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Report on the individual review of the inventory submission of Turkey submitted in 2014*

* In the symbol for this document, 2014 refers to the year in which the inventory was submitted, and not to the year of publication.

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Contents

I. Introduction and summary

1. This report covers the review of the 2014 inventory submission of Turkey, coordinated by the UNFCCC secretariat, in accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (hereinafter referred to as the UNFCCC review guidelines). The review took place from 8 to 13 September 2014 in Ankara, Turkey, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Dennis Rudov (Belarus); energy – Ms. Zhu Songli (China); industrial processes and solvent and other product use – Ms. Maria Jose Lopez (Belgium); agriculture – Mr. Paulo Cornejo Guajardo (Chile); land use, land-use change and forestry (LULUCF) – Ms. Dominique Blain (Canada); and waste – Ms. Sirintornthep Towprayoon (Thailand). Mr. Rudov and Ms. Towprayoon were the lead reviewers. The review was coordinated by Mr. Javier Hanna (UNFCCC secretariat).

2. In accordance with the UNFCCC review guidelines, a draft version of this report was sent to the Government of Turkey, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

3. All encouragements and recommendations in this report are for the next inventory submission, unless otherwise specified, and are based on the expert review team's (ERT's) assessment of the 2014 inventory submission against the UNFCCC review guidelines. The ERT has not taken into account the fact that for the inventory submissions due by 15 April 2015 Parties included in Annex I to the Convention will report using the revised "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" (hereinafter referred to as the UNFCCC Annex I inventory reporting guidelines) adopted through decision 24/CP.19. Therefore, when preparing the 2015 inventory submission, Turkey should evaluate the implementation of the recommendations and encouragements in this report, in the context of those guidelines.

4. In 2012, the main greenhouse gas (GHG) emitted by Turkey was carbon dioxide (CO_2), accounting for 81.3 per cent of total GHG emissions[1] expressed in CO_2 equivalent (CO_2 eq), followed by methane (CH_4) (14.0 per cent) and nitrous oxide (N_2O) (3.4 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.4 per cent of the overall GHG emissions in the country. The energy sector accounted for 70.2 per cent of total GHG emissions, followed by the industrial processes sector (14.3 per cent), the waste sector (8.2 per cent) and the agriculture sector (7.3 per cent). The solvent and other product use sector is reported as not applicable ("NA") and not estimated ("NE"). The LULUCF sector represented a net sink, which offsets 13.6 per cent of total GHG emissions. Total GHG emissions amounted to 439,873.72 Gg CO_2 eq and increased by 133.4 per cent between the base year[2] and 2012. The ERT concluded that the description in the national inventory report (NIR) of the trends for the different gases and sectors is generally reasonable; however, in a number of cases the description of the driving factors behind the trends is needed (see paras. 49, 67, 82 and 90 below).

[1] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified.

[2] The base year for Turkey is 1990, consistent with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part 1: UNFCCC reporting guidelines on annual inventories".

5. Tables 1 and 2 show GHG emissions under the Convention, by gas and by sector, respectively. In table 1, CO_2, CH_4 and N_2O emissions do not include emissions and removals from the LULUCF sector.

Table 1
Greenhouse gas emissions by gas, 1990 to 2012

									(%)
				Gg CO_2 eq					*Change 1990–2012*
Greenhouse gas	*1990*	*1995*	*2005*	*2008*	*2009*	*2010*	*2011*	*2012*	
CO_2	141 560.05	174 087.09	259 791.00	297 849.96	299 671.21	326 848.50	345 734.26	357 498.16	152.5
CH_4	34 053.56	47 393.30	52 553.44	54 026.28	53 754.90	57 303.04	58 049.10	61 623.23	81.0
N_2O	12 217.20	16 823.47	14 670.42	12 997.68	13 909.96	14 150.06	13 728.31	14 787.15	21.0
HFCs	NA, NE	NA, NE	2 379.00	2 669.43	2 839.25	4 009.30	5 308.29	4 681.30	NA
PFCs	603.43	516.43	487.76	347.98	170.56	308.01	320.76	312.75	–48.2
SF_6	NA, NE	NA, NE	858.73	843.10	803.47	875.78	950.23	971.13	NA

Abbreviations: NA = not applicable, NE = not estimated.

