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Framework Convention on Climate Change

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Report on the individual review of the inventory submission of Turkey submitted in 2019*

Note by the expert review team

Summary

Each Party included in Annex I to the Convention must submit an annual inventory of emissions and removals of greenhouse gases for all years from the base year (or period) to two years before the inventory due date (decision 24/CP.19). This report presents the results of the individual inventory review of the 2019 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 7 to 12 October 2019 in Bonn.

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

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Contents

Abbreviations and acronyms

2006 IPCC Guidelines	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
AD	activity data
AWMS	animal waste management system(s)
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"
CORINE	Coordination of Information on the Environment (programme)
CRF	common reporting format
DOM	dead organic matter
EF	emission factor
ENVANIS	national forest management database of Turkey
ERT	expert review team
EU	European Union
FAOSTAT	statistical database of the Food and Agriculture Organization of the United Nations
F-gas	fluorinated gas
GE	gross energy
GHG	greenhouse gas
HFC	hydrofluorocarbon
HWP	harvested wood products
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
IPPU	industrial processes and product use
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
NCV	net calorific value
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
TAM	typical animal mass
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*

I. Introduction

1. This report covers the review of the 2019 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" (decision 13/CP.20). The review took place from 7 to 12 October 2019 in Bonn and was coordinated by Claudia do Valle and Sohel Pasha (secretariat). Table 1 provides information on the composition of the ERT that conducted the review of Turkey.

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

Area of expertise	*Name*	*Party*
Generalist	Elsa Hatanaka	Japan
	Baasansuren Jamsranjav	Mongolia
Energy	Matej Gasperic	Slovenia
	Haakon Marold	Australia
IPPU	Lorenz Moosmann	EU
	Clemêncio Nhantumbo	Mozambique
	Samir Tantawi	Egypt
Agriculture	Britta Maria Hoem	Norway
	Mark Hunstone	Australia
LULUCF	Sekai Ngarize	Zimbabwe
	Atsushi Sato	Japan
Waste	Mayra Rocha	Brazil
	Sirinthornthep Towprayoon	Thailand
Lead reviewers	Mark Hunstone	
	Baasansuren Jamsranjav	

2. The basis of the findings in this report is the assessment by the ERT of the Party's 2019 inventory submission in accordance with the UNFCCC review guidelines.

3. The ERT has made recommendations that Turkey resolve the findings related to issues.[1] 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 shows annual GHG emissions for Turkey, including totals excluding and including the LULUCF sector, indirect CO_2 emissions, and emissions by gas and by sector.

II. Summary and general assessment of the 2019 inventory submission

6. Table 2 provides the assessment by the ERT of the 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.

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

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

Assessment			*Issue ID#(s) in table 3 and/or 5*[a]
Date of submission	Original submission: 13 April 2019 (NIR), 13 April 2019 (CRF tables) version 1		
Review format	Centralized		
Application of the requirements of the UNFCCC Annex I inventory reporting guidelines and Wetlands Supplement (if applicable)	Have any issues been identified in the following areas:		
	(a) Identification of key categories?	No	
	(b) Selection and use of methodologies and assumptions?	Yes	E.14, I.28, A.6, A.7, A.25, L.14, L.34, L.44
	(c) Development and selection of EFs?	Yes	E.19, E.20, I.18, I.23
	(d) Collection and selection of AD?	Yes	E.5, I.4, I.12, I.13, I.17, I.33, A.26, A.27, L.5, L.6, W.6, W.10, W.12, W.13
	(e) Reporting of recalculations?	Yes	E.1
	(f) Reporting of a consistent time series?	Yes	E.7, E.12, E.16, E.22, I.1, A.13, A.14, A.20, L.25
	(g) Reporting of uncertainties, including methodologies?	Yes	E.8, L.9
	(h) QA/QC?	Yes	L.8, L.10, L.21, I.24, L.42
	(i) Missing categories/completeness?[b]	Yes	G.4, E.24, E.25, I.2, I.3, I.14, I.16, I.21, I.22, A.15, L.1 (a), L.46
	(j) Application of corrections to the inventory?	No	
Significance threshold	For categories reported as insignificant, has the Party provided sufficient information showing that the likely level of emissions meets the criteria in paragraph 37 (b) of the UNFCCC Annex I inventory reporting guidelines?	No	E.24, E.25, L.40
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.1, E.13, A.13, A.14, L.35
National inventory arrangements	Have any issues been identified with the effectiveness and reliability of the institutional, procedural and legal arrangements for estimating GHG emissions, including the changes to the national inventory arrangements since the previous inventory submission?	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 the assessment of 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] The ERT identified additional issues in all sectors as well as issues that are not listed in this table but are included in table 5.
[b] Missing categories for which methods are provided in the 2006 IPCC Guidelines may affect completeness and are listed in annex II.

III. Status of implementation of issues raised in the previous review report

7. Table 3 compiles all the recommendations made in previous review reports that were included in the previous review report, published on 2 May 2019.[2] For each issue, the ERT specified whether it believes the issue has been resolved by the conclusion of the review of the 2019 inventory submission and provided the rationale for its determination, which takes into consideration the publication date of the previous review report and national circumstances.

Table 3
Status of implementation of issues raised in the previous review report of Turkey

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
General			
G.1	NIR (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.	Not resolved. There is no information in the NIR on the key drivers of the PFC emission trends, in particular on the decrease in PFC emissions in recent years. According to NIR table 2.3, there was a further significant decrease in overall PFC emissions between 2016 and 2017 (from 140.67 to 73.11 kt CO_2 eq). During the review, Turkey indicated that the information on the key drivers of the PFC emission trends would be included in the next inventory submission.
G.2	QA/QC and verification (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.	Addressing. According to the NIR (section 1.2.3, pp.6–14), Turkey implements general and category-specific QC procedures, as well as the QA activities envisaged in the latest version of the QA/QC plan, which was approved in 2017. During the review, Turkey confirmed that it has made significant efforts to improve the quality of its reporting through implementation of its QA/QC system. The Party's QA/QC plan includes checklists (general and category-specific), which are completed by sectoral experts annually. QA activities were implemented for the agriculture and energy sectors in 2017 and 2018, respectively. QA work for the remaining sectors of the GHG inventory is envisaged to be complete by 2019.
G.3	Uncertainty analysis (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.	Addressing. During the review, Turkey indicated that the results of the uncertainty analysis were taken into account in the 2019 inventory submission. The results of approaches 1 and 2 of the uncertainty analysis were used in prioritizing category-level inventory improvements. The Party also indicated that the results of approach 2 of the uncertainty analysis would be further examined in the next inventory submission.
Energy			
E.1	1. General (energy sector) (E.1, 2018) (E.2, 2016) (E.2, 2015) (24,	Include a separate section in the energy chapter of the NIR providing all detailed information	Addressing. The Party significantly improved the information on recalculations, and presented recalculations and improvements in the NIR in both a separate section (section 10) and

[2] FCCC/ARR/2018/TUR.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	2014) Transparency	on, and the rationale for, recalculations.	category-specific sections (including for bunker fuels). The revision of the national energy balance table was stated as the main reason for the recalculations. However, in section 10, for some categories (e.g. manufacturing industries and construction, other sectors and fugitive emissions) there is still a lack of transparency regarding the period affected by the recalculations and the rationale for the recalculations.
E.2	1. General (energy sector) (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 provide 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.	Not resolved. With regard to country-specific EFs, the NIR (section 1.2.2, p.5) states only that the CO_2 EFs for natural gas, lignite, hard coal, fuel oil and diesel oil are calculated using the results of fuel, slag and ash analyses and gas chromatography. Neither references nor additional information is provided in the NIR. In addition, there is no detailed information in the NIR on how technology-specific EFs used to estimate N_2O emissions from public electricity and heat production are determined. During the review, the Party mentioned that all EFs were reported in the NIR (annex 3).
E.3	Feedstocks, reductants and other non-energy use of fuels – solid fuels – CO_2 (E.5, 2018) (E.23, 2016) (E.23, 2015) (41, 2014) Transparency	Provide information on feedstocks and non-energy use of coking coal.	Resolved. General information on feedstocks, reductants and other non-energy use of fuels is presented in the NIR (section 3.2.3, p.66), including the methodology for the fossil fuels used in integrated iron and steel plants, which are subtracted from the reference approach. Information on coking coal was provided in CRF table 1.A(d).
E.4	Feedstocks, reductants and other non-energy use of fuels – liquid fuels – CO_2 (E.6, 2018) (E.54, 2016) (E.54, 2015) Transparency	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.	Addressing. Explanations regarding the non-energy use of fuels, including a summary table for the use of feedstocks, reductants and other non-energy use of fuels, are provided in the NIR (section 3.2.3, p.66). However, although an explanation is provided in the documentation box of CRF table 1.A(d) for other oil and lubricants, one for naphtha is still missing. See ID# E.19 in table 5.
E.5	International bunkers and multilateral operations – liquid fuels – CO_2, CH_4 and N_2O (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. Limited information is provided on the methodology for determining the AD used in the energy balance for international bunker fuels. The ERT noted that a comparison of the data reported by the Party with the data reported by the General Directorate of Petroleum Affairs to the International Energy Agency shows significant discrepancies in the data for international maritime bunkers for 2009–2012 and for international aviation for 2008–2014. No explanation is provided in the NIR (section 3.2.2, p.61) regarding time-series consistency for international bunker fuels. During the review, the Party confirmed that the AD for both international navigation and international aviation are from the national energy balance and that all relevant institutions are working together to determine a reliable data source for international bunker fuels.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
E.6	International bunkers and multilateral operations – liquid fuels – CO_2, CH_4 and N_2O (E.9, 2018) (E.21, 2016) (E.21, 2015) (40, 2014) (25, 2013) (43, 2012) (40, 2011) Convention reporting adherence	Improve the consistency between CRF tables 1.C and 1.A(b), harmonize and correct the information reported in these tables and apply QC measures to the estimates.	Resolved. The data reported in CRF table 1.D (previously CRF table 1.C) and CRF table 1.A(b) have been harmonized.
E.7	1.A.1.a Public electricity and heat production – gaseous fuels – N_2O (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. An appropriate methodology for addressing the data gaps in the technology split for gaseous fuel combustion prior to 2003 is not presented in the NIR and none of the techniques for ensuring time-series consistency suggested by the 2006 IPCC Guidelines (vol. 1, chap. 5) were applied. According to the NIR (section 3.2.4, p.69), the default CH_4 and N_2O EFs from the 2006 IPCC Guidelines (vol. 2) are used for 1990–2002 because combustion technology data are available only for 2003 onward for this category. During the review, the Party indicated that it would investigate methods to improve the consistency of the time series for 1990–2002.
E.8	1.A.1.a Public electricity and heat production – solid, liquid, gaseous and other fossil fuels – CH_4 and N_2O (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. According to the NIR (section 3.2.4.1, p.84), the uncertainty of the CH_4 EFs was 25 per cent and of the N_2O EFs 75 per cent based on table 2.14 of the 2006 IPCC Guidelines (vol. 2), from which the Netherlands was selected by the Party as an example with plant-specific and default EFs based on expert judgment. During the review, the Party mentioned that it plans to calculate country-specific values for the uncertainty of the CH_4 and N_2O EFs in the next inventory submission.
E.9	1.A.1.a Public electricity and heat production – CO_2, CH_4 and N_2O (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 (section 3.2.4.2, p.84, and section 3.2.5.1, p.97), fuel consumed by ‘autoproducers’ is allocated under subcategory 1.A.1.a. During the review, Turkey explained that although the 2006 IPCC Guidelines recommend that ‘autoproducers’ are considered under the branch of the economy in which they operate, in the national energy balance tables, all electricity and heat production (for sale) by ‘autoproducers’ is included under the electricity and heat production category. The Party stated that since the New Electricity Market Law 6446 was enacted by the Turkish Parliament on 14 March 2013, ‘autoproducers’ became the main electricity producers, and in order to use consistent data sets in the GHG inventory, the Party decided to allocate all emissions from ‘autoproducers’ to subcategory 1.A.1.a. Therefore, GHG emissions for stationary combustion sectors (including subcategory 1.A.2 (manufacturing industries and construction)) were recalculated for 1990–

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			2014, and this new calculation will be used for future inventories.
E.10	1.A.1.b Petroleum refining – liquid and gaseous fuels – CO_2, CH_4 and N_2O (E.12, 2018) (E.56, 2016) (E.56, 2015) Transparency	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 did not provide a comparison of facility-level data with the sectoral totals from the national energy balance for this subcategory in the NIR, as it did for subcategory 1.A.1.a (public electricity and heat production) (NIR table 3.22). However, according to the NIR (p.465), emissions from petroleum refining were calculated using both plant-specific data and data from the national energy balance tables. The Party noticed some differences in the results obtained from the two data sources and indicated in the NIR that it is working on determining the reasons for the differences.
E.11	1.A.2 Manufacturing industries and construction – liquid, solid and gaseous fuels – CO_2 (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 CO_2 EFs for liquid fuels are the same over time (NIR table 3.7). There are inter-annual changes in the CO_2 EFs for hard coal, lignite and coke, but information on these changes is not provided either in annex 3 to the NIR or in NIR section 3.2. During the review, Turkey stated that the proportion of the type of fuel used in industry depends on the prices of the fuels; therefore, the proportion can change from year to year.
E.12	1.A.2 Manufacturing industries and construction – CO_2, CH_4 and N_2O (E.26, 2018) Consistency	Improve the comparability and consistency of the inventory and separate the emissions from pulp, paper and print, non-metallic minerals, and food processing, beverages and tobacco from the emissions reported in category 1.A.2.g other (manufacturing industries and construction) for the entire time series.	Addressing. The Party significantly improved the comparability and consistency of its inventory and separated the non-metallic minerals emissions from the food processing, beverages and tobacco emissions for the whole time series. The only remaining category for which the emissions have not yet been separated from category 1.A.2.g (other (manufacturing industries and construction)) prior to 2011 is category 1.A.2.d (pulp, paper and print). During the review, Turkey stated that it plans to separate emissions from category 1.A.2.d for the next submission.
E.13	1.A.2.a Iron and steel – liquid fuels – CO_2, CH_4 and N_2O (E.14, 2018) (E.57, 2016) (E.57, 2015) Transparency	Improve the transparency of the NIR by including 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. Taking into account the fact that the energy balance for 1990–2014 does not provide sufficient information on the varying composition of petroleum products, the NIR (p.97) does not provide sufficient information on how the AD for specific liquid fuels were determined and how the shares of different oil products impact the CH_4 and N_2O IEFs.
E.14	1.A.3.b Road transportation – liquid fuels – CH_4 and N_2O (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 1.A.3.b would be a key category if using appropriate EFs.	Addressing. According to the NIR (p.133), CH_4 and N_2O emissions were estimated by applying default EFs from the 2006 IPCC Guidelines. The Party provided in the NIR (section 3.2.6.2, p.134) a comparison of emission estimates obtained from the current approach using tier 1 and tier 2 EFs for CH_4 and N_2O with estimates for 2016 and 2017 calculated using the COPERT V software tool for calculating road transport emissions. Significantly lower CH_4 and N_2O emissions resulted from using the model. The Party aims to recalculate emission

