soil areas were not compiled for 2016–2019. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported a consistent land-use area time series in the CRF tables.
L.6	Land representation – CO_2, CH_4 and N_2O	Include the land-use changes that occurred during the periods 1971–1978 for land	Not resolved. The Party did not estimate carbon stock changes considering a 20-year transition period.

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	(L.6, 2020) (L.42, 2019) Accuracy	converted to cropland, grassland and settlements, and 1971–1981 for land converted to forest land, in order to ensure that the areas of land converted categories for all inventory years since 1990 contain the accumulated total of the land-use changes over the past 20 years.	During the review, the Party clarified that the primary data set (USDA National Resources Inventory) used to develop these estimates does not go back to 1971. The Party indicated that work on resolving this issue is still under way, with the goal of reporting the missing periods of land-use changes in the 2023 or 2024 submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet included the land-use changes to ensure that the areas of land converted categories for all inventory years since 1990 contain the accumulated total of the land-use changes over the past 20 years.
L.7	Land representation – CO_2, CH_4 and N_2O (L.7, 2020) (L.43, 2019) Accuracy	Revise the area of unmanaged grassland for Alaska and report on the changes in the NIR.	Not resolved. The Party did not report in its NIR a revised area of unmanaged grassland for Alaska. During the review, the Party clarified that work on reconciling the area of managed grassland in Alaska and the area estimate reported in the inventory is still under way. An update is planned for the 2023 or 2024 submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet revised the area of unmanaged grassland for Alaska.
L.8	Land representation – CO_2, CH_4 and N_2O (L.8, 2020) (L.43, 2019) Transparency	Increase the transparency of the approach to classifying managed and unmanaged land and include a specific example of the change from managed land to unmanaged land in the NIR because this type of land-use change is not common in the inventory reporting of other Parties.	Addressing. The Party reported in its NIR (p.6-9) a description of the national land-use representation system. During the review, the Party clarified that the land representation section (6.1) of the NIR provides detailed information on the definition of managed and unmanaged land, the sources of land-use data, the criteria used to designate managed lands (with lands not designated as managed being unmanaged lands) and the approach for combining the land-use data sets. A multi-year effort to improve land representation, including the use of additional data sets, is under way. The initial updates are expected to be completed in time for inclusion in the 2023 or 2024 submission. The Party provided one example of an area whereby livestock data are collected annually by USDA, and no livestock have occurred in this area since the mid-1970s; therefore, there is no longer active management through livestock grazing. The Party indicated that this is a remote area, at least 10 miles from roads and settlements, and therefore the land is no longer managed on the basis of the implementation criteria. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet fully documented how the assessment of the managed and unmanaged land area has been carried out and has not provided an example in the NIR of the transition from managed to unmanaged land (see also ID#s L.3 and L.7 above).
L.9	Land representation – CO_2, CH_4 and N_2O (L.9, 2020) (L.6, 2019) (L.9, 2018) (L.23, 2016)	When providing detailed information in the NIR on how the different data sources were harmonized, provide explicit information on how the model ensures consistent integration of the three data sources, for example by	Resolved. The Party included in its NIR (pp.6-20–6-22) the section “Approach for combining data sources”. During the review, the Party clarified that it will modify its approach to developing land representation over the next several years and will update the NIR throughout this process. In response to an ERT question on the adjustments applied to the different

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	(L.22, 2015) Transparency	including a visual flow chart of data processing during the harmonization process.	assessments resulting from the three data sources for each land use and land-use change, the Party explained that the current process to extract the adjustments (a python-scripted procedure) will take time.
L.10	4.A Forest land – CO_2 (L.11, 2020) (L.10, 2019) (L.39, 2018) Convention reporting adherence	Report up-to-date information on the verification of the outputs of the model used to estimate SOC changes in mineral soils, for example at the level of annual fluxes in single specific sites representative of the variability of the population or, as done for the DAYCENT model for agricultural soils (NIR figure A-12), at the level of the total cumulated (across the time series and the entire territory modelled) net flux.	Not resolved. The Party included in its NIR (pp.A-378–A-379) the section "Tier 3 model description, parameterization and evaluation" for agricultural lands and provided in annex 3.12 to the NIR details on the methods used to estimate changes in mineral soil carbon stocks in land converted to forest land. However, the Party did not report specific information on the verification of the outputs of the model used for estimating soil carbon stock changes. During the review, the Party clarified that it will include the relevant information (e.g. tables by broad forest type and average carbon stock per unit area, as well as stock changes), expand the discussion on uncertainty to cover the issue of consistency in soil depth across land-use categories and provide data on plot-level soil carbon in a future inventory submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet reported up-to-date information on the verification of the outputs of the model used to estimate SOC changes in mineral soils.
L.11	4.A Forest land – CO_2 and N_2O (L.13, 2020) (L.13, 2019) (L.42, 2018) Transparency	Calculate the carbon stock change in each carbon pool at the level of each single plot and then aggregate the results at the state and national level, and explain any recalculations in the NIR.	Not resolved. The Party reported in its NIR (annex 3.13, p.A-404) that, for each inventory plot in each state, field data from the Forest Inventory and Analysis programme of the USDA Forest Service are used alone or in combination with auxiliary information (e.g. on climate, surficial geology or elevation) to predict carbon density for each forest ecosystem carbon pool (i.e. above-ground and below-ground biomass, deadwood, litter, SOC). However, the Party did not provide appropriate information on the calculation of carbon stock changes in each carbon pool and did not adequately explain the recalculations performed. During the review, the Party clarified that it will include the relevant information (e.g. tables by broad forest type and average carbon stock per unit area, as well as stock changes), expand the discussion on uncertainty to cover the issue of consistency in soil depth across land-use categories and provide data on plot-level soil carbon in a future inventory submission. The ERT found that the current methodology for calculating carbon stock change in forest land is appropriately applied taking into account the information provided by the Party. However, the ERT also noted that this understanding was not clear from the information provided in the NIR and considers that the recommendation has not yet been addressed because the Party has not yet provided appropriate information on the calculation of carbon stock changes in each carbon pool and has not adequately explained the recalculations performed.
L.12	4.A.1 Forest land remaining forest land	Provide in an annex to the NIR detailed tables on average carbon fluxes by region and type	Resolved. The Party did not provide tables on average carbon fluxes by region used for estimating downed deadwood and understory.

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	– CO_2 (L.14, 2020) (L.14, 2019) (L.13, 2018) (L.26, 2016) Transparency	(e.g. the region and forest type classifications described in Smith et al. (2006) and used for estimating downed deadwood and understory, which might better reflect the diversity of forest types and age classes).	During the review, the Party noted that the recommendation is not related to a reporting requirement and basis in methodological guidance that requires providing detailed tables on average carbon fluxes by region. The ERT agrees that the data called for by the recommendation are not related to a reporting requirement.
L.13	4.B Cropland – CO_2 (L.15, 2020) (L.16, 2019) (L.18, 2018) (L.14, 2016) (L.14, 2015) (93, 2013) (107, 2012) Completeness	Estimate the carbon stock changes in living biomass in perennial crops for all years in the time series.	Not resolved. The Party did not report carbon stock changes in living biomass for category 4.B (cropland) in CRF table 4.B. During the review, the Party clarified that it is working on resolving the issue and will address the recommendation in a future inventory submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated the carbon stock changes in living biomass for cropland.
L.14	4.B.2.2 Grassland converted to cropland – CO_2 (L.17, 2020) (L.18, 2019) (L.46, 2018) Completeness	Estimate biomass carbon stock changes using the IPCC default method and factors or, where available, country-specific methods and factors, and report the estimates in the NIR.	Addressing. The Party reported estimates of carbon stock changes for mineral and organic soils for grassland converted to cropland in CRF table 4.B, but did not estimate and report living biomass carbon stock changes for grassland converted to cropland. During the review, the Party clarified that it is working on resolving the issue and will address the recommendation in the next (2023) or a later inventory submission. The Party noted that, as reported in the NIR (p.6-66, footnote 46), SOC stock changes are estimated and reported for land converted to cropland but reporting of carbon stock changes for the above-ground and below-ground biomass, deadwood and litter pools is limited to forest land converted to cropland – the reporting of these pools for other conversions to cropland is a planned improvement. The Party stated that it is currently improving the GHG inventory by estimating the changes in biomass carbon for additional land uses and land-use changes, including grassland converted to cropland. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet estimated and reported the living biomass carbon stock changes for grassland converted to cropland.
L.15	4.B Cropland 4.C Grassland – CO_2 and N_2O (L.18, 2020) (L.19, 2019) (L.47, 2018) Convention reporting adherence	Verify the model's output for the entire time series from 1990 onward and for all applicable land categories (e.g. by verifying the model's output for each land-use category, for the total of the land-use categories or for any subaggregation, as long as the total estimate of all land-use categories modelled is verified) and report on the verification and the results in the NIR.	Not resolved. The Party did not report in its NIR (p.6-64 for cropland and p.6-80 for grassland) additional information on the verification of the model's output. During the review, the Party clarified that efforts to improve the documentation and calibration of the model are ongoing, as is the implementation of additional verification procedures, in line with ongoing methodological refinements for estimating soil carbon, soil N_2O emissions and soil CH_4 emissions. The recommendation will be addressed in the next (2023) or a later inventory submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet provided information on the model's output verification.
L.16	4.C Grassland – CO_2 (L.20, 2020) (L.21,	Report woody grassland as a subdivision of the grassland category, estimate accordingly	Not resolved. The Party did not report woody grassland as a subdivision of the grassland category in CRF table 4.C.

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	2019) (L.49, 2018) Accuracy	the area and carbon stock change for all carbon pools of woody grassland within the category grassland remaining grassland and within all land-use categories of conversion from and to grassland, and report the estimates in the NIR.	During the review, the Party clarified that carbon stock changes are reported for all pools for a component of grassland referred to as woodlands. Woodlands are former forest lands that no longer meet the definition of forest land and are now classified under the grassland category. Because these woodlands were formerly part of the forest land category, data are collected on woody/perennial biomass and these data are used to report on the carbon stock changes. For grassland not part of woodlands, the Party indicated that it does not have woody/perennial biomass data but is assessing how to collect them. Perennial biomass data for other grassland will be included in the next (2023) or a later inventory submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet reported woody grassland as a subdivision of the grassland category in CRF table 4.C.
L.17	4.C.2.2 Cropland converted to grassland – CO_2 (L.22, 2020) (L.24, 2019) (L.51, 2018) Completeness	Estimate biomass carbon stock change using the IPCC default method and factors or, where available, country-specific methods or factors, and explain the estimations in the NIR.	Not resolved. The Party did not estimate and report the living biomass carbon stock changes for cropland converted to grassland, but it did report estimates of carbon stock changes for mineral and organic soils for grassland converted to cropland, in CRF table 4.B. During the review, the Party clarified that it is working on resolving the issue and will address the recommendation in the next (2023) or a later inventory submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated and reported the living biomass carbon stock changes for cropland converted to grassland.
L.18	4.D.1 Wetlands remaining wetlands – CO_2, CH_4 and N_2O (L.23, 2020) (L.25, 2019) (L.25, 2018) (L.34, 2016) (L.27, 2015) Comparability	Noting the need to determine the quantity of peat harvested per ha and the total area undergoing peat extraction, provide the respective AD and IEFs for the on-site CH_4 and N_2O emission estimates in CRF table 4(II) for organic soils under peat extraction.	Resolved. The Party reported information on the approach it applied to estimating emissions for this category in the documentation box in CRF table 4(II). The ERT finds the Party's reporting appropriate given the methods applied. During the review, the Party clarified that only the off-site CO_2 emissions from dissolved organic carbon are calculated on the basis of land area, not the off-site emissions from the horticultural application of peat. Therefore, land area is not reported as it is not applicable to estimating total off-site CO_2 emissions. In addition, it is not possible to generate IEFs for each gas because CO_2, CH_4 and N_2O emissions are calculated using different land areas: for on-site CO_2 emissions, total peat production area is used; for CH_4 emissions, total drained area and the area of ditches used to drain the peatlands are used in separate calculations; and for N_2O emissions, only the area of nutrient-rich peat production is used. Area data are provided only for CH_4 emissions. The NIR includes a table showing the specific areas used for calculating on-site CO_2, as well as CH_4 and N_2O, emissions.
L.19	4.D.2.2 Land converted to flooded land – CO_2 (L.24, 2020) (L.26,	Estimate carbon stock change in flooded land using the 2006 IPCC Guidelines (vol. 4, chap. 7) default method and factors or, where	Resolved. The Party reported in CRF table 4(II) CO_2 and CH_4 emissions from land converted to flooded land and included information for flooded lands in the documentation box.

