United Nations

FCCC/ARR/2021/TUR

Framework Convention on Climate Change

Distr.: General
5 May 2022

English only

Report on the individual review of the inventory submission of Turkey submitted in 2021*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual inventory of emissions and removals of greenhouse gases for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). This report presents the results of the individual review of the 2021 inventory submission of Turkey, 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 4 to 9 October 2021 remotely.

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

Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
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"
COPERT	software tool for calculating road transport emissions
CRF	common reporting format
DOM	dead organic matter
EF	emission factor
ERT	expert review team
EU	European Union
FAOSTAT	statistical database of the Food and Agriculture Organization of the United Nations
F-gas	fluorinated gas
$Frac_{LEACH-(H)}$	fraction of nitrogen input to managed soils that is lost through leaching and run-off
GE	gross energy intake
GHG	greenhouse gas
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
LULUCF	land use, land-use change and forestry
MMS	manure management system(s)
MSW	municipal solid waste
N	nitrogen
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
Nex	nitrogen excretion
NF_3	nitrogen trifluoride
NIR	national inventory report
NO	not occurring
PFC	perfluorocarbon
QA/QC	quality assurance/quality control
SF_6	sulfur hexafluoride
SOC	soil organic carbon
SOM	soil organic matter
TAM	typical animal mass
TOW	total organic load in wastewater
T_{PLANT}	degree of utilization of modern, centralized wastewater treatment plants

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"
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 2021 inventory submission of Turkey, organized by the secretariat in accordance with the UNFCCC review guidelines, particularly 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 4 to 9 October 2021 remotely[1] and was coordinated by Roman Payo, Sohel Pasha, Karin Simonson and Claudia do Valle (secretariat). Table 1 provides information on the composition of the ERT that conducted the review for Turkey.

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

Area of expertise	*Name*	*Party*
Generalist	Justin Goodwin	United Kingdom
	Marcelo Theoto Rocha	Brazil
Energy	Pierre Boileau	Canada
	Veronica Eklund	Sweden
	Yuriko Hayabuchi	Japan
	Nicola McPherson	Australia
IPPU	Yongsook Lyu	Republic of Korea
	Juan Luis Martin Ortega	El Salvador
	Mauro Meirelles de Oliveira Santos	Brazil
Agriculture	Laura Cardenas	United Kingdom
	Etienne Mathias	France
	Batima Punsalmaa	Mongolia
LULUCF	Pierre Brender	United Kingdom
	Craig Elvidge	New Zealand
	Yasna Rojas Ponce	Chile
Waste	Satoshi Kawanishi	Japan
	Tertius Vitus de Kluyver	Australia
	Tatiana Tugui	Republic of Moldova
Lead reviewers	Justin Goodwin	
	Marcelo Theoto Rocha	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2021 inventory submission in accordance with the UNFCCC review guidelines.

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

4. A draft version of this report was communicated to the Government of Turkey, 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 Turkey, including totals excluding and including LULUCF, indirect CO_2 emissions, and emissions by gas and by sector.

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

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

II. Summary and general assessment of the Party's 2021 inventory submission

6. Table 2 provides the assessment by the ERT of the Party's 2021 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 2021 inventory submission of Turkey

Assessment			*Issue ID#(s) in table 3 or 5*[a]
Date of submission	Original submission: NIR, 13 April 2021; CRF tables (version 1), 13 April 2021		
Review format	Centralized review conducted remotely		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and the Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	E.18, I.10, I.26, I.33, I.34, I.36, I.37, A.8, L.10, L.29, W.7, W.9, W.10
	(c) Development and selection of EFs?	Yes	I.20, L.32
	(d) Collection and selection of AD?	Yes	E.5, E.11, E.15, E.20, I.15, A.9, L.9, L.19, L.31
	(e) Reporting of recalculations?	No	
	(f) Reporting of a consistent time series?	Yes	E.9, E.21, I.6, A.12, A.13, L.8
	(g) Reporting of uncertainties, including methodologies?	Yes	E.10
	(h) QA/QC?	Yes	L.14
	(i) Missing categories, or completeness?[b]	Yes	E.17, E.19, I.3, I.4, I.19, I.22, I.24, I.25, L.17, L.25
	(j) Application of corrections to the inventory?	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines?	Yes	
Description of trends	Did the ERT conclude that the description in the NIR of the trends for the different gases and sectors is reasonable?	No	G.2, L.20
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	
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 II.

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 26 May 2020,[3] and had not been resolved by the time of publication of the report on the review of the Party's 2019 inventory submission. The ERT has specified whether it believes the Party had resolved, was addressing or had not resolved each issue 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 Turkey

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	Inventory submission (G.4, 2019) Completeness	Improve the completeness of the inventory, in particular for those categories for which there are methodologies available in the 2006 IPCC Guidelines, by collecting the required data and estimating the related emissions for the next inventory submission.	Resolved. The Party reported in its NIR additional categories for which methodologies are available in the 2006 IPCC Guidelines (e.g. soda ash production and urine in manure burning). The remaining completeness recommendations are presented below in the sector-specific sections of this table (e.g. see ID#s I.3, I.19 and L.17 below) and in annex II.
G.2	NIR (G.1, 2019) (G.6, 2018) Transparency	Improve the transparency of the reported information on the key drivers of the PFC emission trends by providing in section 2 of the NIR detailed information, in particular on the decrease in PFC emissions in recent years.	Addressing. In the NIR (section 4.4, p.209), the Party explained that the increase in F-gas emissions was partially offset by the decrease in PFC emissions from aluminium production (PFC emissions were 625 kt CO_2 eq in 1990 and 73 kt CO_2 eq in 2018) for the only company producing aluminium in the country. In the NIR (section 4.4.3, p.225), it stated that, for 2006 onward, PFC emissions from the aluminium production plant are estimated using a tier 3 methodology. Further, the Party explained in the NIR (section 4.4.3, p.227) that, owing to a change in process at the plant, the company switched to using prebake cells in 2015, having previously used the Søderberg process. This technology change led to a change in EFs, hence the difference in emissions between 2014 and 2015. In addition, PFC, hexafluoroethane and carbon tetrafluoride EFs were recalculated for 2015–2016 using the coefficients in a communiqué of the Ministry of Environment and Urbanization on monitoring and reporting GHGs. During the review, the Party clarified that the reporting system of the aluminium production company is not yet fully developed, so some results could change. The ERT notes, however, that the Party has not

[3] FCCC/ARR/2019/TUR. The ERT notes that the report on the individual inventory review of Turkey's 2020 inventory submission has not been published yet. As a result, the latest previously published inventory review report reflects the findings of the review of the Party's 2019 inventory submission.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			provided information on the overall PFC emission trend in the NIR (section 2).
G.3	QA/QC and verification (G.2, 2019) (G.4, 2018) Convention reporting adherence	Fully implement the QA/QC procedures envisaged in the latest version of the QA/QC plan (approved in 2017), strengthening the quality of the reporting and paying particular attention to the general and specific QC and verification procedures at all stages of inventory preparation.	Resolved. The Party reported in its NIR (section 1.2.3, pp.6–7) the QA/QC procedures implemented since the previous inventory submission, resolving most of the QA/QC issues included in the previous review report. The remaining QA/QC recommendations are presented below in the sector-specific sections of this table. The Party indicated that it implemented the QA/QC procedures set out in the QA/QC plan for the energy, IPPU, agriculture and waste sectors in 2019–2020 (NIR p.14).
G.4	Uncertainty analysis (G.3, 2019) (G.3, 2018) (G.11, 2016) (G.11, 2015) (17, 2014) Convention reporting adherence	Use the results of the uncertainty analysis to prioritize improvements to the inventory.	Resolved. The Party reported in its NIR (in sector-specific chapters) the uncertainty analysis results. During the review, the Party clarified that the improvement process for the inventory takes into account many factors, including the results of the uncertainty analysis for categories with high uncertainty values. The Party explained that the use of approach 2 for many subcategories helped to assess further the uncertainty level figures. In addition to reporting the results of the uncertainty analysis using approach 2 in the NIR (table A7.1, annex 2, p.489), the NIR includes a new table (table A7.2, annex 2, p.490), which presents the approach 2 results for the IPPU sector.
Energy			
E.1	1. General (energy sector) (E.1, 2019) (E.1, 2018) (E.2, 2016) (E.2, 2015) (24, 2014) Transparency	Include a separate section in the energy chapter of the NIR providing all detailed information on, and the rationale for, recalculations.	Resolved. The Party reported in the relevant sections of the NIR that emissions for manufacturing industries and construction categories 1.A.2.a iron and steel, 1.A.2.b non-ferrous metals, 1.A.2.c chemicals and 1.A.2.f non-metallic minerals were recalculated as a result of the revision of country-specific EFs (NIR section 3.2.5, pp.87–108, and chap. 10, pp.456–462). There were no other recalculations for the energy sector. The ERT considers that the information on recalculations is complete.
E.2	1. General (energy sector) (E.2, 2019) (E.22, 2018) Transparency	Provide detailed information on CO_2, CH_4 and N_2O EFs for key categories in the energy sector in the NIR; and details on how country-specific EFs, including the technology-specific EFs used to estimate N_2O emissions from public electricity and heat production, are determined.	Resolved. The Party reported detailed information about all EFs in its NIR (annex 3, pp.508–519) and provided additional information about CH_4 and N_2O EFs (section 3.2, p.48). The Party noted in the NIR (section 3.2, p.48) that technology-specific EFs from the 2006 IPCC Guidelines (vol. 2, chap. 2, section 2.3.3, tables 2.6–2.10) were used to estimate N_2O emissions from public electricity and heat production. During the review, Turkey clarified that technology-specific CH_4 and N_2O EFs are used for category 1.A.1.a fuel combustion – energy industries – public electricity and heat production for 2003–2019, as combustion technology data are available for 2003 onward for this category.
E.3	Feedstocks, reductants and other non-energy use	Include explanations in the documentation box of the relevant CRF table and in the NIR for fuels with non-	Addressing. The Party reported the explanations regarding the non-energy use of fuels, including a summary table for the use of feedstocks,

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	of fuels – liquid fuels – CO_2 (E.4, 2019) (E.6, 2018) (E.54, 2016) (E.54, 2015) Transparency	energy use consumption reported without any associated emissions reported in the inventory.	reductants and other non-energy use of fuels, in the NIR (section 3.2.3, p.65). However, although an explanation was provided in the documentation box of CRF table 1.A(d) for other oil and lubricants, the explanation for naphtha was not provided there. During the review, the Party responded that the explanation for naphtha will be included in the documentation box of CRF table 1.A(d) in its next inventory submission.
E.4	Feedstocks, reductants and other non-energy use of fuels – liquid fuels – CO_2 (E.19, 2019) Convention reporting guidelines	Check the notation keys used in CRF tables 1.A(b) and 1.A(d) for reporting CO_2 emissions from bitumen and correct them, as appropriate, including by providing explanations for the use of the notation keys in their documentation boxes.	Addressing. The Party reported CO_2 emissions from bitumen as "IE" in CRF tables 1.A(b) and 1.A(d). The NIR (table 3.9) states that bitumen is included under other oil in the reference approach. However, the Party has not clearly explained the use of this notation key in the documentation boxes of those tables or in CRF table 9.
E.5	International bunkers and multilateral operations – liquid fuels – CO_2, CH_4 and N_2O (E.5, 2019) (E.8, 2018) (E.19, 2016) (E.19, 2015) (39, 2014) (25, 2013) Accuracy	Determine a reliable data source for international bunker fuels and improve time-series consistency.	Addressing. The Party reported in its NIR (section 3.2.2.2, p.62) that a comparison of the AD for international navigation provided by the Energy Market Regulatory Authority with those reported by the General Directorate of Petroleum Affairs, as reported to IEA, was performed. However, it is not explained which AD source is used in the inventory and how the AD consistency was ensured. During the review, the Party clarified that there are some differences between the definition used by the Ministry of Energy and Natural Resources and the definition reported by the General Directorate of Petroleum Affairs to IEA. Therefore, the Ministry of Transport and Infrastructure uses a national energy balance to calculate emissions from international bunkers across the time series. Regarding the significant discrepancies in the data for international maritime bunkers for 2009–2012 and for international aviation for 2008–2014 identified in the previous review report (FCCC/ARR/2019/TUR), the ERT noted that the Party has provided a reliable data source for international bunkers from the national energy balance and all the relevant institutions are working together to determine a reliable data source for fuels.
E.6	1.A Fuel combustion – sectoral approach – solid fuels – CO_2 (E.20, 2019) Transparency	Investigate the accuracy of the country-specific CO_2 EF for lignite and provide a reference in the NIR to the relevant background documentation or study describing the methodology for determining the CO_2 EF and revise, as appropriate, the CO_2 EF if inaccuracies are identified.	Addressing. In the NIR, the Party reported the use of a country-specific CO_2 EF for lignite, provided the EFs used for 1990–2019 (section 3.2, p.49 and table 3.7) and provided the country-specific oxidation factors (table 3.5, section 3.2, p.49). The ERT notes, however, that Turkey did not provide references to the methodology used for determining the country-specific CO_2 EF in its NIR. During the review, the Party stated