Table 2
Greenhouse gas emissions by sector, 1990 to 2012

									(%)
				Gg CO_2 eq					*Change 1990–2012*
Sector	*1990*	*1995*	*2005*	*2008*	*2009*	*2010*	*2011*	*2012*	
Energy	132 882.67	161 502.25	242 410.91	278 394.60	279 008.58	285 136.00	301 338.59	308 604.26	132.2
Industrial processes	15 442.26	24 206.65	28 780.76	31 675.40	33 160.65	55 674.47	58 610.52	62 773.50	306.5
Solvent and other product use	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA
Agriculture	30 387.74	29 234.20	26 280.12	25 472.99	26 104.14	27 126.84	28 833.07	32 280.78	6.2
LULUCF	–44 070.09	–47 571.21	–49 728.76	–56 600.74	–56 348.97	–57 848.12	–60 826.27	–59 815.01	35.7
Waste	9 721.57	23 877.18	33 268.55	33 191.43	32 875.98	35 557.38	35 308.77	36 215.19	272.5
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**144 364.14**	**191 249.07**	**281 011.58**	**312 133.69**	**314 800.38**	**345 646.57**	**363 264.68**	**380 058.71**	**163.3**
Total (without LULUCF)	**188 434.23**	**238 820.28**	**330 740.34**	**368 734.42**	**371 149.35**	**403 494.70**	**424 090.95**	**439 873.72**	**133.4**

Abbreviations: LULUCF = land use, land-use change and forestry, NA = not applicable, NE = not estimated.

II. Technical assessment of the annual inventory submission

A. Overview

1. Annual submission and other sources of information

6. The 2014 annual inventory submission was submitted on 15 April 2014; it contains a complete set of common reporting format (CRF) tables for the period 1990–2012 and an NIR. The inventory submission was submitted 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 inventories" (hereinafter referred to as the UNFCCC reporting guidelines).

7. The full list of materials used during the review is provided in annex I to this report.

2. Overall assessment of the inventory

8. Table 3 contains the ERT's overall assessment of the inventory submission of Turkey. For recommendations for improvements for specific categories, please see the paragraphs cross-referenced in the table.

Table 3
The expert review team's overall assessment of the inventory submission

		General findings and recommendations
The ERT's findings on completeness		
Energy, industrial processes, solvent and other product use, agriculture and waste[a]	Not complete	Mandatory: in the energy sector: CH_4 emissions from natural gas distribution; CH_4 emissions from other leakage in the residential and commercial sectors; CO_2, CH_4 and N_2O emissions from liquid fuels used as auxiliary fuels in public electricity and heat production; CO_2, CH_4 and N_2O emissions from manufacture of solid fuels and other energy industries; CO_2, CH_4 and N_2O emissions from other transportation; CO_2, CH_4 and N_2O emissions from liquid fuels in petroleum refining (2012); CO_2, CH_4 and N_2O emissions from aviation and marine bunkers (1990–2007); CO_2 fugitive emissions from coal mining activities; and CO_2, CH_4 and N_2O emissions from other fuels (waste) co-fired in cement industry under manufacturing industries and construction. In the industrial processes sector: CO_2 emissions from captive lime of sugar facilities under lime production; CO_2 emissions from soda ash production; CO_2 emissions from iron and steel production (1990–2009) (only the emissions from pig iron are reported); CO_2 emissions from ferroalloys production; SF_6 emissions from SF_6 used in aluminium and magnesium foundries; HFC and PFC emissions from foam blowing, fire extinguishers, aerosols/metered dose inhalers, solvents, other applications using ozone-depleting substance substitutes; and semiconductor manufacture under consumption of halocarbons and SF_6. In the waste sector: CH_4 emissions from industrial wastewater