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	2019) (L.53, 2018) Completeness	available, country-specific methods or factors, and explain the estimations in the NIR.	The ERT noted that the Party changed table 4.D from "NE" in the 2020 submission to "NA". During the review, the Party clarified that it is updating the methodology used for the 2023 submission to utilize country-specific EFs. In addition, the Party plans to update the notation keys in table 4.D from "NA" to "IE" where applicable.
L.20	4.D.2.3 Land converted to wetlands – CO_2 (L.25, 2020) (L.27, 2019) (L.54, 2018) Completeness	Estimate biomass and DOM carbon stock changes for forest land converted to other wetlands as planned for the 2020 submission and explain the estimations in the NIR.	Resolved. The Party reported carbon stock changes in living biomass for land converted to other wetlands (category 4.D.2.3) as numerical values. However, it reported carbon stock changes in DOM for category 4.D.2.3 as "NO" except for 4.D.2.3.1 (forest land converted to other wetlands), for which a numerical value was provided. During the review, the Party explained that it plans to make improvements in this regard for future inventory submissions.
L.21	4.E Settlements – CO_2 (L.27, 2020) (L.29, 2019) (L.27, 2018) (L.15, 2016) (L.15, 2015) (94, 2013) Accuracy	Eliminate the overlap between the urban forest inventory and the forest inventory.	Not resolved. The Party did not eliminate the overlap between the urban forest inventory and the forest inventory. During the review, the Party clarified that, as noted in the uncertainty sections of the NIRs of recent inventory submissions, the overlap between the urban forest inventory and the forest inventory, and how to eliminate it with new National Land Cover Database data, is still being investigated. As indicated in the planned improvements section of the NIR, the Party anticipates reporting an updated status of this issue in the next (2023) inventory submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet eliminated the overlap between the urban forest inventory and the forest inventory.
L.22	4.E.1 Settlements remaining settlements – CO_2 (L.28, 2020) (L.30, 2019) (L.55, 2018) Comparability	Remove the reporting of the carbon stock change associated with yard trimmings and food scraps under the settlements category and allocate it to the category other under the relevant sector.	Not resolved. The Party did not remove the estimates of carbon stock changes associated with yard trimmings and food scraps from category 4.E (settlements) (see ID#s L.23 and L.29 below). The Party reported carbon stock changes from landfilled yard trimmings and food scraps in CRF table 4.E. During the review, the Party clarified that carbon stock estimates from landfilled yard trimmings and food scraps are reported under category 4.E.1 (settlements remaining settlements) because the bulk of the carbon, which comes from yard trimmings, originates from settlement areas. While the majority of food scraps originate from cropland and grassland, in the 2022 inventory, they are reported with yard trimmings under settlements remaining settlements. Additionally, landfills are considered part of the managed land base under settlements (see NIR section 6.1 ("Representation of the US land base")) and the reporting of these carbon stock changes that occur entirely within landfills fits most appropriately within settlements remaining settlements given circumstances specific to the United States and the country-specific approach so they are, therefore, reported under category 4.E.1. The ERT considers that the recommendation has not yet been addressed because the Party has not yet removed the estimates of carbon stock change associated with yard trimmings and food scraps from the settlements category and did not report the

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			emissions from landfilled yard trimmings and food scraps under category 4.H (other), applying a country-specific method or under category 4.G (HWP) as an additional "other" HWP pool in solid waste disposal sites while continuing to ensure that the methods used are consistent with the waste sector reporting as per the 2006 IPCC Guidelines (vol. 4, chap. 12.2.1, and vol. 5, chap. 3.4).
L.23	4.E.1 Settlements remaining settlements – CO_2 (L.29, 2020) (L.31, 2019) (L.55, 2018) Comparability	Report information on the long-term stored carbon stock of yard trimmings and food scraps, as well as on its annual changes, in the memo item in CRF table 5.	Resolved. The Party reported in the memo item in CRF table 5 data on the long-term stored carbon stock of yard trimmings and food scraps. During the review, the Party clarified that the data reported as long-term stored carbon stock of yard trimmings and food scraps in the memo item in CRF table 5 are the same values as those in CRF table 4.E, but CRF table 4.E reports units of "kt C" while CRF table 5 reports units of "CO_2". The Party indicated the value is converted to the appropriate units.
L.24	4.E.2.2 Cropland converted to settlements 4.E.2.3 Grassland converted to settlements – CO_2 (L.30, 2020) (L.32, 2019) (L.56, 2018) Completeness	Estimate biomass carbon stock changes for cropland converted to settlements (category 4.E.2.2) and grassland converted to settlements (category 4.E.2.3) using the IPCC default method and factors (2006 IPCC Guidelines, vol. 4, chap. 8) or, where available, country-specific methods or factors, and explain the estimations in the NIR.	Not resolved. The Party reported AD for land converted to settlements in CRF table 4.E. Emissions from biomass and DOM pools were estimated and reported only for forest land. The Party did not estimate biomass carbon stock changes for cropland converted to settlements (category 4.E.2.2) or for grassland converted to settlements (category 4.E.2.3). During the review, the Party clarified its plans to report these estimates in future inventory submissions. The Party also clarified that the planned improvements section of the NIR includes the estimation, using tier 1 methods and default data, of all the land conversion categories that are currently not estimated. The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated biomass carbon stock changes for cropland converted to settlements (category 4.E.2.2) and for grassland converted to settlements (category 4.E.2.3).
L.25	4.F Other land – CO_2, CH_4 and N_2O (L.40, 2020) Comparability	Report numerical values in CRF table 4.F for managed areas of other land and "NE" for carbon pools for which numerical values cannot be reported, or otherwise develop an assumption for carbon pools being in equilibrium.	Addressing. The Party reported in CRF table 4.F managed land areas and carbon stock change of other land as "NE". During the review, the Party clarified that while the notation keys used in CRF table 4.F were changed to "NE" for the current submission, area estimates will be provided in future inventory submissions. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet reported numerical values in CRF table 4.F for managed land areas of other land. The ERT notes that reporting of carbon stock change values is considered under ID# L.26 below.
L.26	4.F.2 Land converted to other land – CO_2 (L.31, 2020) (L.33,	Report estimates of carbon stock change for land converted to other land using the IPCC default method and factors (2006 IPCC Guidelines, vol. 4, chap. 9) or, where	Not resolved. The Party reported in CRF table 4.F carbon stock changes for land converted to other land as "NE".

ID#	Issue classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
	2019) (L.57, 2018) Completeness	available, country-specific methods or factors, and explain the estimations in the NIR.	During the review, the Party clarified its plans to report estimates of carbon stock changes for land converted to other land in future inventory submissions. The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated carbon stock changes for land converted to other land.
L.27	4.G HWP – CO_2 (L.32, 2020) (L.34, 2019) (L.58, 2018) Transparency	Complete CRF table 4.Gs2 with aggregated values in t C for each of the three HWP subcategories (solid wood, paper and paperboard, and other) and report in the NIR a table with all subcategories used by the model to calculate the HWP contribution as well as the conversion factors applied to obtain carbon weight for each subcategory.	Not resolved. The Party reported in CRF table 4.Gs2 the HWP AD for sawn wood and wood panels as "IE", while numerical values were reported for the paper and paperboard AD for 1990–2020. During the review, the Party clarified its plans to improve the reporting of HWP in CRF Reporter for the 2023 or 2024 submission. The ERT considers that the recommendation has not yet been addressed because the Party has not yet reported the HWP AD in CRF table 4.Gs2 for sawnwood and wood panels for the entire time series and paper and paperboard prior to 1990.
L.28	4.G HWP – CO_2 (L.41, 2020) Transparency	Differentiate clearly between HWP and forest carbon stock changes in the NIR and ensure consistent reporting between the CRF and NIR tables.	Resolved. The Party included in its NIR (pp.6-35–6-36) a section on HWP and reported consistent HWP emissions in CRF table 4.G. During the review, the Party clarified that the description of the methodology for estimating HWP carbon stock changes is included in the forest land remaining forest land section (6.2) of the NIR, but HWP estimates and methods for calculating them are documented separately within that section (in the subsection "Harvested wood carbon" (p.6-35)). All HWP emissions are reported in CRF table 4.G.
L.29	4.H Other (LULUCF) – CH_4 (L.34, 2020) (L.36, 2019) (L.60, 2018) Accuracy	Report the complete calculation of the decay rates applied to yard trimmings and food scraps as well as information on the impact that the calculation has on the CH_4 emission rates applied to other MSW.	Addressing. The previous ERT had suggested that, to resolve this issue, the Party could demonstrate that carbon losses resulting from the decay of yard trimmings and food scraps, as calculated under LULUCF, are coherent with the waste sector estimates of CH_4 emitted from landfills or perform a model calculation of CH_4 emissions from the yard trimmings and food scraps carbon pool in landfills and compare the results with the waste sector CH_4 estimates. The Party did not demonstrate that carbon losses resulting from the decay of yard trimmings and food scraps, as calculated under LULUCF, are coherent with the waste sector estimates of CH_4 emitted from landfills. The ERT found no evidence in the NIR that the Party performed a model calculation of CH_4 emissions from the yard trimmings and food scraps carbon pool in landfills and compared the results with the waste sector CH_4 estimates. The Party included in its NIR (p.6-165) a section on the changes in yard trimmings and food scraps carbon stocks in landfills (which includes NIR table 6-122, containing the decay rates) and reported related carbon stock changes in CRF table 4.E. During the review, the Party clarified that all the emissions calculated for yard trimmings and food scraps are based on this on-site carbon stock, including both the CO_2 emissions given off from decay of DOM and the CO_2 sink (in the form of carbon) arising from the annual deposition of yard trimmings (degradable and non-degradable portions) into landfills. The components of annual production that can be reasonably expected to stay on site include all carbon deposited to a landfill concerning yard

ID#	Issue classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			trimmings. This includes the degradable and non-degradable portions of yard trimmings and the net CO_2 emissions that are produced from them. The Party also clarified that its estimation follows the 2006 IPCC Guidelines in only estimating on-site DOM emissions; as reported in the NIR (section 7.1, p.7-5), CH_4 and CO_2 are the primary constituents of landfill gas generation and emissions. However, according to the 2006 IPCC Guidelines, biogenic CO_2 emissions are not to be reported under the waste sector. The net CO_2 flux from carbon stock changes in landfills are estimated and reported under the LULUCF sector in the NIR (chapter 6). The Party explained that the waste sector calculations focus on methanogenesis (namely, anaerobic decomposition), whereas the LULUCF sector calculations focus only on aerobic decomposition. Landfills are considered a part of the managed land base under settlements (NIR section 6.1 ("Representation of the US land base"), p.6-9) and the reporting of these carbon stock changes that occur entirely within landfills fits most appropriately within the settlements remaining settlements category (4.E.1). In the NIR, the settlements remaining settlements section (6.10), including the changes in yard trimmings and food scraps section, covers only on-site carbon stock changes, reporting changes as either net emissions or net sinks. However, since 1990, landfilled yard trimmings and food scraps have had more deposition of carbon than release as CO_2 emissions, and CO_2 emissions originating from yard trimmings in landfills are considered as on-site emissions. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet demonstrated that carbon losses resulting from the decay of yard trimmings and food scraps, as calculated under LULUCF, are coherent with the waste sector estimates of CH_4 emitted from landfills or performed a model calculation of CH_4 emissions from the yard trimmings and food scraps carbon pool in landfills and compared the results with the waste sector CH_4 estimates.
L.30	4(II) Emissions/removals from drainage and rewetting and other management of organic/mineral soils (L.35, 2020) 4.A forest land – CO_2, CH_4 and N_2O (L.44, 2019) Transparency	Provide information regarding which emissions or removals are estimated under carbon stock change in forest organic soils (category 4.A) and drained forest organic soils (category 4(II)) and how double counting of emissions between the two sources are avoided in the NIR and in the relevant documentation boxes of CRF tables 4.A and 4(II).	Resolved. The Party reported in NIR tables 6-22–6-23 (pp.6-45–6-46) the area of forest on drained organic soils, reporting the same AD in CRF table 4(II). During the review, the Party clarified that carbon stock changes in drained organic soils are reported under forest ecosystem carbon stock changes. The Party noted that in footnote "a" to NIR table 6-8 (p.6-28), it stated that "these estimates include C stock changes from drained organic soils from both Forest Land Remaining Forest Land and Land Converted to Forest Land. (See the section below on CO_2, CH_4, and N_2O Emissions from Drained Organic Soils for the methodology used to estimate the CO_2 emissions from drained organic soils)".
L.31	4(III) Direct N_2O emissions from N mineralization/ immobilization – N_2O (L.37, 2020) (L.37,	Estimate N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land, as well as for their conversion to and from cropland and	Not resolved. The Party reported "NE" in CRF table 4(III) for N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, settlements and other land, as well as for their conversion to and from cropland and grassland and reported "NA" for wetlands.