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			estimates for the previous years of the time series using the results of ongoing studies for the next inventory submission.
E.15	1.A.4 Other sectors – general (E.27, 2018) Comparability	Improve the comparability and consistency of the inventory by separating 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 not separated in the energy balance tables until 2015 and is reported under category 1.A.4.b (residential) for 1990–2014. 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.152), 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.
E.16	1.A.4 Other sectors – liquid fuels – CO_2, CH_4 and N_2O (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 this subcategory 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. According to the NIR (section 3.2.7.3, p.153), the Party reallocated the diesel oil used for agricultural purposes to category 1.A.4.c (CRF table 1.A (a)s4) for 1990–2011 using the statistics on market-specific diesel specification ("rural diesel"). From 2012 onward, some of the diesel oil used for agricultural purposes is included under road transportation, thereby causing time-series inconsistencies as the GHG emissions from diesel oil are reported as decreasing from 15,112 Gg in 2011 to 3,008 Gg in 2012. During the review, Turkey indicated that the Ministry of Energy and Natural Resources modelled agricultural diesel oil consumption, and disaggregation of diesel oil consumption was achieved in 2015 in the national energy balance tables. However, the allocation was not addressed for the years between 2012 and 2014, and all relevant institutions are working together to overcome this inconsistency.
E.17	1.A.4 Other sectors – liquid fuels – CO_2, CH_4 and N_2O (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 this subcategory, 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. According to the information provided in the NIR (section 3.2.7.4, p.153), 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. However, the results of that approach are not yet presented in the NIR.
IPPU			
I.1	2. General (IPPU) (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).	Addressing. The issue was resolved for electrical equipment (2.G.1) (see ID# I.1 in document FCCC/ARR/2018/TUR) and fire protection (2.F.3) (see ID# I.19 in document FCCC/ARR/2018/TUR). No information was reported on SF_6 and PFC emissions from other product use (2.G.2). During the review, Turkey explained that calculations were based on the raw trade data (import and export) provided for each gas by the Ministry of Trade. There is no

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			detailed information in the supplied data on the distribution of gas throughout the sectors.
I.2	2.A.2 Lime production – CO_2 (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.	Addressing. The Party estimated AD for captive lime production in the sugar industry and synthetic soda ash production for 1990–2017 (NIR table 4.5). The ERT noted that the AD and CO_2 emissions reported in CRF table 2 (I).A-Hs1 (3,851.92 kt) reflect quick lime production (minus the amount produced in the sugar industry and the amount of synthetic soda ash production) plus dolomitic lime production. Turkey did not provide evidence for the 100 per cent CO_2 recovery rate reported (see ID# I.3 below) that would justify subtracting the CO_2 from captive lime production.
I.3	2.A.2 Lime production – CO_2 (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 with the emissions from marketed lime under the lime production category.	Addressing. Evidence of the 100 per cent CO_2 recovery rate associated with lime use during sugar production was not provided in the NIR and therefore the Party has not sufficiently justified subtracting the CO_2 from captive lime production from the reported estimates. During the review, Turkey stated that when cleaning the raw juice in sugar production, lime milk and CO_2 are added to precipitate the impurities together with the lime. This lime is subsequently used in agriculture for improving soil and the related emissions are reported under source category 3.G (liming). The lime milk and CO_2 are calcined in separate shaft kilns at the sugar plants. Thus, the CO_2 from the calcination of carbonate containing raw materials is bound completely in the raw juice cleaning process and, therefore, there are no net process CO_2 emissions from lime production during sugar production. The ERT considers that the evidence provided by the Party is an improvement in reporting but not sufficient proof of the 100 per cent CO_2 recovery rate; an explanation is still missing of the validated methods used for calculating the amount of CO_2 that reacts with lime to re-form calcium carbonate or the amount of CO_2 that is not recarbonated to limestone.
I.4	2.A.4 Other process uses of carbonates – CO_2 (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.	Not resolved. The Party did not report in the NIR information on the use of limestone and dolomite mass balances to cross-check the estimates for this category. During the review, Turkey indicated that a study on limestone and dolomite mass balances does not seem feasible in the near future, and that it would be considered in future inventory submissions.
I.5	2.B.1 Ammonia production – CO_2 (I.7, 2018) (I.51, 2016) (I.51, 2015) Transparency	Clarify if the CO_2 emissions used for urea production are included under category 2.D.3 (other (non-energy products from fuels and solvent use)) or under the agriculture sector in line with the 2006 IPCC Guidelines, and transparently report the emissions allocated to the two sectors.	Resolved. Turkey reported in the NIR (p.201) that CO_2 is separated from the synthesis gas in the decarbonizing step of the ammonia production process; some of the CO_2 gas is subsequently used in the urea production process. During the review, Turkey indicated that the CO_2 emissions used for urea production are deducted from the total emissions from ammonia production and that the emissions

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
			from urea application are reported in the NIR (section 5.9, p.306). The Party provided the ERT with a spreadsheet showing the percentage of recovered CO_2 emissions deducted that are subsequently used in urea production. Furthermore, the Party confirmed that emissions from urea use are reported under the agriculture sector in accordance with the 2006 IPCC Guidelines. For the pending issue on the transparency of reported emissions, see ID# I.26 in table 5.
I.6	2.B.9 Fluorochemical production – HFCs, PFCs and SF_6 (I.9, 2018) (I.50, 2016) (I.50, 2015) Comparability	Use the notation key "NO" to report fluorochemical production.	Not resolved. Turkey reported in the NIR (p.219) that there was no fluorochemical production in the country during 1990–2017, and, as such, it should be reported as "NO" . However, the ERT noted that no notation keys were used in CRF table 2(II).B-Hs1. During the review, the Party indicated that "NO" would be used in the next inventory submission.
I.7	2.B.10 Other (chemical industry) – CH_4 (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.	Addressing. The AD and corresponding CH_4 emissions from styrene production were not reported in the NIR or CRF table 2 (I).A-Hs1. During the review, Turkey stated that emissions from styrene production were calculated on the basis of fuel flared in a closed system. The ERT agrees with the closed system methodology followed by Turkey, which covers the reporting of emissions from flaring only and does not require the separate reporting of emissions from styrene production. 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 reported in the 2014 inventory submission and provide an explanation of CH_4 emissions from styrene production in the NIR.
I.8	2.C.1 Iron and steel production – CO_2 (I.21, 2018) Transparency	Either update the equation on p.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.	Addressing. 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) in the 2019 inventory submission (NIR, p.224). During the review, Turkey stated that it corrected the equation for estimating CO_2 emissions from pellet production reported in the 2018 NIR (p.208) in the 2019 inventory submission (NIR, p.224) and for the carbon mass balance, the Party used equations reported in the NIR (pp.224 and 225). In addition, CO_2 emissions from iron and steel or sinter were calculated using equations 4.9 and 4.10 of the 2006 IPCC Guidelines (vol. 3). Turkey reported further details in the NIR (p.229).
I.9	2.C.1 Iron and steel production – CO_2 (I.21, 2018) Transparency	Correct the definition of "E_{CO2}" on page 208 of the NIR to clarify that it refers to emissions from pellet production.	Resolved. The correct definition was reported in the NIR (pp.224–225).
I.10	2.C.1 Iron and steel production – CO_2	Improve the completeness of the CO_2 emission estimation for	Resolved. The difference in percentage of the equivalence between the CO_2 emissions for iron

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	(I.22, 2018) Completeness	integrated iron and steel plants by including all the carbon inputs (e.g. iron ore) both in the method consistent with the 2006 IPCC Guidelines used by the Party and in the carbon balance calculated as a QA/QC check, and ensure that the difference in estimated emissions between these two approaches is minimized, and, if it remains, clearly explain why in the NIR.	and steel plants calculated using the carbon mass balance and the total emissions for relevant CRF categories (1.A.1.a, 1.A.1.c, 1.A.2.a and 2.C.1) is minimized. The difference in percentage of the equivalence is 96 per cent when the data of all the plants are aggregated, and at least 94 per cent on a plant-specific basis (NIR, p.229). The ERT noted that the emissions resulting from the mass balance calculation (22,230 kt CO_2) were higher in the 2018 submission than the total emissions for the above-mentioned CRF categories (21,373 kt CO_2), but are lower in the 2019 submission (20,524 and 21,408 kt CO_2, respectively). During the review, Turkey explained that the difference may be related to the emissions from aromatics and fugitive emissions, both of which are counted as emissions in the carbon balance calculation but not in the calculation based on different plants.
I.11	2.C.4 Magnesium production – SF_6 (I.13, 2018) (I.39, 2016) (I.39, 2015) (95, 2014) Comparability	Correct the notation key used to report SF_6 emissions from magnesium foundries from "NA" to "NE".	Not resolved. The NIR (p.242) states there is no magnesium production in Turkey, which the Party confirmed in response to a question on this matter during the review. The notation key "NO" should therefore be reported in CRF table 2(II) for SF_6 emissions from magnesium foundries rather than leaving the relevant cells blank.
I.12	2.E.5 Other (electronics industry) – HFCs, PFCs and SF_6 (I.23, 2018) Accuracy	Collect the necessary updated AD to reflect national market tendencies and report the corresponding emissions.	Not resolved. Turkey did not apply a recalculation for this category in the 2018 submission and reported neither information on the collection of the necessary AD, updated to reflect national market tendencies, nor the corresponding emissions. During the review, the Party indicated that collection of updated AD is ongoing.
I.13	2.F Product uses as substitutes for ozone-depleting substances – HFCs (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.	Addressing. The Party reported in the NIR (p.257) and confirmed during the review that an EU-funded project on technical assistance for increased capacity for transposition and capacity-building on F-gases started in 2017 and will continue until 2020. The aim is to establish a database for monitoring F-gases and enable Turkey to calculate associated emissions using a higher-tier method.
I.14	2.F Product uses as substitutes for ozone-depleting substances – HFCs and SF_6 (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.	Addressing. The Party reported in its inventory improvement plan and clarified during the review that the EU-funded project related to capacity-building on F-gases (running in 2017–2020) (see ID# I.13 above) would support data collection for future inventory submissions.
I.15	2.F.3 Fire protection – HFCs (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	Addressing. Turkey continued reporting HFC-227ea emissions as "IE" in CRF table 2(II)B-Hs2 and no reference was made to these emissions in CRF table 9. During the review, the Party indicated that it is not currently

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		disposal and indicate clearly in CRF table 9 and the NIR that all HFC-227ea emissions are reported under operating systems (stocks).	possible to separate HFC-227ea emissions from manufacturing, operation and disposal.
I.16	2.F.4 Aerosols – HFCs (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. Turkey did not report information on HFC emissions from metered dose inhalers used in the country. During the review, Turkey indicated that there is a lack of information on metered dose inhalers. While the Party has information on harmonized system codes for inhalers, the codes include other imported medicines and cannot currently be divided into subcodes in order to separate inhaler emissions.
I.17	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs (I.26, 2018) Comparability	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.	Not resolved. During the review, Turkey indicated that it is not currently possible to separate emissions from manufacturing, operation and disposal, and that for the next submission, corrections would be made to the CRF tables, namely, that emissions from manufacturing, operation and disposal of refrigeration and air-conditioning equipment would be reported as "IE" in CRF table 2(II) and CRF table 9.
I.18	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs (I.27, 2018) Accuracy	Verify the product life EF for HFC-32 and revise its estimates, if necessary, as well as 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.	Not resolved. Turkey reported emission estimates for HFC-32 in NIR table 4.44. HFC-32 emissions for 2014–2016 were recalculated. In CRF table 2 (II).B-Hs2, the product life factor changed from 15 to 7.47 per cent for 2014, 47.48 to 16.03 per cent for 2015 and 96.83 to 14.40 per cent for 2016. For 2017, the product life factor was 20.10 per cent. The result of the recalculation is a significantly higher factor for 2016 (an increase from 0.60 to 1,625.00 t) in CRF table 2(II).B-Hs2. The figure for 2017 in the same CRF table is high (4,285.00 t). However, the corresponding figures in NIR table 4.44 are 1.625 and 4.28 t for 2016 and 2017, respectively. During the review, the Party indicated that a default EF was used for the product life factor for HFC-32 and that the factor would be verified for the next inventory submission.
I.19	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs (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. Turkey reported in NIR table 4.43 total HFC emissions for 1999–2017; however, it did not report any emissions for 1999 in the CRF tables. During the review, the Party indicated that values for 1999 were calculated in accordance with the 2006 IPCC Guidelines.
I.20	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs	Improve the transparency of the reporting by providing in the NIR a more detailed description of the main assumptions applied and parameters used in the F-gas model for estimating HFCs, in particular	Addressing. Turkey referred to an EU-funded project (see ID# I.13 above), one goal of which is to establish a database for monitoring F-gases in the country.