		General findings and recommendations
		Please see paragraphs 26, 65 and 130 below for category-specific findings
		The ERT recommends that Turkey estimate and report emissions from all mandatory categories
		Non-mandatory: in the energy sector: CH_4 emissions from solid fuel transformation; and CO_2 and CH_4 emissions from distribution of oil products. In the industrial processes sector: CO_2 emissions from food and drink. In the solvent and other product use sector: CO_2 emissions from paint application; CO_2 and N_2O emissions from degreasing and dry cleaning; CO_2 emissions from chemical products, manufacture and processing; N_2O emissions from use of N_2O for anaesthesia; N_2O emissions from fire extinguishers; and N_2O emissions from aerosol cans. In the waste sector: N_2O emissions from industrial wastewater
		Please see paragraphs 65, 100 and 130 below for category-specific findings
		The ERT encourages Turkey to estimate and report emissions from all non-mandatory categories
Land use, land-use change and forestry[a]	Not complete	Mandatory: carbon stock changes in mineral soils from cropland converted to forest land and from grassland converted to forest land; carbon stock changes in mineral soils from grassland; CO_2 emissions/removals from forest land converted to grassland (all pools); carbon stock changes from wetlands converted to grassland (biomass and mineral soils pools); CO_2 emissions/removals from forest land converted to wetlands (all pools); CO_2 emissions/removals from forest land, cropland and grassland converted to settlements (all pools); CO_2 emissions/removals from forest land and cropland converted to other land (all pools); N_2O emissions from disturbance associated with land-use conversion to cropland; CO_2 emissions from agricultural lime application; CO_2 emissions from biomass burning on land converted to forest land; and CH_4 and N_2O emissions from biomass burning on land converted to forest land (see para. 118 below)
		The ERT recommends that Turkey estimate and report emissions and removals from all mandatory categories
		Non-mandatory: carbon stock changes from the conversion of cropland with perennial biomass to forest land, grassland, wetlands and settlements (biomass pool)
		The ERT encourages Turkey to estimate and report emissions and removals from all non-mandatory categories
The ERT's findings on recalculations and time-series consistency		
Recalculations	Not sufficiently	Please see paragraphs 9, 24, 39, 64, 88 and 114 below for category-specific findings related to the transparency of

		General findings and recommendations
	transparent	recalculations
Time-series consistency	Not sufficiently consistent	Please see paragraphs 10, 25, 29, 37, 39, 40, 41, 50, 71, 74 and 76 below for category-specific findings related to time-series consistency
The ERT's findings on QA/QC procedures	Not sufficient	Turkey has elaborated a QA/QC plan. However, it has implemented limited tier 1 QA/QC procedures in accordance with that plan. The ERT finds that the large number of mistakes in multiple sectors suggests that the tier 1 QC procedures are not appropriately implemented Please see paragraphs 11, 29, 35, 40, 45, 48, 51, 56, 57, 69, 76, 88, 107, 111, 112, 129, 131 and 136 below for category-specific recommendations
The ERT's findings on the transparency	Not sufficiently transparent	Please see paragraphs 12, 25, 41, 44, 46, 52, 58, 67, 77, 79, 83, 85, 87, 90, 92, 93, 94, 96, 98, 103, 104, 106, 110, 114, 116, 127 and 131 below for category-specific recommendations

Abbreviations: ERT = expert review team, QA/QC = quality assurance/quality control.

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

9. In its 2014 inventory submission, Turkey reported recalculations for the entire time series for the energy, industrial processes, LULUCF and waste sectors. The ERT noted that CRF table 8(b) does not contain relevant information and is almost empty for all years. Limited information on recalculations is presented in the NIR for several categories, and the ERT noted that the information provided on recalculations does not cover all the recalculated categories. The ERT also noted that a chapter on recalculations and improvements is not included in the NIR. During the review, in response to questions raised by the ERT, Turkey explained that the recalculations reported for the years 1990–2011 have been performed to take into account new activity data (AD), changes of emission factors (EFs), the correction of systematic mistakes in data and the reallocation of emissions. The ERT recommends that Turkey include detailed information on the performed recalculations in the specific NIR chapters and relevant CRF tables and provide explanatory information, including the rationale for the recalculations, in its next inventory submission.

10. The ERT identified the following issues related to consistency in Turkey's 2014 inventory submission: inconsistent reporting of AD and EFs and use of notation keys for the whole time series for some subcategories in the energy sector (see para. 30 below); inconsistent reporting of emission estimates for coke use in iron and steel production in the energy and industrial processes sectors (emissions are reported in the energy sector for the years 1990–2009 and in the industrial processes for the years 2010–2012) (see para. 53 below); inconsistent use of AD between sectors (e.g. coke use in the energy and industrial processes sectors) (see para. 73 below); and inconsistent data on land areas in the LULUCF sector (see para. 116 below). The ERT recommends that, in its next inventory submission, Turkey consistently use AD, EFs, notation keys and other parameters throughout the inventory, particularly in the energy and LULUCF sectors, as well as correct the allocation

of emissions from coke use in iron and steel production and ensure the consistent use of AD between sectors.