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
	2019) (L.61, 2018) Completeness	grassland, using the IPCC default method and factors (2006 IPCC Guidelines, vol. 4, chap. 11) or, where available, country-specific methods or factors, and report the estimates in CRF table 4(III) and the NIR.	During the review, the Party clarified its plans to report emissions for all land categories in future inventory submissions. The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land, as well as for their conversion to and from cropland and grassland.
L.32	4(IV) Indirect N_2O emissions from managed soils – N_2O (L.38, 2020) (L.38, 2019) (L.62, 2018) Completeness	Estimate indirect N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land and report them in CRF table 4(IV) and explain the estimations in the NIR.	Not resolved. The Party did not estimate indirect N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils from land-use categories other than settlements. For settlements (category 4.E), the Party reported estimates of these emissions in CRF table 4(IV) and provided information on how the estimates were calculated in the documentation box of that table. During the review, the Party clarified its plans to report these emissions for all land categories in future inventory submissions. The ERT considers that the recommendation has not yet been addressed because the Party has not yet estimated indirect N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils from land-use categories other than settlements.
L.33	4(V) Biomass burning – CH_4 and N_2O (L.39, 2020) (L.39, 2019) (L.35, 2018) (L.42, 2016) (L.33, 2015) Completeness	Noting that CH_4 and N_2O emissions from forest fires are key categories, estimate CH_4 and N_2O emissions from biomass burning for land converted to forest land, land converted to wetlands, cropland, grassland and settlements and populate CRF table 4(V).	Addressing. The Party did not estimate emissions from biomass burning for land converted to wetlands, cropland, grassland and settlements. In CRF table 4(V), the Party reported GHG emissions from biomass burning for land converted to forest land, cropland (controlled burning) and grassland (controlled burning) as "IE", while it reported GHG emissions from biomass burning for cropland (wildfires) and for land converted to grassland, wetlands, settlements and other land as "NE". During the review, the Party clarified that it is unable to report these emissions at the level of land-use conversion but it will continue to explore approaches for doing so for future inventory submissions. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet estimated emissions from biomass burning for land converted to wetlands, cropland, grassland and settlements.
Waste			
W.1	5. General (waste) – CO_2, CH_4 and N_2O (W.1, 2020) (W.1, 2019) (W.1, 2018) (W.9, 2016) (W.9, 2015) Transparency	Provide background information that is consistent with the data actually used for the emission estimates, including the waste management practices.	Resolved. The Party reported in its NIR (section 7.1, p.7-6) the trends in the amounts of MSW generated and landfilled, as well as the resulting CH_4 emissions, explaining the differences noted in the two ratios of MSW landfilled to MSW generated as a result of the two data sources and methods used. In NIR box 7-3, the Party explained that data from the State of Garbage survey and the Environmental Research and Education Foundation are used in the MSW methodology, whereas data from EPA are presented in NIR box 7-4 to

ID#	Issue classification[a, b]	Recommendation from previous review report	ERT assessment and rationale
			show trends in waste management in the United States. The quantitative differences between these two data sources are explained in NIR box A-3 (annex 3.14, p.A-451).
W.2	5.A.1 Managed waste disposal sites – CH_4 (W.8, 2020) (W.15, 2019) Transparency	Include information on the oxidation factor used, including an uncertainty analysis for the oxidation factor applied in the estimation.	Resolved. The Party included in its NIR (section 7.1 and NIR figure A-19 (annex 3.14)) information on the oxidation factor used in the estimation, including an uncertainty analysis for this factor.
W.3	5.A.1.a Anaerobic – CH_4 (W.9, 2020) (W.7, 2019) (W.16, 2018) Comparability	Estimate and report separately the amounts of CH_4 flared and CH_4 for energy recovery for anaerobic waste disposal sites in CRF table 5.A.	Not resolved. The Party reported the amounts of CH_4 flared and CH_4 for energy recovery for anaerobic waste disposal sites as "NE" in CRF tables 5.A and 9 and in the NIR (annex 5) for 2005–2020. During the review, the Party indicated that it plans to implement technical changes to the GHGRP to allow waste disposal site operators to provide the volumes of CH_4 flared and CH_4 for energy recovery; however, the timing of such changes has not been settled on.
W.4	5.A.1.a Anaerobic – CH_4 (W.10, 2020) (W.8, 2019) (W.7, 2018) (W.12, 2016) (W.11, 2015) Accuracy	Obtain up-to-date data on the type and fractions of organic waste placed in industrial waste landfills and revise the CH_4 estimates for all major industrial waste landfills.	Addressing. The Party reported in its NIR that it assumes that most of the organic waste placed in industrial waste landfills originates from the food processing (meat, vegetables, fruits) and pulp and paper sectors; thus, its estimates of industrial landfill emissions focus on these two sectors. EPA validated this assumption by analysing GHGRP data for 2016 (the waste disposal information for pulp and paper facilities correlates well with the AD currently used to estimate emissions but not with the waste disposal information on food and beverage facilities). EPA conducted a literature review in 2020 to investigate other sources of industrial food waste and decided to maintain the currently used methodology because of questions around data availability across the time series and because the level of effort required to reproduce and/or merge estimates across the time series is high (2021 NIR section 7.1, p.7-11). The amount of waste landfilled is assumed to be a fraction of production that is held constant over the time series (2021 NIR, annex 3.14). During the review, the Party indicated that a memorandum summarizing the literature research and data availability is being finalized by EPA. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet presented in the NIR up-to-date data on the type and fractions of organic waste placed in industrial waste landfills and, as necessary, updated the estimates for industrial waste landfills.
W.5	5.B.2 Anaerobic digestion at biogas facilities – CH_4 (W.11, 2020) (W.9, 2019) (W.8, 2018) (W.14, 2016) (W.13,	Estimate and report CH_4 emissions from unintentional leakages using the default value of 5 per cent provided in the 2006 IPCC Guidelines.	Addressing. The Party included in its NIR (section 7.4) and CRF table 5.B estimates from anaerobic digestion at biogas facilities using a tier 1 methodology but it is unclear whether the Party estimated and reported CH_4 emissions from unintentional leakages using the default value of 5 per cent provided in the 2006 IPCC Guidelines. During the review the Party clarified that the assumptions (amount of biogas recovered by all AD operations) include unintentional leakages.

ID#	*Issue classification*[a, b]	*Recommendation from previous review report*	*ERT assessment and rationale*
	2015) Transparency		The ERT considers that the recommendation has not yet been fully addressed because while the Party has estimated and reported CH_4 emissions from anaerobic digestion at biogas facilities, it has not transparently explained how it accounts for unintentional leakages.
W.6	5.C.1 Waste incineration – CO_2, CH_4 and N_2O (W.13, 2020) (W.13, 2019) (W.10, 2018) (W.15, 2016) (W.14, 2015) Transparency	Provide in the NIR consistent information on the data that are used for the estimation of emissions from waste incineration (e.g. on the percentage of waste incinerated in 2013 reported in figure 7-2 and tables 3-26 and A-272 of the 2016 NIR).	Resolved. The Party reported in its NIR (section 3.3 and annex 3.7) information on its updated approach to calculating emissions from waste incineration. This updated approach indicates that the Party does not rely on the combustion ratio of MSW but rather on the tons of MSW combusted. The tons of MSW combusted data come from multiple sources (NIR section 7.1) and are consistent with the data used to estimate MSW landfill emissions.
W.7	5.C.1 Waste incineration – CO_2 (W.16, 2020) Accuracy	Provide an explanation for reporting 0 per cent fossil carbon content in paper waste as a country-specific parameter as well as the reference on which the parameter is based.	Resolved. The Party reported in its NIR (section 3.3 and annex 3.7) information on its updated approach to calculating emissions from waste incineration. The updated approach uses a country-specific EF for CO_2 emissions from MSW combustion. The CO_2 EF is based on measured CO_2 emissions divided by the amount of MSW combusted and includes any carbon in the MSW, including from waste nappies, fossil oil and paper.
W.8	5.C.1 Waste incineration – CH_4 and N_2O (W.17, 2020) Completeness	Estimate CH_4 and N_2O emissions from the incineration of sewage sludge at wastewater treatment plants in the country or provide an explanation in the NIR demonstrating that these emissions are already included elsewhere in the GHG inventory.	Resolved. The Party reported in its NIR (annex 5, p.A-486) that it estimated the potential CH_4 and N_2O emissions associated with sewage sludge incineration to demonstrate that they are insignificant. These emissions, which amount to approximately 9 kt CO_2 eq per year, were calculated using data on the amount of sewage sludge incinerated and assumed EFs for N_2O and CH_4 for biomass solids from the GHGRP.
W.9	5.D.2 Industrial wastewater – CH_4 (W.15, 2020) (W.13, 2019) (W.14, 2018) (W.5, 2016) (W.5, 2015) (105, 2013) Completeness	Include information on the non-estimation of CH_4 emissions from sludge under industrial wastewater.	Resolved. The Party included in the NIR (annex 5) an explanation, including a quantified estimate, of CH_4 emissions from sludge from industrial wastewater treatment demonstrating the insignificance of these emissions.

[a] References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) in which the issue or problem was raised. Issues are identified in accordance with paras. 80–83 of the UNFCCC review guidelines and classified as per para. 81 of the same guidelines.

[b] The report on the review of the 2021 inventory submission of the United States was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2020 inventory review report. For the same reason, 2014, 2017 and 2021 are excluded from the list of review years in which issues could have been identified.

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

8. 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 or more successive reviews, including the review of the 2022 inventory submission of the United States, and had not been addressed by the Party by the time of publication of this review report.