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			that the carbon content, oxidation factor and related EF are based on Fott et al. (2006). The Party reported in its NIR (tables 3.6–3.7, p.50) that the CO_2 EF for lignite for 1990 and 2019 is 114.2 and 106.62 t/TJ, respectively, whereas the country-specific oxidation factor for lignite for 1990 and 2019 is 0.950 and 0.966, respectively. The CO_2 EF decreases even though the oxidation factor value increases. During the review, the Party clarified that the decrease in carbon content over time (32.79 and 30.09 t/TJ for 1990 and 2019, respectively, as reported in NIR table 3.5) led to a lower EF even when the oxidation factor increases. The ERT concluded that the accuracy part of the recommendation is resolved.
E.7	1.A Fuel combustion – sectoral approach – solid fuels – CO_2 (E.21, 2019) Accuracy	Investigate the applicability of the CO_2 EF for lignite to sub-bituminous lignite and include a justification in the NIR for the application of the CO_2 EF for lignite to sub-bituminous lignite, or use an appropriate CO_2 EF for sub-bituminous coal.	Resolved. The Party used a country-specific CO_2 EF based on the fuel quality of the local lignite (see ID# E.6 above).
E.8	1.A Fuel combustion – sectoral approach – solid, liquid, gaseous and other fossil fuels – CO_2 (E.22, 2019) Transparency	Provide relevant information in the NIR on the methodology used for determining the country-specific oxidation factors and on the applicability of the analysis reports for solid fuels and the stack gas analysis reports to all fuel combustion activities, including domestic/residential.	Addressing. The Party reported in its NIR the country-specific oxidation factors used for all fuel combustion activities (table 3.6, p.50) and explained how those factors were obtained (annex 3, pp.508–519). During the review, the Party confirmed that the oxidation rates are calculated using ash and slag analysis reports for solid fuels, and stack gas analysis reports for liquid and gaseous fuels. However, no justification was provided of the applicability of the analysis reports to all fuel combustion activities, including domestic/residential.
E.9	1.A.1.a Public electricity and heat production – gaseous fuels – N_2O (E.7, 2019) (E.23, 2018) Consistency	Determine an appropriate methodology for addressing the data gaps in the technology split for gaseous fuel combustion prior to 2003 in order to ensure consistency in the time series.	Not resolved. The Party did not determine a methodology for addressing the data gaps and ensuring time-series consistency in the technology split for gaseous fuel combustion in category 1.A.1.a public electricity and heat production for prior to 2003. According to the NIR (section 3.2.4, p.48), the default CH_4 and N_2O EFs from the 2006 IPCC Guidelines (vol. 2, chap. 2, section 2.3.3, tables 2.6–2.10) are used for 1990–2002 because combustion technology data are available only for 2003 onward for this category. During the review, the Party stated that it will investigate methods for improving the consistency of the time series for 1990–2002. The ERT suggests that the Party apply the most appropriate technique for ensuring time-series consistency from the 2006 IPCC Guidelines (vol. 1, chap. 5, section 5.3) and explain the results (including, if applicable, any recalculations) in the NIR.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
E.10	1.A.1.a Public electricity and heat production – solid, liquid, gaseous and other fossil fuels – CH_4 and N_2O (E.8, 2019) (E.24, 2018) Convention reporting adherence	Use in the uncertainty analysis documented country-specific values for the uncertainty of CH_4 and N_2O EFs, in particular for EFs that are country- or plant-specific, or, if this is not possible, choose and use appropriate default uncertainty values for CH_4 and N_2O EFs and document the values selected and associated assumptions in the NIR.	Addressing. The Party reported the uncertainty of the CH_4 and N_2O EFs as 25 and 75 per cent, respectively, on the basis of the values for the Netherlands in the 2006 IPCC Guidelines (vol. 2, chap. 2, table 2.14, p.2.40). During the review, the Party stated that it will use default values or develop country-specific values as recommended.
E.11	1.A.1.a Public electricity and heat production – CO_2, CH_4 and N_2O (E.9, 2019) (E.25, 2018) Comparability	Investigate how to allocate emissions from 'autoproducers' of electricity to the category relevant to where the electricity is generated in accordance with the 2006 IPCC Guidelines.	Not resolved. According to the NIR (sections 3.2.4.2, p.82, and 3.2.5.1, p.95), fuel consumed by 'autoproducers' is allocated under category 1.A.1.a fuel combustion – energy industries – public electricity and heat production. During the review, the Party explained that, although the 2006 IPCC Guidelines (vol. 1, chap. 8, table 8.2) recommend that 'autoproducers' are reported under the branch of the economy in which they operate and not under category 1.A.1.a, all electricity and heat production by 'autoproducers' is included under the electricity and heat production category in the national energy balance tables. Turkey stated that, since the New Electricity Market Law 6446 was enacted by Parliament on 14 March 2013, 'autoproducers' had become the main electricity producers and, in order to use consistent data sets in its inventory, the Party decided to allocate all emissions from 'autoproducers' to category 1.A.1.a. Therefore, emissions from stationary combustion categories (including category 1.A.2 manufacturing industries and construction) were recalculated for 1990–2014. The ERT noted that the 2006 IPCC Guidelines (vol. 2, chap. 2, table 2.1, p.2.10 and box 2.1) define an 'autoproducer' of electricity as an enterprise that, in support of its primary activity, generates electricity for its own use or for sale, but not as its main business. This should be contrasted with other electricity producers that generate and sell electricity and/or heat as their primary activity. The 2006 IPCC Guidelines also indicate that the ownership (public or private) does not determine the allocation of emissions and emissions from 'autoproduction' should be allocated to the industrial or commercial branches in which the generation activity occurred, rather than to category 1.A.1.a, which is for emissions from plants whose main activity is producing and selling electricity.
E.12	1.A.1.b Petroleum refining – liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.10, 2019) (E.12, 2018)	Improve the transparency of the reporting by including a comparison of facility-level data with the sectoral totals from the national energy balance in the NIR.	Not resolved. The Party has not provided a comparison of facility-level data with the sectoral totals from the national energy balance in the NIR. During the review, the Party stated that the comparison will be included in its next inventory submission.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(E.56, 2016) (E.56, 2015) Transparency		
E.13	1.A.1.b Petroleum refining – liquid fuels – CO_2 (E.23, 2019) Transparency	Provide relevant information in the NIR regarding the large inter-annual change in the CO_2 IEF for liquid fuels between 2015 and 2016.	Addressing. There is a large inter-annual change in the CO_2 IEF for liquid fuels reported in CRF table 1.A(a)s1 between 2015 and 2016. The 2016 value (73.39 t CO_2/TJ) is 25.3 per cent higher than the 2015 value (56.89 t CO_2/TJ). During the review, the Party explained that the addition to the calculation of a new fuel, which has a high carbon content, led to an increase in the CO_2 IEF between 2015 and 2016, and stated that additional information will be included in the next inventory submission.
E.14	1.A.2 Manufacturing industries and construction – liquid, solid and gaseous fuels – CO_2 (E.11, 2019) (E.13, 2018) (E.34, 2016) (E.34, 2015) (51, 2014) Transparency	Provide sufficient information on the inter-annual changes in the CO_2 EFs in the NIR.	Not resolved. The ERT noted that there are still significant inter-annual changes in the CO_2 EF (e.g. 55.27 and 53.67 t/TJ for gaseous fuels, or 97.39 and 109.98 t/TJ for solid fuels for 2018 and 2019, respectively). The Party did not provide information about inter-annual changes in the CO_2 EFs for this category in the NIR. During the review, the Party stated that information will be included in the NIR of its next inventory submission.
E.15	1.A.2 Manufacturing industries and construction – CO_2, CH_4 and N_2O (E.12, 2019) (E.26, 2018) Comparability	Improve the comparability and consistency of the inventory and separate the emissions from pulp, paper and print (1.A.2.d), food processing, beverages and tobacco (1.A.2.e) and non-metallic minerals (1.A.2.f) from the emissions reported in category 1.A.2.g other (manufacturing industries and construction) for the entire time series.	Addressing. The only category for which the emissions for 1990–2010 have not yet been separated from those under category 1.A.2.g other (manufacturing industries and construction) is category 1.A.2.d pulp, paper and print.
E.16	1.A.2.a Iron and steel – liquid fuels – CO_2, CH_4 and N_2O (E.13, 2019) (E.14, 2018) (E.57, 2016) (E.57, 2015) Transparency	Include information on significant changes in the trend in AD composition for the different shares of oil products and on how these impact the CH_4 and N_2O IEFs.	Not resolved. The NIR does not include sufficient information on how the AD for specific liquid fuels were determined and how the share of different oil products have an impact on the CH_4 and N_2O IEFs. For example, the NIR does not include information on the share of liquefied petroleum gas and gas diesel oil in liquid fuels that caused the AD fluctuations between 1990 and 2014. In addition, changes also occur after 2014. For example, the N_2O IEF changed significantly between 2015 (0.60 kg/TJ), 2016 (0.48 kg/TJ) and 2017 (0.56 kg/TJ). The ERT considers that explaining the fuel mix could improve the transparency of the reporting across the time series. During the review, the Party clarified that the energy balance for 1990–2014 does not provide sufficient information on the varying composition of petroleum products. The Party does not currently have any plans to make improvements in this area.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
E.17	1.A.3.a Domestic aviation – liquid fuels (gasoline) – CO_2, CH_4 and N_2O (E.24, 2019) Completeness	Estimate emissions from aviation gasoline consumption in domestic aviation or report these emissions as "IE" if this consumption is included elsewhere, or alternatively use "NE" in CRF table 1.A(a)s3 with a justification in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. The Party continued to report CO_2, CH_4 and N_2O emissions from aviation gasoline use as "NO" in CRF table 1.A(a)s3. During the review, the Party clarified that the gasoline consumption in this category is included in jet kerosene consumption.
E.18	1.A.3.b Road transportation – liquid fuels – CH_4 and N_2O (E.14, 2019) (E.15, 2018) (E.43, 2016) (E.43, 2015) (58, 2014) Accuracy	Move to a higher-tier method for calculating N_2O (and CH_4) emissions, as it is likely that category 1.A.3.b would be a key category if using appropriate EFs.	Addressing. The Party continued to estimate CH_4 and N_2O emissions by applying default EFs from the 2006 IPCC Guidelines (vol. 2, chap. 3, tables 3.2.2–3.2.5) (NIR section 3.2.6.2, p.128). Turkey provided in the NIR (section 3.2.6.2, p.129) a comparison of emission estimates obtained from the current approach using tier 1 and 2 EFs for CH_4 and N_2O with estimates for 2016 and 2018 calculated using COPERT. Significantly lower CH_4 and N_2O emission estimates were calculated when using COPERT. The Party is planning to recalculate the emission estimates for the previous years of the time series for the next inventory submission.
E.19	1.A.3.d Domestic navigation – liquid fuels (gasoline) – CO_2, CH_4 and N_2O (E.25, 2019) Completeness	Estimate emissions from gasoline consumption in domestic navigation or report these emissions as "IE" if this consumption is included elsewhere, or alternatively, use "NE" in CRF table 1.A(a)s3 with a justification in line with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. The Party continued to report CO_2, CH_4 and N_2O emissions from domestic navigation gasoline use as "NO" in CRF table 1.A(a)s3. During the review, the Party clarified that gasoline consumption under this category is included in diesel consumption.
E.20	1.A.4 Other sectors – general (E.15, 2019) (E.27, 2018) Comparability	Separate the emissions under category 1.A.4.a (commercial/institutional) from the emissions reported under category 1.A.4.b (residential) for the entire time series.	Addressing. The fuel consumption for category 1.A.4.a commercial/ institutional is reported under category 1.A.4.b residential for 1990–2014 (category 1.A.4.a is reported as "NO, IE" for 1990–2014). Fuel consumption is only separated in the energy balance tables for 2015 onward. However, the appropriate disaggregation of fuels is part of the Party's planned inventory improvements and, according to the information provided in the NIR (section 3.2.7.2, p.142), all relevant institutions are working together to overcome this inconsistency and allocate the emissions to either category 1.A.4.a or category 1.A.4.b for the entire time series. During the review, the Party clarified that disaggregated data on fuel consumption for residential and for commercial/institutional sectors were available for 2015 onward thanks to the improvement in data-collection methods and infrastructure. Although updating the historical time series for before 2015 as recommended is theoretically possible, the data would be of limited use as it is not possible to obtain the exact disaggregated figures for a 25-year span starting from 1990.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
E.21	1.A.4 Other sectors – liquid fuels – CO_2, CH_4 and N_2O (E.16, 2019) (E.17, 2018) (E.37, 2016) (E.37, 2015) (54, 2014) Consistency	Revise the emission estimates, reallocating the diesel oil used for agricultural purposes to subcategory 1.A.4.c agriculture/forestry/fishing by using assumptions based on the historical trend of the ratio of diesel oil used for agriculture to the total diesel oil used in the country.	Addressing. The Party reported the reallocation of diesel oil used for agricultural purposes to subcategory 1.A.4.c agriculture/forestry/fishing in CRF table 1.A(a)s4 for 1990–2011 using the statistics on market-specific diesel specification ("rural diesel"). For 2012 onward, some of the diesel oil used for agricultural purposes is included under subcategory 1.A.3.b road transportation, thereby causing time-series inconsistencies, as, for example, CO_2 emissions for subcategory 1.A.4.c decreased from 15,064.92 kt in 2011 to 2,975.15 kt in 2012. The NIR (p.144) explains that, owing to a classification problem for diesel oil consumption in the energy balance table for 2012, some of the diesel oil used for agricultural purposes is included in road transportation. The trend also seems inconsistent between 2014 (3,044.74 kt) and 2015 (8,797.29 kt) because the emissions from liquid fuels reported under subcategory 1.A.4.c for 2015 onward include the modelling of the consumption for the diesel oil used for agricultural purposes. During the review, the Party explained that investigations regarding further improvement of the methodology for the estimation of diesel oil are ongoing.
E.22	1.A.4 Other sectors – liquid fuels – CO_2, CH_4 and N_2O (E.17, 2019) (E.18, 2018) (E.37, 2016) (E.37, 2015) (54, 2014) Transparency	Provide a clear explanation in the NIR of the allocation of diesel oil used for agricultural purposes to subcategory 1.A.4.c agriculture/forestry/fishing, using assumptions based on the historical trend of the ratio of diesel oil used for agriculture to the total diesel oil used in the country.	Addressing. The Party reported that the Ministry of Energy and National Resources disaggregated the data on diesel oil consumption in the agriculture sector using a comparison method in which data from similar countries on the total harvested crop area and the consumption of petroleum products were weighted to derive an indicator for Turkey (NIR section 3.2.7.3, p.144). However, the allocation of the diesel oil across the time series is not clearly explained in the NIR (see ID# E.21 above). During the review, the Party explained that investigations regarding the further improvement of the methodology for the estimation of diesel oil are ongoing.
E.23	1.B.1.b Solid fuel transformation – solid fuels – CH_4 (E.26, 2019) Transparency	Present in the NIR the assumptions regarding the treatment of lignite as sub-bituminous coal; report the number of abandoned underground coal mines per type of coal and their respective years of closure.	Addressing. The Party uses a tier 2 method to estimate CH_4 emissions from abandoned underground coal mines (NIR section 3.3.1, p.152). According to the NIR (table 3.57, p.153), the Party applies the coefficients for sub-bituminous coal for abandoned underground coal mines from the 2006 IPCC Guidelines (vol. 2, chap. 4, table 4.1.9) to lignite coal mines. During the review, the Party explained that Turkish lignite can be assumed to be sub-bituminous in quality. Regarding the number of abandoned underground coal mines, the ERT noted that the NIR does not include the number of abandoned underground coal mines per type of coal and their respective years of closure.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
IPPU			
I.1	2. General (IPPU) (I.1, 2019) (I.1, 2018) (I.19, 2018) (I.58, 2016) (I.58, 2015) Consistency	Provide a consistent time series of emissions of SF_6 under the appropriate categories of electrical equipment (2.G.1) and fire protection (2.F.3) and of SF_6 and PFCs from other product use (2.G.2).	Resolved. The Party did not report SF_6 emissions for categories 2.F.3 product uses as substitutes for ozone-depleting substances – fire protection or 2.G.2 other product manufacture and use – SF_6 and PFCs from other product use, and estimated those emissions for 1996 onward for category 2.G.1 other product manufacture and use – electrical equipment. The Party did not report PFC emissions for category 2.G.2 other product manufacture and use – SF_6 and PFCs from other product use. Turkey reported in its NIR (section 4.8, p.247) that it assumed that SF_6 is used only in electrical instruments. Nevertheless, the Party explained that improvements in the data for the sector will take place within the scope of the EU-funded technical assistance project for increased capacity for transposition and capacity-building on F-gases, which concluded in 2020. The ERT considers that the recommendation has been addressed because the Party has investigated the categories and reported as fully as possible considering the data available.
I.2	2. General (IPPU) (I.24, 2019) Convention reporting adherence	Implement QC procedures and double-check the final CRF tables, particularly for categories reported as "NE" and "IE" in CRF table 9, and maintain consistency between the NIR and the CRF tables in accordance with paragraph 37(d) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. The Party implemented QC procedures and explained the use of the notation keys "IE" and "NE" in CRF table 9, including for CO_2 emissions for category 2.C.1.b pig iron, HFC-134a emissions for category 2.F.6.a emissive and N_2O emissions for category 2.G.3.a medical applications.
I.3	2.A.2 Lime production – CO_2 (I.2, 2019) (I.2, 2018) (I.2 and I.10, 2016) (I.2 and I.10, 2015) (72, 2014) Completeness	Include captive lime production emissions in the estimates for this category.	Not resolved. The Party reported in its NIR (section 4.2.2, p.170) that it assumed that all the CO_2 from lime production for sugar refining precipitates and therefore no CO_2 is emitted. Turkey did not provide evidence for the 100 per cent CO_2 recovery rate reported (see ID# I.4 below) that would justify subtracting the CO_2 from captive lime production. The ERT notes, however, that captive lime production emissions were not included in the inventory.
I.4	2.A.2 Lime production – CO_2 (I.3, 2019) (I.3, 2018) (I.47, 2016) (I.47, 2015) Completeness	Provide evidence of the 100 per cent CO_2 recovery rate associated with lime use during sugar refining and precipitate production in the NIR (any proven and validated method used to calculate the amount of CO_2 that reacts with lime to reform calcium carbonate or the amount of CO_2 that is not recarbonated to limestone in the refining process can be provided as evidence), or report the CO_2 emissions from the lime produced in sugar mills together	Not resolved. No evidence was provided of the 100 per cent CO_2 recovery rate associated with lime use during sugar refining and precipitate production, nor were the CO_2 emissions from the lime produced in sugar mills reported together with the emissions from marketed lime under the lime production category. During the review, the Party stated that the current assessment of the CO_2 recovery rate is based on expert judgment, but it plans to contact the sugar factory company to clarify the situation.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
		with the emissions from marketed lime under the lime production category.	
I.5	2.A.4 Other process uses of carbonates – CO_2 (I.4, 2019) (I.4, 2018) (I.48, 2016) (I.48, 2015) Accuracy	Undertake limestone and dolomite mass balances to cross-check the estimates in order to increase the accuracy of the inventory.	Resolved. During the review, the Party stated that a study on limestone and dolomite mass balances does not seem feasible in the near future. The ERT noted that limestone and dolomite mass balances are not mandatory and considers this issue resolved.
I.6	2.B.8 Petrochemical and carbon black production – AD (I.27, 2019) Consistency	Investigate the rationale for the significant increase in vinyl chloride monomer production of 26.2 per cent between 2015 and 2016 and report the results of the investigation in the NIR.	Addressing. No information is included in the NIR regarding the significant increase in vinyl chloride monomer production of 26.2 per cent between 2015 and 2016. During the review, the Party clarified that high volatility in demand and price of some products had led to high fluctuations in production. The ERT noted that the Party should include this information in its next inventory submission.
I.7	2.B.9 Fluorochemical production – HFCs, PFCs and SF_6 (I.6, 2019) (I.9, 2018) (I.50, 2016) (I.50, 2015) Convention reporting adherence	Use the notation key "NO" to report fluorochemical production.	Not resolved. The Party has not reported HFC, PFC or SF_6 emissions in CRF tables 2(II) and 2(II).B-Hs1. During the review, the Party clarified that it will use the appropriate notation key in its next inventory submission.
I.8	2.B.10 Other (chemical industry) – CH_4 (I.7, 2019) (I.10, 2018) (I.28, 2016) (I.28, 2015) (92, 2014) Transparency	Validate and double-check the AD on styrene production for the complete time series, provide the missing estimates if emissions occurred in the country and include explanations for the emission trend in the NIR.	Not resolved. The ERT notes that the 2006 IPCC Guidelines do not provide a methodology for styrene production. However, the ERT considers that the Party should continue reporting the CH_4 emissions that were reported in the 2014 submission and provide an explanation of CH_4 emissions from styrene production in the NIR. During the review, the Party clarified that production values from previous years are still being investigated.
I.9	2.C.1 Iron and steel production – CO_2 (I.8, 2019) (I.21, 2018) Transparency	Either update the equation on page 207 of the NIR to clarify that it is applied at the plant level to estimate emissions from iron and steel or sinter (not pig iron or sinter) or clarify that the equation currently included in the NIR represents an overall carbon mass balance calculation conducted as a QA/QC check in estimating emissions from iron and steel and sinter production.	Not resolved. In the 2021 NIR (p.214), Turkey did not update the equation for estimating CO_2 emissions from iron and steel production and sinter production reported in the 2018 NIR (p.207), which is still labelled as the equation for pig iron and sinter production. During the review, the Party clarified that it used equations 4.9–4.10 from the 2006 IPCC Guidelines (vol. 3, chap. 4) to estimate CO_2 emissions from iron, steel and sinter production. The ERT considers that these equations are equivalent to the equation reported on page 214 of the NIR (section 4.4.1), although the text in the NIR is unclear as to how the production of iron and steel/pig iron/sinter should be used in this equation and the text does not mention steel.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
I.10	2.C.1 Iron and steel production – CO_2 (I.28, 2019) Accuracy	Make efforts to retain the enhanced data-collection method in order to revert to the use of a higher-tier method (tier 2) for the estimation of CO_2 emissions for category 2.C.1 (iron and steel production).	Addressing. The Party continued to estimate CO_2 emissions for category 2.C.1 iron and steel production using a tier 1 method, although CO_2 emissions are identified as key by level and trend (NIR annex 1, p.464, table A1). During the review, the Party clarified that studies are ongoing regarding a sustainable data-collection process for a tier 2 method for the emissions from electric arc furnaces.
I.11	2.C.4 Magnesium production – SF_6 (I.11, 2019) (I.13, 2018) (I.39, 2016) (I.39, 2015) (95, 2014) Convention reporting adherence	Correct the notation key used to report SF_6 emissions from magnesium foundries from "NA" to "NE".	Not resolved. The Party did not report AD or SF_6 emissions for the subcategory. During the review, the Party acknowledged that this is an error and will be corrected in the next inventory submission.
I.12	2.D.1 Lubricant use – AD (I.29, 2019) Transparency	Investigate and then report in the NIR the reason for the significant decrease in the AD for lubricant use between 2015 and 2016 (47.0 per cent) and explain the trend in the NIR.	Not resolved. There continues to be a significant inter-annual change in lubricant use AD between 2015 (432.00 kt) and 2016 (229.00 kt) reported in CRF table 2(I).A-Hs2. The Party did not explain the trend in the AD but reported in the NIR (section 4.5.1, p.237) and confirmed during the review that AD are obtained from the national oil table in the joint energy questionnaire of IEA, the statistical office of the EU and the United Nations Economic Commission for Europe. The NIR does not include information on the significant decrease between 2015 and 2016 or on the trend in the AD for lubricant use.
I.13	2.D.2 Paraffin wax use – CO_2 (I.30, 2019) Transparency	Investigate and then report in the NIR the reason for the significant increase in the AD for paraffin wax use between 2013 and 2014 (109.1 per cent); include information on the AD variations in the NIR.	Not resolved. The Party reported in its NIR (section 4.5.2, p.240) and confirmed during the review that AD are obtained from the national oil table in the joint energy questionnaire of IEA, the statistical office of the EU and the United Nations Economic Commission for Europe. The NIR does not include information on the significant increase between 2013 and 2014 or on the trend.
I.14	2.D.2 Paraffin wax use – CH_4 and N_2O (I.31, 2019) Convention reporting adherence	Use the correct notation key, that is replace "NE" with "NA", in the CRF tables for reporting CH_4 and N_2O emissions from paraffin wax use.	Not resolved. The Party continued to report CH_4 and N_2O emissions from paraffin wax use as "NE" instead of "NA" in CRF table 2(I)s2. During the review, the Party acknowledged that this was done in error and will be corrected in the next inventory submission.
I.15	2.E.5 Other (electronics industry) – HFCs, PFCs and SF_6 (I.12, 2019) (I.23, 2018) Accuracy	Collect the necessary updated AD to reflect national market tendencies and report the corresponding emissions.	Not resolved. The Party recalculated SF_6 emissions but only on the basis of the Party's economic growth. During the review, the Party clarified that updating the AD to reflect market tendencies is under consideration.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
I.16	2.F Product uses as substitutes for ozone-depleting substances – HFCs (I.13, 2019) (I.17, 2018) (I.2 and I.40, 2016) (I.2 and I.40, 2015) (66 and 96, 2014) (43, 2013) (67, 2012) Accuracy	Establish sound data-collection methods to estimate and report actual emissions from different F-gas applications under this category and investigate the possibility of moving to a higher-tier method (only potential emissions calculated) for refrigeration and air-conditioning equipment.	Resolved. The Party reported in its NIR (section 4.7, p.246) that, for future inventory submissions, improvements in the sector data will take place within the scope of the national technical assistance project for increased capacity for transposition and capacity-building on F-gases, which started in 2017 and concluded in 2020. During the review, the Party clarified that the national project was funded by the EU and concluded in August 2020. The ERT considers that the recommendation has been fully addressed regarding the issue of data collection. The ERT noted that there are several subcategories under category 2.F product uses as substitutes for ozone-depleting substances and has raised a new recommendation for subcategory 2.F.6 other applications, the only subcategory under 2.F identified as key by the Party (see ID# I.36 in table 5).
I.17	2.F Product uses as substitutes for ozone-depleting substances – HFCs and SF_6 (I.14, 2019) (I.18, 2018) (I.42, 2016) (I.42, 2015) (97, 2014) Completeness	Implement the mandatory data-collection system (under the ministerial regulation on F-gases) as planned, and increase the completeness and overall data quality of the inventory.	Resolved. The implementation of domestic legislation is not a requirement of the UNFCCC Annex I inventory reporting guidelines and the completeness of the inventory is considered in ID# I.16 above.
I.18	2.F.3 Fire protection – HFCs (I.15, 2019) (I.24, 2018) Comparability	Provide estimates of HFC-227ea emissions from manufacturing, operation and disposal separately, or, if this is not possible, continue using "IE" for manufacturing and disposal and indicate clearly in CRF table 9 and the NIR that all HFC-227ea emissions are reported under operating systems (stocks).	Not resolved. The Party continued reporting emissions from manufacturing and disposal as "IE". It did not explain the use of this notation key in CRF table 9 or the NIR. During the review, the Party clarified that this will be corrected in its next inventory submission.
I.19	2.F.4 Aerosols – HFCs (I.16, 2019) (I.25, 2018) Completeness	Taking into account the high probability that metered dose inhalers are used in Turkey, estimate and report HFC emissions from metered dose inhalers or provide evidence that these emissions are not occurring in the country.	Not resolved. The Party did not report HFC emissions from metered dose inhalers. During the review, Turkey clarified that there is a lack of information on metered dose inhalers, as the harmonized system codes for inhalers also include other imported medicines and these codes cannot currently be subdivided. The Party added that the Ministry of Environment, Urbanization and Climate Change and the Ministry of Trade are working on the subject.
I.20	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs	Report complete emissions from refrigeration and air-conditioning equipment from manufacturing, operation and disposal by subcategory under category 2.F.1 instead of category 2.F.6 in accordance with the UNFCCC Annex I inventory reporting guidelines, or, if this is not possible,	Not resolved. The Party continued to report emissions from refrigeration and air-conditioning equipment from manufacturing, operation and disposal under category 2.F.6 instead of by subcategory under category 2.F.1 and no notation key is used to clarify the reporting in CRF table