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	(I.29, 2018) Transparency	the assumed average initial filling and the number of units of equipment on the market for all years of the time series.	
I.21	2.F.6 Other applications (product uses as substitutes for ozone-depleting substances) – HFCs (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.	Addressing. During the review, Turkey indicated that owing to a lack of information, the calculation cannot currently be performed and, according to the national regulation on waste electrical and electronic equipment, companies must collect and store gases recovered from retired refrigeration and air-conditioning equipment. The Party added that it is working on data collection for an F-gas database (see ID# I.13 above); once the database is established, the calculation will be able to be made.
I.22	2.G Other product manufacture and use – N_2O (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. N_2O emissions from medical applications (2.G.3.a) (e.g. anaesthesia) were reported as "NE". During the review, Turkey indicated that, provided data are available, it would include N_2O emissions for anaesthesia and other applications under this category in its planned inventory improvements.
I.23	2.G.1 Electrical equipment – SF_6 (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.	Addressing. Turkey reported SF_6 emissions from manufacturing, operation and disposal as an aggregate amount. During the review, the Party referred to an EU-funded project (see ID#s I.13 and I.20 above) that will enable it to establish a database for monitoring F-gases in the country.
Agriculture			
A.1	3. General (agriculture) (A.2, 2018) (A.4, 2016) (A.4, 2015) (106, 2014) (61, 2013) (88, 2012) Transparency	Provide more transparent information in annexes 3 and 7 to the NIR (including information on the sources of uncertainties, any issues affecting time-series consistency and category-specific QA/QC and verification procedures) and provide tables showing the time series for the EFs and AD by category, as well as detailed documentation supporting the choice of EFs, including when default EFs are applied.	Resolved. NIR annexes 3 and 7, referred to in the recommendation, had information on QA/QC procedures and the uncertainty analysis in the 2014 NIR but not in the NIRs of subsequent years. The uncertainty data sources are provided in the category-specific sections of the 2019 NIR. Annex 3 to the 2019 NIR (p.512) has a table with the EFs used for the agriculture sector and the sources for the EFs, which has improved the transparency of reporting. Turkey also reported the time series for some of the AD used in NIR table 5.9 (e.g. milk yield) and NIR table 5.17 (e.g. organic and inorganic fertilizer).
A.2	3. General (agriculture) – CH_4 and N_2O (A.14, 2018) Transparency	Transparently explain the reduction observed in the populations of most livestock species between 1990 and 2016 in the NIR.	Resolved. Explanations for the reductions in the actual populations of livestock species (other than cattle, sheep and goats) since 1990 are provided in the NIR (p.269).
A.3	3.A.1 Cattle – CH_4 (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.	Not resolved. According to the CRF table 3.As1, Turkey used option A (dairy and non-dairy cattle) for classifying cattle in the 2019 inventory submission. During the review, the Party stated that this issue would be resolved when the required parameters and data required for using higher-tier method calculations in

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			manure management become available (see ID# A.23 in table 5).
A.4	3.A.1 Cattle – CH_4 (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 intake used for the calculation of CH_4 emissions from enteric fermentation for cattle.	Not resolved. The sources of data and corresponding references for average animal mass, milk productivity and GE intake used for calculating CH_4 emissions from enteric fermentation for cattle are not included in the NIR. During the review, Turkey explained that it plans to improve its reporting in this regard for the next inventory submission.
A.5	3.A.1 Cattle – CH_4 (A.16, 2018) Transparency	Summarize in the NIR the methods used to calculate GE intake 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).	Not resolved. Turkey did not provide the data and methodology used for calculating the GE intake for dairy and non-dairy cattle in the NIR. During the review, Turkey explained that it plans to improve its reporting in this regard for the next inventory submission.
A.6	3.B Manure management – CH_4 (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. Turkey estimated CH_4 emissions from manure management for all categories using a tier 1 method and default EFs from the 2006 IPCC Guidelines. In the NIR (p.467), Turkey mentioned its ongoing work on estimating country-specific parameters in order to upgrade to the use of a tier 2 method for calculating CH_4 emissions from manure management (2006 IPCC Guidelines, vol. 4, equation 10.23). Country-specific values were provided for both GE intake (NIR, p.279) and MMS (NIR, p.287). The ERT considers Turkey could explore the possibility of resolving this issue by calculating volatile solid excretion rates using the country-specific values for GE intake provided in NIR table 5.9 and default EFs from the 2006 IPCC Guidelines (vol. 4, equation 10.24) for the other variables (feed digestibility, urinary energy, ash content of manure and maximum methane-producing capacity of manure), until country-specific values are developed. During the review, the Party mentioned that cattle is a significant livestock category in Turkey, and enhanced livestock characterization is planned to be used in the inventory for dairy and non-dairy cattle for this key category; however, it did not provide a time frame for implementing the enhancement in the inventory.
A.7	3.B Manure management – CH_4 and N_2O (A.18, 2018) Accuracy	Collect the necessary AD and estimate and report CH_4 and N_2O emissions from manure management using country-specific	Addressing. Turkey still uses a tier 1 method and default EF when estimating CH_4 emissions from manure management for significant animal groups. Regarding N_2O emissions from manure management, the ERT commends the Party for its progress in developing the

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		EFs and appropriate tier methods from the 2006 IPCC Guidelines.	methodology used, which now includes country-specific values for the distribution of AWMS and country-specific Nex values for the most significant animal groups. For estimating CH_4 and N_2O emissions from manure management, both of which are key categories, the ERT is of the view that the Party could use enhanced livestock characterization for the significant animal groups in accordance with the 2006 IPCC Guidelines and an appropriate tier method from the 2006 IPCC Guidelines (see also ID# A.3 above).
A.8	3.B Manure management – CH_4 and N_2O (A.19, 2018) Accuracy	Revise AWMS usage for all livestock species to reflect national circumstances, or apply the default AWMS from the 2006 IPCC Guidelines for the relevant region, and transparently provide the necessary documentation in the NIR.	Resolved. Turkey reviewed the distribution across AWMS for all livestock species and provided new information in NIR table 5.14, including a country-specific distribution for all species, except for the minor population of swine, for which default values were used. The changes resulted in recalculations of the entire time series for manure management.
A.9	3.B Manure management – N_2O (A.7, 2018) (A.10, 2016) (A.10, 2015) (110, 2014) (68, 2013) Accuracy	Revise the emission estimates by applying national values of Nex and AWMS distribution.	Resolved. Turkey reviewed the distribution across AWMS for all livestock species and provided new information in NIR table 5.14, including a country-specific distribution for all species, except for the minor population of swine, for which default values were used. Nex values were calculated using country-specific TAM values for the significant livestock categories; NIR table 5.11 presents these values. National Nex values for sheep and goats have also been included in the inventory. On the basis of the new information, recalculations were done for the entire time series (NIR, p.288).
A.10	3.B Manure management – N_2O (A.20, 2018) Accuracy	Recalculate Nex per MMS for daily spread, liquid systems and digesters for dairy cattle to reflect the national MMS distribution for dairy cattle.	Resolved. Turkey updated its MMS distribution and recalculated the Nex per MMS for dairy cattle, thereby better reflecting its national circumstances (NIR, p.286).
A.11	3.B.1 Cattle – N_2O (A.21, 2018) Accuracy	Estimate the Nex rate for dairy and non-dairy cattle using national data, and transparently provide detailed documentation to support the estimated values in the NIR.	Resolved. The Nex rates for cattle are based on country-specific values for TAM (NIR, p.283).
A.12	3.B.1 Cattle – CH_4 and N_2O (A.5, 2018) (A.14, 2016) (A.14, 2015) Transparency	Include further explanation of the sources and assumptions used for deriving the AD, including information on why all AD and the distribution to the MMS reported for the "dairy cattle – hybrid" category always represent the mean values of the categories "dairy cattle – culture" and "dairy cattle – domestic".	Resolved. Turkey updated the MMS distribution in the NIR (table 5.14) and now uses country-specific AD for manure handled in different management systems. These AD, sourced from the Turkish Statistical Institute, are based on assumptions explained in the NIR (pp.284–287).
A.13	3.B.3 Swine – CH_4 (A.23, 2018) Consistency	Assess the significant inter-annual changes in the CH_4 IEF for swine manure management, in particular	Not resolved. The Party did not include an explanation for the inter-annual changes in the CH_4 IEF in the 2019 inventory submission. During the review, Turkey assessed the inter-annual changes and explained that, as shown in

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		in the latest years of the time series, and include the results in the NIR.	NIR table 5.12, the CH_4 EFs for swine are highly sensitive to temperature changes. The swine population was concentrated in Antalya and Izmir in 2014–2017 – these cities have different average temperatures, thus different EFs are used for their animal populations. Therefore, a change in the limited number of swine has a significant effect on the (weighted average EF) IEF for the country as a whole: a small decrease in number can lead to a huge percentage change in the IEF. This information has not been included in the NIR.
A.14	3.B.3 Swine – CH_4 and N_2O (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. Turkey did not revise the population of swine in the 2019 submission and did not provide any reasons for the population's significant inter-annual changes in the NIR. The splicing technique from the 2006 IPCC Guidelines was not used. CRF table 3.B(a)s1 shows the population of swine increased by 96.9 per cent (3,495 pigs) between 2002 and 2003, dropped between 2004 and 2005 and was fairly steady until another increase between 2011 and 2012. Overall, between 1990 and 2017, the population of swine decreased by 88.7 per cent (10,639 pigs). During the review, Turkey explained that official statistics for animal numbers were used, and further, that although it would like to determine the reason for the inter-annual changes, it is difficult because swine is not a significant livestock category in Turkey and the relevant data for 2002 and 2003 were collected over 15 years ago.
A.15	3.B.5 Indirect N_2O emissions – N_2O (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.	Not resolved. Turkey reported indirect N_2O emissions from leaching and run-off from manure management as "NE". In CRF table 9, the explanation provided is that no applicable tier 1 method is available in the 2006 IPCC Guidelines. During the review, Turkey mentioned that it has begun work on estimating indirect N_2O emissions from leaching and run-off from manure management. Turkey plans to report the estimated emissions for this source category in the next inventory submission.
A.16	3.C.1 Irrigated – CH_4 (A.25, 2018) Transparency	Include in the NIR the rationale for the selection of the scaling factor to account for the differences in water regime during the cultivation period and the scaling factors to account for the differences in water regime in the pre-season before the cultivation period, along with the assumptions applied in relation to the scaling factor for soil type and rice cultivar and the scaling factor for both type and amount of organic amendment applied.	Resolved. Turkey provided a transparent description in the NIR (p.292) of the method, rationale and factors used.
A.17	3.D.a.2.b Sewage sludge applied to soils – N_2O	Include information in the NIR to explain the declining trend in N_2O emissions for this category since	Resolved. Turkey provided an explanation for the trend for sewage sludge in the NIR (p.298).

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	(A.26, 2018) Transparency	2005, including the drivers affecting this trend (e.g. the increase in the number of landfills, the new legislation that limits the sewage applied to soils, and the change in wastewater treatment methods).	
A.18	3.F Field burning of agricultural residues – CH_4 and N_2O (A.27, 2018) Completeness	Include information in the NIR to justify that maize is not subject to field burning in the country, or collect AD and estimate CH_4 and N_2O emissions from field burning of maize crop residue.	Resolved. Turkey estimated CH_4 and N_2O emissions from the field burning of maize crop residue for the entire time series in CRF table 3.F.
A.19	3.H Urea application – CO_2 (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.	Addressing. In response to a request made by the previous ERT during the 2018 review to provide documentation and a reference for the amount of urea applied in the country (production, import and use) for the entire time series (1990–2016), the Party provided urea application data for 1981–2017 obtained from the Ministry for Food and Agriculture (see https://www.tarimorman.gov.tr/Konular/Bitkisel-Uretim/Bitki-Besleme-ve-Tarimsal-Teknolojiler/Bitki-Besleme-Istatistikleri (in Turkish)). This reference was included in the 2019 NIR (p.307) but without the weblink. No explanation is provided in the 2019 NIR for the rise in urea application in the last two reporting years. During the review, Turkey explained that the increase in urea application in recent years is due in particular to its use as a substitute for N-based fertilizers. Turkey has restricted the use of N-based fertilizers since June 2016, which has led to a shift in farmers' choice of fertilizer.
LULUCF			
L.1	4. General (LULUCF) – CO_2 and N_2O (L.1, 2018) (L.1, 2016) (L.1, 2015) (table 3, 2014) (72, 2013) (105, 2012) (91, 2011)	Use existing data, make all the necessary efforts to collect new data and report estimates for the mandatory categories, subcategories and pools identified in the review report and, for clarity, listed below:	
	Completeness	(a) Carbon stock changes in mineral soils for grassland;	Not resolved. Turkey reported the carbon stock changes in mineral soils as "NO" for all pools, with the exception of organic soils, in CRF table 4.C, assuming no change in carbon stocks for grassland remaining grassland. The ERT noted that, in accordance with the UNFCCC Annex I inventory reporting guidelines, the correct notation key is "NA" when assuming no carbon stock changes occurred.
		(b) CO_2 emissions/removals from forest land converted to grassland (all pools);	Resolved. For land converted to grassland, Turkey reported in CRF table 4.C and the NIR (section 6.4, p.357) CO_2 emissions and removals for all carbon pools, including organic soils.

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		(c) Carbon stock changes for wetlands converted to grassland (biomass and mineral soils pools);	Resolved. Turkey reported in the NIR (section 6.4, pp.359–361) the carbon stock changes for the biomass and mineral soils pools.
		(d) CO_2 emissions/removals from forest land, cropland and grassland converted to settlements (all pools);	Resolved. Turkey reported in the NIR (section 6.6, pp.373–375) and CRF table 4.E CO_2 emissions and removals for all pools for forest land, cropland and grassland converted to settlements. Turkey also reported that it expects that the next inventory submission will include detailed results of the EU-funded project on technical assistance for developing an analytical basis for the LULUCF sector (2017–2019) as well as updates to the related reporting (NIR, p.467).
		(e) CO_2 emissions/removals from forest land and cropland converted to other land (all pools).	Resolved. For forest land converted to other land, Turkey reported the carbon stock changes in living biomass, DOM and mineral soils in CRF table 4.F. For cropland converted to other land, Turkey reported the carbon stock changes in living biomass and mineral soils and reported the carbon stock changes in DOM as "NO" in CRF table 4.F. Turkey reported organic soils for both forest land converted to other land and cropland converted to other land as "NO" in CRF table 4.F.
L.2	4. General (LULUCF) – CO_2 (L.2, 2018) (L.15, 2016) (L.15, 2015) Completeness	Improve the completeness of the reporting by providing estimates for the land-use categories and transitions that occur in the country and for which there are default IPCC methods. Where the notation key "NE" is used, indicate in both the NIR and the CRF completeness table why the emissions and removals have not been estimated in accordance with paragraph 37 of the UNFCCC Annex I inventory reporting guidelines.	Resolved. Turkey has improved the reporting of some categories for which emissions were previously not estimated, including forest land converted to settlements. Where the notation key "NE" is used, Turkey reported in CRF table 9 and the NIR (p.383) why the emissions and removals were not estimated, in accordance with paragraph 37 of the UNFCCC Annex I inventory reporting guidelines. Turkey reported CO_2 emissions and removals for all pools for grassland and cropland converted to settlements in the NIR (sections 6.3 and 6.4, respectively).
L.3	4. General (LULUCF) – CO_2 (L.3, 2018) (L.3, 2016) (L.3, 2015) (115, 2014) Convention reporting adherence	Strengthen the institutional arrangements to improve the inventory preparation process, specifically the integration of data and information for the LULUCF sector.	Resolved. Turkey reported in the NIR (section 6.1, p.311) on its strengthening of institutional arrangements related to the reporting of the LULUCF inventory, which is managed by a group of 10 experts covering different elements of the LULUCF sector. Turkey also reported in the NIR (section 6.1, p.316) that a new wall-to-wall spatially explicit map derived from a satellite-based land cover monitoring system was implemented in the latest reporting year, which has led to better integration of data for and information on the LULUCF sector.
L.4	4. General (LULUCF) – CO_2 (L.4, 2018) (L.5, 2016) (L.5, 2015) (117, 2014) (74 and 75, 2013) Accuracy	Clarify the description of land categories and check the integrity of the total land area over the entire time series, reporting on the findings.	Resolved. Turkey provided in the NIR (pp.314–315) further clarification of land-use categories. The total land area reported in NIR table 4.1 was maintained across the time series, thereby resolving the issue of fluctuating total land area in the previous submission.