11. Until its 2014 inventory submission, Turkey did not have a formal quality assurance/quality control (QA/QC) plan and only some general QC procedures were applied to the inventory. The ERT noted numerous errors and inconsistencies between the CRF tables and the NIR and within the NIR itself. In response to questions raised by the ERT during the review, Turkey informed the ERT that in May 2014 its QA/QC plan was approved by the Climate Change and Air Management Coordination Board (CCAMCB). Also, Turkey informed the ERT that in 2014 an external peer review of the GHG inventory was performed by international experts from Austria (for the energy, industrial processes, agriculture and waste sectors) and Slovenia (for the LULUCF sector). The conclusions of these reviews were shown to the ERT. Turkey also stated that the QA/QC plan will be implemented starting from the 2015 inventory submission following the decision of CCAMCB. The procedures will be obligatory for all the institutions that provide inputs to the inventory. The ERT recommends that Turkey implement the QA/QC procedures envisaged in the QA/QC plan, strengthening the quality of its reporting, and pay particular attention to the general and specific QC procedures of the inventory and ensure that all the institutions involved in the inventory preparation process realize the importance of the QC procedures and check the quality of their inputs to the inventory. The ERT noted that recommendations related to QA/QC procedures made in previous review reports have not been taken into consideration for a number of years, such as improvement of the QC procedures at all stages of inventory preparation and implementation of sector-specific QA/QC procedures and recommends that Turkey fully implement these recommendations in its next inventory submission.

12. Although the NIR of the 2014 inventory submission has been expanded compared with the NIR of the 2013 inventory submission, the ERT noted that it is not yet sufficiently transparent. The ERT noted the following areas where transparency needs to be improved foremost: the description in the NIR of the trends in emissions and the inclusion of not only a statistical description of trends but also the driving factors and underlying reasons for the different emission trend behaviour; the description of the expert judgement regarding the selection of AD, EFs and methodologies; and adherence of the structure of the NIR to that described in the annotated NIR outline, included in the annex to the UNFCCC Annex I inventory reporting guidelines. The ERT also noted that most categories are reported at the level of detail required in the CRF tables; however, several categories in the industrial processes sector have been reported as confidential (e.g. ammonia and nitric acid production) and their emissions reported in an aggregated manner under one single category, because Turkish Statistics Law No. 5429 requires that in certain conditions plant-specific data be considered confidential. However, Turkey provided documents and information, including the confidential data requested by the ERT during the review, allowing the ERT to make a detailed review of this information (see paras. 80, 85, 88, 91 and 92 below). In addition, in response to questions raised by the ERT during the review, Turkey showed the ERT that all necessary information for conducting a more in-depth analysis of trends is available in the country. The ERT recommends that Turkey: provide adequate and detailed descriptions of the key drivers for the emission trends in the country; fully and transparently describe actions taken and decisions made during the inventory preparation process, as well as the expert judgement used for the selection of AD, EFs and methodologies; report emissions from the categories with confidential data by aggregating them at a more appropriate category level; and more closely follow the annotated NIR outline structure, including the provision of appropriate category-specific information, in its next inventory submission.

3. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Inventory planning

13. The NIR and additional information provided by Turkey during the review described the institutional arrangements for the preparation of the inventory. There were changes to the inventory planning process for the 2014 inventory submission, as identified by Turkey in response to questions raised by the ERT during the review. In particular, a QA/QC plan was approved in May 2014 and the plan will be implemented for the 2015 inventory submission. The Turkish Statistical Institute (TurkStat) is the agency responsible for compiling the GHG inventory and coordinates the inventory preparation by the Greenhouse Gas Emission Inventory Working Group, which is one of seven technical working groups under CCAMCB formed by Prime Ministerial Decree No. 2001/2 and updated by Prime Ministerial Decrees Nos. 2010/18, 2012/2 and 2004/13. TurkStat has been designated as the focal point for the national emissions inventory by decision of CCAMCB in 2009, according to the Official Statistical Programme (OSP) based on Turkish Statistics Law No. 5429. OSP has been established in 2007 for a five-year period in order to determine the basic principles and standards for dealing with the production and dissemination of official statistics and to produce reliable, timely, transparent and impartial data required at both the national and international levels. The second stage of OSP began in 2012 and will run until 2017. Other institutions are also involved in the inventory preparation process, either by providing data for emission estimation, such as the Ministry of Energy and Natural Resources (MENR) or by estimating the emissions, such as the Ministry of Transport, Maritime Affairs and Communications, MENR, the Ministry of Food, Agriculture and Livestock, the Ministry of Forest and Water Affairs (MFWA) and the Ministry of Environment and Urbanization.