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(I.17, 2019) (I.26, 2018) Comparability	report the notation key "IE" in the appropriate cells of the CRF tables and include information in CRF table 9 and the NIR on where these emissions are reported.	2(II).B-Hs2. During the review, the Party clarified that it will reallocate those emissions in its next inventory submission.
I.21	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs (I.18, 2019) (I.27, 2018) Accuracy	Improve the consistency and accuracy of the reporting between CRF table 2(II).B-H and the NIR with respect to the reporting of HFC-32 emissions; and verify the product life EF for HFC-32 and revise the estimates, if necessary.	Addressing. The Party reported in its NIR (section 4.7, p.245) the same values as in CRF table 2(II).B-Hs2 for HFC-32 emissions, so that part of the recommendation is resolved. However, the Party did not verify the product life EF for HFC-32 (and, if necessary, revise its estimates) so the second part of the recommendation has not yet been resolved. During the review, the Party clarified that it was not planning to review the EF value for HFC-32. Turkey provided the spreadsheet used for calculating emissions for this subsector, with the parameters used. The ERT noted that the model was not used correctly. For example, for 2019, the value of 726.74 for "filled into new manufactured products" in CRF table 2(II).B-Hs2 is the same as "in operating systems", which in the model is 1,510.36 t, and the EF was 15 per cent, while in CRF table 2(II).B-Hs2 it is 30.8 per cent. The ERT concluded that the model (taken from the 2006 IPCC Guidelines (vol. 3, chap. 7, pp.7.46–7.47; spreadsheet V3_An1_Calculation_example_for_2F1.xls, available at https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/XLS/V3_An1_Calculation_example_for_2F1.xls)) was modified to include more years than the model was designed to cover and that may have led to errors. In addition, there were other problems in the use of the modified spreadsheet, such as line 41 for the item "Bank" in sheet entitled "Calc", the equivalent to "in operating systems" in CRF table 2(II).B-Hs2, which contains the same data for 2016–2019, regardless of the chosen gas, and presents negative values for earlier years of the time series.
I.22	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs (I.19, 2019) (I.28, 2018) Completeness	Estimate HFC emissions for 1999 by collecting data for 1999 or using interpolation in accordance with the 2006 IPCC Guidelines for between 1998 and 2000 (assuming that in 1998 no HFCs were consumed).	Not resolved. The NIR continues to state that HFCs have been used in the country since 1999 (section 4.7, p.243). The NIR (section 4.7, table 4.38, p.244) reports HFC emissions for 1999 (60.8 kt CO_2 eq). However, emissions are reported in the CRF tables only for 2000 onward, and reported as "NO" in the CRF tables for 1999. During the review, the Party acknowledged that this was done in error and will be corrected in the next inventory submission.
I.23	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs	Provide in the NIR a more detailed description of the main assumptions applied and F-gas used in the F-gas model for estimating HFCs, in particular the assumed average initial filling and the number of units of equipment on the market for all years of the time series.	Not resolved. The NIR does not include the assumed average initial filling and the number of units of equipment on the market for all years of the time series. During the review, the Party clarified that an EU-funded national technical assistance project on F-gases concluded in August 2020 but the associated improvements have not yet been fully implemented.

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(I.20, 2019) (I.29, 2018) Transparency		
I.24	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs (I.21, 2019) (I.30, 2018) Completeness	Calculate and report HFC disposal emissions from retired refrigeration and air-conditioning equipment, and, if applicable, the amount of recovery of these gases.	Not resolved. Emissions from disposal of equipment are not reported (reported as "NO" in CRF table 2(II).B-H under category 2.F.6). During the review, the Party provided the spreadsheet used for the emission calculation, which contains information on the release of agent from retired equipment for several HFCs. After comparing the spreadsheet and CRF table 2(II).B-H, the ERT concluded that it seems that emissions from retired equipment are included in "emissions from stocks" in the CRF table.
I.25	2.G Other product manufacture and use – N_2O (I.22, 2019) (I.20, 2018) (I.2 and I.45, 2016) (I.2 and I.45, 2015) (66 and 100, 2014) Completeness	Report all likely occurring emissions, such as N_2O emissions from anaesthesia and other applications.	Not resolved. Under category 2.G.3.a, N_2O emissions from medical applications (e.g. anaesthesia) were reported as "NE". During the review, the Party clarified that studies on calculating N_2O emissions from anaesthesia and other applications are ongoing.
I.26	2.G.1 Electrical equipment – SF_6 (I.23, 2019) (I.31, 2018) Accuracy	Report SF_6 emissions from manufacturing, operation and disposal separately, taking into account the long-term use of such equipment, in accordance with the 2006 IPCC Guidelines.	Not resolved. In the NIR (section 4.8, p.247) the Party reported that SF_6 is used only in electrical equipment, mainly in circuit breakers. Emissions are reported on the basis of import and export data for SF_6 (for 2013 onward). The ERT considers that the recommendation has not yet been addressed because the Party has not reported emissions from manufacturing, operation and disposal separately. During the review, Turkey confirmed that all annually imported SF_6 is incorporated into operating systems and default EFs are used for leakage during lifetime. The Party also clarified that an EU-funded technical assistance project on F-gases concluded in August 2020 but the associated improvements have not yet been fully implemented.
I.27	2.G.1 Electrical equipment – SF_6 (I.32, 2019) Convention reporting adherence	Maintain consistency between CRF table 9 (last row) and the corresponding NIR table.	Not resolved. CRF table 9 (last row) indicates that, owing to lack of data, SF_6 emissions for category 2.G.1 electrical equipment were reported as "NE". However, emissions are reported in CRF table 2(I)s2 and NIR table 4.41 (section 4.8, p.248). During the review, the Party indicated that the information in CRF table 9 will be corrected in the next inventory submission.
I.28	2.G.1 Electrical equipment – SF_6 (I.33, 2019) Comparability	Report SF_6 emissions from manufacturing, operation and disposal separately, taking into account the long-term use of such equipment, in accordance with the 2006 IPCC Guidelines (vol. 3, table 6.2)	Not resolved. The Party did not report the emissions separately. Moreover, the Party reported AD for operation and disposal as "NO" in CRF table 2(II).B-Hs2, although it reported the product life and disposal

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			loss factors as well as emissions from stocks and disposal as "IE" in the same table, which is contradictory.
Agriculture			
A.1	3. General (agriculture) – CH_4 and N_2O (A.20, 2019) Transparency	Address the inconsistency between the definitions of the population of dairy and non-dairy cattle and include information in the NIR on the reasons for the rise in dairy cattle and the decrease in non-dairy cattle in the animal population trend in 2003.	Addressing. The Party reported in its NIR (footnote to table 5.6, section 5.1, p.262) the revised method for estimating dairy cattle population for 2003 (as the average of the population figures for 2002 and 2004) and described in the NIR (section 5.1, p.262) the types of dairy cattle. Further, Turkey reported in the NIR (section 5.1, tables 5.6–5.7, pp.262 and 264) the total number of non-dairy cattle, but did not clarify the definition of non-dairy cattle. The Party explained in the NIR (footnote to table 5.6) that the reason for the rise in number of dairy cattle (and the corresponding decrease in number of non-dairy cattle) in 2003 was a change in methodology used by the Turkish Statistical Institute. The ERT considers that the recommendation has not been fully addressed as the Party has not included in the NIR a description of the types of non-dairy cattle included in the estimation of emissions.
A.2	3. General (agriculture) – CH_4 and N_2O (A.21, 2019) Transparency	Provide the rationale and a data source for the TAM values for all animal groups in chapter 5 of the NIR and in the reference list of the NIR.	Addressing. The Party reported in the NIR (footnotes to tables 5.15–5.16, section 5.3, pp.282–283) information on the data sources for livestock mass and Nex values. However, there is insufficient information provided as to how the data were compiled in the case of cattle (table 5.15) and which sources were used in the case of sheep and goats (table 5.16). During the review, the Party clarified that TAM values are live weight figures. For NIR table 5.16, it has carefully analysed the official notification on the registration (published in the Official Gazette on 12 December 2004) regarding several animal species, which includes live weight data. TAM values for sheep (domestic and merino) and goats have been derived from those data. The Party stated that a tier 2 method is used for the calculation of enteric fermentation emissions for cattle. In order to be consistent with the live weight figures used under category 3.A enteric fermentation, Turkey uses the same weighted average figures calculated for each of the reporting years for dairy and other cattle (non-dairy cattle) under the category 3.B CH_4 emissions from manure management. The Party explained that all Nex values are calculated using tier 1 methodology (2006 IPCC Guidelines, vol. 4, chap. 10, equation 10.30) and referred to annex 3 to its NIR (pp.516–517) for the EFs used. The ERT considers that the recommendation has not been fully addressed, as the Party has not included in the NIR the rationale for the TAM values for all animal groups, in particular how the different data sources were compiled.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
A.3	3. General (agriculture) – CH_4 and N_2O (A.22, 2019) Transparency	Improve the QA/QC procedures related to the NIR text to ensure that it provides up-to-date methodological information and numerical data.	Resolved. The Party reported in its NIR the EFs used to estimate emissions from cattle in the NIR (sections 5.2 and 5.3, pp.273 and 284, respectively) and the distribution of manure among various MMS (section 5.3, p.286, table 5.19). This corrected the issues identified in the previous recommendation. The ERT concluded that Turkey has improved its QA/QC procedures.
A.4	3.A.1 Cattle – CH_4 (A.3, 2019) (A.17, 2018) Accuracy	Report in the planned improvement section of the NIR the plan to improve the estimation and reporting of CH_4 emissions from enteric fermentation using enhanced livestock classification in accordance with the 2006 IPCC Guidelines.	Resolved. The Party reported in its NIR (section 5.1, pp.261–265) the description and figures for the cattle population. The Party applied a tier 2 methodology for cattle (NIR section 5.3, p.283). The Party used option A in CRF tables 3.As1, 3.B(a)s1 and 3.B(b) to report emissions. The Party recalculated CH_4 emissions for the entire time series and, as a result, estimated emissions increased by between 0.3 and 2.9 per cent per year.
A.5	3.A.1 Cattle – CH_4 (A.4, 2019) (A.15, 2018) Transparency	Include in the NIR information on the sources of data and relevant references for the average animal mass, milk productivity and GE used for the calculation of CH_4 emissions from enteric fermentation for cattle.	Resolved. The Party reported in its NIR (section 5.2, p.273, tables 5.12–5.13) the sources of information on and the time series of the parameters included in the tier 2 calculation of CH_4 emissions from cattle.
A.6	3.A.1 Cattle – CH_4 (A.5, 2019) (A.16, 2018) Transparency	Summarize in the NIR the methods used to calculate GE for dairy and non-dairy cattle, including providing the data and references used for the relevant parameters (net energy for maintenance, animal activity, lactation, work, pregnancy and growth; the ratio of energy available in the diet for maintenance to digestible energy consumed; and the ratio of net energy available for growth in the diet to digestible energy consumed).	Resolved. The Party reported in its NIR (section 5.2, p.273) the details of the methodology applied to calculate GE and estimate CH_4 emissions from cattle, including the references. The NIR (tables 5.12–5.13, pp.275–276) includes the time series of the tier 2 parameters used in the calculation.
A.7	3.A.1 Cattle – CH_4 (A.23, 2019) Transparency	Update the methodological description in the NIR for the estimation of enteric CH_4 emissions from cattle to reflect the tier 2 method and enhanced livestock characterization used, and include AD (animal population data, TAM values, GE, Y_m, feed digestibility) and the relevant data sources for all three cattle categories (mature dairy cattle, other mature cattle and growing cattle).	Addressing. The Party reported CH_4 emissions using option A in the CRF tables. The Party reported in its NIR (section 5.1, pp.261–266) consistent descriptions, AD and parameters for the cattle categories (dairy and non-dairy, including the subcategories for dairy). During the review, the ERT questioned why the Party was using option A for reporting emissions from cattle when it has developed an enhanced livestock classification, as provided in the 2006 IPCC Guidelines (vol. 4, chap. 10). The Party clarified that it started using option A for calculating and reporting emissions from cattle long before it started using option B only for estimating, but not reporting, enteric fermentation emissions. Option A for cattle is the key option on which the entire cattle emission calculations are based (except for 3.A enteric fermentation). Moreover, option A is also used for estimating cattle manure management (CH_4 and N_2O) emissions.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
A.8	3.B Manure management – CH_4 (A.6, 2019) (A.6, 2018) (A.8, 2016) (A.8, 2015) (109, 2014) (67, 2013) Accuracy	Estimate emissions for significant livestock categories using the tier 2 method with country-specific EFs, including enhancing livestock population characterization and taking into account the relevant IPCC guidance.	Not resolved. The Party reported in its NIR (section 5.3, p.283) that it applied a tier 1 methodology to estimate CH_4 emissions from manure management. It stated that this is a key category. During the review, the Party clarified that using a tier 2 methodology is an improvement that cannot be considered in the short term owing to currently insufficient data and parameters.
A.9	3.B Manure management – CH_4 and N_2O (A.7, 2019) (A.18, 2018) Accuracy	Collect the necessary AD and estimate and report CH_4 and N_2O emissions from manure management using country-specific EFs and appropriate tier methods from the 2006 IPCC Guidelines.	Addressing. The Party reported in its NIR (section 5.3, p.283) that it applied a tier 1 method for estimating CH_4 and N_2O emissions from manure management. In the NIR (section 5.3, p.277), Turkey stated that CH_4 and N_2O emissions were identified as key categories. The ERT noted that, according to the relevant decision tree in the 2006 IPCC Guidelines (vol. 4, chap. 10, figure 10.3), these emissions should be estimated using a tier 2 method for the significant animal species. During the review, the Party confirmed that it used a tier 1 method for estimating CH_4 and N_2O emissions from manure management and that using a tier 2 method is an improvement that cannot be considered in the short term owing to currently insufficient data and parameters, but that country-specific parameters are in the process of being introduced.
A.10	3.B Manure management – N_2O (A.24, 2019) Transparency	Include the data source for the country-specific MMS distribution in the NIR.	Addressing. The Party reported in its NIR (section 5.3, p.286, table 5.19) the distribution of manure across MMS, but no detailed information on the source of these AD was provided. In the NIR (section 5.3, p.278), the Party stated that the Turkish Statistical Institute has asked experts for their views on the topic, investigated countries in the Mediterranean Basin whose agriculture sector resembles that of Turkey, contacted regional offices for relevant data, researched field data available in the Turkish Statistical Institute and scrutinized as yet unpublished agriculture-related data in order to obtain a distribution that would better reflect national conditions. During the review, the Party clarified that it used a variety of sources to calculate an MMS distribution that would reflect national conditions appropriately and more accurately than the default values in the 2006 IPCC Guidelines. The ERT, however, could not find the details of these sources, and Turkey explained that it cannot provide the detailed list of the sources referred to in the NIR (p.278) because the MMS distribution includes a significant amount of expert judgment (including that of university experts). The sources used are not available in the public domain. The ERT noted that the 2006 IPCC Guidelines (vol. 1, annex 2A.1) include a protocol for documenting expert elicitation.
A.11	3.B Manure management – N_2O	Describe the method used for estimating emissions from manure burned for fuel in the NIR; and include a	Addressing. The Party reported in its NIR (section 5.3, p.285) that 50 per cent of burned manure is assumed to be burned for energy and reported