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L.5	4. General (LULUCF) – CO_2 (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.	Addressing. In the NIR (pp.315 and 316), Turkey provided clarification on the inconsistencies between the two data sources for forest land and other land (namely the CORINE land cover map and ENVANIS). The Party reported that the EU-funded project on technical assistance for developing an analytical basis for the LULUCF sector (2017–2019) is expected to provide Turkey with the capacity to develop land-use matrices and improve its reporting by the next inventory submission (NIR, p.467).
L.6	4. General (LULUCF) – CO_2 (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.	Addressing. The Party provided a sample land-use transition matrix in NIR table 6.4. However, the ERT considers that the information provided in that matrix is not clear. During the review, in response to a request made by the ERT for the sample land-use matrix to be provided in Excel format, the Party indicated that it would be provided in the next inventory submission. See ID# L.43 in table 5.
L.7	4. General (LULUCF) – CO_2 (L.9, 2018) (L.16, 2016) (L.16, 2015) Transparency	Prioritize the integration of the ENVANIS national forest management database and CORINE, and include in the NIR information on progress in the integration and data validation.	Resolved. Turkey reported in the NIR (p.311) that the new system has addressed the inconsistency issue by reporting using one land cover detection system for all land-use categories under the LULUCF sector.
L.8	4. General (LULUCF) (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 noted that Turkey continues 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 still exist. In CRF table 4(V), emissions from wildfires are reported as "NE", whereas they are not included in NIR table 6.5, which is table 6.3 in the previous NIR. Table numbers NIR 6.2, 6.13, 6.15 and 6.16 referred to in the previous recommendation are redundant as the 2019 NIR was restructured and information matching that in the previous NIR tables was not provided in tabular format (see ID#s L.22 and L.35 below).
L.9	4. General (LULUCF) (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.	Not resolved. In the NIR (annex 2, p.489) the same EF uncertainty value (4.5 per cent) is reported for forest land, grassland, cropland, wetlands, settlements, other land and HWP without explaining the rationale behind its use. The ERT considers that it is unlikely that the same uncertainty value applies to the EFs for all land-use categories. During the review, the Party explained that the overall EF uncertainty is 4.5 per cent; therefore this value was used for forest land, grassland, cropland, wetlands, settlements, other land and HWP.
L.10	Land representation (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	Not resolved. The ERT noted that inconsistencies in CRF table 4.1 still exist in the representation of land areas between the end of one inventory year and the beginning of the next reported year. Turkey has not reproduced

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		consistently initial and final areas in CRF table 4.1.	the final areas reported in CRF table 4.1 for 2016 as initial areas for 2017 in CRF table 4.1, for forest land (final area for 2016: 22,851.09 kha; initial area for 2017: 22,980.61 kha), cropland (final area for 2016: 27,137.28 kha; initial area for 2017: 27,206.01 kha) and grassland (final area for 2016: 24,109.92 kha; initial area for 2017: 24,116.48 kha). During the review, Turkey indicated that the land-use areas in CRF table 4.1 were incorrectly reported as they include 20-year transitions instead of annual transitions, which explains the reason for the differences. The ERT notes that this time-series inconsistency in CRF table 4.1 will be addressed when the Party corrects the table using annual area changes.
L.11	Land representation (L.24, 2018) Completeness	Provide an explanation of where the areas of natural rivers and lakes are included in the NIR, and, if not included, revise the definition of wetlands to ensure adherence to the 2006 IPCC Guidelines and recalculate emissions for the entire time series to reflect the revised definition.	Resolved. Turkey provided an explanation of where the areas of natural rivers and lakes are included in the NIR (p.365) and performed recalculations for the entire time series to reflect the revised definition.
L.12	Land representation (L.24, 2018) Completeness	Provide information on where other managed wetland areas (e.g. peatlands) are included.	Resolved. Turkey provided information in the NIR (p.315) on where other managed wetland areas (e.g. peatlands) are included.
L.13	Land representation (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.	Addressing. The land representation system has been updated since the previous submission and the land-use matrix table in CRF table 4.1 has also been updated. However, the information on some land-use conversion categories (e.g. forest land converted to other land uses) is not clear from the information in the NIR (section 6.2, p.322). During the review, Turkey provided information on land area changes in Excel format, except for forest land converted to other land uses. In addition, the Party highlighted that the land representation system has been changed to better reflect the tracking of land area changes.
L.14	4.A Forest land – CO_2 (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. Turkey reported recalculated estimates for forest land for the entire time series (NIR, p.338). The Party has improved the reporting of forest land using the results from a project initiated in 2013, which has provided a more integrated approach to forest management and better estimation methods, including information on disaggregation by forest type and species type for the biomass carbon pool. However, during the review, Turkey indicated that for forest land, it plans to disaggregate the increment data for ecological zones in the short term. The soil and DOM carbon stocks will be updated as more national studies become available (NIR, p.467).
L.15	4.A Forest land – CO_2 (L.11, 2018) (L.10,	Provide clear and complete information in the NIR on the data	Resolved. The Party provided information on the data sources and estimation methodology in

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	2016) (L.10, 2015) (122, 2014) (77–79, 2013) (98, 2012) Transparency	sources and estimation methodology.	the NIR under the relevant section for each land-use category, including forest land (NIR, sections 6.1–6.13).
L.16	4.A Forest land – CO_2 (L.12, 2018) (L.17, 2016) (L.17, 2015) Transparency	Continue efforts to improve the transparency of underlying forest data and the methods used for determining and calculating forest stock and increment as well as data on removals in the ENVANIS national forest management database.	Resolved. The Party reported in the NIR (tables 6.10–6.11) information on the growing stock volume and the net annual increment volume from ENVANIS and provided an explanation of how data were derived from forest management plans. The source for other parameters such as the average basic wood density and the national biomass conversion and expansion factor provided in NIR table 6.12 are based on the results from a national study (Tolunay, 2013).
L.17	4.A.1 Forest land remaining forest land – CO_2 (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.	Not resolved. For calculating the annual carbon loss in wood removals (NIR, p.332), Turkey used equation 2.12 of the 2006 IPCC Guidelines (vol. 4). During the review, Turkey highlighted that the national definition of annual wood removals was applied and the annual wood removal data are actualized national data from the General Directorate of Forestry on annual wood removals.
L.18	4.A.2.2 Grassland converted to forest land – CO_2 (L.13, 2018) (L.18, 2016) (L.18, 2015) Accuracy	Verify the accuracy of the estimates for mineral soil net carbon stock change and apply a recalculation if deemed necessary.	Resolved. Turkey provided information in the NIR (section 6.4, p.362) on how the estimates of carbon stock changes for all land uses, including grassland converted to forest land, were verified. Recalculations were performed for grassland converted to forest land and other land-use categories under the LULUCF sector for the entire time series.
L.19	4.A.2.2 Grassland converted to forest land – CO_2 (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 grassland converted to forest land in the NIR (section 6.4, p.357) and provided information on the parameters used for estimating the emissions in NIR tables 6.25–6.26. During the review, the Party provided additional information in Excel format on the background data used for calculating net emissions and removals, and indicated that detailed information on the background data and carbon stock values used would be included in the NIR in the next inventory submission.
L.20	4.A.2.2 Grassland converted to forest land – CO_2 (L.27, 2018) Transparency	Provide in CRF table 4.A and the NIR detailed information on the areas converted for each subcategory under grassland to facilitate understanding of the changes from one year to another in the implied carbon stock change factors for grassland converted to forest land.	Resolved. Turkey reported in the NIR (section 6.4, p.357) detailed information on the parameters used for estimating changes in carbon stocks for grassland (one type) converted to forest land. Consequently, data in CRF table 4.A were reported without disaggregation into subcategories under grassland. During the review, the Party provided detailed information on the types of conversion from grassland to forest land and explained that Turkey's new land cover system only gathers data on one type of grassland, namely pasture, not the three subcategories reported in the previous submission, which helps to explain the observed changes in IEFs

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			for grassland converted to forest land for all carbon pools.
L.21	4.B Cropland – CO_2 (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. Inconsistencies still exist between the NIR and CRF tables in the current inventory submission. For 2017, the area reported for cropland in NIR figure 6.10 is approximately 26,925 kha, whereas in CRF table 4.1 it is 26,925.12 kha and in CRF table 4.B it is 27,121.07 kha. No tables with absolute values of cropland areas were provided in the NIR, only a graph (NIR figure 6.10).
L.22	4.B Cropland – CO_2 (L.18, 2018) (L.20, 2016) Transparency	Check that the NIR text is updated to reflect the content of the present year's reporting in the CRF tables.	Resolved. The NIR text (section 6.3, p.356) has been updated to reflect the content of the present year's reporting in the CRF tables.
L.23	4.B Cropland – CO_2 (L.28, 2018) Accuracy	Either assess and document in the NIR the methodological approach used to generate the country-specific carbon stock of biomass per area for annual crops, or, if this is not possible, use the default value from table 8.4 of the 2006 IPCC Guidelines (vol. 4) (4.7 t carbon/ha).	Resolved. Turkey used the default value for carbon stock changes on land converted to cropland from table 5.9 of the 2006 IPCC Guidelines (vol. 4) (5 t carbon/ha) to estimate the carbon stock of biomass per area for annual crops in the NIR (section 6.3, p.343).
L.24	4.B Cropland – CO_2 (L.29, 2018) Consistency	Review the underlying methods and areas used to estimate CO_2 emissions and removals for cropland, and, as appropriate, revise the estimated CO_2 emissions and removals for cropland and explain in the NIR the reasons for any remaining significant variations in the emission trend from 1990 to 2016 and subsequent years.	Resolved. Turkey provided an explanation in the NIR (section 6.3, p.342) of the underlying methods and areas used to estimate CO_2 emissions and removals for cropland. The Party revised the estimated CO_2 emissions and removals for cropland and provided relevant reasons in the NIR for the remaining significant variations in the emission trend from 1990 to 2017 (NIR, p.340). Consequently, the cropland category is now an emissions source owing to conversions to cropland.
L.25	4.B Cropland – CO_2 (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.	Addressing. The Party reported that it uses a tier 1 method to estimate the DOM carbon pool, 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 method can be applied (NIR, section 6.3, p.343). No recalculation was made and no explanation was provided for the change in carbon stock for the DOM pool between 2007–2015 and 2016.
L.26	4.B Cropland – CO_2 (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 will generate carbon stock factors for perennial crops specific to Turkey.	Addressing. Turkey indicated in the NIR (pp.342–343) that the data for the carbon stock value for above-ground biomass used in the calculations for perennial crops were taken from a 2018 report by Canaveira et al. and explained their applicability to national circumstances. However, the ERT noted that the full reference for the Canaveira et al. report is missing from the reference list.

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L.27	4.B Cropland – CO_2 (L.32, 2018) Accuracy	Given the importance of poplar plantations to the country, further assess whether all poplar plantations are accurately included in the inventory calculations.	Resolved. In the NIR (section 6.3, p.342) under cropland, Turkey created a subcategory under perennial crops for poplar plantations. In the NIR (p.318), the Party explained the approach for the differentiation of perennial crops, including poplar plantations.
L.28	4.B.2 Land converted to cropland – CO_2 (L.33, 2018) Transparency	If reporting "NO" for all pools for forest land converted to cropland is based on expert judgment, provide in the NIR detailed information on how this judgment was elicited and documented (in line with the 2006 IPCC Guidelines, vol. 1, annex 2A.1). If the reporting of "NO" cannot be justified, report corresponding CO_2 emissions.	Resolved. Turkey estimated the carbon stock changes in all pools for forest land converted to cropland and explained the method used in the NIR (section 6.3, pp.346–347).
L.29	4.C Grassland – CO_2 (L.34, 2018) Transparency	Provide in the NIR the areas of grassland under each subcategory (pasture, natural grassland and green areas), as well as the differentiated carbon stocks per unit of area, to increase the transparency of the reporting.	Resolved. Turkey provided in the NIR (section 6.4, p.358) both the areas of grassland under non-woody vegetation for grazing (pasture) and the differentiated carbon stocks per unit of area (NIR section 6.4, pp.359–361) in order to increase the transparency of the reporting. Grassland was also disaggregated by ecological zone. During the review, the Party highlighted that the land-use definition for grassland was revised as a new land cover classification was introduced; green areas and natural grassland do not exist under the new system.
L.30	4.C Grassland – CO_2 (L.34, 2018) Transparency	Indicate in the NIR the assumptions regarding the carbon stock change from conversion of land to grassland (e.g. for tier 1) in accordance with the 2006 IPCC Guidelines (vol. 4, p.6.25), including that it is assumed grassland achieves steady-state biomass during the first year following conversion.	Resolved. Turkey indicated in the NIR (table 6.24) the assumptions regarding the carbon stock change from conversion of land to grassland (e.g. for tier 1) in accordance with the 2006 IPCC Guidelines (vol. 4, p.6.25), namely that grassland is assumed to achieve steady-state biomass during the first year following conversion.
L.31	4.C Grassland – CO_2 (L.35, 2018) Transparency	Provide in a single table for each subcategory of grassland (natural grassland, pasture and green areas) all the carbon stock values applied to estimate the changes in carbon stocks, and avoid referencing values that are not used in the calculations.	Resolved. Turkey provided a single table (NIR table 6.26) for each subcategory of grassland (pasture) with all the carbon stock values applied to estimate the changes in carbon stocks, disaggregated by ecological zone. During the review, the Party highlighted that the land-use definition for grassland was revised as a new land cover classification was introduced; green areas and natural grassland do not exist under the new system.
L.32	4.C.2 Land converted to grassland – CO_2 (L.36, 2018) Accuracy	Review, and as appropriate revise, the values of carbon stocks applied so far in the calculation of carbon stock changes for the conversion of forest land to grassland on the basis of literature available for the country (e.g. Tolunay (2011)) or appropriate IPCC default values.	Resolved. Turkey provided in the NIR (tables 6.24–6.25) revised values of carbon stocks with differentiation of forest types applied in the calculation of carbon stock changes for the conversion of forest land to grassland on the basis of available literature in the country.
L.33	4.C.2 Land converted to grassland – CO_2	Provide in section 6.4 of the NIR detailed information regarding the	Addressing. Turkey reported in NIR tables 6.24 (biomass), 6.25 (DOM) and 6.26 (soils)

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	(L.36, 2018) Accuracy	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 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).	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 type (coniferous, deciduous, mixed forest, and other forested land and grassland) and by ecological zone. However, the information in CRF table 4.C on grassland converted to forest land is not presented 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). This level of disaggregation was provided as supporting files in Excel format during the review.
L.34	4.C.2.1 Forest land converted to grassland – CO_2 (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 2017 (CRF table 4.C). This is not in accordance with the 2006 IPCC Guidelines, which state the land conversion categories must include land categories for the past 20 years. During the review, Turkey stated that the results of land-use transition for 20 years were added to CRF table 4.C. The Party indicated that the data on land conversion are calculated from a new land representation system and they show an upward trend in conversions. Turkey has limited statistical data on land-use areas before 1990, which are inconsistent with the new system. The ERT noted that this issue is caused by including the cumulative area changes only since 1990 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. See ID# L.44 in table 5.
L.35	4.D Wetlands – CO_2 (L.19, 2018) (L.13, 2016) (L.13, 2015) (124, 2014) Transparency	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.	Addressing. Turkey reported emissions from land conversion to wetlands for all years since 2012 (CRF table 4.D). The Party did not provide AD and reported emissions from conversion of cropland and grassland to wetlands as “NO” in CRF table 4.D without explaining in the NIR the reason for using this notation key.