Table 4
Issues identified in three or more successive reviews and not addressed by the United States of America

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
General		
G.1	Improve the completeness of the inventory, in particular by including those categories for which there are methodologies in the 2006 IPCC Guidelines.	7 (2012–2022)
G.2	Provide a justification in the NIR, based on the likely level of emissions as per paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines, for all sources and sinks that occur but are considered insignificant and excluded from the inventory and for which there are methodologies provided in the 2006 IPCC Guidelines, and provide in the NIR evidence that the total national aggregate of estimated emissions for all mandatory gases and categories considered insignificant remains below 0.1 per cent of national total GHG emissions.	3 (2019–2022)
Energy		
E.2	(a) Research CO_2 EF data for fuel gas used by upstream oil and gas producers, and natural gas that has been processed and injected into downstream distribution networks, in order to determine whether a different CO_2 EF for fuel gas used in offshore oil and gas production than the CO_2 EF for the processed gas that enters the transmission, storage and distribution networks used in power and industrial plants and by other users is warranted and whether it can be determined; and (b) document the findings of the research on the CO_2 EFs in the NIR.	4 (2018–2022)
E.8	Report only emissions from fuels combusted for the use of energy under fuel combustion, and reallocate the relevant emissions currently reported under the subcategory NEU (other) and part of the fuel used under the subcategory United States territories (other).	7 (2012–2022)
E.9	Continue to research the data for the emissions from the NEU of fuels reported under the energy and IPPU sectors mass-balance method used across petrochemical production to estimate CO_2 emissions from the NEU of fuels and the method based on process emissions reported under facility-level reporting used to estimate emissions from feedstock consumption under IPPU, and further clarify the country-specific approach used in the NIR consistent with paragraph 10 of the UNFCCC Annex I inventory reporting guidelines.	4 (2018–2022)
E.12	Harmonize and reconcile the data between the reference and the sectoral approach for the reporting of jet kerosene consumption between CRF tables 1.A(b) and 1.D or furnish an adequate explanation of inconsistencies, where appropriate.	6 (2013–2022)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
E.13	Advance the research on CH_4 and N_2O emissions from the combustion of landfill gas, sewage gas and other biogas in order to review data sources for biogas, review the reporting of non-CO_2 emissions in the waste sector, and assess the need to add new estimates.	4 (2018–2022)
E.15	Research whether data are available to accurately reallocate emissions from fuel use by agricultural mobile machinery from subcategory 1.A.2.g to 1.A.4.c.ii and fuel use for fishing vessels to 1.A.4.c.iii in order to improve the comparability of the submission and ensure that emissions of all gases from a given source are reported under the same IPCC category. If data are not available to accurately reallocate emissions to the different categories, clarify in the NIR the country-specific approach taken consistently with paragraph 10 of the UNFCCC Annex I inventory reporting guidelines.	4 (2018–2022)
E.18	Advance the research in order to implement as soon as practicable the following improvements indicated during previous reviews: (c) Apply a consistent methodology over time to estimate vehicle miles travelled for on-road vehicles by vehicle type, defined by wheelbase. (d) Include ongoing research and documentation of minor emissions sources currently not included in the inventory, such as urea use in trucks, bio jet fuel, and compressed natural gas or LPG use in shipping.	4 (2018–2022)
E.21	Either present information in the NIR to justify the omission of any fossil carbon component in the CO_2 EF for biofuel use (e.g. fatty acid methyl ester use) or update the inventory estimates to account for emissions from the fossil carbon component of biofuels, explaining the estimations in the NIR.	4 (2018–2022)
IPPU		
I.3	Conduct further research and consultation with industry, state-level regulators and/or statistical agencies to access additional AD and EFs and/or to seek verification of the current method and assumptions for estimating emissions from ceramics and non-metallurgical magnesium production and report on progress in the NIR.	5 (2015–2022)
I.4	Allocate emissions from all fossil fuel uses (i.e. fuel and feedstock) for NH_3 production under subcategory 2.B.1 of the IPPU sector in accordance with the 2006 IPCC Guidelines.	5 (2015–2022)
I.6	Gather the necessary data and report N_2O emissions from glyoxal and glyoxylic acid production.	4 (2018–2022)
I.7	Allocate CO_2 emissions from the production of calcium carbide to the IPPU sector in line with the 2006 IPCC Guidelines or provide clarity in the NIR as to the country-specific approach taken.	4 (2018–2022)
I.9	Progress with plans to analyse new data reported by facilities (i.e. GHGRP data) and include emissions from the combustion and flaring from installations not currently included in the inventory.	5 (2015–2022)
I.10	Develop a methodology that is consistent with the 2006 IPCC Guidelines as soon as is practicable, allocating relevant fuel and feedstock emissions within the IPPU sector.	5 (2015–2022)
I.12	Explain the allocation of the emissions from coke production and iron and steel production across both the energy and the IPPU sectors, including the amount of carbon stored in the products of iron and steel production (this could be done, for	5 (2015–2022)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
	example, through the provision of a quantitative summary of the carbon balance used to compile and quality check the inventory estimates).	
I.17	Investigate the reasons for the SF_6 IEF increase between 2009 and 2011 and report in the NIR on the outcome of the investigation and on any recalculations of AD, EFs or emissions resulting from those investigations.	4 (2018–2022)
I.18	Estimate separately CO_2 emissions from lubricants and paraffin wax use and report them under category 2.D.	4 (2018–2022)
I.19	Investigate possible SF_6 emissions from airborne warning and control systems, particle accelerators and radars and include them in the next inventory submission, providing a description of the identified sources, the SF_6 emissions from them for the entire time series, a methodology description and an uncertainty analysis, in accordance with the 2006 IPCC Guidelines (vol. 2, chap. 8, pp.8.23–8.25 and 8.26–8.30).	4 (2018–2022)
Agriculture		
A.1	Include in the NIR (e.g. in annex 5) an indication of the sources and categories not estimated for Alaska and Hawaii, or, if the emissions are insignificant, justify their exclusion on the basis of the likely level of emissions in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	3 (2019–2022)
A.2	Explore the use of alternative data sources to derive AD for the years of the time series where no DAYCENT data are available (2013–2017), and if alternative data sets are not available, use proxy data or extrapolation methods to derive AD.	3 (2019–2022)
A.5	Undertake a quantitative uncertainty assessment in conjunction with future planned methodological updates.	4 (2018–2022)
A.6	Update regional diet characterization data used in the estimation of CH_4 emissions from cattle in order to more accurately reflect the differences in diets across farms and states.	4 (2018–2022)
A.8	Investigate the possibility of using additional data sources (e.g. farm extension services) to derive country-specific information on calf births from dairy cows throughout the year and report on the results of this investigation in the NIR.	4 (2018–2022)
A.10	Update the quantitative uncertainty assessment for CH_4 emissions from manure management.	4 (2018–2022)
A.14	Report the correct Nex values for beef cattle calves, dairy cattle calves and beef replacement heifers in CRF table 3.B(b) so that they reflect the true average Nex rate.	3 (2019–2022)
A.15	Replace “IE” for the Nex rate for heifer stockers and beef replacement heifers with the actual Nex rates applied for those animal classes in CRF table 3.B(b); and replace the Nex rates for dairy cattle and non-dairy cattle with “IE” and explain in the documentation box of CRF table 3.B(b) that the Nex rates are reported for individual livestock classes.	3 (2019–2022)
A.17	Include all N_2O emissions for Alaska and Hawaii in the emissions reported under this category or clearly outline in the improvement plan steps for including those emissions in the inventory.	4 (2018–2022)
LULUCF		
L.1	Conclude the technical work under way to be able to provide estimates for the carbon stock changes in the living biomass and DOM pools for each conversion category from forest land to any other land use for each year based on a reliable land-use change matrix, and report on the achievements made.	6 (2013–2022)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
L.2	Include all managed United States lands in the inventory; improve the consistency of the time series of national areas; and report on the achievements made.	7 (2012–2022)
L.3	Until the Party is able to report anthropogenic emissions and removals from the entire national managed land area, report non-estimated managed land as a subdivision in the relevant CRF tables (i.e. tables 4.A–4.E) so that the managed land area for each land category reported in CRF table 4.1 corresponds with that reported for the same category in CRF tables 4.A–4.E.	4 (2018–2022)
L.4	Report in the NIR preliminary emission or removal estimates for the land areas of the United States territories reported as a preliminary result of the planned improvement carried out for the inventory.	3 (2019–2022)
L.5	Resolve the inconsistencies in land-use areas in the time series reported in the CRF tables.	5 (2016–2022)
L.6	Include the land-use changes that occurred during the periods 1971–1978 for land converted to cropland, grassland and settlements, and 1971–1981 for land converted to forest land, in order to ensure that the areas of land converted categories for all inventory years since 1990 contain the accumulated total of the land-use changes over the past 20 years.	3 (2019–2022)
L.7	Revise the area of unmanaged grassland for Alaska and report on the changes in the NIR.	3 (2019–2022)
L.8	Increase the transparency of the approach to classifying managed and unmanaged land and include a specific example of the change from managed land to unmanaged land in the NIR because this type of land-use change is not common in the inventory reporting of other Parties.	3 (2019–2022)
L.10	Report up-to-date information on the verification of the outputs of the model used to estimate SOC changes in mineral soils, for example at the level of annual fluxes in single specific sites representative of the variability of the population or, as done for the DAYCENT model for agricultural soils (NIR figure A-12), at the level of the total cumulated (across the time series and the entire territory modelled) net flux.	4 (2018–2022)
L.11	Calculate the carbon stock change in each carbon pool at the level of each single plot and then aggregate the results at the state and national level, and explain any recalculations in the NIR.	4 (2018–2022)
L.13	Estimate the carbon stock changes in living biomass in perennial crops for all years in the time series.	7 (2012–2022)
L.14	Estimate biomass carbon stock changes using the IPCC default method and factors or, where available, country-specific methods and factors, and report the estimates in the NIR.	4 (2018–2022)
L.15	Verify the model's output for the entire time series from 1990 onward and for all applicable land categories (e.g. by verifying the model's output for each land-use category, for the total of the land-use categories or for any subaggregation, as long as the total estimate of all land-use categories modelled is verified) and report on the verification and the results in the NIR.	4 (2018–2022)
L.16	Report woody grassland as a subdivision of the grassland category, estimate accordingly the area and carbon stock change for all carbon pools of woody grassland within the category grassland remaining grassland and within all land-use categories of conversion from and to grassland, and report the estimates in the NIR.	4 (2018–2022)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
L.17	Estimate biomass carbon stock change using the IPCC default method and factors or, where available, country-specific methods or factors, and explain the estimations in the NIR.	4 (2018–2022)
L.21	Eliminate the overlap between the urban forest inventory and the forest inventory when new National Land Cover Database data become available. If possible, develop spatially explicit and spatially continuous representations of land to eliminate such overlaps and to enable the production of better settlement area estimates.	6 (2013–2022)
L.22	Remove the reporting of the carbon stock change associated with yard trimmings and food scraps from under the settlements category and allocate it to the category other under the relevant sector.	4 (2018–2022)
L.24	Estimate biomass carbon stock changes for cropland converted to settlements (category 4.E.2.2) and grassland converted to settlements (category 4.E.2.3) using the IPCC default method and factors (2006 IPCC Guidelines, vol. 4, chap. 8) or, where available, country-specific methods or factors, and explain the estimations in the NIR.	4 (2018–2022)
L.26	Report estimates of carbon stock change for land converted to other land using the IPCC default method and factors (2006 IPCC Guidelines, vol. 4, chap. 9) or, where available, country-specific methods or factors, and explain the estimations in the NIR.	4 (2018–2022)
L.27	Complete CRF table 4.Gs2 with aggregated values in t C for each of the three HWP subcategories (solid wood, paper and paperboard, and other) and report in the NIR a table with all subcategories used by the model to calculate the HWP contribution as well as the conversion factors applied to obtain carbon weight for each subcategory.	4 (2018–2022)
L.29	Report the complete calculation of the decay rates applied to yard trimmings and food scraps as well as information on the impact that the calculation has on the CH_4 emission rates applied to other MSW.	4 (2018–2022)
L.31	Estimate N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land, as well as for their conversion to and from cropland and grassland, using the IPCC default method and factors (2006 IPCC Guidelines, vol. 4, chap. 11) or, where available, country-specific methods or factors, and report the estimates in CRF table 4(III) and the NIR.	4 (2018–2022)
L.32	Estimate indirect N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land and report them in CRF table 4(IV) and explain the estimations in the NIR.	4 (2018–2022)
L.33	Noting that CH_4 and N_2O emissions from forest fires are key categories, estimate CH_4 and N_2O emissions from biomass burning for land converted to forest land, land converted to wetlands, cropland, grassland and settlements and populate CRF table 4(V).	5 (2015–2022)
Waste		
W.3	Estimate and report separately the amounts of CH_4 flared and CH_4 for energy recovery for anaerobic waste disposal sites in CRF table 5.A.	4 (2018–2022)
W.4	Obtain up-to-date data on the type and fractions of organic waste placed in industrial waste landfills and revise the CH_4 estimates for all major industrial waste landfills.	5 (2015–2022)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
W.5	Estimate and report CH_4 emissions from unintentional leakages using the default value of 5 per cent provided in the 2006 IPCC Guidelines.	5 (2015–2022)

[a] Reports on the reviews of the 2017 and 2021 inventory submissions of United States have not yet been published. Therefore, 2017 and 2021 were] not included when counting the number of successive years for this table. In addition, as the reviews of the Party's 2015 and 2016 inventory submissions were conducted together, they are not considered successive reviews and 2015/2016 is counted as one year.