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(A.25, 2019) Transparency	description in NIR chapter 5 of where in the energy or waste sector the emissions from burning of manure are reported.	under the energy sector (subcategory 1.A.4.b residential), and the other 50 per cent is reported under pasture, range and paddock (under 3.B manure management). The Party based its assumption on the 2006 IPCC Guidelines (vol. 4, chap. 10, section 10.5.2). However, the ERT noted that the 50/50 split in the 2006 IPCC Guidelines refers to the amount of N excreted in urine and dung, not to the proportion of manure that is burned. The ERT also noted that the NIR does not describe clearly the method for estimating the emissions from manure burned, but does state where the emissions from the other 50 per cent of burned manure are reported. During the review, the Party provided the spreadsheets with the calculations, where about 13 per cent of the total cattle manure is burned for fuel. However, the ERT considers that it is not clear how the amount of manure used for burning (13 per cent of total cattle manure) was calculated and why Turkey estimates emissions from only 50 per cent of this burned manure. The 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.14) state that for Asia about half of cattle manure is used for fuel with the remainder managed in dry systems, which would indicate that the Party is not using an IPCC value but a country-specific value. During the review, Turkey explained that the 13 per cent value originates from the energy balance, specifically from the residential sector for heating purposes, and that the rationale for the 50 per cent value of burned manure is explained in the 2006 IPCC Guidelines (vol. 4, chap. 10, p.10.58). The ERT noted, however, that the explanation in the 2006 IPCC Guidelines refers to the split of the N in urine and dung and not to the proportion of manure excreted that is burned. During the review, the Party clarified that recalculations are applied to the entire time series and it included related information on energy emissions from burned manure in the NIR (section 5.3, p.285). The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet clearly explained in the NIR how N_2O emissions are estimated and allocated.
A.12	3.B.3 Swine – CH_4 (A.13, 2019) (A.23, 2018) Consistency	Assess the significant inter-annual changes in the CH_4 IEF for swine manure management, in particular in the latest years of the time series, and include the results in the NIR.	Not resolved. The Party reported in its NIR (section 5.3, p.285, table 5.17) the CH_4 IEF and its temperature dependence for swine. The ERT noted that the explanation provided on the issue during the previous review on the different allocation of the animals per average temperature across the time series was not included in the NIR. During the review, the Party clarified that CH_4 emissions from manure management from swine are negligible (e.g. 0.0005 per cent of total livestock CH_4 emissions for 2019); therefore, they do not constitute a priority for improvement. The ERT does not, however, consider this sufficient justification for the lack of detail in the NIR regarding the reasons for the inter-annual changes in

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			the CH_4 IEF for swine. The ERT considers that the Party should explain the reasons for the inter-annual changes in the CH_4 IEF for swine manure to resolve this recommendation.
A.13	3.B.3 Swine – CH_4 and N_2O (A.14, 2019) (A.22, 2018) Consistency	Check the population of swine used in the calculations and assess and report in the NIR the reasons for any significant inter-annual changes observed in the population of swine across the time series. In cases where large inter-annual changes cannot be explained, consider whether using a splicing technique from the 2006 IPCC Guidelines would provide more accurate estimates.	Not resolved. The Party reported in its NIR (section 5.1, p.262, table 5.6) the population numbers for swine where there are large inter-annual changes. During the review, Turkey clarified that it is difficult to determine the reasons for these changes because swine is not a significant livestock category in the country and emissions are potentially negligible.
A.14	3.B.5 Indirect N_2O emissions – N_2O (A.15, 2019) (A.24, 2018) Completeness	Collect relevant data and estimate indirect N_2O emissions from leaching and run-off in accordance with the 2006 IPCC Guidelines.	Resolved. The Party reported in its NIR (section 5.3, p.280) and CRF table 3.B(b) indirect emissions of N_2O from manure management from volatilization, but no indirect emissions from leaching and run-off (these emissions were reported as "NE"). A note to NIR table 5.14 indicates that the Party considers these emissions insignificant and reported the estimates for the likely level of these emissions, amounting to 144 kt CO_2 eq for 2019. The ERT noted that the likely level is below the threshold for reporting according to the UNFCCC Annex I inventory reporting guidelines (253 kt CO_2 eq for Turkey for 2019). During the review, the Party clarified that it used equations 10.28–10.29 of the 2006 IPCC Guidelines (vol. 4, chap. 10) to estimate N_2O emissions from manure management from leaching and run-off as 144 kt CO_2 eq. Turkey also used the value of 4.5 per cent (mid-value between 3 and 6 per cent) as the fraction of managed manure N losses due to leaching and run-off, which it deemed suitable given the dry conditions of the country. The ERT considers that the recommendation on completeness is resolved but it raised a new recommendation for the Party to explain the calculations in the NIR (see ID# A.21 in table 5).
A.15	3.D.a.2.b Sewage sludge applied to soils – N_2O (A.26, 2019) Accuracy	Include information on the data sources used for the amount of sewage sludge spread and relevant references in the reference list in the NIR and update the N content in the emission calculations of sewage sludge with the national value, as planned, and justify the use of this value.	Resolved. The Party updated the N content in the calculation of emissions from sewage sludge and reported the revised N_2O emissions. The source of AD for the calculation of emissions from sewage sludge and the value for the N content are explained and justified in the NIR (section 5.5, p.298). CRF table 3.D includes the amount of N and the IEF used for the estimations.
A.16	3.D.a.2.c Other organic fertilizers applied to soils – N_2O (A.27, 2019) Transparency	Include information on which other organic fertilizers applied to soils are included in the reporting and a justification for the assumption that compost N covers the main N input in this source category and no other N input of significance exists. Further, include information on the data sources used for the fertilizers reported under the	Addressing. The Party reported in its NIR (section 5.5, p.298) two organic fertilizers as sources of N_2O emissions: sewage sludge and compost. Further, Turkey reported in the NIR (section 5.5, p.298) that the country-specific N content value for sewage sludge (5.15 per cent) is calculated as an average according to the values presented in a specific research study (Topaç and Başkaya, 2008), while the N content for compost is assumed

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		source for category 3.D (other organic fertilizers applied to soils) and relevant references in the reference list in the NIR. Finally, revise the calculations so that the N content in the compost used as fertilizer is reflected properly.	to be 1 per cent. However, the source of the value for compost was not clear to the ERT. During the review, the Party explained that the 1 per cent value for the N content for compost is based on expert judgment but it did not provide any specific sources. Further, Turkey explained that it asked an academic to provide an estimate on the N content, and the estimated N content of between 0.5 and 1 per cent was based on publications in the public domain and international websites that were judged to be suitable for the calculations, taking into account the structure of compost produced in the country. The Party uses the higher value of 1 per cent in order not to underestimate the emissions and intends to perform recalculations once a country-specific percentage figure is available. The ERT considers that Turkey has not yet provided the justification for the source of the value for the N content used in compost. The Party explained that it reports only compost values under category 3.D.a.2.c other organic fertilizers applied to soils. The Party recalculated the emissions for the subcategory for its 2020 submission to correct the detected error in the N content. The Party stated that it has used the value of 1 per cent to correct and improve its calculations significantly since the 2020 submission so that the N content in the compost used as fertilizer is reflected properly. The ERT requested and received a copy of the relevant data and calculations and it confirmed that the calculations are correct. However, the information in the NIR is not transparent regarding the source of the N content for compost. Although the Party indicated during the review that the source of the N content for compost was based on expert judgment, the ERT noted that the use of expert judgment is not documented in the NIR in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 3, section 3.2.2.3; and vol. 1, chap. 2, section 2.2 and annex 2A.1 on expert elicitation).
A.17	3.D.a.4 Crop residues – N_2O (A.28, 2019) Transparency	Include in the NIR (e.g. in tabular format) information on the country-specific and default fractions used in the calculations and their data sources; improve QA/QC procedures to ensure that all recalculations are transparently described in NIR sections 5 and 10 under the relevant emissions source category.	Resolved. The Party reported in its NIR (section 5.5, p.300) the methodology applied to estimate emissions from crop residues and, in CRF table 3.D, the N input and resulting IEF in the calculation of emissions. Turkey had reported in its 2020 NIR (section 5.5, p.295) that it revised the AD for crop residues for 2017. The AD provided in section 5 of the 2020 NIR are consistent with the AD provided in section 10 of the same NIR. There were no further recalculations made for the subcategory for the 2021 submission.
A.18	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O	Include information on the source of the area of cultivated organic soils in the NIR under section 5; improve QA/QC procedures to ensure that all recalculations are described in	Resolved. The Party reported in its NIR (section 5.5, p.299) that the AD relating to emissions from cultivation of histosols are based on LULUCF data and CRF tables 4.B and 4.C. During the review, the Party clarified

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(A.29, 2019) Transparency	NIR sections 5 and 10 under the relevant emissions source category.	that the data source is given in the footnote to NIR table 5.22 (section 5.5, p.295) and, in response to a request from the ERT, explained that further details, namely that the AD are provided by the new satellite-based land cover monitoring system, are provided in the NIR (section 6.1, p.315). The ERT noted that the Party did not perform any recalculations for this category, so no explanations in the NIR were required.
A.19	3.H Urea application – CO_2 (A.19, 2019) (A.28, 2018) Transparency	Provide the source of urea application data, and explain the reasons for the observed overall increase in the amount of urea applied, particularly in recent years, in the NIR.	Resolved. The Party reported in its NIR (section 5.9, p.306) the reasons for the increase in the amount of urea applied to soils. Turkey also stated in its NIR (section 5.9, p.307) the source of the data for urea application and the fact that it used the consumption data.
LULUCF			
L.1	4. General (LULUCF) – CO_2 (L.5, 2019) (L.5, 2018) (L.6, 2016) (L.6, 2015) (117, 2014) (73, 2013) Accuracy	Using domestic data and information, undertake the necessary work to develop an internally consistent land framework and harmonize the two major data sources in order to produce a spatially consistent breakdown of land-use categories for the whole country, over time, and report on progress.	Resolved. The Party has developed a new land framework covering the whole country for 1990–2015. However, although the developed system should provide internally consistent information, there remain issues with reporting (see ID# L.8 below).
L.2	4. General (LULUCF) – CO_2 (L.6, 2019) (L.8, 2018) (L.16, 2016) (L.16, 2015) Accuracy	Treat with priority the issue of land representation under the LULUCF sector and provide a complete land-use matrix for the entire time series.	Resolved. The Party reported in CRF table 4.1 a complete land-use matrix for 1991–2019. The ERT considers that the recommendation has been addressed, but notes that there are many inconsistencies in the matrix (see ID# L.8 below), that no assessment has been made of land-use change for 1971–1990, and that areas converted to a different land use should be reported under the relevant land-use conversion category for 20 consecutive years before reporting them under the corresponding land remaining category (see ID# L.9 below).
L.3	4. General (LULUCF) (L.8, 2019) (L.21, 2018) Convention reporting adherence	Strengthen the sector-level QC procedures to ensure consistency between the information provided in the NIR and the CRF tables, particularly with respect to NIR tables 6.2, 6.3, 6.13, 6.15 and 6.16.	Addressing. The ERT notes that the Party continued to improve the reporting of sector-level QC procedures to ensure consistency between the information provided in the NIR and the CRF tables. However, some inconsistencies remain. For instance, Turkey reported in the NIR (section 6.2, p.330, table 6.12) that 1.38 kha grassland was converted to forest land in 2018. Considering the 20-year transition period for land converted to another land use and that 1.24 kha grassland was converted to forest land in 1998, the increase in area of grassland converted to forest land reported in CRF table 4.A should not exceed 0.14 kha (1.38–1.24 kha) when comparing the reporting for 2018 with the reporting for 2017, but it was approximately 2.22 kha (63.374 kha for 2018 compared with 61.156 kha for 2017).

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			Turkey also continued to use the notation key "NO" in CRF table 4(II) for non-CO_2 emissions from drained soils in forest land but the notation key "NE" in NIR table 6.5 (section 6.1, p.320). Further, the notation key "NA" is used in NIR table 6.5 for biomass burning for cropland, grassland, wetlands and settlements, whereas "IE", "NE" and "NO" are used for those land uses in CRF table 4(V). The ERT considers that the recommendation has not yet been fully addressed because the reporting on land areas is still inconsistent between NIR table 6.12 and CRF table 4.A and because of the inconsistencies in the use of notation keys between NIR table 6.5 and CRF tables 4(II) and 4(V).
L.4	4. General (LULUCF) (L.9, 2019) (L.22, 2018) Convention reporting adherence	Explain in the NIR the rationale for reporting the same uncertainty values for AD and EFs for different categories (forest land, grassland, cropland, wetlands and HWP) for CO_2 emissions or update the uncertainty analysis to better reflect national circumstances.	Resolved. The Party updated its uncertainty analysis and reported in its NIR (annex 2, pp.482–488, table A6) different uncertainty estimates for each land use. A new issue has been raised on the reporting of relative uncertainties (see ID# L.29 in table 5).
L.5	4. General (LULUCF) (L.42, 2019) Convention reporting adherence	Strengthen sector-level QC procedures to ensure consistency between the information provided in the NIR and the CRF tables, and between CRF table 4.1 and the background tables for the sector.	Not resolved. The Party reported in the NIR (section 6.1, p.309, figure 6.1) net removals that are not the same as those reported in CRF table 10s1 for 1991–2017 (differences of up to 82 kt CO_2 eq). As noted in ID# L.14 below, there are also inconsistencies between NIR figure 6.10 (section 6.3, p.340) and CRF table 4.1. Further, there are differences between the background tables for land areas for each land use and CRF table 4.1. For example, for 2019, the area of forest land is reported in CRF table 4.A as 22,983.82 kha but in CRF table 4.1 as 22,795.95 kha; the area of cropland is reported in CRF table 4.B as 27,149.09 kha but in CRF table 4.1 as 26,954.26 kha; and the area of grassland is reported in CRF table 4.C as 24,115.84 kha but in CRF table 4.1 as 24,050.39 kha. During the review, the Party explained that in future inventory submissions it will ensure consistency between the information given in the NIR and CRF tables, and land areas will be presented in the NIR in tabular format. The ERT considers that the recommendation has not yet been addressed because the Party has not yet corrected the inconsistencies between the NIR and CRF tables 4.1, 4.A, 4.B and 4.C.
L.6	Land representation (L.10, 2019) (L.23, 2018) Convention reporting adherence	Strengthen QC procedures to ensure consistent representation of land between the end of one inventory year and the beginning of the next and report correctly and consistently initial and final areas in CRF table 4.1.	Not resolved. The ERT noted inconsistencies in CRF table 4.1 between the final areas of forest land, cropland, grassland, wetlands and settlements reported for some years and the initial areas of the same land use reported for the beginning of the next reported year. For example, the final areas of forest land reported for 1992–2018 do not match the initial areas of forest land reported for 1993–2019. The largest difference is –71 kha between the final area of forest reported for 2012 and the initial area of forest for 2013.

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			During the review, the Party explained that a working group of the Ministry of Agriculture and Forestry has been preparing a project proposal for updating the reporting.
L.7	Land representation (L.13, 2019) (L.25, 2018) Transparency	Include in the NIR information on the relationship between the data in NIR table 6.18 and the data in the CRF tables, in particular CRF table 4.1. If the data in NIR table 6.18 are currently not being used in the inventory calculations but as a means of QA of the areas of land-use changes used in the emission calculations, describe this exercise in the NIR.	Resolved. The Party is no longer presenting land-use change in tabular format in its NIR and therefore the ERT considers that the previous recommendation is resolved. The ERT notes that ID# L.5 above discusses the remaining inconsistencies regarding reporting between the NIR, CRF table 4.1 and the CRF background tables.
L.8	Land representation (L.43, 2019) Consistency	Provide a consistent land-use matrix for the entire time series, presenting land area changes related to conversions of forest land to other land uses, to facilitate a better assessment and understanding of how land-use changes are used in the emission calculations and accurately document in the NIR how land-use changes from forest land to other land uses are assessed and detected.	Not resolved. The Party did not include a consistent land-use matrix for the entire time series (see ID# L.5 above regarding the reporting in CRF table 4.1). In addition, section 6.2 of the NIR (e.g. pp.321–322) does not provide a better understanding of how land-use change from forest land to other land uses is assessed (especially as to whether the system distinguishes between temporary clear-felled areas awaiting restocking from deforested land). During the review, Turkey explained that the distinction between temporary clear-felled areas awaiting restocking and deforested land is verified by ancillary data such as forest-stand maps. The ERT considers that the recommendation has not yet been addressed because the Party has not provided a consistent land-use matrix for the entire time series in CRF table 4.1 and has not provided text clarifying whether temporarily unstocked forest land is reported as forest land or as land converted to other land uses.
L.9	Land representation (L.44, 2019) Accuracy	Report the areas converted to a different land use under the relevant land-use conversion category for 20 consecutive years before reporting them under the corresponding land remaining category. (This means that, for each year, the cumulative total area reported under each land-use change category should equal the cumulative area that has been converted to that land use over the past 20 years; however, the area of land under conversion that has been subject to a second land-use change during the 20-year conversion period should be subtracted from the cumulative total.)	Not resolved. The Party did not estimate land-use change before 1990. Therefore, the conversion categories only cover 20 years from 2010 onward. During the review, the Party explained that there are only limited statistical data on land-use areas before 1990 and that those data are not consistent with those used to support approach 3 (spatially explicit land-use conversion data) used from 1990 onward. The ERT notes that the decision tree for preparation of land-use data in the 2006 IPCC Guidelines (vol. 4, chap. 3, figure 3.1) foresees a mix of approaches when national circumstances are such that the primary data set does not provide a complete time series. Further, the commencement time for the historical data required is based on the amount of time needed for DOM and soil carbon stocks to reach equilibrium following land-use conversion (20 years is recommended as a default, but can be longer), according to the 2006 IPCC Guidelines (vol. 4, section 3.3). The ERT considers that the recommendation has not yet been addressed because the