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L.36	4.D.2 Land converted to wetlands – CO_2 (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. Turkey reported emissions from the conversion of cropland and grassland to wetlands as "NO" for all years in CRF table 4.D and did not provide a justification in the NIR for using this notation key. In addition, previously reported information on emissions and areas related to wetlands was discontinuous.
L.37	4.E.2 Land converted to settlements – CO_2 (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, to ensure the transparency of the reporting.	Addressing. Turkey reported information in NIR tables 6.33–6.35 on the parameters used for estimating the changes in carbon stock for biomass, DOM and soils for land converted to settlements and on their consistency with the 2006 IPCC Guidelines. However, the Party did not provide information in the NIR on the equations used for estimating the changes in carbon stock. Sources of parameters used were provided in the NIR (section 6.6, p.370); however, sources of AD used were not.
L.38	4.E.2.2 Cropland converted to settlements – CO_2 (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 have been performed, the values provided in the previous inventory submission are retained.	Addressing. Turkey created subcategories for land uses for which carbon stock change factors are available (e.g. annual and perennial crops) in NIR table 6.33, but not in CRF table 4.E. Recalculations were made for all subcategories for all years and the NIR (p.376) provides the rationale and explanations for changes since the previous inventory submission.
L.39	4.E.2.2 Cropland converted to settlements – CO_2 (L.40, 2018) Accuracy	Apply the same data set over time (e.g. do not apply new CORINE data only for the years available), or, where this is not possible, apply the methodological approaches (splicing techniques) provided in the 2006 IPCC Guidelines (vol. 1, chap. 5) to estimate the non-observed values and ensure a consistent data set.	Resolved. The ERT noted that Turkey used a single land cover map under a satellite Earth observation system based on an AD monitoring system for LULUCF for the entire national territory for its 2019 submission. The system relies on wall-to-wall spatially explicit mapping to analyse LULUCF AD and changes for 1990–2015. Recalculations were made for all subcategories for all years using a consistent data set. Consequently, the same emission figure being reported for 2007–2015 in the 2017 and 2018 inventory submissions is rectified (in CRF table 4.E).
L.40	4(III) Direct N_2O emissions from N mineralization/ immobilization – N_2O (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 the 2019 inventory submission in CRF table 4(III), including for other land. Instead, the notation key "NO" was used and its use was not justified in the NIR in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.
L.41	4.G HWP – CO_2 (L.20, 2018) (L.21, 2016) Accuracy	Check that the data presented in the CRF tables for HWP are complete and correct and report a corrected time series for the category.	Resolved. Turkey reported a complete time series since 1960 in CRF table 4.G and corrected the production data for sawn wood and wood panels for 2014. The Party included AD for paper and paperboard for the first time for the complete time series. However, some of

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			the information was reported as "IE" (see ID# L.47 in table 5).
Waste			
W.1	5.A Solid waste disposal on land – CH_4 (W.1, 2018) (W.16, 2016) (W.16, 2015) Comparability	Provide disaggregated emission estimates from unmanaged waste disposal sites and managed waste disposal sites.	Resolved. CH_4 emissions from unmanaged and managed waste disposal sites have been disaggregated in CRF table 5.A and in NIR table 7.3.
W.2	5.A.1 Managed waste disposal sites – CH_4 (W.4, 2018) Accuracy	Investigate the completeness and accuracy of the different data sources and, as appropriate, update the time series of MSW composition, by component, by applying a relevant splicing technique from the 2006 IPCC Guidelines to ensure a consistent time series. If data used correspond to 1993, 2006 and 2014, apply a splicing technique from the 2006 IPCC Guidelines (e.g. interpolation combined with extrapolation) for the remaining years rather than using the data for 1993 for the whole period 1990–2001, the data for 2006 for the whole period 2002–2013 or the data for 2014 for the whole period 2014–2016.	Resolved. Turkey updated the time series by disseminating the waste composition data across 1990–2017, applying the suggested splicing technique from the 2006 IPCC Guidelines, as presented in NIR table 7.10, in order to provide a consistent time series.
W.3	5.A.1 Managed waste disposal sites – CH_4 (W.5, 2018) Transparency	Improve the transparency of the inventory by adding information in the NIR to justify that emissions from clinical waste disposed to landfill can be considered negligible in accordance with paragraph 37(b) of the UNFCCC Annex I inventory reporting guidelines.	Resolved. Turkey included emission calculations for clinical waste disposed in landfill in CRF table 5.A and reported the estimates in the clinical waste section of the NIR (pp.413–415). The AD used for clinical waste are based on a survey conducted by the Turkish Statistical Institute.
W.4	5.B.1 Composting – CH_4 and N_2O (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.	Addressing. Turkey explained in the NIR (p.420) that the reason for the fluctuations in AD between 2001 and 2013 could be the different capacities of the facilities. However, the ERT noted that the different installed capacities of the facilities is not in itself an explanation for the large inter-annual fluctuations seen in NIR table 7.24 and figure 7.3.
W.5	5.B.1 Composting – CH_4 and N_2O (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.	Not resolved. Turkey did not include the number of facilities operating each year or separately indicate the total capacity of composting plants for each year in NIR table 7.23. During the review, the Party stated that detail information on the number of facilities operating with installed capacity is provided in the NIR (pp.418–419). However, the ERT noted that the number of facilities operating is only provided for 2016–2017, and installed capacity is indicated in terms of percentage of composted waste for only one facility for 2015–2017.

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
W.6	5.C.2 Open burning of waste – CO_2, CH_4 and N_2O (W.7, 2018) Accuracy	Change the classification of garden and park MSW to biogenic in the emission calculations and in NIR table 7.25 and recalculate GHG emissions for the entire time series accordingly, and describe the recalculation in the NIR.	Addressing. Turkey changed the classification of garden and park MSW from non-biogenic to biogenic in NIR table 7.29 and recalculated the CO_2, CH_4 and N_2O emissions for the time series accordingly. However, in NIR table 7.30, which presents the default dry matter content, the garden and park MSW are still classified as non-biogenic.
W.7	5.D Wastewater treatment and discharge – CH_4 (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.	Addressing. Sludge used for agricultural soils is reported under the agriculture sector (NIR table 5.17) and the sludge balance provided to the ERT during the review includes the amount of sludge used for agricultural soils. However, the information reported between the waste (category 5.D) and agriculture (category 3.D) sectors with respect to the amount of sludge used on agricultural soils was not provided in the NIR.
W.8	5.D Wastewater treatment and discharge – CH_4 (W.8, 2018) Completeness	Improve the completeness of the GHG inventory by including the emissions from sludge landfilled.	Resolved. Emissions from sludge landfilled were included in the national emissions under CH_4 emissions from solid waste disposal in CRF table 5.A and data are also provided in NIR table 7.20.
W.9	5.D Wastewater treatment and discharge – CH_4 (W.8, 2018) Transparency	Improve the transparency of the NIR by reporting 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).	Addressing. Emissions from sludge landfilled were included in the NIR (table 7.19). However, information on the amount sent to other types of treatment (incineration, agriculture, composting, etc.) or on the characteristics (carbon and N content) of these amounts was not provided in the NIR. During the review, Turkey presented a sludge balance with the amount of sewage sludge from domestic wastewater that is sent to each of the different treatments and stated that it would provide the balance in the next inventory submission.
W.10	5.D.1 Domestic wastewater – CH_4 (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 parameter used for the degree of treatment utilization by population class for the whole time series was not improved. However, following the recommendation, Turkey included in the NIR (pp.454–455) a plan to improve the CH_4 emission parameter used for the degree of treatment utilization by population class for the whole time series wherein the results from an ongoing study being carried out to determine specific values for this parameter would be applied. Turkey stated that after the study has been completed, the emissions and AD time series would be recalculated accordingly.
W.11	5.D.1 Domestic wastewater – N_2O	Use available data from the Food and Agriculture Organization of the	Resolved. Turkey used available data on protein consumption from FAOSTAT for up to

ID#	*Issue classification*[a, b]	*Recommendation made in previous review report*	*ERT assessment and rationale*
	(W.3, 2018) (W.18, 2016) (W.18, 2015) Consistency	United Nations country profile of food security indicators for Turkey for corresponding years of the inventory and IPCC gap-filling techniques for the years with missing data where country-specific information is not available.	2013. Data for after 2013 were extrapolated, as indicated in the NIR (p.452). Recalculations were made for 2014–2016, as mentioned in the recalculations section of the NIR (p.454).
W.12	5.D.1 Domestic wastewater – N_2O (W.10, 2018) Accuracy	Improve the accuracy of the T_{PLANT} parameter for the whole time series by applying the results achieved from the 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.	Addressing. Turkey stated in the NIR (p.449) that it has developed T_{PLANT} values for the entire time series, explaining that for 1990–2000 the T_{PLANT} parameter was considered as "NO" because the N removal process was not available before 2001 in wastewater treatment plants. During the review, the Party provided a table with T_{PLANT} values for 1990–2017, which were reported in CRF table 5(D) under additional information for each year. However, the T_{PLANT} values considered for 2002–2017 were not presented in the NIR. Moreover, Turkey did not include the data source for this parameter to explain how it was estimated. In the recalculations section of the NIR (p.454), Turkey stated that it has recalculated the emissions using the country-specific T_{PLANT} values.
W.13	5.D.2 Industrial wastewater – CH_4 (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 accuracy of the parameter used for the fractional usage for different types of waste treatment and discharge pathways for the whole time series was not improved in the 2019 inventory submission. Following the recommendation, Turkey stated in the planned improvements section of the NIR (pp.454–455) that it plans to improve the CH_4 emission parameter used for the fractional usage for different types of waste treatment and discharge pathways for the whole time series by applying the results from an ongoing study being carried out to determine specific values for this parameter. After the study has been completed, Turkey will recalculate the emissions and AD for the time series accordingly.

[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 review of the 2017 inventory submission of Turkey did not take place in 2017 and, as such, the 2017 annual review report was not available at the time of the 2019 review. Therefore, no recommendations from the 2017 annual review report are reflected in this table. For the same reason, 2017 is excluded from the list of review years in which the issue could have been identified.

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

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 successive reviews, including the review of the 2019 inventory submission of Turkey, and have not been addressed by the Party.

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

ID#	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*[a]
General		
G.3	Use the results of the uncertainty analysis to prioritize improvements to the inventory	4 (2014–2019)
Energy		
E.1	Include a separate section in the energy chapter of the NIR providing all detailed information on, and the rationale for, recalculations	5 (2013–2019)
E.4	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	3 (2015/2016–2019)
E.5	Determine a reliable data source for international bunker fuels and improve time-series consistency	5 (2013–2019)
E.10	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	3 (2015/2016–2019)
E.11	Provide sufficient information on the inter-annual changes in the CO_2 EFs in the NIR	4 (2014–2019)
E.13	Improve the transparency of the NIR by including 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	3 (2015/2016–2019)
E.16	Revise the emission estimates, reallocating the diesel oil used for agricultural purposes to this subcategory 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	4 (2014–2019)
E.17	Provide a clear explanation in the NIR of the allocation of diesel oil used for agricultural purposes to this subcategory, 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	4 (2014–2019)
IPPU		
I.1	Provide a consistent time series of emissions of SF_6 and PFCs from other product use (2.G.2)	3 (2015/2016–2019)
I.2	Include captive lime production emissions in the estimates for this category	4 (2014–2019)

ID#	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*[a]
I.3	Provide evidence of the 100 per cent CO_2 recovery rate associated with lime used during sugar refining and precipitate production in the NIR, 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	3 (2015/2016–2019)
I.4	Undertake limestone and dolomite mass balances to cross-check the estimates in order to increase the accuracy of the inventory	3 (2015/2016–2019)
I.6	Use the notation key "NO" to report fluorochemical production	3 (2015/2016–2019)
I.7	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	4 (2014–2019)
I.11	Correct the notation key used to report SF_6 emissions from magnesium foundries from "NA" to "NE"	4 (2014–2019)
I.13	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	6 (2012–2019)
I.14	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	4 (2014–2019)
I.22	Report all likely occurring emissions, such as N_2O emissions from anaesthesia and other applications	4 (2014–2019)
Agriculture		
A.6	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	5 (2013–2019)
LULUCF		
L.1	Estimate the carbon stock changes in mineral soils for grassland	7 (2011–2019)
L.5	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	5 (2013–2019)
L.6	Treat with priority the issue of land representation under the LULUCF sector and provide a complete land-use matrix for the entire time series	3 (2015/2016–2019)
L.14	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	4 (2014–2019)
L.19	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	3 (2015/2016–2019)
L.21	Correct detected inconsistencies and, as part of QA/QC routines, check that data presented in the NIR in tables, text	3 (2015/2016–2019)

ID#	*Previous recommendation for the issue identified*	*Number of successive reviews issue not addressed*[a]
	and figures are consistent and match the latest data reported in the CRF tables (i.e. regarding areas of cropland)	
L.22	Check that the NIR text is updated to reflect the content of the present year's reporting in the CRF tables	3 (2016–2019)
L.35	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	4 (2014–2019)
Waste	No issues identified	

[a] The review of the 2017 inventory submission of Turkey did not take place in 2017. Therefore, 2017 was not included when counting the number of successive years in table 4. As the reviews of the Party's 2015 and 2016 inventory submissions were conducted together, they are not considered successive and 2015/2016 is considered as one year.