V. Additional findings made during the individual review of the Party's 2022 inventory submission

9. Table 5 presents findings made by the ERT during the individual review of the 2022 inventory submission of the United States that are additional to those identified in table 3.

Table 5
Additional findings made during the individual review of the 2022 inventory submission of the United States of America

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
General			
G.3	Further improvements (identified by the Party)	The Party described in its NIR planned improvements for most categories. The ERT commends the United States for its ambition to continue to improve the inventory. However, the ERT noted that the NIR does not include information on or an overview of the improvement planning process and considerations for prioritizing improvements. During the review, the Party explained that it maintains a GHGI Improvement Tracker, which is updated annually with all planned improvements. A priority is assigned to each planned improvement in the Tracker. The ERT encourages the Party to include in the NIR a description of the process for prioritizing the planned improvements to its inventory.	Not an issue/problem
G.4	QA/QC and verification	The Party described in its NIR (p.1-16) the process for independent expert review. However, the ERT noted that it is not clear from the information provided how many experts are involved, whether there is a rotation of experts or the pool of experts remains fixed, and what instructions are provided to the experts. During the review, the Party clarified the number of experts involved in independent expert review, described the turnover in the expert pool and explained that experts receive a guidance memo, which includes a request to flag any available information that could be used to estimate emissions for categories currently not included in the inventory. The experts are free to provide feedback on areas other than those related to the guiding questions provided to them. The ERT also noted the good approach to the independent expert review implemented by the Party.	Not an issue/problem

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		The ERT encourages the Party to expand the description of the process for independent expert review in the NIR, including by reporting information on the pool of experts and the guidance provided to them, as provided to the ERT during the review.	
G.5	Methods	The Party reported the key category analysis in the NIR (section 1.5, pp.1-17 and 1-22) and additional information on the analysis in annex 1 to the NIR. The Party provides methodological tier information within the category-specific methodological discussions across the NIR. CRF table summary 3 includes information on the methodological tier used but the ERT noted that it is not possible to link this information to specific key categories owing to the high level of aggregation automated in CRF table summary 3 for all Parties. It is therefore not clear which methodological tier was used and whether the recommended methods from the appropriate decision tree in the 2006 IPCC Guidelines are used for the key categories.	Yes. Transparency
		During the review, the Party provided the ERT with a spreadsheet mapping the results of the key category analysis to the methodological tier(s) used for each category and including additional information on the methodological choice, where relevant.	
		The ERT recommends that the Party provide an overview of the methodological tiers used for estimating emissions and sinks for the key categories, which, for example, may be in a spreadsheet similar to the one provided to the ERT during the review, either for the inventory as a whole or for each sector.	
G.6	Uncertainty analysis	The Party reported in its NIR (pp.1-26–1-27) overall uncertainties for the GHG inventory for 1990 and 2020. The uncertainties reported are very similar (–5 to +6 per cent for 1990 and –6 to +6 per cent for 2020). The NIR (p.A-524) also describes improvements (recent and ongoing, as well as planned) to the inventory, for example the use of more detailed data from the GHGRP, which are expected to reduce uncertainties over time.	Yes. Transparency
		During the review, the Party explained that some improvements have already been made to significant sources, which has offset the trend within the relevant category (e.g. improvements to oil and gas system estimates have resulted in a slight decrease in the uncertainty for 2020 compared with that for 1990 for CO_2 and a slight increase compared with that for 1990 for CH_4). The United States noted that some categories for which GHGRP data have been used to improve the inventory are insignificant categories. The ERT agrees with the explanations provided and notes that changes in emission levels arising from the improvements, for example a decrease in emissions for categories with reduced uncertainty, could mean that uncertainties will increase over the time series.	
		The ERT recommends that the Party include more information on the trend in the uncertainties for its GHG inventory in future inventory submissions, such as that provided to the ERT during the review concerning why improvements did not result in a decrease in the uncertainty.	
G.7	Uncertainty analysis	The Party reported in its NIR (p.A-516) that for most sources, one of six probability density functions was used for the uncertainty analysis: normal, log-normal, uniform, triangular, pert or beta. While extensive information on uncertainty is provided in both the general and the sectoral chapters of the NIR, the ERT noted that it is not always specified which probability density function was used for individual categories.	Not an issue/problem
		During the review, the Party provided the ERT with additional information and examples of the probability density functions used for different categories.	
		The ERT encourages the Party to include in the NIR information on the probability density function used for the uncertainty analysis for each category in those cases where this information is not already included.	

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
G.8	AD	The Party reported in annex 5 to the NIR information on the sources and sinks not estimated in the inventory, which the ERT found very useful. The ERT noted that for some of the sources (e.g. CO_2 emissions from ceramics production and SF_6 and PFCs used in various applications), the likely level of emissions exceeds the significance threshold provided in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines; therefore, these sources cannot be considered insignificant. During the review, the Party clarified that estimating emissions from these sources is a priority and that work on collecting the necessary AD is ongoing. The Party indicated that there is a possibility that the results will be reflected in the 2024 submission. The ERT recommends that the Party continue with the planned improvements with the aim of including the categories not estimated and for which the likely level of emissions exceeds the significance threshold in future submissions and provide an update on progress on the planned improvements concerning the estimation of these categories in the 2023 submission.	Yes. Completeness
Energy			
E.29	1. General (energy sector) – CO_2, CH_4 and N_2O	The Party reported in NIR table A-235 12 sources of emissions under the energy sector not currently estimated in the inventory. Two of the identified sources have no estimation methodology in the 2006 IPCC Guidelines, but the others do have a methodology. These sources are N_2O emissions from biomass combustion for domestic aviation; CH_4 and N_2O emissions from biomass combustion for motorcycles, railways, domestic navigation and non-transportation mobile; CO_2, CH_4 and N_2O emissions from gaseous fuel combustion for navigation; CO_2, CH_4 and N_2O emissions from liquid and gaseous fuels used in pipeline transport; and CO_2, CH_4 and N_2O emissions from medical waste incineration included under category 1.A.5.a. The likely level of emissions is provided for all sources except for CH_4 and N_2O emissions from the combustion of biogas (see ID# E.13 in table 3) and CO_2 emissions from gaseous fuels used in domestic navigation and ranges in amount from miniscule (0.0015 kt CO_2 eq) to close to the threshold of significance (342.6 kt CO_2 eq; the threshold for significance for the United States was 500.00 kt CO_2 eq in 2020). During the review, the Party provided the ERT with information on the priorities assigned to the sources currently not estimated in the inventory. The ERT noted that, in general, the sources with a high likely level of emissions have been assigned a high priority, but one of the sources with the highest likely level of emissions (medical waste incineration) is classified as low priority. The ERT recommends that the Party (1) continue its efforts to estimate and report emissions for sources not currently included in the inventory, especially those sources for which methodologies are available in the 2006 IPCC Guidelines (1.A.3.a domestic aviation (N_2O emissions from biomass), 1.A.3.b.iv motorcycles (CH_4 and N_2O emissions from biomass), 1.A.3.c railways (CH_4 and N_2O emissions from biomass), 1.A.3.d domestic navigation (CH_4 and N_2O emissions from biomass), 1.A.3.d domestic navigation (CO_2 emissions from gaseous fuels), 1.A.3.e.i pipeline transport (CO_2, CH_4 and N_2O emissions from liquid fuels), 1.A.3.e.i pipeline transport (CO_2, CH_4 and N_2O emissions from gaseous fuels), 1.A.3.e.ii non-transportation (CH_4 and N_2O emissions from mobile-biomass), 1.A.5.a incineration of waste (CO_2 emissions from medical waste incineration), 1.A.5.a stationary fuel combustion (CH_4 and N_2O emissions from biomass in United States territories), 1.B.1.a.2.ii fugitive emissions (CO_2 emissions from coal mining related to post-mining activities), 1.B.1.a.1.iii fugitive emissions (CO_2 emissions from abandoned underground coal mines)); and (2) add information to NIR table A-235 on the prioritized efforts relating to the	Yes. Completeness