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			Party has not yet showed that assuming no land-use change in the 20 years before 1990 leads to the most accurate estimate of emissions and removals that can be made on the basis of available data.
L.10	4.A Forest land – CO_2 (L.14, 2019) (L.10, 2018) (L.9, 2016) (L.9, 2015) (122, 2014) Accuracy	Conduct a thorough scientific assessment of the estimation methods used for forest land, ensuring a comprehensive and balanced approach to calculating carbon inputs and outputs for each pool, and revise the estimates, if necessary.	Addressing. The ERT noted that the uptake of CO_2 in forest land is the most important key category for its impact on the trend for 1990–2019 (NIR annex 1, table A4, p.473) and the third most important key category for level assessment, with an uptake of 75,057.32 kt CO_2 for 2019 (NIR annex 1, table A.2, p.465). Between 1990 and 2019, the net uptake increased by 44 per cent, notwithstanding a slight decrease in area and a concomitant increase in harvest. The Party has not reported further recalculations beyond those included in its 2019 submission. The disaggregation of the increment data for ecological zones is now referred to as a medium-term, rather than a short-term, improvement, without further explanation. Estimation of carbon stocks for carbon pools for which emissions are currently not reported (namely deadwood, litter and mineral soils) also continue to be reported as a medium-term improvement in the NIR (section 6.2, p.338). The NIR does not include a scientific assessment of the estimation methods used for forest land that ensures a comprehensive and balanced approach to calculating carbon inputs and outputs for each pool. For instance, it is stated in the NIR (section 6.2, p.322) that the increment data taken from the Inventory Statistical System for Forests show large increases in increment, which may be caused by rehabilitation projects that took place in the early 2000s, but no other evidence is presented to show that the large increase in increment between 2014 and 2015 can be explained by those rehabilitation projects. There also seems to be an inconsistency between the 2010–2015 increase in increment and the increase in increment reported in national forest statistics (see ID# L.29 in table 5). Finally, the NIR does not include an explanation for the apparent inconsistency between the decrease in growing stock reported in the NIR (section 6.2, p.326, table 6.10) between 2015 and 2016 and between 2018 and 2019. These losses do not appear to be consistent with the net gain for both forest land remaining forest land and land converted to forest land reported in figures 6.5–6.6 of the NIR (section 6.2, p.328), as the losses reported in figures 6.5–6.6 are much larger than those from deforestation and wildfires in those years. During the review, the Party explained that only carbon stock changes in the soil and DOM carbon pools are calculated using a tier 1 method (i.e. assuming no net change). Biomass carbon stock changes in forest land remaining forest land are calculated using a tier 2 method with country-

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			specific EFs. All pools of land converted to forest land are calculated using tier 2 EFs. The ERT considers that the recommendation has not yet been fully addressed because the rate of change and size of the sink leads to the need for scientific validation of the methodology behind the forest increment and removal estimates and inclusion of further explanation in the NIR. The ERT notes that the Party is using tier 1 methods, not accounting for changes in all pools of forest land remaining forest land, although this is a key category, without stating that the soil and DOM carbon pools are not key categories. According to the 2006 IPCC Guidelines (vol. 1, chap. 4, table 4.1, and vol. 4, chap. 1, section 1.3.3), Parties should determine which pools are significant for the key categories identified in the LULUCF sector, but Turkey has not reported which subcategories and pools are key categories.
L.11	4.A Forest land – CO_2 (L.45, 2019) Convention reporting adherence	Correct the table numbering as part of routine QA/QC checks and update the references for the tables for the forest area, annual increment and growing stock changes since 1990.	Resolved. The Party gave in its NIR (section 6.2, p.323) the correct reference for the tables for the forest area, annual increment and growing stock changes since 1990. The ERT did not identify other issues related to table numbering for the LULUCF sector.
L.12	4.A.1 Forest land remaining forest land – CO_2 (L.17, 2019) (L.26, 2018) Transparency	Apply the definition of annual wood removals presented in the 2006 IPCC Guidelines (annual wood removals, roundwood, m^3/year), or, if not applicable, provide a justification for including more than the actual wood annually removed in the calculations for this category.	Addressing. The Party has removed the explanation included in its 2018 NIR (p.310) that wood harvesting data include whole harvested woods as industrial harvesting, including planned harvests. During the review, the Party clarified that all the wood removals have been applied to the productive forests, which is consistent with the definition of forest land in the NIR (pp.321–323). However, the Party has not clarified whether the statistics used allow it to track the volume of tree felled (rather than sold) in a specific year.
L.13	4.A.2.2 Grassland converted to forest land – CO_2 (L.19, 2019) (L.14, 2018) (L.18, 2016) (L.18, 2015) Transparency	Include in the NIR a section on grassland converted to forest land under section 6.4, report in the NIR the background data used for calculating net emissions and removals from soils and further document the country-specific values used.	Addressing. The Party reported in its NIR (section 6.4, p.359) the parameters used for estimating the emissions and removals from soils in table 6.26 for DOM and table 6.27 for soils. However, it did not include further documentation regarding the sources of the country-specific values used. The ERT considers that the recommendation has not yet been fully addressed because the Party has not yet provided detailed information on the background data and carbon stock values used.
L.14	4.B Cropland – CO_2 (L.21, 2019) (L.15, 2018) (L.19, 2016) (L.19, 2015) Convention reporting adherence	Correct detected inconsistencies and, as part of QA/QC routines, check that data presented in the NIR in tables, text and figures are consistent and match the latest data reported in the CRF tables (i.e. regarding areas of cropland).	Not resolved. The areas of cropland reported in CRF tables 4.1 and 4.B do not match. For example, for 2019, the final area of cropland reported in CRF table 4.1 is 26,954.56 kha, but 27,149.09 kha in CRF table 4.B, and approximately 27,135 kha according to figures 6.10–6.11 in the NIR (section 6.3, p.340). For 2019, the reported area of cropland remaining

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
			cropland is approximately 26,930 kha in figure 6.10 of the NIR but 26,944.75 kha in CRF table 4.B. During the review, the Party clarified that it will ensure consistency between the information given in the NIR and the CRF tables in future inventory submissions and that land areas will be presented in the NIR in tabular format.
L.15	4.B Cropland – CO_2 (L.25, 2019) (L.30, 2018) Consistency	Revisit the calculations and parameters used to estimate DOM in cropland and either recalculate or revise the emissions from cropland using revised parameters for 2016 or explain in the NIR the reasons for such a significant change in the carbon stock for the DOM pool between 2007–2015 and 2016.	Resolved. The Party reported in its NIR (section 6.3, p.342) that it uses a tier 1 method to estimate the DOM carbon pool for cropland remaining cropland, and that, when national data on different crop and climate types and management practices or periodic inventories are improved, the gain–loss or stock–difference methods can be applied. In addition, since the 2019 submission, there have not been any significant differences in emissions reported for the DOM pool for cropland between 2007–2015 and 2016. During the review, the Party confirmed that calculations of changes of DOM are only performed for areas that are changed from forest areas to agricultural areas.
L.16	4.B Cropland – CO_2 (L.26, 2019) (L.31, 2018) Transparency	Provide in the NIR a clear explanation of the carbon stock value for above-ground biomass used in the calculations for perennial crops and the applicability of this value to national circumstances, and indicate whether the ongoing capacity-building projects in the country (e.g. the EU-funded project initiated in 2017) will generate carbon stock factors for perennial crops specific to Turkey.	Addressing. The Party reported in its NIR (pp.341–342) that the data for the carbon stock value for above-ground biomass used in the calculations for perennial crops were taken from a report by Canaveira et al. (2018) and explained their applicability to national circumstances. However, the ERT noted that the full reference for the report is missing from the reference list. During the review, the Party clarified the reference to Canaveira et al. (2018).
L.17	4.C.1 Grassland remaining grassland – CO_2 and N_2O (L.1, 2019) (L.1, 2018) (L.1, 2016) (L.1, 2015) (table 3, 2014) (72, 2013) (105, 2012) (91, 2011) Completeness	Use existing data, make all the necessary efforts to collect new data and report estimates for carbon stock changes in mineral soils for grassland.	Addressing. The Party reported the carbon stock changes for grassland remaining grassland as "NA" for all pools, with the exception of organic soils, in CRF table 4.C, assuming no change in carbon stocks. The ERT considers that the recommendation has not yet been fully addressed because reporting of carbon stock changes in mineral soils for grassland remaining grassland is mandatory and, even when a tier 1 method is applied, the Party should explain whether the grassland systems are degraded or improved when compared with native conditions (see the 2006 IPCC Guidelines, vol. 4, chap. 6, figure 6.1). Such information was not provided in the NIR.
L.18	4.C.2 Land converted to grassland – CO_2	Provide in section 6.4 of the NIR detailed information regarding the carbon stock values used for the calculations for conversion of forest land to grassland for all pools, and include in CRF table 4.C information on grassland	Resolved. The Party reported in tables 6.25 (biomass), 6.26 (DOM) and 6.27 (soils) in its NIR (section 6.4, pp.358–359) information on the carbon stock values used for the calculations for conversion of forest land to grassland for all carbon pools. Forest land is disaggregated by forest

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(L.33, 2019) (L.36, 2018) Accuracy	converted to forest land by subcategory (e.g. degraded coniferous forest land converted to natural grassland; degraded coniferous forest land converted to pasture; degraded coniferous forest land converted to green areas; productive coniferous forest land converted to natural grassland; productive coniferous forest land converted to pasture; productive coniferous forest land converted to green areas; degraded deciduous forest land converted to natural grassland; degraded deciduous forest land converted to pasture; degraded deciduous forest land converted to green areas; productive deciduous forest land converted to natural grassland; productive deciduous forest land converted to pasture; and productive deciduous forest land converted to green areas).	type (coniferous, deciduous, mixed forest, and other forested land and grassland) and by ecological zone. Although the information in CRF table 4.C on forest land converted to grassland is not presented by subcategory (e.g. degraded coniferous forest land converted to natural grassland, degraded coniferous forest land converted to pasture and degraded coniferous forest land converted to green areas), the ERT notes that such information is not mandatory, although it would further improve the transparency of the reporting.
L.19	4.C.2.1 Forest land converted to grassland – CO_2 (L.34, 2019) (L.37, 2018) Accuracy	Ensure that all land areas in transition from forest land to grassland that reach the end of transition time (default 20 years) are subtracted from that state and added to the grassland remaining grassland category in CRF table 4.C.	Not resolved. The areas of forest land converted to grassland increased steadily from 1990 to 2019 (CRF table 4.C: from "NO" for 1990 and 0.47 kha for 1991 to 51.81 kha for 2019). The ERT noted that this issue is caused by including the cumulative area changes only from 1990 onward under the land conversion categories, instead of ensuring that all land areas in transition from forest land to grassland that reach the end of transition time (default 20 years) are subtracted from that state and added to the grassland remaining grassland category in CRF table 4.C. This is not in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 3, p.3.9), which state that the commencement time for the historical land-use change data requirement is at least 20 years. The Party reported in its NIR (section 6.1, pp.317–318) that it has limited statistical data on land use before 1990, and that the national forest inventory is not spatially explicit and, although available for 1972 onward, it is based on a definition of forest which is incompatible with the current system (which relies principally on Landsat imagery). The ERT notes that the decision tree for preparation of land-use area data in the 2006 IPCC Guidelines (vol. 4, chap. 3, figure 3.1) foresees a mix of approaches when national circumstances are such that the primary data set does not provide a complete time series for the country. Overall, the ERT considers that the recommendation has not yet been addressed because the Party has not yet shown that assuming no conversion of forest land to grassland before 1990 is the more accurate assumption on the basis of existing evidence.
L.20	4.D Wetlands – CO_2 (L.35, 2019) (L.19, 2018) (L.13, 2016) (L.13, 2015)	Explain the trends in AD, taking into consideration the recommendations made in the previous review report on	Addressing. The Party reported emissions and removals from land converted to other wetlands for 1991 onward but did not provide AD or report emissions from conversion of land to peat extraction or flooded

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
	(124, 2014) Transparency	consistent land-use information and on the proper use of notation keys.	land (both reported as "NO" in CRF table 4.D). The explanation provided in the NIR (section 6.5, p.362) that the notation key "NO" has been used for peat extraction and that when more detailed data on peat extraction are available a default methodology can be applied suggests that the notation key "NE" should have been used for the conversion of land to peat extraction. For conversion to flooded land, no explanation is provided in the NIR for using the notation key "NO". However, the methodological documents shared by Turkey suggest that its land-use change tracking system is able to track conversion to flooded land instead of other wetlands and references in the peer-review literature consulted by the ERT suggest a significant increase in flooded land over recent decades (e.g. Ataol and Onmuş (2021)). The ERT considers that the recommendation has not yet been fully addressed because the Party has not justified the use of the notation key "NO" for land converted to flooded land and used the notation key "NO" where "NE" would be expected for land converted to peat extraction on the basis of the information provided by Turkey in the NIR.
L.21	4.D.2 Land converted to wetlands – CO_2 (L.36, 2019) (L.38, 2018) Transparency	Include a justification in the NIR for the discontinuity of previously reported information on emissions and areas related to wetlands (e.g. the area of cropland or grassland converted to wetlands) and the reporting of "NO" and "NE" in CRF table 4.D.	Not resolved. The Party reported emissions from the conversion of cropland and grassland to flooded land as "NO" for all years in CRF table 4.D and did not provide a justification in the NIR for using this notation key.
L.22	4.E.2 Land converted to settlements – CO_2 (L.37, 2019) (L.39, 2018) Transparency	Provide information in the NIR regarding the equations used to estimate the changes in carbon stock for biomass, litter and soils for land converted to settlements and their consistency with the 2006 IPCC Guidelines, as well as the AD and parameters used and their source.	Addressing. Turkey reported information in its NIR (section 6.6, pp.372–373, tables 6.36–6.38) on the parameters used for estimating the changes in carbon stock for biomass, DOM and soils for land converted to settlements. However, the Party did not provide information in the NIR on the equations used for estimating the changes in carbon stock. The sources of the parameters used were provided in the NIR (section 6.6, pp.369–370); however, the NIR (p.370) includes references to table 6.20 that, in fact, referred to the content of figure 6.20 and the sources of AD used were not provided in that section of the NIR. During the review, the Party clarified that the equations used to estimate changes in carbon stock for soils for biomass, DOM and land converted to settlements will be included in the NIR of its next inventory submission.
L.23	4.E.2.2 Cropland converted to settlements – CO_2 (L.38, 2019) (L.40, 2018) Accuracy	Create subcategories for land uses for which carbon stock change factors are available (e.g. annual and perennial crops) in the CRF tables, and provide in the NIR a rationale and explanation for changes performed since the previous inventory submission, ensuring that if no recalculations	Resolved. The Party reported subcategories for land uses for which carbon stock change factors are available (e.g. annual and perennial crops) in the NIR (section 6.6, p.372, table 6.36) and provided explanations for the changes, but did not create corresponding subcategories in its reporting in CRF table 4.E. Although the creation of subcategories for land uses for which carbon stock changes are available in CRF table 4.E