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

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

Table 5
Additional findings made during the individual review of the 2019 inventory submission of Turkey

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue?*[a]
General			
G.4	Inventory submission	In NIR table A8.1 and CRF table 9, Turkey reported as "NE" categories for which methods are included in the 2006 IPCC Guidelines and explained that there were no data available. During the review, the Party explained that, for some of those categories reported as "NE", studies on data availability are ongoing. The ERT recommends that Turkey 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.	Yes. Completeness
G.5	NIR	In the NIR (section 1.2.3, pp.6–7), Turkey reported that the quality of the national inventory system is ensured by the QA/QC system, through the QA/QC plan adopted in 2014, and referred to annexes II and III to the QA/QC plan for general and category-specific QC procedures, respectively. However, according to the previous review report (FCCC/ARR/2018/TUR, table 5, ID# G.4), the most recent QA/QC plan was officially approved in October 2017 (the plan is available at https://biruni.tuik.gov.tr/yayin/views/visitorPages/english/index.zul). During the review, the Party clarified that the annexes mentioned in the NIR are from the most recent QA/QC plan, approved in 2017. The ERT encourages Turkey to improve the transparency of the reported information by providing in the NIR a link to the QA/QC plan where the annexes mentioned in the NIR (annexes II–III) can be found.	Not an issue
G.6	Recalculations	Many recalculations were performed for the 2019 inventory submission and information on recalculations, including the reasons for performing them, was provided in the NIR (section 10, pp.457–468). However, no information was provided on how the recalculations ensure time-series consistency. During the review, Turkey explained that the principle behind performing recalculations is ensuring time-series consistency, which means that, as far as possible, the time series should be calculated using the same method and data sources for all years. The ERT encourages Turkey to improve the transparency of the information reported in section 10 of the NIR by providing information on how the recalculations implemented ensure the consistency of the time series.	Not an issue
G.7	Uncertainty analysis	Turkey reported information on the uncertainty analysis in section 1.6 of and annex 2 to the NIR. However, table A6 in annex 2 is inconsistent with table 3.3 of the 2006 IPCC Guidelines (vol. 1) and there is no indication of key categories, which should be identified by the Party in accordance with paragraph 42 of the UNFCCC Annex I inventory reporting guidelines. During the review, the Party explained that uncertainty information is presented in the NIR in accordance with table 3.2 of the 2006 IPCC Guidelines (vol. 1). The ERT encourages Turkey to present uncertainty information in accordance with table 3.3 of the 2006 IPCC Guidelines (vol. 1) and indicate in that table those categories that have been identified as key categories in the inventory.	Not an issue
Energy			
E.18	1. General (energy sector)	For 2017, the difference between the reference approach and sectoral approach for solid fuels is 7.02 per cent for energy use and 4.89 per cent for CO_2 emissions (CRF table 1.A(c)). The information provided in the NIR (section 3.2.1, p.59) states the reason for these differences is that a single conversion factor was used in the reference	Not an issue

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue?[a]
		approach to convert ktoe to TJ, while specific NCVs for fuels were used to convert the amount of fuel use in the sectoral approach to energy. The ERT noted that only one conversion factor is possible between the two energy units ktoe and TJ; therefore, the reason provided by the Party in the NIR does not seem to be appropriate. During the review, the Party explained that the difference between the sectoral and reference approach for solid fuels (7.02 per cent) is due to the different NCV used in the energy balance and the plant-specific NCVs; however, according to NIR table 3.23, the difference (in TJ) between the two approaches for both lignite and hard coal consumption is just 0.6 per cent. The ERT encourages Turkey to assess the differences between the sectoral and reference approach for solid fuels for its next inventory submission.	
E.19	Feedstocks, reductants and other non-energy use of fuels – liquid fuels – CO_2	Bitumen is reported as "NO" in CRF table 1.A (d) (in previous submissions values were reported) and "IE" in CRF table 1.A (b), including for non-energy use, while in NIR table 3.15 bitumen is reported as non-energy use. During the review, the Party provided NIR table 3.15 in Excel format with the name of the fuel and the amount of the fuel, the latter of which is not reported within the fuel combustion sector for 2017. There is a lack of transparency regarding the sources of AD for bitumen because, according to the NIR (p.67), the data used are from the national energy balance tables, which provide more aggregated information. However, in the national energy balance table presented in the NIR (p.517), the energy balance for bitumen is presented in a clearly identifiable column, thereby enabling disaggregated reporting. The ERT recommends that Turkey 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.	Yes. Comparability
E.20	1.A Fuel combustion – sectoral approach – solid fuels – CO_2	For lignite, Turkey reported the use of a country-specific CO_2 EF and provided the EFs used for 1990–2017 in the NIR (p.508), as well as country-specific oxidation factors in NIR table 3.6, without providing references in the NIR to literature that explains the methodology used for determining the country-specific CO_2 EF. The ERT noted that the average national CO_2 EF for lignite (excluding the oxidation factor) in 1990 and 2017 was 120.23 and 110.18 t CO_2/TJ, respectively, while the NCV of lignite (total primary energy supply) from the national energy balance for 1990 and 2017 was 8.76 and 8.06 MJ/kg, respectively, which indicates lignite with a higher NCV has a higher CO_2 EF than lignite with a lower NCV. During the review, the Party provided the time series for the NCV for lignite and explained that Turkish lignite has a low carbon content and NCV. The Party also explained that the CO_2 EF is calculated using the equation: carbon EF (t carbon/TJ) × oxidation factor × (44/12) = EF (t CO_2/TJ), where the carbon EF can be calculated using the equation: 1,000 × carbon content (t carbon/t fuel)/NCV (MJ/ t fuel). Furthermore, the Party stated that the NCV of lignite decreases throughout the time series, as does the carbon content. Therefore, the EF of lignite decreases throughout the time series. The ERT is of the view that if the amount of carbon in the physical unit of fuel (t carbon/kg) is decreasing (nominator), the NCV (MJ/kg) (denominator) is also decreasing, but this does not mean that the EF (quotient) is decreasing. The ERT recommends that Turkey 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.	Yes. Accuracy
E.21	1.A Fuel combustion –	Turkey reported in the national energy balance for 2017 (and in the information provided during the review) the consumption of lignite. The NCV for 2017 (17.8 MJ/kg) was derived by dividing the energy consumption in ktoe	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue?*[a]
	sectoral approach – solid fuels – CO_2	with the energy consumption in kt from the national energy balance referred to in the NIR, which is available on the website of the General Directorate of Energy Affairs (https://www.eigm.gov.tr/tr-TR/Denge-Tablolari/Denge-Tablolari). This NCV is above the IPCC upper threshold for lignite for all fuel combustion activities, if applying the country-specific CO_2 EF for lignite used for category 1.A.1 (energy industries) (see NIR, p.505). During the review, the Party provided additional information on the NCVs used in the final consumption and confirmed that Turkish lignite can be assumed to be sub-bituminous in quality. However, the Party did not provide the ERT with any information on how the CO_2 EF currently used by Turkey is applicable to lignite of such quality, taking into account the fact that the CO_2 EF for lignite is decreasing with an increasing NCV (on the basis of the ERT assessment of the data in the NIR as well as data provided by Turkey during the review). The ERT recommends that Turkey 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.	
E.22	1.A Fuel combustion – sectoral approach – solid, liquid, gaseous and other fossil fuels – CO_2	In the NIR (table 3.6) Turkey presented the country-specific oxidation factors used for all fuel combustion activities. No study or reference document related to the determination of the country-specific oxidation factors was provided in the NIR. During the review, the Party explained 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. The ERT recommends that Turkey 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.	Yes. Transparency
E.23	1.A.1.b Petroleum refining – liquid fuels – CO_2	There is a large inter-annual change in the CO_2 IEF for liquid fuels between 2015 and 2016 (CRF table 1.A (a)s1)). 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). The ERT noted that for 2015 the CO_2 IEF for liquid fuels is below the CO_2 IEF for gaseous fuels (54.63 t CO_2/TJ), with only a 4.1 per cent difference. During the review, the Party explained that the addition of a new fuel, which has high carbon content, to the calculation resulted in an increase in the CO_2 IEF between 2015 and 2016. The ERT recommends that Turkey provide relevant information in the NIR regarding the large inter-annual change in the CO_2 IEF for liquid fuel between 2015 and 2016.	Yes. Transparency
E.24	1.A.3.a Domestic aviation – liquid fuels (gasoline) – CO_2, CH_4 and N_2O	Turkey reported as "NO" GHG emissions from aviation gasoline use in domestic aviation. During the review, the Party provided an explanation for using this notation key: the fuel data used for the transportation sector are taken from the energy balance table issued by the Ministry of Energy and Natural Resources. Turkey confirmed that some light aircraft use gasoline; however, the amount of gasoline used in those aircraft is negligible. The ERT recommends that Turkey 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.	Yes. Completeness
E.25	1.A.3.d Domestic navigation – liquid fuels (gasoline) – CO_2, CH_4 and N_2O	Turkey reported as "NO" GHG emissions from gasoline use in domestic navigation. The ERT noted that, according to the 2006 IPCC Guidelines, this source category covers all waterborne transport – from recreational craft to large ocean-going cargo ships. During the review, the Party explained that gasoline used in domestic navigation is negligible and is therefore not shown in the energy balance table.	Yes. Completeness

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue?*[a]
		The ERT recommends that Turkey 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.	
E.26	1.B.1.b Solid fuel transformation – solid fuels – CH_4	Turkey has started using a tier 2 method to estimate CH_4 emissions from abandoned coal mines. The ERT noted that according to table 3.71 of the NIR, the Party applies the coefficients used in the calculation of abandoned coal mine CH_4 emissions from table 4.1.9 of the 2006 IPCC Guidelines (vol. 2) for underground sub-bituminous coal mines to lignite coal mines. During the review, the Party explained that Turkish lignite can be assumed to be sub-bituminous in quality.	Yes. Transparency
		The ERT recommends that Turkey present in the NIR the assumptions regarding the treatment of lignite as sub-bituminous coal and report the number of abandoned underground coal mines per type of coal and their respective years of closure.	
IPPU			
I.24	2. General (IPPU) – AD – CO_2, CH_4 and SF_6	Turkey reported as "IE" emissions for some categories; for example, 2.B.8.b (ethylene) (CO_2 and CH_4), 2.B.8.c (ethylene dichloride and vinyl chloride monomer) (CO_2 and CH_4), 2.B.8.e (acrylonitrile) (CO_2 and CH_4), 2.C.1.b (pig iron) (CO_2), 2.G.1 (electrical equipment) (SF_6), 2.H.1 (pulp and paper) (AD) and 2.H.2 (food and beverages industry) (AD). The ERT noted that almost all categories under the IPPU sector that are reported as "IE" are not listed in CRF table 9. During the review, Turkey confirmed that when importing the Excel spreadsheets to CRF Reporter, the text boxes were not uploaded properly, and that this issue would be considered and the text boxes inserted manually if the situation reoccurs.	Yes. Convention reporting adherence
		The ERT recommends that Turkey 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.	
I.25	2.A.3 Glass production – CO_2	Turkey moved to a higher-tier method (tier 3) to estimate the CO_2 emissions from glass production; this method is based on accounting for the carbonate input to the glass melting furnace. Turkey applied the EFs in accordance with the 2006 IPCC Guidelines for three types of carbonate, namely, sodium carbonate or soda ash, limestone and dolomite. The Party reported in its NIR (p.187) that total glass production was previously estimated using data from the country's largest glass production company. For the current inventory submission, other producers were also contacted and their production data were collected in addition to their raw material consumption data. Recalculations for the whole time series were conducted and the resulting changes in emissions ranged between a decrease of 47.4 per cent (for 1996) and an increase of 17.2 per cent (for 2016).	Not an issue
		The ERT commends Turkey for enhancing the reporting of CO_2 emissions from glass production by moving from a tier 2 to a tier 3 method.	
I.26	2.B.1 Ammonia production – CO_2	Turkey produces ammonia in two plants; one of the plants also produces urea by using CO_2 gas as feedstock. The CO_2 is separated from the synthesis gas in the decarbonizing step during the ammonia production process. Some of the CO_2 gas is then used in the urea production process and the remaining gas is released to the atmosphere. The ERT noted that recalculations were made for CO_2 emissions from ammonia production, which resulted in a decrease in CO_2 emissions varying from 17.5 to 56.8 per cent. Turkey reported in the NIR (p.205) that the recalculations were made for two reasons: (1) the change in carbon content of natural gas and recovered CO_2 from urea production and	Not an issue