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		planned improvements for all these sources, noting in particular that the likely level of CH_4 and N_2O emissions from the combustion of biogas is currently missing (see ID# E.13 in table 3).	
E.30	1.A Fuel combustion – sectoral approach – solid, liquid and gaseous fuels – CO_2	The Party described in annex 2.2 to the NIR the methodology and data used to estimate the carbon content of various fuels. The Party noted that the carbon content of different types of coal is based on 8,672 samples, 6,588 of which are samples measured by the United States Geological Survey in 1998. The United States does not use GHGRP data either directly for reporting or indirectly for verification purposes. During the review, the Party clarified that the GHGRP covers only a portion of the total national fossil fuel combustion emissions and that about a third of total emissions are estimated using the tier 3 approach. Furthermore, for data providers using the tier 3 approach, it is not always possible to calculate an EF because emissions and fuel use are reported separately. The United States stated its intention to continue to evaluate the use of GHGRP data for verifying data from other sources. The ERT noted that the GHGRP has been running for many years and hence there is a substantial amount of data available that could provide valuable verification of the currently used EFs. The ERT recommends that the Party utilize data reported under the GHGRP to verify the country-specific CO_2 EFs currently in use for estimating emissions from the combustion of solid, liquid and gaseous fuels, many of which were derived a considerable number of years ago.	Yes. Convention reporting adherence
E.31	1.A Fuel combustion – sectoral approach – gaseous fuels – CO_2, CH_4 and N_2O	The Party reported in CRF tables 1.A(a)s1–1.A(a)s4 two CO_2 IEFs for gaseous fuels: 50.14 t/TJ and 51.72 t/TJ. The ERT noted that it is not clear from the NIR why there are two IEFs and how the United States determined that the higher value would be applied for all subcategories of category 1.A.2 (manufacturing industries and construction) and for subcategory 1.A.4.c.i (stationary (other sectors)) plants in agriculture. During the review, the Party clarified that the different IEFs arose as a result of the inclusion of still gas as a gaseous fuel, and that still gas consumption was assumed to be evenly distributed among the above-mentioned categories. The ERT noted that this categorization of fuels does not follow the definitions provided in the 2006 IPCC Guidelines (see also ID# E.4 in table 3). Furthermore, the ERT noted that still gas is likely to primarily be used in chemical industries close to the place of production and that it seems unlikely that it would be introduced into general natural gas transmission and distribution networks. The ERT recommends that the Party examine the use of still gas with the aim of reporting emissions from the consumption of still gas under the relevant subcategory(ies) rather than assuming that its consumption is evenly distributed across all subcategories of category 1.A.2 (manufacturing industries and construction) and subcategory 1.A.4.c.i (stationary (other sectors)).	Yes. Accuracy
E.32	1.A.1.a Public electricity and heat production – biomass – CO_2, CH_4 and N_2O	The Party reported in its NIR (p.A-136) that only two EFs were considered for biomass, that is, one for wood/wood waste boilers and one for wood recovery boilers. The lowest of the EFs (1 kg/TJ for both CH_4 and N_2O) was used for estimating emissions from wood recovery boilers. The CH_4 and N_2O IEFs reported in CRF table 1.A(a)s1 are both 0.3 kg/TJ. The ERT noted that wood recovery boilers are typically used in the pulp and paper industry rather than in public electricity and heat production. During the review, the Party clarified that woody biomass is used in boilers associated with solid fuel use, such as stokers and fluidized beds, and that an EF of 1.0 kg/TJ was used for wood combustion for estimating both CH_4 and N_2O emissions. However, the emissions were based on fuel use data from the Acid Rain Program data set, while the AD reported in CRF table 1.A(a)s1 were based on EIA data – this leads to the observed difference in IEFs and	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue?[a]
		EFs used. The ERT noted that, except under special circumstances, it is not good practice to base emission estimates on AD that are different from those reported in the CRF tables and that the biomass amount reported by EIA is significantly higher than the data used from the Acid Rain Program. The ERT recommends that the Party investigate the collection of AD to ensure that all biomass is accounted for in the emission estimates for this category.	
E.33	1.A.2 Manufacturing industries and construction – biomass – CO_2, CH_4 and N_2O	The Party reported in CRF table 1.A(a)s2 all biomass consumption under category 1.A.2.g.vii (other), while biomass consumption for all other 1.A.2 subcategories was reported as "IE". During the review, the Party clarified that GHGRP data are determined by fuel type by industry, and then the fuel types are mapped to EIA fuel types and compared with data from the EIA Manufacturing Energy Consumption Survey to develop a time series of fuel use. The United States stated that better matching of GHGRP and Manufacturing Energy Consumption Survey reporting across industries is an ongoing area of work and the focus has been on fossil fuels. The ERT noted that the Manufacturing Energy Consumption Survey includes a category "Other", which includes biomass and other fuels, and that significant consumption is reported for industries such as "Food", "Wood products" and "Paper", which normally are significant consumers of biomass. The ERT recommends that the Party explore the available energy data with the aim of reporting biomass consumption under the correct subcategory(ies) of 1.A.2 rather than following the current practice of reporting all consumption under 1.A.2.g.vii (other) and reporting consumption for all other subcategories as "IE".	Yes. Comparability
E.34	1.A.3.a Domestic aviation – jet kerosene – CO_2, CH_4 and N_2O	The ERT noted that the carbon EF used under the reference approach (18.67 t C per TJ, corresponding to about 68.5 t CO_2 per TJ) is quite different from the IEF reported under the sectoral approach for international bunkers (66.89 t CO_2 per TJ) but matches the IEF for domestic aviation. During the review, the Party clarified that bunker fuel emissions from commercial aircraft were estimated using the tier 3 methodology while bunker fuel emissions from domestic aviation were estimated using the tier 2 methodology with the same EF as that used for the reference approach. The rationale provided for using the tier 2 methodology for domestic aviation when data for implementing a tier 3 methodology are available was to be consistent with the tier used for other energy combustion emissions. The ERT noted that data on the origin and destination of flights and on air traffic movements are available and the emissions could be estimated using the tier 3 methodology. The ERT recommends that the Party make use of the available data, which are already applied to international aviation, for estimating emissions from domestic aviation, thereby improving the accuracy of the emission estimates.	Yes. Accuracy
E.35	1.A.5.a Stationary – other fossil fuels – CO_2, CH_4 and N_2O	The Party described in its NIR (section 3.3, p.3-57, and annex 3.7, p.A-225) the methodology and data used for estimating emissions from waste incineration. However, the ERT could not identify the Party's rationale for using CH_4 and N_2O EFs to back estimate waste amounts. Furthermore, the ERT was unable to reproduce the calculations for CH_4 and N_2O emissions. During the review, the Party clarified that data on the amount of waste do not come directly from the GHGRP; non-CO_2 emissions from waste incineration were calculated using default EFs from the 2006 IPCC Guidelines in order to back estimate these data. The United States also clarified that the unit indicated in NIR tables 3-27 and A-110 ("metric tons") is incorrect; the correct unit is short tons.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		The ERT recommends that the Party (1) expand in the NIR the explanation of how data on waste amounts have been derived and why using CH_4 and N_2O emissions as a proxy for these data is suitable and (2) correct the unit in NIR tables 3-27 and A-110 from "metric tons" to "short tons".	
E.36	1.C CO_2 transport and storage – CO_2	The Party presented AD for EOR and geological sequestration of CO_2 in NIR box 3-6 (p.3-87) but reported AD and CO_2 emissions as "IE" in CRF table 1.C. The Party explained in CRF table 9 that emissions for EOR are included in CRF table 1.B.2, but geologic sequestration is not mentioned. Furthermore, the ERT noted that no recovery is reported from oil and gas in CRF table 1.B.2 and the amount of CO_2 recovered from the fuel combustion sector is very small (0.005 kt in 2020) and significantly less than what is reported in the NIR.	Yes. Transparency
		During the review, the Party indicated that work on evaluating the use of GHGRP data for reporting CO_2 capture and sequestration, including discussion with stakeholders, is under way and that it plans to include the results of this work in the 2023 or 2024 submission.	
		The ERT recommends that the Party (1) complete the work on evaluating the suitability of GHGRP data for reporting on CO_2 capture and geological sequestration and (2) report relevant AD and emissions in CRF table 1.C, report the amount of CO_2 recovered, by sector, in the relevant CRF tables, and document the estimation in the NIR.	
IPPU			
I.20	2.A.3 Glass production – CO_2	The Party reported in its NIR (p.4-22) that the AD used for estimating CO_2 emissions from glass production consist of the amounts of limestone, dolomite and soda ash used in glass production. The Party also reported that the data are obtained from three sources: GHGRP, the United States Geological Survey and the United States Bureau of Mines. The Party stated in the NIR (p.4-22) that "GHGRP collects data from glass production facilities with greenhouse gas emissions greater than 25,000 metric tons CO_2 Eq". For soda ash, information on facilities with emissions below this threshold is obtained from the United States Geological Survey, but for limestone and dolomite, the source of this information is not described in the NIR.	Yes. Accuracy
		During the review, the Party clarified that some glass production facilities fall below the GHGRP reporting threshold for limestone and dolomite. The Party indicated that work on better assessing the completeness of emission estimates is ongoing. The ERT noted that the emissions from glass production are currently underestimated in the inventory for all years of the time series and pointed out that expert judgment could be used to derive the national total consumption of dolomite and limestone to produce glass.	
		The ERT recommends that the Party estimate and report the emissions from all glass production occurring in the country by collecting the missing data from facilities whose production generates emissions that fall below the established threshold of 25,000 metric tonnes CO_2 eq used by the GHGRP, or by obtaining expert judgment on the national total consumption of dolomite and limestone in glass production, which is currently not considered.	
I.21	2.B.1 Ammonia production – CO_2	The Party reported in its NIR (p.4-31) that the CO_2 that is captured during the NH_3 production process and used to produce urea does not contribute to the CO_2 emission estimates for NH_3 production. CO_2 emissions resulting from the consumption of urea are attributed to the category where urea is consumed or applied. CO_2 emissions from agricultural applications of urea are accounted for under the agriculture sector, in category 3.H (urea application) (NIR section 5.6). CO_2 emissions from non-agricultural applications of urea are accounted for under the IPPU sector, in category 2.B.10 (NIR section 4.6).	Not an issue/problem

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue?[a]
		In category 3.H, the data on urea application for 2017–2020 were not available so were estimated by the Party (NIR p.5-50) in line with 2006 IPCC Guidelines and then deducted from the total domestic supply of urea to estimate emissions from urea consumption for non-agricultural purposes under category 2.B.10 (other (chemical industry)). The ERT encourages the Party to continuing obtaining data on urea application from 2017 onward as in previous submissions.	
I.22	2.F.1 Refrigeration and air conditioning – HFCs	The Party reported in NIR equation A-8 (annex 3.9, p.A-238) the approach for estimating emissions from the manufacturing of refrigeration and air-conditioning equipment. In this equation, the quantity of chemical in new equipment is multiplied by an EF and adjusted for applicability to obtain the emissions. Manufacturing EFs used by the Party were reported in NIR table A-122 but the source of the EFs was not provided (see ID# I.23 below). During the review, the Party clarified that first-fill emissions are a function of the quantity of chemical contained in new equipment and the proportion of equipment that is filled with refrigerant in the United States. The Party also clarified that first-fill loss rates used were informed by several sources, including the 2006 IPCC Guidelines, Italy's NIR and reports published by the Department of Energy and Climate Change of the United Kingdom of Great Britain and Northern Ireland in 2011 and 2014 (with the more recent report containing individual end-use first-fill estimates). The ERT noted that the EFs provided in table 7.9 of the 2006 IPCC Guidelines (vol. 3, chap. 7) are expressed in percentage of initial charge, not in percentage of gas contained in the equipment after first filling. The ERT also noted that gas that is contained in new equipment is already deducted from the emissions that have occurred during the prefilling of gases in manufacturing operations. Therefore, applying the EF to the amount of gas contained in new equipment results in a potential underestimation of emissions from the manufacturing of refrigeration and air-conditioning equipment. Furthermore, the ERT noted that the Party did not provide evidence in the NIR that the emission estimates cover all gases used for first filling (either in the AD or the EF) in order to demonstrate that an underestimation of emissions does not occur. The ERT recommends that the Party either provide in the NIR evidence that the current estimates cover all the gases used in the first filling of refrigeration and air-conditioning equipment or recalculate HFC emissions for category 2.F.1 (refrigeration and air conditioning) by updating the amount of gas filled into new equipment or by adjusting the EF to account for the prefilling emissions that occurred during manufacturing.	Yes. Accuracy
I.23	2.F Product uses as substitutes for ozone-depleting substances – HFCs and PFCs	The Party described in its NIR (section 4.24) the approach followed for estimating emissions from product uses as substitutes for ODS (category 2.F), providing the HFC and PFC emissions as well as information on the subcategories estimated in the inventory: 2.F.1 (refrigeration and air conditioning), 2.F.4 (aerosols), 2.F.2 (foam blowing agents), 2.F.5 (solvents) and 2.F.3 (fire protection). During the review, the Party explained that it uses the Vintaging Model for estimating category 2.F emissions. As noted in the NIR (p.4-140), the model "predicts ODS and ODS substitute use in the United States based on modelled estimates of the quantity of equipment or products sold each year containing these chemicals and the amount of the chemicals required to manufacture and/or maintain equipment and products over time". The Party referred the ERT to annex 3.9 to the NIR, in which it provided a brief description of the modelling approach, the methodology followed and assumptions made by subcategory, and the model outputs. Regarding the AD used, the Party stated (NIR p.A-236) that the Vintaging Model synthesizes data from a variety of sources, including the ODS tracking system maintained by the Stratospheric Protection Division of EPA, the GHGRP run by the Climate Change Division of EPA, submissions to EPA under its Significant New Alternatives Policy programme, and	Yes. Convention reporting adherence