ID#	Issue classification[a, b]	Recommendation made in previous review report	ERT assessment and rationale
		have been performed, the values provided in the previous inventory submission are retained.	would further improve transparency of reporting, the ERT notes that this is not mandatory according to the UNFCCC Annex I inventory reporting guidelines.
L.24	4(III) Direct N_2O emissions from N mineralization/ immobilization – N_2O (L.40, 2019) (L.41, 2018) Convention reporting adherence	Provide information in the NIR regarding the expert judgment that led to the conclusion that N_2O emissions from mineralization occurring in other land are negligible in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Not resolved. The notation key "NE" was not used in CRF table 4(III), including for other land. Instead, the notation key "NO" was used. The insignificance of the emissions was not justified in the NIR in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines. During the review, the Party stated that the calculations show that N_2O emissions from mineralization from other land in CRF table 4(III) are negligible.
L.25	4(V) Biomass burning – CO_2, CH_4 and N_2O (L.46, 2019) Completeness	Collect information on areas burned owing to wildfires for grassland and estimate emissions in future inventory submissions; and report controlled burning as "NO" and provide a rationale for the use of the notation key in the NIR.	Addressing. The Party reported controlled burning as "NO" in CRF table 4(V), except for forest land, for which "NA" was used. Turkey continued to report both grassland remaining grassland and land converted to grassland as "NE" in CRF table 9 owing to lack of AD on burned areas. The Party reported in its NIR (section 6.1, p.320, table 6.5) that the notation key "NA" was used for biomass burning for cropland, grassland, wetlands and settlements, but only the notation keys "NO", "NE" and "IE" were used within CRF table 4(V). During the review, the Party explained that controlled burning does not occur in grassland areas but wildfires do occur. Biomass burning emissions are reported under the land-use category in which they occur. The ERT considers that the recommendation has not yet been addressed because the Party has not collected information on areas burned owing to wildfires for grassland or provided an explanation in the NIR for the use of the notation key "NO" for controlled burning.
L.26	4.G HWP – CO_2 (L.47, 2019) Transparency	Considering that the use of the notation key "IE" for some import and export data is not appropriate, estimate the exact figures for HWP categories in the NIR for sawn wood and wood panels for 1990 and paper and paperboard exports for 1960–1973, 1976–1991 and 1995–2002, and report the values in CRF table 4.Gs2.	Resolved. The Party used the notation key "NO" in CRF table 4.Gs2 for the years for which no export of paper or paperboard is reported in FAOSTAT.
Waste			
W.1	5.A.1 Managed waste disposal sites – CH_4 (W.14, 2019) Convention reporting adherence	Correct the notation key (from "NO" to "IE") used in NIR table 7.21 for reporting emissions from clinical waste disposed in landfills.	Resolved. The Party reported in table 7.21 of its NIR (section 7.2, p.412) using the notation key "IE" instead of "NO" for emissions from clinical waste disposed in landfills for 1990–2003.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
W.2	5.B.1 Composting – CH_4 and N_2O (W.4, 2019) (W.6, 2018) Transparency	Provide a more detailed explanation of the AD trend, focusing on the reasons for the fluctuations in AD observed between 2001 and 2013.	Resolved. The AD used by the Party for the time series were recalculated for the 2020 submission. The Party reported in its NIR (section 7.3, p.416) that AD for 1990–2000 were estimated using the fraction of waste composted, whereas AD for 2001–2013 were obtained by estimating from surrogate data, with the exception of data for 2005 and 2012, where survey data were used. In 2015, the official data on the amount of waste treated by composting plants started to be compiled directly from the relevant facilities for years without a survey (2015, 2017 and 2019). A complete time series was thus obtained with the available survey data (2014, 2016 and 2018). During the review, the Party clarified that the updated AD have fewer inter-annual fluctuations.
W.3	5.B.1 Composting – CH_4 and N_2O (W.5, 2019) (W.6, 2018) Transparency	Change the type of data reported in NIR table 7.19 by replacing the current information reported (number of facilities with installed capacity) with the number of facilities operating each year and separately indicating the capacity of each plant.	Resolved. The Party changed the type of data reported in table 7.23 (table 7.19 in the 2018 NIR) of its NIR (section 7.3, p.416), including data on the number of installed and operating plants and total capacity of composting plants for 1994–2019. The Party explained that AD for 1990–2000 were estimated on the basis of the amount of MSW delivered to composting plants (1994–1998, 2001–2004, 2006, 2008, 2010, 2012, 2014, 2016 and 2018) according to the municipal waste statistics of the Turkish Statistical Institute, as provided in table 7.5 of the NIR (section 7.2, p.394). The composted waste data are available in the municipal waste statistics for 2006, 2008 and 2010, and in the waste disposal and recovery facilities statistics for 2005, 2012, 2014, 2016 and 2018. The amount of waste treated by composting plants is approximately half the amount of waste delivered to composting plants (0.49). This fraction was used as a multiplier for 1990–2000 with amount of waste delivered to composting plants survey data. For 2001–2013, survey data were used where available (2005 and 2012) and, otherwise, estimated from surrogate data. For 2015 onward, official data on the amount of waste treated by composting plants are available either from a survey (2014, 2016 and 2018) or directly from the relevant facilities for the years in which no survey was conducted (2015, 2017 and 2019). However, the ERT noted that the data for 2019 seemed to be missing from table 7.23 of the NIR (section 7.3, p.416). During the review, the Party clarified that data for 2019 are available in NIR table 7.23, as 2018 was written twice in the table in error. As stated in the NIR (section 7.3, pp.416–417), for non-survey years (2015, 2017 and 2019) the number and total capacity of composting plants with installed capacity is assumed to be the same as in the previous year. Therefore, it is assumed that 2019 data are the same as 2018 data.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
W.4	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.6, 2019) (W.7, 2018) Accuracy	Change the classification of garden and park MSW to biogenic in the emission calculations and in NIR table 7.25, recalculate GHG emissions for the entire time series accordingly and describe the recalculation in the NIR.	Resolved. The Party reported in its NIR (section 7.4, pp.429–430) that it changed the classification of garden and park MSW from non-biogenic to biogenic in the NIR (section 7.4, p.430, tables 7.29–7.30) and therefore recalculated the relevant CO_2, CH_4 and N_2O emissions.
W.5	5.D Wastewater treatment and discharge – CH_4 (W.7, 2019) (W.8, 2018) Transparency	Improve the consistency of the data reported between the waste (category 5.D) and agriculture (category 3.D) sectors with respect to the amount of sludge produced from wastewater and the amount used on agricultural soils.	Resolved. The Party provided in the NIR (section 7.5, p.441, table 7.37) a sludge balance with the amount of sewage sludge from domestic wastewater that is sent to each of the different treatments.
W.6	5.D Wastewater treatment and discharge – CH_4 (W.9, 2019) (W.8, 2018) Transparency	Report a complete sludge balance, including the total amount produced (from domestic and industrial wastewater), the amount sent to each of the different treatments (landfill, incineration, agriculture, composting, etc.) and, if possible, their specific characteristics (carbon and N content).	Resolved. The Party reported in the NIR (section 7.5, p.441, table 7.37) a sludge balance with the amount of sewage sludge from domestic wastewater that is sent to each of the different treatments, although Turkey did not provide in the NIR information on the specific characteristics of sludge (carbon and N content). During the review, the Party clarified that the carbon and N content of sludge is not mandatory information used in the calculations for category 5.D. Information on the N content of sludge is provided in the agriculture sector of the NIR (section 5.5, p.298). The country-specific N content value for sewage sludge is 5.15 per cent, calculated as an average on the basis of the values in a research study (Topaç and Başkaya, 2008). A reference to the study is provided in the NIR (references section, p.535). The ERT agrees with the Party that reporting the carbon and N content of the sludge is not mandatory and considers that Turkey has resolved the recommendation.
W.7	5.D.1 Domestic wastewater – CH_4 (W.10, 2019) (W.9, 2018) Accuracy	Improve the accuracy of the parameter used for the degree of treatment utilization by population class for the whole time series by applying the results of the ongoing study being carried out to determine specific values for this parameter (every two years after 2008) and recalculate the AD and corresponding CH_4 emissions for the time series accordingly. If the aforementioned study is not available for the next inventory submission, improve the transparency of the planned improvement section by mentioning the study, including a brief description of the scope, the progress achieved and the date that the results are expected to be available.	Addressing. The Party reported in its NIR (section 7.5, p.454) its plan to improve the parameters used in the estimation of CH_4 emissions, both for the degree of treatment utilization by population class and for the fraction usage for different types of wastewater treatment and discharge pathways for the entire time series, by applying the results from a study that was under way. During the review, the Party clarified that, owing to the coronavirus disease 2019 pandemic, the study could not be completed.
W.8	5.D.1 Domestic wastewater – N_2O	Improve the accuracy of the T_{PLANT} parameter for the whole time series by applying the results achieved from the	Resolved. The Party recalculated the T_{PLANT} parameters and, consequently, N_2O emissions for 2014–2017 based on the results of the

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(W.12, 2019) (W.10, 2018) Accuracy	ongoing study being carried out to determine specific values for this parameter (every two years after 2008) and recalculate the AD and corresponding N_2O emissions for the whole time series accordingly. If the results are not available for the next inventory submission, improve the transparency of the NIR by including the data source for this parameter, explaining how it has been estimated, and mentioning in the planned improvement section the ongoing study being carried out to improve this factor, including a brief description of the scope and progress achieved, as well as the date that the results are expected to be available.	study carried out to determine specific values for this parameter. This led to lower estimated emissions for 2014, 2016 and 2017 (by 0.45, 0.43 and 0.72 per cent, respectively) and higher estimated emissions for 2015 (by 0.34 per cent). Turkey explained this recalculation in its 2020 NIR (section 7.5, p.443). The Party reported in CRF table 5.D, under additional information, T_{PLANT} values for 2001–2019.
W.9	5.D.2 Industrial wastewater – CH_4 (W.13, 2019) (W.11, 2018) Accuracy	Improve the accuracy of the parameter used for the fractional usage for different types of waste treatment and discharge pathways for the whole time series by applying the results achieved from the ongoing study being carried out to determine specific values for these parameters (every two years after 2008) and recalculate the AD and corresponding CH_4 emissions for the whole time series accordingly. If the results are not available for the next inventory submission, improve the transparency of the NIR by including the data source for the fractional usage parameter and mentioning in the planned improvement section the ongoing study, including a brief description of the scope and progress achieved, as well as the date that the results are expected to be available.	Addressing. The Party reported in its NIR (section 7.5, p.454) its plan to improve the parameters used in the estimation of CH_4 emissions, both for the degree of treatment utilization by population class and for the fraction usage for different types of waste treatment and discharge pathways for the entire time series, by applying the results from a study that was under way. During the review, the Party clarified that, owing to the coronavirus disease 2019 pandemic, the study could not be completed.

[a] References in parentheses are to the paragraph(s) and the year(s) of the previous review report(s) in which the issue 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 2020 inventory submission of Turkey was not available at the time of this review. Therefore, the recommendations reflected in this table are taken from the 2019 inventory review report. For the same reason, 2020 and 2017 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 2021 inventory submission of Turkey, and had not been addressed by the Party at the time of publication of this review report.

Table 4
Issues identified in three or more successive reviews and not addressed by Turkey

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
General		
G.2	Improve the transparency of the reported information on the key drivers of the PFC emission trends by providing in section 2 of the NIR detailed information, in particular on the decrease in PFC emissions in recent years.	3 (2018–2021)
Energy		
E.3	Include explanations in the documentation box of the relevant CRF table and in the NIR for fuels with non-energy use consumption reported without any associated emissions reported in the inventory.	4 (2015/2016–2021)
E.5	Determine a reliable data source for international bunker fuels and improve time-series consistency.	6 (2013–2021)
E.9	Determine an appropriate methodology for addressing the data gaps in the technology split for gaseous fuel combustion prior to 2003 in order to ensure consistency in the time series.	3 (2018–2021)
E.10	Use in the uncertainty analysis documented country-specific values for the uncertainty of CH_4 and N_2O EFs, in particular for EFs that are country- or plant-specific, or, if this is not possible, choose and use appropriate default uncertainty values for CH_4 and N_2O EFs and document the values selected and associated assumptions in the NIR.	3 (2018–2021)
E.11	Investigate how to allocate emissions from 'autoproducers' of electricity to the category relevant to where the electricity is generated in accordance with the 2006 IPCC Guidelines.	3 (2018–2021)
E.12	Improve the transparency of the reporting by including a comparison of facility-level data with the sectoral totals from the national energy balance in the NIR.	4 (2015/2016–2021)
E.14	Provide sufficient information on the inter-annual changes in the CO_2 EFs in the NIR.	5 (2014–2021)
E.15	Improve the comparability and consistency of the inventory and separate the emissions from pulp, paper and print (1.A.2.d), food processing, beverages and tobacco (1.A.2.e) and non-metallic minerals (1.A.2.f) from the emissions reported in category 1.A.2.g other (manufacturing industries and construction) for the entire time series.	3 (2018–2021)
E.16	Include information on significant changes in the trend in AD composition for the different shares of oil products and on how these impact the CH_4 and N_2O IEFs.	4 (2015/2016–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
E.18	Move to a higher-tier method for calculating N_2O (and CH_4) emissions, as it is likely that 1.A.3.b would be a key category if using appropriate EFs.	5 (2014–2021)
E.20	Separate the emissions under category 1.A.4.a (commercial/institutional) from the emissions reported under category 1.A.4.b (residential) for the entire time series.	3 (2018–2021)
E.21	Revise the emission estimates, reallocating the diesel oil used for agricultural purposes to subcategory 1.A.4.c agriculture/forestry/fishing by using assumptions based on the historical trend of the ratio of diesel oil used for agriculture to the total diesel oil used in the country.	5 (2014–2021)
E.22	Provide a clear explanation in the NIR of the allocation of diesel oil used for agricultural purposes to subcategory 1.A.4.c agriculture/forestry/fishing, using assumptions based on the historical trend of the ratio of diesel oil used for agriculture to the total diesel oil used in the country.	5 (2014–2021)
IPPU		
I.3	Include captive lime production emissions in the estimates for this category.	5 (2014–2021)
I.4	Provide evidence of the 100 per cent CO_2 recovery rate associated with lime use during sugar refining and precipitate production in the NIR (any proven and validated method used to calculate the amount of CO_2 that reacts with lime to reform calcium carbonate or the amount of CO_2 that is not recarbonated to limestone in the refining process can be provided as evidence), or report the CO_2 emissions from the lime produced in sugar mills together with the emissions from marketed lime under the lime production category.	4 (2015/2016–2021)
I.7	Use the notation key “NO” to report fluorochemical production.	4 (2015/2016–2021)
I.8	Validate and double-check the AD on styrene production for the complete time series, provide the missing estimates if emissions occurred in the country and include explanations for the emission trend in the NIR.	5 (2014–2021)
I.9	Either update the equation on page 207 of the NIR to clarify that it is applied at the plant level to estimate emissions from iron and steel or sinter (not pig iron or sinter) or clarify that the equation currently included in the NIR represents an overall carbon mass balance calculation conducted as a QA/QC check in estimating emissions from iron and steel and sinter production.	3 (2018–2021)
I.11	Correct the notation key used to report SF_6 emissions from magnesium foundries from “NA” to “NE”.	5 (2014–2021)
I.15	Collect the necessary updated AD to reflect national market tendencies and report the corresponding emissions.	3 (2018–2021)
I.18	Provide estimates of HFC-227ea emissions from manufacturing, operation and disposal separately, or, if this is not possible, continue using “IE” for manufacturing and disposal and indicate clearly in CRF table 9 and the NIR that all HFC-227ea emissions are reported under operating systems (stocks).	3 (2018–2021)
I.19	Taking into account the high probability that metered dose inhalers are used in Turkey, estimate and report HFC emissions from metered dose inhalers or provide evidence that these emissions are not occurring in the country.	3 (2018–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
I.20	Report complete emissions from refrigeration and air-conditioning equipment from manufacturing, operation and disposal by subcategory under category 2.F.1 instead of category 2.F.6 in accordance with the UNFCCC Annex I inventory reporting guidelines, or, if this is not possible, report the notation key "IE" in the appropriate cells of the CRF tables and include information in CRF table 9 and the NIR on where these emissions are reported.	3 (2018–2021)
I.21	Improve the consistency and accuracy of the reporting between CRF table 2(II).B-H and the NIR with respect to the reporting of HFC-32 emissions; and verify the product life EF for HFC-32 and revise the estimates, if necessary.	3 (2018–2021)
I.22	Estimate HFC emissions for 1999 by collecting data for 1999 or using interpolation in accordance with the 2006 IPCC Guidelines for between 1998 and 2000 (assuming that in 1998 no HFCs were consumed).	3 (2018–2021)
I.23	Provide in the NIR a more detailed description of the main assumptions applied and F-gas used in the F-gas model for estimating HFCs, in particular the assumed average initial filling and the number of units of equipment on the market for all years of the time series.	3 (2018–2021)
I.24	Calculate and report HFC disposal emissions from retired refrigeration and air-conditioning equipment, and, if applicable, the amount of recovery of these gases.	3 (2018–2021)
I.25	Report all likely occurring emissions, such as N_2O emissions from anaesthesia and other applications.	5 (2014–2021)
I.26	Report SF_6 emissions from manufacturing, operation and disposal separately, taking into account the long-term use of such equipment, in accordance with the 2006 IPCC Guidelines.	3 (2018–2021)
Agriculture		
A.8	Estimate emissions for significant livestock categories using the tier 2 method with country-specific EFs, including enhancing livestock population characterization and taking into account the relevant IPCC guidance.	6 (2013–2021)
A.9	Collect the necessary AD and estimate and report CH_4 and N_2O emissions from manure management using country-specific EFs and appropriate tier methods from the 2006 IPCC Guidelines.	3 (2018–2021)
A.12	Assess the significant inter-annual changes in the CH_4 IEF for swine manure management, in particular in the latest years of the time series, and include the results in the NIR.	3 (2018–2021)
A.13	Check the population of swine used in the calculations and assess and report in the NIR the reasons for any significant inter-annual changes observed in the population of swine across the time series. In cases where large inter-annual changes cannot be explained, consider whether using a splicing technique from the 2006 IPCC Guidelines would provide more accurate estimates.	3 (2018–2021)
LULUCF		
L.3	Strengthen the sector-level QC procedures to ensure consistency between the information provided in the NIR and the CRF tables, particularly with respect to NIR tables 6.2, 6.3, 6.13, 6.15 and 6.16.	3 (2018–2021)
L.6	Strengthen QC procedures to ensure consistent representation of land between the end of one inventory year and the beginning of the next and report correctly and consistently initial and final areas in CRF table 4.1.	3 (2018–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
L.10	Conduct a thorough scientific assessment of the estimation methods used for forest land, ensuring a comprehensive and balanced approach to calculating carbon inputs and outputs for each pool, and revise the estimates, if necessary.	5 (2014–2021)
L.12	Apply the definition of annual wood removals presented in the 2006 IPCC Guidelines (annual wood removals, roundwood, m^3/year), or, if not applicable, provide a justification for including more than the actual wood annually removed in the calculations for this category.	3 (2018–2021)
L.13	Include in the NIR a section on grassland converted to forest land under section 6.4, report in the NIR the background data used for calculating net emissions and removals from soils and further document the country-specific values used.	4 (2015/2016–2021)
L.14	Correct detected inconsistencies and, as part of QA/QC routines, check that data presented in the NIR in tables, text and figures are consistent and match the latest data reported in the CRF tables (i.e. regarding areas of cropland).	4 (2015/2016–2021)
L.16	Provide in the NIR a clear explanation of the carbon stock value for above-ground biomass used in the calculations for perennial crops and the applicability of this value to national circumstances, and indicate whether the ongoing capacity-building projects in the country (e.g. the EU-funded project initiated in 2017) will generate carbon stock factors for perennial crops specific to Turkey.	3 (2018–2021)
L.17	Use existing data, make all the necessary efforts to collect new data and report estimates for carbon stock changes in mineral soils for grassland.	8 (2011–2021)
L.19	Ensure that all land areas in transition from forest land to grassland that reach the end of transition time (default 20 years) are subtracted from that state and added to the grassland remaining grassland category in CRF table 4.C.	3 (2018–2021)
L.20	Explain the trends in AD, taking into consideration the recommendations made in the previous review report on consistent land-use information and on the proper use of notation keys.	5 (2014–2021)
L.21	Include a justification in the NIR for the discontinuity of previously reported information on emissions and areas related to wetlands (e.g. the area of cropland or grassland converted to wetlands) and the reporting of “NO” and “NE” in CRF table 4.D.	3 (2018–2021)
L.22	Provide information in the NIR regarding the equations used to estimate the changes in carbon stock for biomass, litter and soils for land converted to settlements and their consistency with the 2006 IPCC Guidelines, as well as the AD and parameters used and their source.	3 (2018–2021)
L.24	Provide information in the NIR regarding the expert judgment that led to the conclusion that N_2O emissions from mineralization occurring in other land are negligible in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	3 (2018–2021)

ID#	*Previous recommendation for issue*	*Number of successive reviews issue not addressed*[a]
Waste		
W.7	Improve the accuracy of the parameter used for the degree of treatment utilization by population class for the whole time series by applying the results of the ongoing study being carried out to determine specific values for this parameter (every two years after 2008) and recalculate the AD and corresponding CH_4 emissions for the time series accordingly. If the aforementioned study is not available for the next inventory submission, improve the transparency of the planned improvement section by mentioning the study, including a brief description of the scope, the progress achieved and the date that the results are expected to be available.	3 (2018–2021)
W.9	Improve the accuracy of the parameter used for the fractional usage for different types of waste treatment and discharge pathways for the whole time series by applying the results achieved from the ongoing study being carried out to determine specific values for these parameters (every two years after 2008) and recalculate the AD and corresponding CH_4 emissions for the whole time series accordingly. If the results are not available for the next inventory submission, improve the transparency of the NIR by including the data source for the fractional usage parameter and mentioning in the planned improvement section the ongoing study, including a brief description of the scope and progress achieved as well as the date that the results are expected to be available.	3 (2018–2021)

[a] The reports on the reviews of the 2017 and 2020 inventory submissions of Turkey have not yet been published. Therefore, 2017 and 2020 were not included when counting the number of successive years for this table. In addition, as the reviews of the Party's 2015 and 2016 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 2021 inventory submission

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

Table 5
Additional findings made during the individual review of the 2021 inventory submission of Turkey

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
General			
		No general findings additional to those included in table 3 were made by the ERT during the review.	
Energy			
E.24	Fuel combustion – reference approach – all fuels – CO_2, CH_4 and N_2O	The Party did not report apparent energy consumption excluding non-energy use, reductants and feedstocks of liquid, solid or gaseous fuels in the reference approach for 2018–2019 in CRF table 1.A(c), thereby reducing the possibility of meaningful comparison of the energy consumption across the reference and sectoral approaches (currently, a 100 per cent difference is reported per fuel) in the table.	Yes. Comparability