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue?*[a]
		(2) the fact that in the previous inventory submission, total CO_2 emissions and recovered CO_2 emissions were reported separately in CRF Reporter, assuming that CRF Reporter automatically calculates net emissions (net equalling total minus recovered). As the Party subsequently realized that CRF Reporter does not automatically calculate the net emissions, the recovered and net CO_2 emissions were entered separately in the current inventory submission. During the review, Turkey provided a spreadsheet with information on the CO_2 emissions from ammonia production and recovered CO_2 emissions from urea production. Further, the Party clarified that the recovered CO_2 emissions are calculated on the basis of the amount of urea production, which is consistent with the 2006 IPCC Guidelines. After checking the spreadsheet, the ERT found that the percentage of subtracted recovered CO_2 emissions from urea production ranged from 17.5 to 56.8 per cent; this emission decrease percentage is in line with the 2006 IPCC Guidelines and the estimates reported by other countries. Moreover, the Party confirmed during the review that the CO_2 emissions from urea use are reported under the agriculture sector in accordance with the 2006 IPCC Guidelines. The ERT reviewed the reporting under category 3.H (urea application), noting that it was not clear from the methodology used by the Party that the emissions from recovered CO_2 used for urea production are deducted from the total emissions from ammonia production. The ERT commends Turkey for sharing the above information during the review and enhancing its reporting for this category through overcoming the CRF Reporter problem.	
I.27	2.B.8 Petrochemical and carbon black production – AD	There is a large inter-annual change in the AD for ethylene dichloride and vinyl chloride monomer reported in CRF table 2(I).A-Hs1 between 2015 (119.07 kt) and 2016 (154.96 kt). Turkey clarified in the CRF table that the AD are for vinyl chloride monomer production. The 2016 value is 26.2 per cent higher than the 2015 value. During the review, Turkey explained that these data are taken from only one plant and confirmed that vinyl chloride monomer production is dependent on demand. The ERT recommends that Turkey 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.	Yes. Consistency
I.28	2.C.1 Iron and steel production – CO_2	Turkey reported in the NIR (p.229) that there was a change in the methodology used for estimating the CO_2 emissions from electric arc furnaces from tier 2 to tier 1, which had previously been changed from tier 1 to tier 2. The change in the methodology resulted in a change in CO_2 emissions, ranging from –9.4 per cent in 1995 to +8.8 per cent in 2000. During the review, the Party indicated that it had used a tier 1 method to calculate emissions from electric arc furnaces until the 2017 inventory submission. In the 2018 inventory submission, detailed data were obtained, enabling emissions to be calculated using a tier 2 method. In the 2019 inventory submission, the data-collection method used for the 2018 inventory submission could not be sustained and, as a result, the emissions were calculated using a tier 1 method. The ERT noted that CO_2 emissions from 2.C.1 (iron and steel production) is a key category. The ERT recommends that Turkey 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).	Yes. Accuracy
I.29	2.D.1 Lubricant use – AD	There is a significant inter-annual change in lubricant use AD between 2015 (432.00 kt) and 2016 (229.00 kt) (CRF table 2(I).A-Hs2). The 2016 value is 47.0 per cent lower than the 2015 value. Overall, between 1990 (297.00 kt) and 2016, the amount of lubricants used declined by 22.9 per cent. During the review, Turkey clarified that the data on	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue?[a]
		the amount of lubricant used were taken from the petroleum consumption questionnaire reported to the International Energy Agency. The ERT recommends that Turkey investigate and then report in its NIR the reason for the significant decrease in the AD for lubricant use between 2015 and 2016 (47.0 per cent), as well as explain the trend in the NIR.	
I.30	2.D.2 Paraffin wax use – CO_2	There is a significant inter-annual change in paraffin wax use AD between 2012 (29.00 kt) and 2013 (11.00 kt) (CRF table 2(I).A-Hs2). The 2013 value is 62.0 per cent lower than the 2012 value. Between 2013 and 2014 (23.00 kt) the amount of paraffin wax use increased again, by 109.1 per cent. During the review, Turkey stated that the amount of paraffin wax used is taken from the petroleum consumption questionnaire reported to the International Energy Agency. The ERT recommends that Turkey investigate and then report in its NIR the reason for the significant increase in the AD for paraffin wax use between 2013 and 2014 (109.1 per cent), as well as include information on the AD variations in the NIR.	Yes. Transparency
I.31	2.D.2 Paraffin wax use – CH_4 and N_2O	Turkey reported as "NE" CH_4 and N_2O emissions from paraffin wax use (CRF table 2(I).s2); however, the 2006 IPCC Guidelines (vol. 3, table 5.1) cover only CO_2. During the review, Turkey confirmed that the notation key "NE" should be replaced by "NA". The ERT recommends that Turkey 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.	Yes. Comparability
I.32	2.G.1 Electrical equipment – SF_6	CRF table 9 (last row) indicates that, owing to a lack of data, SF_6 emissions for category 2.G.1 (electrical equipment) were reported as "NE", while emission data were reported in CRF table 2(I).s2 and NIR table 4.45. During the review, Turkey explained that there is no information on the number of units and capacity of the equipment used, imported or exported, or on the number of units of destroyed equipment, and the imported gas amount was assumed to be 2.0 per cent emitted in the year of import. The Party stated that the notation key was already corrected in the system. The ERT commends Turkey for correcting the notation key prior to the next inventory submission. The ERT recommends that Turkey maintain consistency between CRF table 9 (last row) and the corresponding NIR table in the next inventory submission.	Yes. Convention reporting adherence
I.33	2.G.1 Electrical equipment – SF_6	Estimates of SF_6 emissions from electrical equipment were reported in NIR table 4.45. The ERT noted that SF_6 emissions for this category have decreased significantly compared with the 2018 inventory submission (e.g. the SF_6 emissions for 2016 have decreased from 80.00 to 1.60 t). Turkey reported in its NIR (p.257) that data for electricity consumption are obtained from the Turkish Electricity Transmission Corporation and the trade data for SF_6 are provided by the Ministry of Trade. These data are reported in NIR table 4.45, which shows the distribution of electricity consumption, SF_6 consumption (import and export values) and emissions of SF_6 emitted from the circuit breakers used in the electricity industry. The Party used the IPCC default EF values of 2.0 per cent as a global average (including natural leakage and emissions from operation, maintenance and disposal) and calculated the emissions accordingly. The recalculations resulted in a decrease in SF_6 emissions of 98.0 per cent for the entire time series. The ERT commends Turkey for improving the reporting under this category.	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue?*[a]
		The ERT recommends that Turkey 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).	
Agriculture			
A.20	3. General (agriculture) – CH_4 and N_2O	The animal population trend for dairy cattle rose in 2003 and, in the same year, the number of non-dairy cattle decreased. During the review, Turkey informed the ERT that the trends of cattle numbers in the official animal population statistics are due to a methodological change applied following the results of an animal survey (2001 census). Until 2002, the distribution between dairy and non-dairy cattle and milk yields was based on the previous animal survey, which was undertaken in 1984. In 2003, temporary calculations taken from the 2001 census were used to calculate milk production and milking animals. From 2004 onward, the final results from the 2001 census have been used for calculating milk production and milking animals. The ERT recommends that Turkey 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. Further, the ERT encourages Turkey to consider whether using a splicing technique from the 2006 IPCC Guidelines would provide more accurate estimates in the next inventory submission.	Yes. Consistency
A.21	3. General (agriculture) – CH_4 and N_2O	The Nex rates are based on country-specific values for TAM (except buffaloes) provided in NIR tables 5.10–5.11. Transparent documentation on the source supporting the selected country-specific values was not included in the NIR. It is not clear whether the live weight or the slaughter weight of the animals was used. During the review, Turkey confirmed that the TAM values are live weight figures. With respect to NIR table 5.10, Turkey analysed the official notification on the registration (published in the Official Gazette on 12 December 2004) of several animal species, which also includes live weight data. TAM values for sheep (domestic and merino) and goats were derived from those data. The default value provided in the 2006 IPCC Guidelines (vol. 4, p.10.79) was used for buffaloes. The Party indicated that the same TAM values were used for cattle in categories 3.A–3.B, but the data source for the TAM values in NIR table 5.9 that were used for category 3.A is also absent. The Party informed the ERT that data from the Ministry of Agriculture and Forestry and data from previous surveys on agriculture provided by the Turkish Statistical Institute were the key sources for the live weight data for cattle. Turkey also informed the ERT that it aims to improve the transparency of the related reporting in the next inventory submission. The ERT recommends that Turkey 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.	Yes. Transparency
A.22	3. General (agriculture) – CH_4 and N_2O	Some outdated text was detected in the NIR; for example, for enteric fermentation and manure management. Turkey used a tier 2 method to estimate emissions from enteric fermentation for cattle. The text in the NIR (p.277) under methodological issues describes how a default CH_4 EF is chosen for the different groups of cattle. This explanation is no longer relevant for the estimation of emissions from enteric fermentation because country-specific values are now used, and could instead be included with the information on the emissions source for category 3.B (manure management), as default EFs are still used for this emissions source. Under the source category description provided in the NIR (p.280), it is stated that representative MMS distribution data are not available for the entire country, and	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue?[a]
		therefore default distribution values are used. This text is outdated: NIR table 5.14 provides country-specific values for the distribution of MMS in Turkey. The ERT recommends that Turkey improve the QA/QC procedures related to the NIR text to ensure that it provides up-to-date methodological information and numerical data.	
A.23	3.A.1 Cattle – CH_4	Turkey reported emissions from cattle using a tier 2 method and enhanced livestock characterization (NIR, p.277). The methodological description in the NIR does not reflect the tier 2 method and the use of the enhanced livestock characterization, and weighted averages are provided for growing cattle and other mature cattle in NIR table 5.9. During the review, Turkey informed the ERT that it used option B (mature dairy cattle, other mature cattle, growing cattle) for emissions from enteric fermentation for cattle, but reported those emissions using option A (dairy cattle, non-dairy cattle) in order to ensure consistency with its CRF reporting for emissions from manure management for cattle. The ERT recommends that Turkey 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 intake, methane conversion rate, feed digestibility) and the relevant data sources for all three cattle categories (mature dairy cattle, other mature cattle and growing cattle).	Yes. Transparency
A.24	3.B Manure management – N_2O	The distribution across MMS for all livestock species was reviewed by Turkey and new information with country-specific values for all species – except swine, for which default values were used – has been included in NIR table 5.14. However, information on the source of the country-specific distribution across MMS and how it has been derived is lacking in the NIR. The same distribution is used for the whole time series. Turkey mentions in the NIR (p.269) that the agriculture sector has undergone changes owing to urbanization, with a trend towards fewer animals in smaller households in rural areas. It might be expected that this has also led to changes in the MMS used for some animal groups. On the data sources, Turkey informed the ERT during the review that it used expert judgment on a distribution that would better reflect country-specific conditions; investigated countries in the Mediterranean Basin whose agriculture sectors resembles that of Turkey's; searched for relevant data on MMS distribution in some regional offices of the Turkish Statistical Institute; looked for field experience in agriculture-related data gained over a period of years within the Turkish Statistical Institute; and scrutinized agriculture-related data that have not yet been published in order to establish a distribution that would better reflect its national conditions. Turkey informed the ERT that it does not currently have data available that would also reflect the possible changes in the agriculture sector, but that the current MMS distribution is a good representation of the country's situation and aims to represent the entire reporting period. The ERT commends Turkey for improving the inventory by using a country-specific MMS distribution. The ERT recommends that Turkey include the data source for the country-specific MMS distribution in the NIR.	Yes. Transparency
A.25	3.B Manure management – N_2O	In NIR table 5.14, some manure is allocated as burned for fuel or as waste (approximately 4.0 per cent for cattle and buffaloes and 6.0 per cent for swine), however, the NIR provides no information on the allocation of possible emissions from such manure. During the review, Turkey informed the ERT that the emissions from that manure are included entirely under the energy sector. In the 2006 IPCC Guidelines (vol. 4, p.10.58) it is stated that when estimating the Nex for animals whose manure is classified in the MMS as burned for fuel (table 10.21, default EFs for direct N_2O emissions from manure management), it should be kept in mind that the dung is burned and the urine stays in the field. As a rule of thumb, 50 per cent of the N excreted is in the dung and 50 per cent is in the urine. The	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue?*[a]
		Guidelines further state that if the burned dung is used as fuel, then emissions are reported under the IPCC category fuel combustion, whereas if the dung is burned without energy recovery, the emissions should be reported under the IPCC category waste incineration. The ERT recommends that Turkey describe the method used for estimating emissions from manure burned for fuel in the NIR. The ERT also recommends that Turkey include a description in NIR chapter 5 of where in the energy or waste sector the emissions from burning of manure are reported.	
A.26	3.D.a.2.b Sewage sludge applied to soils – N_2O	The data source for the amount of sewage sludge spread is not provided in the NIR and there is no information on the assumptions made regarding the N content in sewage sludge used in the calculations. Turkey informed the ERT during the review that all calculations are based on dry matter values of sewage sludge. Data are reported from wastewater treatment plants. The related time series of AD (sewage sludge applied on agricultural soils) was provided by the Water and Waste Statistics Group operating under the Environment, Energy and Transport Statistics Department at the Turkish Statistical Institute. The Water and Waste Statistics Group is responsible for a survey on municipal wastewater statistics. Turkey also informed the ERT that during the review it found that the calculations would need to be revised in order to adjust for the N content more correctly for the next submission. No more information was provided by Turkey on the current calculations. The Party plans to use 6.0 per cent as the percentage of N content in sewage sludge on the basis of national values sourced from a national study (a table with values was shared with the ERT during the review). The ERT is of the view that the proposed Turkish value seem realistic. The ERT recommends that Turkey include information on the data sources used for the amount of sewage sludge spread and relevant references in the reference list in the NIR. The ERT also recommends that Turkey update the N content in the emission calculations of sewage sludge with the national value, as planned, and justify the use of this value.	Yes. Accuracy
A.27	3.D.a.2.c Other organic fertilizers applied to soils – N_2O	Information on the fertilizers reported under the source information for category 3.D (direct and indirect N_2O emissions from agricultural soils) for other organic fertilizers applied to soils (NIR table 5.17) and the source of the AD were not provided. During the review, Turkey informed the ERT that the fertilizers reported under the source for category 3.D for other organic fertilizers applied to soils consist only of the emissions reported on the annual amount of total compost N applied to soils. During the review, Turkey stated that it discovered the N content had not been reflected correctly in the inventory submission, without providing more information on the current calculations. Turkey also informed the ERT that the related time series of AD was provided by the Water and Waste Statistics Group operating under the Environment, Energy and Transport Statistics Department at the Turkish Statistical Institute. The ERT recommends that Turkey include information on which other organic fertilizers applied to soils are included in the reporting and a justification for its assumption that compost N covers the main N input in this source category and no other N input of significance exists. The ERT also recommends that Turkey include information on the data sources used for the fertilizers reported under the source for category 3.D (other organic fertilizers applied to soils) and relevant references in the reference list in the NIR, and revise the calculations so that the N content in the compost used as fertilizer is reflected properly.	Yes. Accuracy
A.28	3.D.a.4 Crop residues – N_2O	Emissions from crop residues in CRF table 3.D were recalculated in the 2019 inventory submission. The recalculations are mentioned in the 2019 NIR (p.302), but the reasons for and description of the recalculations were not provided. Turkey informed the ERT during the review that the classification of a few crops was corrected, which	Yes. Transparency