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue?[a]
		various sources published by international organizations. The information provided on assumptions includes information on market transition assumptions and parameters used in the estimation (i.e. EFs and lifetime of equipment). The market transition assumptions consist of a definition of substitutes by end-use category and the average growth rate for individual market sectors from the base year to 2030. Regarding the parameters used in the estimation, the Party provided summary information by end use, using ranges to represent the values that are used within specific end-use categories. The ERT noted that according to paragraph 50 of the UNFCCC Annex I inventory reporting guidelines, "the NIR shall include: (a) Descriptions, references and sources of information for the specific methodologies, including higher-tier methods and models, assumptions, EFs and AD, as well as the rationale for their selection. For tier 3 models, additional information for improving transparency," with footnote 11 specifying that "Parties should, as applicable, report information on: basis and type of model, application and adaptation of the model, main equations/processes, key assumptions, domain of application, how the model parameters were estimated, description of key inputs and outputs, details of calibration and model evaluation, uncertainty and sensitivity analysis, QA/QC procedures adopted and references to peer-reviewed literature". The ERT also noted that the Party did not provide in the NIR the input data used in the calculations (see ID# I.26 below) or describe in sufficient detail how the parameters used in the model were estimated (see ID#s I.24 and I.25 below). Furthermore, references to peer-reviewed literature and information on the sensitivity of the estimations were not provided. Additionally, the ERT noted that the Party did not report in the QA/QC section the results of a comparison of the estimates obtained from the Vintaging Model with those obtained using the tier 1 approach. The ERT recommends that the Party report information on key input and output data used in the Vintaging Model, a detailed description of how the parameters used in the model at end-use category were estimated, references to peer-reviewed literature on the modelling approach followed by the model, a sensitivity analysis of the estimates made by the model, and a comparison of the estimates obtained from the model with those obtained using the tier 1 estimation approach.	
I.24	2.F Product uses as substitutes for ozone-depleting substances – HFCs	The Party reported in NIR tables A-121 and A-123–A-128 (annex 3.9) average annual growth rates for individual market sectors by gas and equipment type. The Party stated that "the market for each equipment type is assumed to grow independently, according to annual growth rates" (p.A-239). The ERT noted that the raw data used by the Vintaging Model and information on how annual growth rates are used in the methodology to estimate the AD are not included in the NIR. During the review, the Party explained that the Vintaging Model estimates begin with a 1985 stock and sales estimate for each end use. An annual growth rate is then applied to the 1985 sales estimate to reflect growth in the market. In a given year, total stock for each end use is equivalent to the stock from the previous year plus new units/chemical entering the market less units/chemical reaching end of life (i.e. disposed) or emitted. Furthermore, the Party clarified that owing to confidentiality concerns and the other assumptions applied, it was unable to share 1985 stock and sales estimates for every end use. However, the Party provided an example for motor vehicle air conditioning, where the annual growth rate assumption was applied annually since 1985 to a sales estimate to calculate the total stock as the stock in the previous year, plus sales in the current year, minus the amount disposed of in the current year. The ERT concluded that the Party has applied the splicing technique 'surrogate data' (2006 IPCC Guidelines, vol. 1, chap. 5), using 1985 data as the basis for estimating the AD for the whole time series, and	Yes. Accuracy

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue?[a]
		noted that this approach substantially increases the uncertainty of category 2.F, which is a key category for the level and the trend (NIR table 1.4, p.1-20). The ERT recommends that the Party collect data with which to update the 1985 estimate of stock of gases in operation, recalculate the emissions for the entire time series (1990–2020) and report the differences between the current and recalculated estimates in the next inventory submission. The ERT encourages the Party to prioritize this category in the improvement plan of the inventory given the importance of the emissions source (2.F is a key category for the level and the trend) and the very high uncertainty of the estimates.	
I.25	2.F Product uses as substitutes for ozone-depleting substances – HFCs	The Party reported in its NIR (pp.4-141–4-142) that data from HFC suppliers have been collected under the GHGRP since 2011, but that "GHGRP data is not used directly to estimate emissions of ODS Substitutes because it does not include complete, publishable information on the sectors or end-uses in which that chemical will be used, so it does not provide the data that would be needed to calculate the source or time that chemical is emitted". Furthermore, the Party noted in the NIR (p.4-145 and annex 3) that GHGRP data are not considered complete because suppliers could be underreporting to the GHGRP. Despite this potential underreporting, the ERT noted that, for 2020, GHGRP data are 22 per cent higher than the input data used by the Vintaging Model (NIR table 4-105 and annex 3). The ERT also noted that the Vintaging Model does not include every saturated HFC that is reported under the GHGRP (NIR p.4-144 and annex 3). During the review, the Party clarified that information on the differences between the data from the two sources is reported in the NIR (p.4-142 and annex 3) and highlighted that the GHGRP data relate to net supply, and therefore the comparison with the Vintaging Model input data used for the inventory is one of potential emissions versus actual emissions. The ERT noted that the data have different scopes (supply versus estimated consumption). However, as noted in the NIR, the GHGRP data are not complete (not all HFC supply is considered), and despite the time lapse between supply and consumption, the comparison between the summation of all years for which data are available leads to differences of more than 10 per cent, reflecting inconsistencies in the approach followed by the Vintaging Model (either in the growth rates used to calculate the input gases or in the assumptions made to calculate the amount of gases in operation in equipment). The Party informed the ERT that future reporting under the American Innovation and Manufacturing Act may provide some useful information for verifying and possibly improving the Vintaging Model, although this reporting is not expected to resolve the fact that bulk supply data are not available at the level of detail necessary to allocate quantities to each end use. The Party indicated that any improvements using these new data will be incorporated into the 2024 or 2025 submission at the earliest. The ERT recommends that the Party (1) collect new input data for the Vintaging Model (including data on the amount of gas used in manufacturing, amount of gas contained in equipment in operation and amount of gas disposed of) that will allow it to recalculate the emissions for category 2.F for the entire time series (1990–2020); and (2) find a way to enhance the completeness of reporting to include all fluorinated gases used in the country.	Yes. Accuracy
I.26	2.F Product uses as substitutes for ozone-depleting substances – HFCs and PFCs	The Party reported in NIR table A-122 (annex 3.9) the EFs used for calculating HFC emissions from refrigeration and air conditioning, by end use, including information on the lifetime of equipment. Furthermore, the Party explained in the NIR that EFs for disposal emissions were developed taking into account the original charge capacity of the equipment. The original charge of the equipment was also used in equations A-8, A-9 and A-10 to calculate emissions from manufacturing, operation and disposal respectively. However, the ERT noted that the amount of gases charged into the equipment (i.e. the nominal capacity of gases) was not reported in the NIR.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		During the review, the Party clarified that information on charge amounts was gathered from sources similar to those from which the assumptions used for deriving EFs were obtained. Furthermore, the Party provided charge amounts by equipment type that are representative of the ODS charge amount assumptions used in the Vintaging Model for some end uses. However, the HFC charge amount of the equipment was not provided. The ERT recommends that the Party report in the NIR information on the charge capacity of equipment, by equipment type, used in estimating emissions for category 2.F, specifying the source of information and clarifying the assumptions made, if any.	
I.27	2.F.1 Refrigeration and air conditioning – HFCs	The Party reported in NIR table A-122 (annex 3.9) the parameters used for calculating HFC emissions from refrigeration and air conditioning, by end use, including information on the lifetime of equipment. The lifetime data and EFs were presented as ranges for most end-use categories to protect the confidentiality of the source of individual EFs used, as noted in the NIR (p.A-236), including for centrifugal chillers, commercial unitary air conditioning, industrial process refrigeration, mobile air conditioners and transport refrigeration. The ERT noted that presenting the information in the form of ranges prevents a detailed assessment of the adequacy of the EFs used at the equipment level and the source of information for each of the parameters used was not provided in the NIR. During the review, the Party clarified that some of the end-use categories presented in NIR table A-122 include multiple end uses, in particular transport refrigeration and mobile air conditioners, which results in a wide-ranging annual emission rate estimate. The Party provided the EFs used for calculating emissions from stocks in transport refrigeration and mobile air conditioners, as follows (in per cent): transport refrigeration (aggregated), 19.4–36.4; road transport, 23.2–36.4; intermodal containers, 19.4–26.4; merchant fishing transport, 33.2; reefer ships, 23.2; modern rail transport, 33.2; mobile air conditioners (aggregated), 2.3–18.0; light-duty vehicles, 66.4–18.0; light-duty trucks, 5.9–13.0; heavy-duty vehicles, 13.0; school and tour buses, 9.6; transit buses, 9.6; and trains, 2.3. The Party also provided references to the source of information on the lifetime of equipment as follows: stand-alone commercial applications (2006 IPCC Guidelines), small retail food equipment (EPA, 2016; United Nations Environment Programme, 2010), ice makers/machines (EPA, 2016) and vending machines (EPA, 2016; United States Department of Energy, 2001; Lawrence Berkeley National Laboratory, 2004; National Automatic Merchandising Association, 2007; Oko-Recherche GmbH, 2011; ARMINES, 2010). The ERT noted that the EFs provided by the Party fall outside the default EF ranges provided in the 2006 IPCC Guidelines (vol. 3, table 7.9) for light-duty vehicles, light-duty trucks, school and tour buses, transit buses and trains; for these end uses, the Party did not specify in the NIR the source of information for the EFs used or an explanation of the differences between the EFs used and the default EFs from the 2006 IPCC Guidelines. The ERT also noted that the EFs reported in NIR table A-122 are provided in the form of ranges for most end-use categories, and transport refrigeration is not differentiated from mobile air conditioning. Furthermore, the ERT noted that the rationale behind the assumptions made regarding the selection of EFs and the lifetime of equipment was not reported in the NIR. The ERT concluded that the information reported in the NIR does not allow a determination of the EFs used by the Party by end-use category. During the review, the Party noted that the assumption and inputs are based on sources specific to the United States where possible and may differ from default values in the 2006 IPCC Guidelines. Furthermore, the Party noted that the EF ranges presented in NIR annex 3.9 represent the EFs for all vintages within a specific equipment type that are within the installed base in the baseline years of the NIR (therefore, older vintages with higher EFs than newer	Yes. Transparency

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue?[a]
		vintages may be represented in the ranges provided). The Party indicated that it intends to investigate the possibility of providing further disaggregated data as described. If such data can be reported without divulging confidential business information used to develop the model, they will be included as available, starting with the 2025 inventory submission. The ERT recommends that the Party report (or provide a reference to) in the NIR disaggregated information on the EFs and lifetime of equipment by type of equipment under each end-use category, avoiding the use of ranges where it does not divulge confidential information, providing the source of information for each parameter and justifying the selection of each parameter.	
I.28	2.F.1 Refrigeration and air conditioning – HFCs	The Party reported in NIR tables A-121 and A-123–A-128 (annex 3) the assumptions made regarding the penetration of new equipment into the market for the different activities under category 2.F. The Party noted in the NIR (p.A-239) that "as new technologies replace older ones, it is generally assumed that there are improvements in their leak, service, and disposal emission rates". The ERT noted that the impact on the inventory methodology (i.e. AD and EFs used) of the assumptions made regarding the penetration of new equipment and the improvement in leaks is not described in the NIR. During the review, the Party clarified that while its discussions with equipment manufacturers indicate that it is widely maintained that new equipment generally has an improved leak rate, not all refrigeration and air-conditioning equipment is modelled to have an incremental improvement in leak rate over time in the Vintaging Model. The Party described the example of motor vehicle air conditioners, which are estimated in the Vintaging Model using average vehicle leak rates for passenger vehicles reported to the Minnesota Pollution Control Agency. The Party provided information on the evolution of the average EFs by vehicle type for 2009–2018. The ERT noted that the information provided by the Party consists of average EFs by equipment type and year for the end-use category mobile air conditioning. This information suggests that the penetration assumptions reported in the NIR impact the average EFs used by equipment type under each end-use category. The ERT also noted that the Party complemented the transition assumptions with additional assumptions from different sources to estimate the time series of each EF. The ERT further noted that information specifying the assumptions made and their source and the rationale behind the method for estimating the temporal evolution of EFs are not provided in the NIR. The ERT recommends that the Party report in the NIR information on the time series of EFs by equipment type, specifying what assumptions have been made to estimate the temporal evolution of these EFs and providing the source of information on each assumption made.	Yes. Transparency
Agriculture		No findings for the agriculture sector additional to those included in table 3 were made by the ERT during the review.	
LULUCF			
L.34	Land representation	The Party reported in its NIR (section 6.1 ("Recalculations discussion"), p.6-23) that no recalculations were performed for the 1990–2019 portion of the time series, thus the land-use areas for 2020 were assumed to be the same as those for 2019. The ERT noted that the area of forest land has been recalculated. During the review, the Party clarified that the AD reported in CRF table 4.A have not been recalculated, while the corresponding forest land data in CRF table 4.1 have been recalculated. The Party also clarified that land representation was not updated for the 2022 submission, in either the NIR or the CRF tables, because updates were not ready in time for the QA processes planned (NIR pp.6-10 and 6-23). The Party further clarified that data from	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		the updated Forest Inventory and Analysis programme of the USDA Forest Service were included in the estimates related to forest land (NIR p.6-10), which explains the differences in data reported across CRF tables 4.1 and 4.A and sections of the NIR (i.e. 6.1 on land representation and 6.2 on forest land). The Party informed the ERT that for the 2022 submission, a simple approach to extend the land representation to 2020 was applied and that a complete updated land representation will be reported in the 2023 submission, resolving the existing discrepancies. The ERT noted that this is inconsistent with the 2006 IPCC Guidelines (vol. 4, chap. 3 (land representation)) because the data reported in the land matrix table should be consistent with the AD reported in the sectoral background tables used for the estimation of emissions and removals. The ERT recommends that the Party ensure that land representation is consistent throughout the next inventory submission, with AD on the assessed land-use categories being used consistently for estimating emissions and removals and reported consistently in the relevant CRF tables, as well as being described adequately in the relevant sections of the NIR.	
L.35	4(V) Biomass burning – CH_4 and N_2O	The Party reported CH_4 and N_2O emissions from biomass burning in forest land remaining forest land in CRF table 4(V). The ERT noted that the areas affected by fires were recalculated for the entire time series but a summary table containing the recalculations performed by year and the key drivers of the recalculations was not provided in the NIR. During the review, the Party clarified that for Alaska, areas affected by fires were updated for the entire time series while for the conterminous United States, they were updated for 2000–2020. The Party confirmed that, as reported in the NIR (p.6-41), these data updates resulted in recalculations for specific years. In addition, as described in the NIR (pp.6-37 and 6-41), updates to the fire methodology mean that emission estimates for prescribed fires are no longer reported separately, which necessitated broader recalculations across the time series. The ERT encourages the Party to increase the transparency of its reporting by including in the NIR a summary table containing the recalculations performed, by year, and the key drivers of the recalculations for CH_4 and N_2O emissions from biomass burning in forest land remaining forest land.	Not an issue/problem
Waste		No findings for the waste sector additional to those included in table 3 were made by the ERT during the review.	