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		The ERT recommends that the Party report apparent energy consumption excluding non-energy use, reductants and feedstocks of liquid, solid and gaseous fuels in the reference approach for 2018–2019 in CRF table 1.A(c).	
E.25	1.A.2.c Chemicals – solid fuels – CO_2, CH_4 and N_2O	The CO_2, CH_4 and N_2O IEFs for solid fuels for 2019 in CRF table 1.A(a)s2 (9,967,834.96 t CO_2/TJ, 1,000,000.00 kg CH_4/TJ and 150,000.00 kg N_2O/TJ, respectively) are five orders of magnitude higher than the IEFs for previous years (92.45–114.18 t CO_2/TJ, 10.00 kg CH_4/TJ and 1.50 kg N_2O/TJ, respectively).	Yes. Convention reporting adherence
		During the review, the Party explained that the AD for 2019 were reported using an incorrect unit of measurement, namely not TJ, and that the unit of measurement will be corrected in the next inventory submission. Turkey also explained that the issue with the AD did not have an impact on the emission estimates reported in the CRF tables.	
		The ERT recommends that the Party report the consumption of solid fuels for 2019 using the correct unit of measurement, namely TJ, in CRF table 1.A(a)s2.	
IPPU			
I.29	2. General (IPPU)	The Party provided in its NIR incorrect information in several instances. On page 456 (chap. 10), it stated that there was a recalculation owing to a unit of measurement error in data entry for categories 2.E electronics industry and 2.F product uses as substitutes for ozone-depleting substances; however, category 2.E has not been recalculated and category 2.F was recalculated, but not owing to an error in the unit of measurement. On page 190 of the NIR (section 4.3.1), the title of figure 4.9 is incorrect, as the figure shows total GHG emissions (CO_2, CH_4 and N_2O), not just CO_2 emissions, as the title indicates.	Yes. Convention reporting adherence
		The ERT recommends that the Party review and, if necessary, revise the text in the NIR (chap. 10, p.456) on the recalculations performed for categories 2.E electronics industry and 2.F product uses as substitutes for ozone-depleting substances, and change the title of figure 4.9 in the NIR to indicate that it shows total GHG emissions (CO_2, CH_4 and N_2O) and not just CO_2 emissions.	
I.30	2. General (IPPU)	The Party did not explain in CRF table 9 many of the notation keys used in the other CRF tables. For example, CO_2 and CH_4 emissions for category 2.B.8.b ethylene were reported as "IE" in CRF table 2(I).A-Hs1, and HFC emissions (except HFC-134a) from manufacturing for category 2.F.6 other applications were reported as "IE" in CRF table 2(II).B-Hs2. The Party reported in the documentation box to CRF table 2(I).A-Hs1 that category 2.B.2 is included under category 2.B.8.g.	Yes. Transparency
		The ERT recommends that the Party explain in CRF table 9 the notation keys used for CO_2 and CH_4 emissions for category 2.B.8.b ethylene in CRF table 2(I).A-Hs1, and for HFC emissions (except HFC-134a) from manufacturing for category 2.F.6 other applications in CRF table 2(II).B-Hs2.	
I.31	2.A.1 Cement production – CO_2	The Party reported in table 4.3 of its NIR (section 4.2.1, p.166) CO_2 emissions and AD (e.g. clinker and cement production) across the time series, but values for 2019 were not reported. However, CRF table 2(I).A-Hs1 includes clinker production and CO_2 emissions for 2019. During the review, the Party clarified that the values for 2019 were omitted from NIR table 4.3 in error.	Yes. Convention reporting adherence
		The ERT recommends that the Party complete the information on CO_2 emissions and AD (e.g. clinker and cement production) for all years, including 2019, in NIR table 4.3.	
I.32	2.A.2 Lime production – CO_2	The Party reported in table 4.5 of its NIR (section 4.2.2, p.171) CO_2 emissions from lime production. It reported 2,642 and 2,565 kt CO_2 for 2018 and 2019, respectively. However, Turkey reported 2,786.68 kt CO_2 for 2018–2019	Yes. Convention reporting adherence

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue?[a]
		in CRF table 2(I).A-Hs1. The ERT believes that the figures in the NIR do not account for emissions from dolomitic lime. During the review, the Party clarified that the values for 2018–2019 in NIR table 4.5 are incorrect. The ERT recommends that the Party correct the CO_2 emissions from lime production in NIR table 4.5 and report values for all years, including 2018–2019, that are consistent with the values in CRF table 2(I).A-Hs1.	
I.33	2.C.3 Aluminium production – PFCs	According to the NIR (section 4.4.3, p.225), PFC emissions from the only aluminium production plant in the country are estimated using tier 3 methodology for 2006 onward. The ERT notes that the 2006 IPCC Guidelines (vol. 3, chap. 4, table 4.16) for a tier 2 method indicate the ratio of hexafluoroethane and carbon tetrafluoride, ranging from 0.053 to 0.085 for the Søderberg process and from 0.121 to 0.252 for prebake technology. On the basis of table 4.28 of the NIR (section 4.4.3, p.227) this relation is 0.044 up to 2015 (Søderberg process) and 0.846 for 2015 onward (prebake technology). No explanation on the change was provided in the NIR. During the review, the Party clarified that the aluminium production plant switched to using prebake cells in 2015, previously using the Søderberg process. The monitoring system is not yet fully developed and some values are not measured but only estimated by the company. In addition, the amount of aluminium produced changes every year. It is likely that these factors are causing the differences in the ratio. The ERT noted that this explanation does not justify the values used for 2015 onward. The ERT recommends that the Party (1) estimate PFC emissions using a tier 2 method, including tier 2 parameters from the 2006 IPCC Guidelines (vol. 3, chap. 4, section 4.4.2.4), in particular the ratio between hexafluoride and carbon tetrafluoride emissions, until the proper monitoring system for tier 3 estimations is in place; and (2) explain the recalculation in the NIR. The ERT also recommends that the Party explain the change in the production technology in 2015 in the NIR.	Yes. Accuracy
I.34	2.E.5 Other (electronics industry) – SF_6	The Party reported SF_6 emissions for 1990–2009 as "NO", for 2010–2016 as 1.85 t and an increase every year from 2017 onward: by 7.4 per cent between 2016 and 2017, by 26.1 per cent between 2017 and 2018 and by 0.9 per cent between 2018 and 2019. According to the NIR (section 4.6, p.242), SF_6 emissions for 2019 were updated from the emissions in 2018 on the basis of the Party's economic growth in 2019 (0.9 per cent). The same approach was adopted for 2018 and 2017. During the review, the Party clarified that the 26.1 per cent increase between 2017 and 2018 is an error and should be 2.6 per cent. As a result, SF_6 emissions for 2018 and, consequently, 2019 were overestimated. The ERT recommends that the Party base the SF_6 emission estimates on annual AD, by estimating the part of the SF_6 import that is used in category 2.E electronics industry and the part used in category 2.G other product manufacture and use; if this is not possible, the updated economic growth should be used for 2018 onward, with an explanation for the recalculation provided in the NIR.	Yes. Accuracy
I.35	2.F Product uses as substitutes for ozone-depleting substances – HFCs	The Party reported in its NIR (section 4.7, p.243) the parameters and assumptions used for calculating emissions for category 2.F product uses as substitutes for ozone-depleting substances. The Party used a lifetime of 15 years for refrigeration and air-conditioning equipment that uses HFCs. During the review, Turkey provided the spreadsheet used for calculating emissions for this category, containing the parameters used in the estimations, which differ from those reported in the NIR (section 4.7, p.243) (e.g. lifetime is 10 years for all HFCs except HFC-227ea in the spreadsheet). The ERT noted that the 10-year value is below the	Yes. Convention reporting adherence

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		default values for most of the sub-applications in the 2006 IPCC Guidelines (vol. 3, chap. 7, table 7.9) and no justification was provided in the NIR for the value used. The ERT recommends that the Party report accurately in the NIR the parameters used in the estimations for calculating emissions for category 2.F product uses as substitutes for ozone-depleting substances, together with the assumptions used and justification for their use.	
I.36	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs	The Party used a tier 1 method to estimate HFC emissions (NIR section 4.7, p.243). The ERT noted that Turkey identified this category as key by level and trend (NIR annex 1, table A1, p.464). The ERT also noted that the 2006 IPCC Guidelines (vol. 3, chap. 7, p.7.16) indicate that tier 1 methods can be used when the application is not a key category. The ERT recommends that the Party estimate the emissions for category 2.F.6 product uses as substitutes for ozone-depleting substances – other applications using a tier 2 method and explain the recalculation in the NIR.	Yes. Accuracy
I.37	2.G.1 Electrical equipment – SF_6	According to the NIR (section 4.8, p.247), the Party assumes SF_6 is used only in electrical equipment, mainly in circuit breakers. Net consumption was based on the net import of SF_6 from 2013, the first year where customs data for SF_6 are available. The ERT noted that Turkey reported SF_6 emissions in another category, namely 2.E electronics industry. During the review, the Party acknowledged that SF_6 emitted from the electronics industry was not deducted from the raw trade data and, as a result, from the SF_6 emissions for category 2.G.1 other product manufacture and use – electrical equipment. The ERT recommends that the Party correct the overestimation of SF_6 emissions in category 2.G.1 other product manufacture and use – electrical equipment by deducting the SF_6 emitted from 2.E electronics industry from the amount of net imported SF_6 used to estimate emissions for category 2.G.1.	Yes. Accuracy
Agriculture			
A.20	3. Agriculture – CH_4, N_2O	The Party reported in its NIR information on the estimation of emissions for the cattle (sections 5.1, p.262, and 5.3, p.283) and sheep categories (section 5.2, p.273). NIR table 5.6 shows the livestock population for different categories for the entire time series, where poultry is presented as a single category and swine and camels are presented together. NIR tables 5.15–5.16 show typical animal mass and Nex values for several categories, where poultry is presented as a single category and swine and camels separately. Regarding swine in NIR table 5.16, a note to the table describes Nex value for swine on the basis of an estimated country population of 90 per cent market swine and 10 per cent breeding swine, based on the 2006 IPCC Guidelines (vol. 4, chap. 10, table 10.19). However, swine are reported under one category in every other section of the NIR, including for the estimation of CH_4 emissions. NIR tables 5.17–5.18 show CH_4 EFs for livestock categories, where poultry is presented as a single category and swine and camels separately. Table 5.19 of the NIR (section 5.3, p.286) lists additional livestock categories (swine, buffalo, camels, horses, goats, mules and asses, and three poultry categories (chickens, ducks and geese, and turkeys)). However, the ERT could not easily locate the description of these categories in the text of the NIR, nor any detail on their manure and its management. During the review, the Party clarified that significant information is presented in the NIR (in tables and in the text on the agriculture sector), and crucial information is also given on page 261 of the NIR. Turkey noted that it considered that these animal categories are not significant according to the 2006 IPCC Guidelines and referred to tables 5.15–5.16 of the NIR (section 5.3, pp.282–283) as well.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		The ERT recommends that the Party improve in the NIR the transparency of the description of the methodology used to estimate CH_4 and N_2O emission for sheep, swine and poultry.	
A.21	3.B.5 Indirect N_2O emissions – N_2O	The Party reported in its NIR (section 5.3, p.280) and CRF table 3.B(b) indirect emissions of N_2O from manure management from volatilization, but no indirect emissions from leaching and run-off (these emissions were reported as "NE"). A note to NIR table 5.14 indicates that the Party considers these emissions insignificant and reported the estimates for the likely level of these emissions (144 kt CO_2 eq for 2019, below the threshold for reporting according to the UNFCCC Annex I inventory reporting guidelines (253 kt CO_2 eq for Turkey for 2019)). However, the NIR does not indicate how those emissions were calculated.	Yes. Transparency
		During the review, the Party clarified that it used equations 10.28–10.29 of the 2006 IPCC Guidelines (vol. 4, chap. 10) to estimate N_2O emissions from manure management from leaching and run-off as 144 kt CO_2 eq. The Party also explained that it used the value of 4.5 per cent (mid-value between 3 and 6 per cent) as the fraction of managed manure N losses due to leaching and run-off, which it deemed suitable given the dry conditions of the country.	
		The ERT recommends that the Party explain in the NIR how it estimated the likely level of indirect N_2O emissions from leaching and run-off.	
A.22	3.D Direct and indirect N_2O emissions from agricultural soils – N_2O	According to the NIR (section 5.5, p.300), the Party applied tier 1 methodology for estimating N_2O emissions from soils. As the direct and indirect N_2O emissions are identified as key categories (NIR table A1, p.464), the ERT noted that the 2006 IPCC Guidelines (vol. 4, chap. 11, figure 11.2) require that country-specific data be obtained and, if rigorously documented country-specific EFs are available, tier 2 or 3 methodology should be applied.	Not an issue
		During the review, Turkey stated that the enhancement from tier 1 to tier 2 methodology for estimating N_2O emissions from soils requires appropriate country-specific data and parameters and it currently cannot assess when these data will become available. The ERT notes that no rigorously documented country-specific EFs are available and therefore the Party cannot yet apply tier 2 methodology.	
		The ERT notes ID#s A.15 and A.18 in table 3 regarding sewage sludge and histosols, but those issues do not cover indirect N_2O emissions. The ERT encourages the Party to develop country-specific EFs in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 11, figure 11.2) and use tier 2 methodology to estimate direct and indirect N_2O emissions from agricultural soils.	
A.23	3.D.a.5 Mineralization/ immobilization associated with loss/gain of SOM – N_2O	According to the NIR (section 5.5, p.292), N_2O emissions due to mineralization or immobilization related to loss or gain of SOC in cropland remaining cropland did not occur in the entire reporting period. The Party listed mineralization of cropland SOM loss as a contributor to direct N_2O emissions from soils in its NIR (section 5.5, p.298), possibly referring to emissions for land converted to cropland reported in CRF table 4(III). N_2O emissions are also reported as "NO" in CRF table 3.D. Further, the footnote to table 5.22 of the NIR (section 5.5, p.295) states that SOM refers to mineralization or immobilization associated with loss or gain of SOM and that related AD are taken from CRF table 4.B. The notation key "NO" was used for emissions due to mineralization related to losses of SOC in cropland remaining cropland for the entire reporting period because the related AD do not show a net carbon loss from cropland remaining cropland in CRF table 4.B. However, as Turkey mentioned in its NIR (section 6.3, pp.342–345), methodologies for estimating carbon stock changes for both conversions of annual cropland to perennial cropland and perennial cropland to annual cropland, the ERT assumed that the gains reported in CRF table 4.B for cropland remaining cropland correspond to a net figure and that some conversion of perennial cropland to annual	Not an issue