ID#	Finding classification	Description of the finding with recommendation or encouragement	Is finding an issue?[a]
		led to a change in the parameters used in accordance with the "major crop types" listed in table 11.2 of the 2006 IPCC Guidelines (vol. 4). Turkey consulted universities and agricultural research institutions in order to derive a country-specific classification of the national crop types. The ERT commends Turkey for this improvement. In the NIR (p.299), Turkey stated that better data for renewal fraction and fraction removed were requested and received from the Ministry of Agriculture and Forestry in order to improve estimations of N_2O emissions from crop residues. During the review, Turkey informed the ERT that this statement was outdated, and provided a description of the source of the country-specific fractions and the values used in the calculations. The renewal fraction for a yearly crop is 1 by definition of 1/X, where X is one year. This figure is used for most of the crops listed in the classification in table 11.2 of the 2006 IPCC Guidelines (vol. 4) (since almost all crops are yearly crops). For perennial crops, Turkey used 0.25 (as a result of 1/X, where X is four years) for the following major crop types and individual crops only on the basis of the information received from the Ministry of Agriculture and Forestry: perennial grasses, grass-clover mixtures and alfalfa. The fraction removed values for all major crop types and individual crops as received from the Ministry of Agriculture and Forestry are as follows: (1) for major crop types: grains (0.75), beans and pulses (0.80), tubers (0.00), root crops and other (0.00), N-fixing forages (0.80), non-N-fixing forages (1.00), perennial grasses (0.90) and grass-clover mixtures (0.90); and (2) for individual crop types: alfalfa (0.90), maize, millet, soya bean and dry bean (0.80), wheat, rice, barley, oats, sorghum and rye (0.75), peanuts (0.70) and potatoes (0.00). The ERT recommends that Turkey 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. The ERT also recommends that Turkey improve its QA/QC procedures to ensure that all recalculations are transparently described in NIR sections 5 and 10 under the relevant emissions source category.	
A.29	3.D.a.6 Cultivation of organic soils (i.e. histosols) – N_2O	The source of the AD and the method used for estimating N_2O emissions from the cultivation of organic soils is not transparently described in the NIR. The time series for the AD has been recalculated in the 2019 inventory submission. However, no information on the recalculations and the reason for them was provided in the NIR. During the review, Turkey informed the ERT that the AD are taken from CRF tables 4.B and 4.C. Given there had been a recalculation within the LULUCF sector regarding the related AD, Turkey recalculated the estimates for this subcategory accordingly for the entire reporting period on the basis of the results from the EU-funded project on technical assistance for developing analytical basis for the LULUCF sector. The ERT, while finding the reporting to be consistent between the agriculture and LULUCF sectors, recommends that Turkey include information on the source of the area of cultivated organic soils in the NIR under section 5. The ERT also recommends that Turkey improve its QA/QC procedures to ensure that all recalculations are described in NIR sections 5 and 10 under the relevant emissions source category.	Yes. Transparency
LULUCF			
L.42	4. General (LULUCF)	Several inconsistencies exist between the information provided in the NIR and the CRF tables for the LULUCF sector. For example, in NIR figure 6.1, the emission trends of LULUCF sector net removals including HWP for 1990–2017 are not consistent with the data provided in CRF table 10s1 on emission trends for 1990–2017. Inconsistencies in NIR figure 6.10 and CRF table 4.1 are as follows: cropland remaining cropland for 1990 is reported in NIR figure 6.10 as approximately 27,150 kha and in CRF table 4.1 as 27,157.90 kha, while for 2017 the land area value is reported in CRF table 4.1 as 27,152.06 kha and in NIR figure 6.10 as 26,925 kha (approximately).	Yes. Convention reporting adherence

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue?*[a]
		No absolute values of areas are provided in tabular format in the NIR for cropland; instead, the ERT found land areas provided in graphical format. The ERT also noted differences between the background tables for land areas for each land use and CRF table 4.1; for example: (1) forest land is reported in CRF table 4.A as 22,851.25 kha and in CRF table 4.1 as 22,854.39 kha; (2) cropland is reported in CRF table 4.B as 27,121.07 kha and in CRF table 4.1 as 27,152.06 kha; and (3) grassland is reported in CRF table 4.C as 24,114.74 kha and in CRF table 4.1 as 24,116.48 kha. During the review, the Party explained that the calculations of land areas were made using data from Turkey's new system, and that consistency between the information provided in the NIR and the CRF tables would be ensured to the extent possible in future inventory submissions. The ERT recommends that Turkey strengthen its 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.	
L.43	Land representation	In the NIR (section 6.2 p.323), the Party reported that the previous system was not able to identify land conversions between forests and other land uses, and it was assumed that conversions occur only from and to grassland; but now all land conversions have been tracked with high accuracy and the emissions and removals reported. However, the ERT considers that information on and an explanation of land area conversions from forest land to other land uses were not provided in the NIR, although in the CRF tables some information on conversions from forest land to other land areas was provided for the biomass carbon pool, despite the Party applying a new satellite-based land cover monitoring system that should be able to track land-use conversions with high accuracy. During the review, the Party initially informed the ERT that these kinds of land conversions have not been observed since 1990 in the satellite-based land cover monitoring system. The ERT requested information in Excel format on land area changes from forest land to other land-use categories. Turkey provided such information in Excel format, which showed that the predominant land-use conversion from forest land is conversion to grassland, followed by conversion to other land and to cropland (perennial). The ERT considers that the consistent reporting of areas for all land uses and land-use transitions in the CRF tables and in the NIR is mandatory and essential for the completeness and transparency of the LULUCF reporting. The ERT recommends that Turkey 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.	Yes. Consistency
L.44	Land representation	Turkey does not fully and consistently apply the IPCC method of reporting cumulative areas over a 20-year transition period (or over a longer transition period selected by the Party) for all the land-use change conversion categories since the total area of land converted among all categories in the 2019 inventory submission should be based on the cumulative of areas since 1990. This explains the observed continuous increase in the area of land-use conversion categories for some categories such as forest land converted to grassland. During the review, the Party indicated that the use of the new satellite-based land cover monitoring system allows the tracking of all land areas and area changes for conversion categories over the 20-year transition period. The Party also indicated that the NIR (pp.318–319) includes some description of the transition period and how conversions were calculated. Turkey has limited statistical data on land-use areas before 1990, and they are inconsistent with the new system. The ERT considers that Turkey	Yes. Accuracy

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue?*[a]
		should consistently report land area changes for conversion categories for the past 20 years, even if limited data exist for the period before 1990, taking into account the reporting of cumulative land areas in the CRF background tables. The ERT recommends that Turkey 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 (see ID# L.34 in table 3).	
L.45	4.A Forest land – CO_2	Table numbers 6.6, 6.7 and 6.8 referred to the NIR (p.324) are incorrect. During the review, the Party confirmed that the last sentence on page 324 of the NIR was inadvertently written incorrectly; the revised sentence should read as follows: “The comparison of removals by forestry sector, according to the forest area, annual increment and growing stock changes since 1990 is given in tables 6.7, 6.11 and 6.10”. The ERT recommends that Turkey correct the table numbering as part of its routine QA/QC checks and update the references for the tables for the forest area, annual increment and growing stock changes since 1990.	Yes. Convention reporting adherence
L.46	4(V) Biomass burning – CO_2, CH_4 and N_2O	Turkey reported both grassland remaining grassland and land converted to grassland as “NE” in CRF table 9 owing to a lack of AD on burned areas. 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 recommends that Turkey collect information on areas burned owing to wildfires for grassland and estimate emissions in future inventory submissions. The ERT also recommends that the Party report controlled burning as “NO” and provide a rationale for the use of the notation key in the NIR.	Yes. Completeness
L.47	4.G HWP – CO_2	The Party reported “IE” for some years in CRF table 4.Gs2 for sawn wood and wood panels for 1990 and for paper and paperboard exports for 1960–1973, 1976–1991 and 1995–2002. However, no explanation for the use of this notation key is provided in the NIR. During the review, Turkey explained that no information for sawn wood, wood panels, paper and paperboard exports exists for those years in FAOSTAT. Turkey indicated that these data are included under the production data and the notation key “IE” was therefore used but that explanation of the use of “IE” would be provided in the next inventory submission. The ERT considers that when applying the production approach, identifying the amount of domestically produced, imported wood and exported wood is essential, because the information is fundamental data and allows the Party to determine the system boundary of the production approach. The ERT, considering that the use of the notation key “IE” for some import and export data is not appropriate, recommends that Turkey 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.	Yes. Transparency

ID#	*Finding classification*	*Description of the finding with recommendation or encouragement*	*Is finding an issue?*[a]
Waste			
W.14	5.A.1 Managed waste disposal sites – CH_4	Turkey included emissions from clinical waste disposed in landfills in CRF table 5.A. However, in the NIR (section 7.2, p.414), Turkey reported that since clinical waste was not collected separately before 2003, between 1990 and 2003 these emissions were included in statistics on solid waste disposal sites and therefore Turkey reported them as "IE". The ERT noted that in NIR table 7.21, the notation key used for 1990–2003 is "NO" instead of "IE". During the review, Turkey clarified that the correct notation key is "IE", not "NO". The ERT recommends that Turkey correct the notation key (from "NO" to "IE") used in NIR table 7.21 for reporting emissions from clinical waste disposed in landfills.	Yes. Convention reporting adherence

[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 for Turkey for submission year 2019, as submitted by Turkey

Table 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 2–3 show GHG emissions reported under the Convention by Turkey by gas and by sector, respectively.

Table 1
Total greenhouse gas emissions for Turkey, 1990–2017
(kt CO_2 eq)

	Total GHG emissions excluding indirect CO_2 emissions		*Total GHG emissions including indirect CO_2 emissions*[a]	
	Total including LULUCF	*Total excluding LULUCF*	*Total including LULUCF*	*Total excluding LULUCF*
1990	163 437.03	219 201.69	NA	NA
1995	190 185.21	247 584.91	NA	NA
2000	237 333.89	298 889.95	NA	NA
2010	325 168.72	398 660.53	NA	NA
2011	350 457.09	427 571.90	NA	NA
2012	372 533.78	446 935.09	NA	NA
2013	362 492.74	438 968.82	NA	NA
2014	380 452.39	457 961.87	NA	NA
2015	374 984.46	472 190.81	NA	NA
2016	402 539.09	498 468.94	NA	NA
2017	426 345.50	526 252.99	NA	NA

Note: Emissions/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 2
Greenhouse gas emissions by gas for Turkey, excluding land use, land-use change and forestry, 1990–2017
(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	42 406.91	24 661.02	NO	625.30	NO	NO	NO

	CO_2[a]	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3
1995	180 903.05	42 504.55	23 565.86	NO	611.44	NO	NO	NO
2000	229 790.60	43 561.56	24 807.80	115.66	601.00	NO	13.34	NO
2010	314 380.03	51 315.18	29 425.91	3 054.28	461.74	NO	23.39	NO
2011	339 482.25	53 686.29	30 465.07	3 432.64	480.36	NO	25.28	NO
2012	353 666.21	57 070.27	31 556.22	4 256.83	359.06	NO	26.49	NO
2013	345 220.58	55 450.50	33 529.97	4 470.24	270.60	NO	26.92	NO
2014	361 675.46	57 284.61	33 935.14	4 778.45	255.42	NO	32.78	NO
2015	381 331.94	51 333.48	34 689.71	4 636.96	158.99	NO	39.74	NO
2016	401 239.74	53 867.21	37 067.87	6 116.92	140.67	NO	36.52	NO
2017	425 329.60	54 193.40	38 535.02	8 048.73	73.11	NO	73.12	NO
Per cent change 1990–2017	**180.7**	**27.8**	**56.3**	**NA**	**–88.3**	**NA**	**NA**	**NA**

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

Table 3
Greenhouse gas emissions by sector for Turkey, 1990–2017
(kt CO_2 eq)

	Energy	IPPU	Agriculture	LULUCF	Waste	Other
1990	139 601.24	22 836.47	45 679.99	–55 764.67	11 083.99	NO
1995	166 318.24	25 247.31	43 668.36	–57 399.69	12 350.99	NO
2000	216 053.71	26 227.12	42 260.71	–61 556.06	14 348.40	NO
2010	287 047.24	48 107.22	43 975.79	–73 491.81	19 530.28	NO
2011	308 666.17	52 749.42	46 400.14	–77 114.82	19 756.18	NO
2012	320 488.91	55 011.95	52 079.99	–74 401.31	19 354.23	NO
2013	307 523.30	58 059.52	55 214.75	–76 476.08	18 171.25	NO
2014	325 767.12	58 516.91	55 508.21	–77 509.48	18 169.63	NO
2015	340 907.25	57 039.91	55 428.34	–97 206.35	18 815.31	NO
2016	359 671.35	62 175.13	58 181.64	–95 929.85	18 440.82	NO
2017	379 900.74	66 454.60	62 542.62	–99 907.49	17 355.03	NO
Per cent change 1990–2017	**172.1**	**191.0**	**36.9**	**79.2**	**56.6**	**NA**

Notes: (1) Emissions/removals reported in the sector other (sector 6) are not included in the total GHG emissions. (2) Turkey did not report indirect CO_2 emissions in CRF table 6.

Annex II

Additional information to support findings in table 2 in this report

Missing categories that may affect completeness

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

(a) 1.A.3.a domestic aviation (CO_2, CH_4 and N_2O) (see ID# E.24 in table 5 in this report);

(b) 1.A.3.d domestic navigation (CO_2, CH_4 and N_2O) (see ID# E.25 in table 5 in this report);

(c) 2.A.2 lime production (CO_2) (see ID#s I.2 and I.3 in table 3 in this report);

(d) 2.F product uses as substitutes for ozone-depleting substances (HFCs and SF_6) (see ID# I.14 in table 3 in this report);

(e) 2.F.4 aerosols (HFCs) (see ID# I.16 in table 3 in this report);

(f) 2.F.6 other applications (product uses as substitutes for ozone-depleting substances) (HFCs) (see ID# I.21 in table 3 in this report);

(g) 2.G other product manufacture and use (N_2O) (see ID# I.22 in table 3 in this report);

(h) 2.G.2 SF_6 and PFCs from other product use (SF_6 and PFCs) (see ID# I.1 in table 3 in this report);

(i) 4.C.1 grassland remaining grassland, 4(V) biomass burning and wildfires (CO_2, CH_4 and N_2O) (see ID# L.46 in table 5 in this report);

(j) 4.C.2 land converted to grassland, 4(V) biomass burning and wildfires (CO_2, CH_4 and N_2O) (see ID# L.46 in table 5 in this report).

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 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands*. T Hiraishi, T Krug, K Tanabe, et al. (eds.). Geneva: IPCC. Available at http://www.ipcc-nggip.iges.or.jp/public/wetlands/.

B. UNFCCC documents

Inventory review reports

Reports on the individual reviews of the 2011, 2012, 2013, 2014, 2015, 2016 and 2018 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 and FCCC/ARR/2018/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%202019.pdf.

Annual status report for Turkey for 2019. Available at http://unfccc.int/resource/docs/2019/asr/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 are reproduced as received:

Tolunay D. 2011. Total carbon stock and carbon accumulation in living tree biomass in forest ecosystems of Turkey. *Turkish Journal of Agriculture and Forestry.* 35: pp.265–279.

Tolunay D. 2013. The Factors which used for calculate biomass and carbon amount from growing stock of trees in Turkey. *Conference for the 50th Year of the Forestry Sector Planning*, 26–28 November 2013, Antalya, Turkey.

Turkish Statistical Institute. 2017. *National Inventory System. Quality Assurance and Quality Control Plan.* Ankara, 10 October 2017. Available at https://biruni.tuik.gov.tr/yayin/views/visitorPages/english/index.zul.