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

Annex I

Overview of greenhouse gas emissions and removals as submitted by the United States of America in its 2022 inventory submission

Tables I.1–I.3 provide an overview of the total GHG emissions and removals as submitted by the United States.

Table I.1
Total greenhouse gas emissions for the United States of America, 1990–2020
(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions and removals including indirect CO_2 emissions*[a]	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*
1990	5 592 825.17	6 453 450.22	NA	NA
1995	5 953 586.11	6 785 363.61	NA	NA
2000	6 502 364.38	7 327 593.21	NA	NA
2010	6 246 405.88	7 007 442.26	NA	NA
2011	6 044 358.10	6 845 087.12	NA	NA
2012	5 806 598.66	6 606 523.76	NA	NA
2013	6 017 079.95	6 784 494.22	NA	NA
2014	6 061 974.19	6 843 355.82	NA	NA
2015	5 988 939.72	6 689 006.13	NA	NA
2016	5 711 228.86	6 537 871.03	NA	NA
2017	5 719 766.06	6 500 975.39	NA	NA
2018	5 918 246.01	6 687 512.57	NA	NA
2019	5 841 238.06	6 571 725.75	NA	NA
2020	5 222 411.06	5 981 354.37	NA	NA

Note: Emissions and removals reported for the sector other (sector 6) are not included in the total GHG emissions.
[a] The Party did not report indirect CO2 emissions in CRF table 6.

Table I.2
Greenhouse gas emissions by gas for the United States of America, excluding land use, land-use change and forestry, 1990–2020
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	5 122 496.25	780 814.10	450 473.41	46 289.63	24 255.67	226.82	28 846.42	47.92
1995	5 427 798.48	773 178.68	466 534.27	72 513.41	18 642.94	1 745.43	24 867.18	83.24
2000	6 016 350.57	718 072.37	442 316.43	113 434.15	15 928.35	4 710.43	16 576.66	204.24
2010	5 681 392.04	705 311.78	452 709.36	145 668.17	4 768.81	9 746.39	7 288.03	557.69
2011	5 546 628.96	679 771.45	443 410.87	148 714.75	7 348.24	10 432.94	8 203.72	576.19
2012	5 345 454.26	674 575.23	414 617.44	147 025.18	6 433.40	11 111.55	6 728.62	578.07
2013	5 480 926.10	670 076.22	461 722.20	146 947.86	6 156.13	11 797.33	6 369.04	499.34
2014	5 528 871.28	666 072.51	471 769.75	151 551.24	5 788.30	12 438.74	6 347.47	516.55
2015	5 376 577.93	666 713.76	466 466.83	154 139.17	5 237.25	13 830.42	5 474.38	566.38
2016	5 251 757.63	657 592.19	449 199.71	153 387.82	4 424.97	14 918.20	6 019.33	571.18
2017	5 210 957.58	663 758.35	444 577.11	154 982.14	4 153.96	16 120.96	5 860.20	565.08
2018	5 376 657.23	671 097.63	457 717.22	154 399.11	4 758.41	16 643.49	5 652.95	586.54
2019	5 259 143.84	668 826.70	456 808.87	159 188.02	4 578.80	16 751.09	5 856.50	571.92
2020	4 715 691.11	650 419.18	426 053.93	162 201.98	4 412.32	16 553.49	5 401.65	620.71
Percentage change 1990–2020	**–7.9**	**–16.7**	**–5.4**	**250.4**	**–81.8**	**7 198.0**	**–81.3**	**1 195.3**

Note: Emissions and removals reported for the sector other (sector 6) are not included in this table.
[a] The United States did not report indirect CO_2 emissions in CRF table 6.

Table I.3
Greenhouse gas emissions and removals by sector for the United States of America, 1990–2020
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	5 341 126.66	346 239.67	551 889.92	–860 625.06	214 193.98	NA
1995	5 626 731.95	375 063.81	571 028.87	–831 777.50	212 538.97	NA
2000	6 195 590.92	395 091.75	553 619.18	–825 228.83	183 291.36	NA
2010	5 884 060.41	362 821.54	592 764.56	–761 036.38	167 795.76	NA
2011	5 732 066.57	379 353.26	574 256.28	–800 729.02	159 411.01	NA
2012	5 520 534.25	367 821.14	556 725.96	–799 925.11	161 442.42	NA
2013	5 661 084.21	367 798.28	597 736.85	–767 414.26	157 874.88	NA
2014	5 700 328.27	378 910.16	606 528.69	–781 381.63	157 588.70	NA
2015	5 543 136.94	375 856.34	613 529.53	–700 066.41	156 483.32	NA
2016	5 413 123.45	368 987.57	601 866.26	–826 642.17	153 893.76	NA
2017	5 372 745.63	369 363.07	603 195.69	–781 209.32	155 670.99	NA
2018	5 539 451.84	373 420.00	616 720.21	–769 266.57	157 920.53	NA
2019	5 409 760.62	379 537.11	622 860.79	–730 487.69	159 567.23	NA
2020	4 854 672.14	376 429.09	594 668.53	–758 943.31	155 584.61	NA
Percentage change 1990–2020	**–9.1**	**8.7**	**7.8**	**–11.8**	**–27.4**	**NA**

Note: The United States did not report indirect CO_2 emissions in CRF table 6.

Annex II

Additional information to support findings in table 2

Missing categories that may affect completeness

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

(a) 1.A fuel combustion (CH_4 and N_2O emissions from biogas) (see ID# E.13 in table 3);

(b) 1.A.3 transport (CO_2, CH_4 and N_2O emissions from liquid fuels in domestic navigation) (see ID# E.18 in table 3);

(c) 1.A.3.a domestic aviation (N_2O emissions from biomass) (see ID# E.29 in table 5);

(d) 1.A.3.b road transportation – liquid fuels (CO_2) – fossil carbon component of biofuel (see ID# E.21 in table 3);

(e) 1.A.3.b.iv motorcycles (CH_4 and N_2O emissions from biomass) (see ID# E.29 in table 5);

(f) 1.A.3.c railways (CH_4 and N_2O emissions from biomass) (see ID# E.29 in table 5);

(g) 1.A.3.d domestic navigation (CH_4 and N_2O emissions from biomass) (see ID# E.29 in table 5);

(h) 1.A.3.d domestic navigation (CO_2 emissions from gaseous fuels) (see ID# E.29 in table 5);

(i) 1.A.3.e.i pipeline transport (CO_2, CH_4 and N_2O emissions from liquid fuels) (see ID# E.29 in table 5);

(j) 1.A.3.e.i pipeline transport (CO_2, CH_4 and N_2O emissions from gaseous fuels) (see ID# E.29 in table 5);

(k) 1.A.3.e.ii non-transportation (CH_4 and N_2O emissions from mobile-biomass) (see ID# E.29 in table 5);

(l) 1.A.5.a incineration of waste (CO_2 emissions from medical waste incineration) (see ID# E.29 in table 5);

(m) 1.A.5.a stationary fuel combustion (CH_4 and N_2O emissions from biomass in United States territories) (see ID# E.29 in table 5);

(n) 1.B.1.a.2.ii Fugitive Emissions (CO_2 emissions from coal mining related to post-mining activities) (see ID# E.29 in table 5);

(o) 1.B.1.a.1.iii fugitive emissions (CO_2 emissions from abandoned underground coal mines) (see ID# E.29 in table 5);

(p) 1.C CO_2 transport and storage (CO_2) (see ID# E.36 in table 5);

(q) 2.A.4 other process uses of carbonates (CO_2 emissions for categories 2.A.4.a (ceramics) and 2.A.4.c (non-metallurgical magnesium production)) (see ID# I.3 in table 3);

(r) 2.B.8 petrochemical and carbon black production (CH_4 and N_2O emissions from ethylene production) (see ID# I.9 in table 3);

(s) 2.G.2 SF_6 and PFCs from other product use (SF_6 and PFC emissions from airborne warning and control systems, particle accelerators and radars) (see ID# I.19 in table 3);

(t) 3 general (agriculture) (CH_4 and N_2O emissions for Alaska and Hawaii) (see ID# A.1 in table 3);

(u) 3.D direct and indirect N_2O emissions from agricultural soils for Alaska and Hawaii (see ID# A.17 in table 3);

(v) 4 general (LULUCF) (carbon stock changes in the living biomass and DOM pools for categories 4.D.2.2.1 (forest land converted to peat extraction) and 4.F.2.1 (forest land converted to other land)) (see ID# L.1 in table 3);

(w) 4.B cropland (carbon stock changes in living biomass in perennial crops for all years) (see ID# L.13 in table 3);

(x) 4.B.2.2 grassland converted to cropland (carbon stock changes in biomass) (see ID# L.14 in table 3);

(y) 4.C.2.2 cropland converted to grassland (carbon stock changes in biomass) (see ID# L.17 in table 3);

(z) 4.E.2.2 cropland converted to settlements and 4.E.2.3 grassland converted to settlements (biomass carbon stock changes) (see ID# L.24 in table 3);

(aa) 4.F.2 land converted to other land (carbon stock changes) (see ID# L.26 in table 3);

(bb) 4(III) direct N_2O emissions from N mineralization/immobilization (N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands, settlements and other land, as well as for their conversion to and from cropland and grassland) (see ID# L.31 in table 3);

(cc) 4(IV) indirect N_2O emissions from managed soils (indirect N_2O emissions associated with the mineralization of the N content of SOC losses in mineral soils for forest land, wetlands and other land) (see ID# L.32 in table 3);

(dd) 4(V) biomass burning (CH_4 and N_2O emissions from biomass burning for land converted to forest land and land converted to wetlands, cropland, grassland and settlements) (see ID# L.33 in table 3).

Annex III

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

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C. Other documents used during the review

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