ID#	Finding classification	Description of finding with recommendation or encouragement	Is finding an issue?[a]
		cropland does occur, and that those conversions are associated with losses of SOC based on the country-specific carbon stock changes reported in table 6.20 of the NIR (section 6.3, p.344). The ERT noted that this is not in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 11, p.11.15) because, where there are losses of carbon, N mineralization and related N losses occur. The calculation should not use net change in soil carbon stocks as AD, as reported by Turkey in CRF table 4.B, and instead consider gains and losses separately, or the NIR should include an explanation of the impossibility of estimating gross changes in mineral soil carbon is a limitation that creates a bias in the N_2O emission estimate (2006 IPCC Guidelines, vol. 4, chap. 11, p.11.16). During the review, the Party clarified that the footnote to table 5.22 of the NIR (section 5.5, p.295) and the information on page 292 (section 5.5) of the NIR is correct. The emissions for this subcategory do not occur for the entire reporting period and the paragraph on page 298 (section 5.5) of the NIR aims to list all potential emission sources from managed soils, regardless of their current standing. The Party explained that it uses the data given in the CRF tables for the LULUCF sector to assess the situation for the entire reporting period. The ERT encourages the Party to estimate emissions from mineralization using as AD for equation 11.8 of the 2006 IPCC Guidelines disaggregated losses by land use and management system (which would allow the losses of soil carbon in annual cropland converted to perennial cropland to be reflected), report associated emissions across the time series and explain the recalculation performed in the NIR. If Turkey maintains its current approach, the ERT encourages the Party to explain in the NIR that the impossibility of estimating gross changes in mineral soil carbon is a limitation that creates a bias (underestimate) in the N_2O emission estimates associated with mineralization from losses of SOC stocks in mineral soils through management practices.	
A.24	3.D.b Indirect N_2O emissions from managed soils – N_2O	The Party reported in its NIR (section 5.5, p.301) how it developed its country-specific value for $Frac_{LEACH-(H)}$. The assumptions are that the method applies to all years, water holding capacity is zero, leaching occurs in wet but not dry areas of the country, and a value is derived on the basis of the ratio between wet and dry areas, that, when multiplied by 0.3 (default value for humid regions from the 2006 IPCC Guidelines (vol. 4, chap. 11, table 11.3)), produces 0.015 as the new $Frac_{LEACH-(H)}$ value. The ERT noted that the footnote to table 11.3 in the 2006 IPCC Guidelines (vol. 4, chap. 11) includes guidance to determine the regions where the default value of 0.3 should be applied and where the regional default value is zero. The ERT requested that the Party provide further justification for the application of 0.015 as the country-specific $Frac_{LEACH-(H)}$ value. During the review, Turkey provided a detailed explanation to justify the country-specific value on pages 300–301 of the NIR (section 5.5). Before responding to the related recommendation given in ID# A.19 in the 2016 review report (FCCC/ARR/2016/TUR), the default $Frac_{LEACH-(H)}$ value of 0.30 was used instead of the currently used country-specific value of 0.015. This means that related emissions for this subsource category would be calculated at 14.99 kt N_2O by using the default IPCC $Frac_{LEACH-(H)}$ value of 0.30 for 2019. Currently, the actual reporting value is 0.75 kt N_2O given in CRF table 3.D, cell E21. The Party explained that it uses a country-specific value in order to assess the country's emissions on the basis of the recommendation in the 2016 review report (ID# A.19 in document FCCC/ARR/2016/TUR). The use of this country-specific value was also assessed during the 2018 review (ID# A.12 in document FCCC/ARR/2018/TUR). However, the current ERT considers that the country-specific approach is still insufficiently explained in the NIR.	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		The ERT recommends that the Party explain how the country-specific value for $Frac_{LEACH-(H)}$ (0.015, based on a ratio between wet and dry areas that has no relationship with the fraction of N that is leached) is calculated and how it is consistent with equation 11.10 and the footnote to table 11.3 of the 2006 IPCC Guidelines (vol. 4, chap. 11), which includes guidance to determine the regions where the IPCC default value (0.3) should be applied.	
LULUCF			
L.27	4. General (LULUCF) – CO_2, CH_4 and N_2O	The Party reported in its NIR on uncertainty in the LULUCF sector with relative uncertainties expressed as a percentage of the reported emissions or removals. Turkey used the notation key "NA" at the pool level when there were no emission estimates, but mentioned a relative uncertainty of 0 per cent at the aggregate level, for instance in the NIR in tables 6.18 (section 6.2, p.336), 6.24 (section 6.3, p.355), 6.29 (section 6.4, p.360), 6.34 (section 6.5, p.366), 6.39 (section 6.6, p.375), 6.41 (section 6.7, p.377) (for land converted to another land), in tables 6.42 (section 6.8, p.378), 6.43 (section 6.9, p.378), 6.45 (section 6.10, p.380) and 6.47 (section 6.11, p.381) (overall), and in tables 6.29 (section 6.4, p.360), 6.34 (section 6.5, p.366) and 6.39 (section 6.6, p.375) (for land remaining in the same category). The ERT considers that using the notation key "NA" instead of 0 per cent for categories where the subcategories have been reported as "NE" would improve the transparency of reporting. Further, when prioritizing improvements, Turkey should assess the potential order of magnitude of the unreported categories. Turkey also used the notation key "NO" for some categories where "NA" would have been more appropriate, such as reporting the carbon content in living biomass in table 6.29 in the NIR (section 6.4, p.360). The ERT encourages the Party to use the notation key "NA" when presenting relative uncertainties for aggregate categories for which emissions or removals have not been estimated.	Not an issue
L.28	4. General (LULUCF) – CO_2, CH_4 and N_2O	The Party included in its NIR (section 6.1, p.319) a reference to a "confusion matrix" that provides information on the accuracy of land-use classification and referred to it as "figure 10", but no such figure was included in the NIR. Further, the Party included a cross-reference in the NIR (section 6.2, p.323) to "figure 6.8", but the reference should, in fact, be to table 6.8 (see also a similar issue in ID# L.22 in table 3). The ERT recommends that the Party include in its inventory submission the figure referred to as figure 10 in the 2021 NIR and include a correct reference to table 6.8 in section 6.2 of the NIR.	Yes. Transparency
L.29	4.A Forest land – CO_2	The Party reported in its NIR (section 6.2, p.322, table 6.6) higher increment rates for deciduous, coniferous and mixed forest types than for the average across all productive forests after 2015, according to the General Directorate of Forestry statistics (available at https://www.ogm.gov.tr/tr/e-kutuphane/resmi-istatistikler). For example, for 2019, increments of 3.89 m^3/ha for deciduous forests, 4.45 m^3/ha for coniferous forests and 4.17 m^3/ha for mixed forests are given in NIR table 6.6, when the average increment for all productive forests was approximately 3.5 m^3/ha, according to ratios established using table 1.4 and 1.6, or 1.1 and 1.3, of the General Directorate of Forestry statistics. Further, the huge increase in increment of 47 per cent reported by Turkey between 2010 and 2015 for productive coniferous forest types in NIR table 6.6 is not supported by the General Directorate of Forestry statistics, where the increment for productive coniferous forest is approximately 10 per cent, after taking into account that part of the increment in coniferous trees reported for 2015 occurred in areas of mixed woodland reported separately from 2015 onward only. These differences appear to have led to an overestimation of carbon stock gains in the forest sink reported by Turkey in CRF table 4.A. This overestimation of the carbon sink may be further reinforced by the assumption that the increment for productive forest estimated from the Inventory Statistical System for Forests surveys, according to which productive forest represents about 57 per cent of Turkey's forest, can be used in	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		conjunction with the area of productive forest according to the classification of land use specifically developed for the inventory submission (under which productive forests cover an area 50 per cent larger, so about 86 per cent of total forest land). During the review, the Party explained that the inventory estimates are based on the Inventory Statistical System for Forests, which is constructed using field measurements of sample areas for renewed forest management plans. Turkey further explained that each national forest inventory cycle lasts 10 years, and that the Inventory Statistical System for Forests uses a weighted average for the average increment for all years but the General Directorate of Forestry statistics use aggregated average values for years between the cycles. The Party indicated also that the uncertainties of the forestry statistics are higher than the uncertainties of the Inventory Statistical System for Forests. The ERT recommends that the Party check carefully the assumptions used for increment values reported in the inventory, and, if the inconsistencies with the increment reported in tables 1.3 and 1.6 of the General Directorate of Forestry statistics (available at https://www.ogm.gov.tr/tr/e-kutuphane/resmi-istatistikler) correspond to inaccuracies in the statistics themselves rather than in the assumptions used for the inventory, explain in the NIR why the increase over time of the increment of productive forests assumed for the inventory on the basis of the data from the Inventory Statistical System for Forests is more accurate than that which can be estimated using the General Directorate of Forestry statistics for the same types of forest.	
L.30	4.A Forest land	In its NIR (section 6.2, p.323), the Party explained that a forest definition of 10 per cent crown cover, 1 ha minimum mapping unit and 5 m tree height is applied to all subcategories, but added that the land below 10 per cent crown closure are classified under other forested land as a subcategory of forest land, and that agriculturally used tree crops are classified under perennial cropland and are not part of the forest definition. Further, in the NIR (section 6.1, p.315), Turkey stated that woody grassland, for example, is likely to be found around forests, so its proximity to a forest boundary has been taken into consideration. The ERT noted that the Party could indicate more clearly how the consideration of the proximity to a forest boundary to determine whether to report a parcel as other forested land under forest land or grassland is in accordance with the 2006 IPCC Guidelines (vol. 4, chap. 3, p.3.6), where it is stated that forest land includes all land with woody vegetation consistent with thresholds used to define forest land in the national GHG inventory. It also includes systems with a vegetation structure that currently fall below, but in situ could potentially reach, the threshold values used by a country to define the forest land category. During the review, the Party clarified that the rationale for including the areas of other forested land under forest land is for consistency with the Global Forest Resources Assessment of the Food and Agriculture Organization of the United Nations and the national forest inventory, and that these areas of other forested land are subject to rehabilitation and restoration activities, so have the potential to become productive forests (and with a crown cover of more than 10 per cent). The ERT recommends that the Party clarify in its NIR that it includes other forested land as a subcategory of forest land rather than grassland, as it has a vegetation structure that currently falls below, but in situ could potentially reach, the 10 per cent crown cover threshold value used by Turkey in its definition of forest land (the ERT notes that this would clarify that the total area of forest land cannot be assessed by the analysis of remote-sensing products alone but requires the integration of administrative records).	Yes. Transparency

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		The ERT also recommends that the Party not refer to those areas of other forested land as woody grassland in NIR table 6.3 to avoid confusion with reporting under grassland.	
L.31	4.G HWP – CO_2	The ERT noted some inconsistencies in the AD and assumptions used in CRF table 4.Gs2 on the production, import and export of wood panels, and paper and paperboard. For paper and paperboard production, the Party included values consistent with FAOSTAT reporting (available at http://www.fao.org/faostat/en/#data/FO/) for 1961–2018 for the category, but only with wood pulp production for 2019. For imports and exports of paper and paperboard, the values reported for 2018 in CRF table 4.Gs2 (2,699,953 and 900,384 t, respectively) were similar to those reported in FAOSTAT for that year (2,674,942 and 959,810 t, respectively) but for all other years the amounts reported in CRF table 4.Gs2 were consistent with wood pulp import and export only. As a result, for 1961–2019, paper and paperboard imports reported by Turkey in CRF table 4.Gs2 are 2.5 times smaller than those in FAOSTAT (19,528,941 t in CRF table 4.Gs2, compared with 49,290,594 t in FAOSTAT), while paper and paperboard exports reported by Turkey in CRF table 4.Gs2 are 7.5 times smaller than those in FAOSTAT (1,084,802 t in CRF table 4.Gs2, compared with 8,157,484 t in FAOSTAT). For the import and export of wood panels, the ERT understands that the time series used by Turkey includes, for 1961–2017, only a fraction of wood-based panels. For instance, for 1990–2017, cumulated import and export of wood panels in FAOSTAT are 75 and 14,000 per cent higher, respectively, than those reported in CRF table 4.Gs2. Imports of 8,626,851.57 m^3 and exports of 92,947.75 m^3 were reported in CRF table 4.Gs2 for 1990–2017, while the corresponding figures in FAOSTAT were 15,195,496 m^3 and 13,083,179 m^3, respectively, according to FAOSTAT. During the review, the Party stated that the paper and paperboard 1961–2018 time series will be recalculated for the next inventory submission. The ERT recommends that the Party uses accurate and consistent AD for HWP and explain any recalculations in the NIR.	Yes. Accuracy
L.32	4.B.2.1 Forest land converted to cropland – CO_2	In tables 6.21 (section 6.3, p.346), 6.25 (section 6.4, p.358), 6.30 (section 6.5, p.364) and 6.36 (section 6.6, p.372) of the NIR, the Party reported biomass of degraded forests (other forested land) as 4.05 t carbon/ha. Further, in NIR tables 6.21 and 6.36, Turkey reported that the conversion of degraded forest to annual cropland and settlements corresponds to carbon sinks in biomass the first year after conversion. However, the ERT is of the view that it is rather unlikely that there is on average an increase in the biomass pool in the first year following the conversion of degraded forests to settlements. During the review, Turkey stated that the tier 2 EFs for those conversions, based on country-specific carbon stocks in biomass used for degraded forests and settlements, only accounted for woody biomass in those land uses and did not include non-woody biomass. The carbon stocks for settlements used in the GHG inventory are based on a study analysing carbon density in settlements around Istanbul only (NIR p.370). As a result, the carbon stocks per unit area reported for settlements in the NIR (p.369) do not represent the level of carbon stocks across the country. In addition, considering that degraded forests are characterized by a crown cover of less than 10 per cent, the ERT is of the view that grass vegetation may represent an important fraction of the total biomass pool in those forests, and that excluding it from the estimates could lead to an additional underestimation of losses in the biomass pool associated with the conversion of degraded forests to settlements.	Yes. Accuracy

ID#	*Finding classification*	*Description of finding with recommendation or encouragement*	*Is finding an issue?*[a]
		The ERT recommends that the Party use accurate EFs for changes in biomass, capturing non-woody biomass, for the assessment of the impact of land-use change from degraded forest land to other land use.	
Waste			
W.10	5.D.2 Industrial wastewater – CH_4	The Party assumed that TOW and emissions for 2019 were the same as for 2018 (NIR section 7.5, p.446, table 7.41) owing to lack of data for 2019. However, the ERT noted that TOW has increased every year since 2010 and therefore assuming the same value for 2019 as for 2018 may lead to an underestimation of TOW for 2019. During the review, the Party clarified that the relevant AD used for calculating TOW and emissions are obtained from the section on manufacturing industry establishments of the water and wastewater statistics published by the Turkish Statistical Institute, which is based on a biennial survey. Data for the years not surveyed are estimated by linear interpolation. In the most recent submission, the 2019 data cannot be interpolated because the 2020 data are not available, so the 2019 data were assumed to be the same as for 2018. In the next inventory submission, the 2019 data will be interpolated using the 2018 and 2020 data. The ERT recommends that the Party review and justify the assumption used when there is a data gap for TOW for the latest reported year to ensure that the assumption is in accordance with the 2006 IPCC Guidelines (vol. 1, chap. 5, section 5.3) and does not lead to an over- or underestimation of the emissions.	Yes. Accuracy

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

Annex I

Overview of greenhouse gas emissions and removals as submitted by Turkey in its 2021 inventory submission

1. Tables I.1–I.3 provide an overview of the total GHG emissions and removals as submitted by Turkey. Table I.1 shows total GHG emissions, including and excluding LULUCF and, for Parties that have decided to report indirect CO_2 emissions, with and without indirect CO_2. Tables I.2 and I.3 show GHG emissions reported under the Convention by Turkey by gas and by sector, respectively.

Table I.1
Total greenhouse gas emissions and removals for Turkey, base year–2019
(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	163 795.21	219 572.21	NA	NA
1995	190 610.58	247 993.71	NA	NA
2000	237 401.56	298 954.23	NA	NA
2010	325 723.59	399 143.06	NA	NA
2011	351 040.04	428 120.39	NA	NA
2012	373 110.38	447 582.08	NA	NA
2013	363 202.88	439 694.38	NA	NA
2014	381 445.29	458 953.88	NA	NA
2015	376 070.35	473 335.82	NA	NA
2016	402 948.15	498 886.78	NA	NA
2017	425 098.56	524 980.91	NA	NA
2018	427 901.73	522 476.63	NA	NA
2019	422 085.53	506 080.42	NA	NA

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

Table I.2
Greenhouse gas emissions and removals by gas for Turkey, excluding land use, land-use change and forestry, 1990–2019
(kt CO_2 eq)

	CO_2[a]	*CH_4*	*N_2O*	*HFCs*	*PFCs*	*Unspecified mix of HFCs and PFCs*	*SF_6*	*NF_3*
1990	151 508.47	42 487.58	24 950.87	NO	625.30	NO	NO	NO
1995	180 903.05	42 613.47	23 865.75	NO	611.44	NO	NO	NO
2000	229 790.60	43 667.29	24 766.35	115.66	601.00	NO	13.34	NO
2010	314 380.03	51 352.79	29 828.74	3 054.28	461.74	NO	65.48	NO
2011	339 482.25	53 731.92	30 925.83	3 432.64	480.36	NO	67.37	NO
2012	353 666.21	57 139.65	32 091.75	4 256.83	359.06	NO	68.58	NO
2013	345 220.58	55 544.39	34 119.54	4 470.24	270.60	NO	69.02	NO
2014	361 675.46	57 453.38	34 567.28	4 927.46	255.42	NO	74.88	NO
2015	381 331.94	51 604.09	35 356.10	4 802.87	158.99	NO	81.83	NO
2016	401 239.74	54 465.07	37 699.76	5 262.92	140.67	NO	78.61	NO
2017	425 329.23	54 779.69	39 145.96	5 534.60	73.11	NO	118.33	NO
2018	419 436.91	58 084.97	39 287.36	5 502.39	36.62	NO	128.39	NO
2019	399 344.91	60 264.23	40 229.32	6 064.07	62.18	NO	115.71	NO
Percentage change 1990–2019	**163.6**	**41.8**	**61.2**	**NA**	**–90.1**	**NA**	**NA**	**NA**

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

Table I.3
Greenhouse gas emissions and removals by sector for Turkey, 1990–2019
(kt CO_2 eq)

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
1990	139 601.24	22 836.47	46 053.68	–55 777.00	11 080.83	NO
1995	166 318.24	25 247.31	44 079.79	–57 383.13	12 348.37	NO
2000	216 053.71	26 227.12	42 332.13	–61 552.67	14 341.27	NO
2010	287 047.24	48 149.31	44 409.31	–73 419.47	19 537.20	NO
2011	308 666.18	52 791.52	46 901.07	–77 080.35	19 761.62	NO
2012	320 488.90	55 054.05	52 662.08	–74 471.70	19 377.06	NO
2013	307 523.31	58 101.61	55 857.58	–76 491.50	18 211.88	NO
2014	325 767.11	58 708.01	56 219.32	–77 508.58	18 259.45	NO

	Energy	*IPPU*	*Agriculture*	*LULUCF*	*Waste*	*Other*
2015	340 907.26	57 247.91	56 133.27	–97 265.48	19 047.38	NO
2016	359 671.35	61 363.22	58 893.78	–95 938.63	18 958.43	NO
2017	379 900.74	63 985.68	63 262.40	–99 882.35	17 832.09	NO
2018	373 125.47	65 867.12	65 337.76	–94 574.90	18 146.27	NO
2019	364 369.80	56 439.28	68 023.70	–83 994.88	17 247.63	NO
Percentage change 1990–2019	**161.0**	**147.1**	**47.7**	**50.6**	**55.7**	**NA**

Note: Turkey 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.3.a Domestic aviation – liquid fuels (gasoline) (CO_2, CH_4 and N_2O) (see ID# E.17 in table 3);

(b) 1.A.3.d Domestic navigation – liquid fuels (gasoline) (CO_2, CH_4 and N_2O) (see ID# E.19 in table 3);

(c) 2.A.2 Lime production (CO_2) (see ID#s I.3 and I.4 in table 3);

(d) 2.F.4 Aerosols (HFCs) (see ID# I.19 in table 3);

(e) 2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) (HFCs) (see ID#s I.22 and I.24 in table 3);

(f) 2.G Other product manufacture and use (N_2O) (see ID# I.25 in table 3);

(g) 4.C.1 Grassland remaining grassland (CO_2 and N_2O) (carbon stock changes in mineral soils for grassland) (see ID# L.17 in table 3);

(h) 4(V) Biomass burning (CO_2, CH_4 and N_2O) (see ID# L.25 in table 3).

Annex III

Reference documents

A. Reports of the Intergovernmental Panel on Climate Change

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

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

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

B. UNFCCC documents

Annual review reports

Reports on the individual reviews of the 2011, 2012, 2013, 2014, 2015, 2016, 2018 and 2019 inventory submissions of Turkey, contained in documents FCCC/ARR/2011/TUR, FCCC/ARR/2012/TUR, FCCC/ARR/2013/TUR, FCCC/ARR/2014/TUR, FCCC/ARR/2015/TUR, FCCC/ARR/2016/TUR, FCCC/ARR/2018/TUR and FCCC/ARR/2019/TUR, respectively.

Other

Aggregate information on greenhouse gas emissions by sources and removals by sinks for Parties included in Annex I to the Convention. Note by the secretariat. Available at https://unfccc.int/sites/default/files/resource/AGI_2021_Final%20Version.pdf.

Annual status report for Turkey for 2021. Available at https://unfccc.int/sites/default/files/resource/asr2021_TUR.pdf.

C. Other documents used during the review

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

Ataol M and Onmuş O (2021). *Wetland loss in Turkey over a hundred years: implications for conservation and management*. Ecosystem Health and Sustainability, 7:1, 1930587, DOI: 10.1080/20964129.2021.1930587.

Canaveira P, Manso S, Pellis G, Perugini L, De Angelis P, Neves R, Papale D, Paulino J, Pereira T, Pina A, Pita G, Santos E, Scarascia-Mugnozza G, Domingos T, and Chiti T (2018). Biomass Data on Cropland and Grassland in the Mediterranean Region. Final Report for Action A4 of Project MediNet. Available at https://www.lifemedinet.com/documents.

Fott P, Kolář F and Vácha D (2006). Determination of emission and oxidation factors in monitoring CO_2 emissions for emission trading scheme. Acta Geodyn. Geomater., vol. 3, No. 4 (144), 5-11.

Topaç FO and Başkaya HS (2008). *Evsel Nitelikli Arıtma Çamurlarının Bitki Besin Düzeylerinin Değerlendirilmesinde Azot Formlarının Önemi* (Importance of Nitrogen Forms in the Evaluation of Plant Nutrient Levels of Domestic Sludges). Uludağ University, Journal of The Faculty of Engineering, 13(1). Available at https://dergipark.org.tr/tr/pub/uumfd/issue/21680/233346.