14. During the review, the ERT noted that, despite the formal agreements of cooperation between institutions, the inventory team often faces difficulties in the direct communications between the inventory compilers and the responsible experts from the ministries involved, in addition to the overload of staff when one person is responsible for several sectors of the inventory. Therefore, the ERT concluded that the Party's institutional arrangements for the preparation of the inventory still need to be enhanced in order to maintain a sustainable inventory preparation process. In this respect, Turkey may consider:

(a) Increasing the number of qualified staff in the TurkStat inventory team;

(b) Ensuring the participation in the inventory preparation process of highly qualified experts and institutions available in Turkey in addition to the current staff and using their recommendations in order to improve the estimates of emissions and removals at the sectoral and national levels;

(c) Developing a reliable and sustainable system for the collection of AD and EFs with the goal of improving estimates and closing all gaps, including with respect to categories not yet covered;

(d) Implementing the national QA/QC plan that involves all institutions participating in the preparation of the inventory.

Inventory preparation

15. Table 4 contains the ERT's assessment of Turkey's inventory preparation process. For improvements related to specific categories, please see the paragraphs cross-referenced in the table.

Table 4
Assessment of inventory preparation by Turkey

Issue	*Expert review team assessment*	*General findings and recommendations*
Key category analysis		
Was the key category analysis performed in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF?	No	Level analysis was performed, including and excluding LULUCF. No trend analysis was reported, and the LULUCF sector has been included in the key category analysis aggregated as one single category. The ERT recommends that Turkey improve its key category analysis by providing the trend analysis, and adhere closely to the recommendations of the relevant IPCC guidance regarding the disaggregation and consideration of inventory categories (see para. 16 below)
Approach followed?	Tier 1	
Were additional key categories identified using a qualitative approach?	No	
Does Turkey use the key category analysis to prioritize inventory improvements?	No	
Assessment of uncertainty analysis		
Approach followed?	Tier 1	
Was the uncertainty analysis carried out consistent with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF?	No	No uncertainty analysis on the trend was reported, and the LULUCF sector uncertainties have been reported aggregated at the sector level. For a number of categories, a value of 0 per cent uncertainty has been used for the AD. The ERT recommends that Turkey perform the uncertainty analysis both on the total level of emissions and the trend, including and excluding LULUCF, in accordance with the recommendations of the relevant IPCC guidance (see para. 17 below)
Quantitative uncertainty (including LULUCF)	Level = 5.9%	
	Trend = not provided	
Quantitative uncertainty (excluding LULUCF)	Level = not provided	
	Trend = not provided	

Abbreviations: AD = activity data, ERT = expert review team, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, IPCC good practice guidance for LULUCF = IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, LULUCF = land use, land-use change and forestry.

16. The ERT noted that Turkey reported a level key category analysis; however, the Party did not report a trend key category analysis in its 2014 inventory submission. The ERT also noted that the LULUCF sector has been included in the key category analysis aggregated as one single category. During the review, in response to questions raised by the ERT, Turkey provided the ERT with revised level and trend key category analyses, both including and excluding the LULUCF sector disaggregated by category, and also distinguishing categories by fuel type in the energy sector. Turkey informed the ERT that this information will also be included in its next inventory submission. The ERT welcomes this improvement and recommends that Turkey continue improving its key category analysis and adhere closely to the recommendations of the relevant Intergovernmental Panel on Climate Change (IPCC) guidance (e.g. by including the categories that are currently reported as "NE") and use the results to prioritize inventory improvements in its next inventory submission. Also, the ERT recommends that Turkey perform a qualitative key category analysis for the categories currently aggregated under the category other in the industrial processes sector due to confidentiality reasons, and include the results of this analysis in its next inventory submission.

17. The ERT noted that Turkey reported an uncertainty analysis on the total level of emissions; however, it did not report an uncertainty analysis on the trend. The ERT also noted that the LULUCF sector uncertainties have been reported aggregated at the sector level (40 per cent uncertainty for AD and 10 per cent for EFs). Moreover, for a number of categories, a value of 0 per cent uncertainty has been used for the AD in the analysis, which is unlikely to be true. However, the ERT noted that uncertainty values for some parameters are available in the LULUCF chapter of the NIR. The ERT recommends that, in its next inventory submission, Turkey perform the uncertainty analysis both on the total level of emissions and the trend, including and excluding LULUCF, in accordance with the recommendations in the relevant IPCC guidance, in particular by disaggregating the LULUCF sector into the relevant categories and using country-specific uncertainty values or default values, where appropriate, together with adequate expert judgement and transparently documented considerations and assumptions made during the analysis. The ERT also recommends that Turkey use the results of its uncertainty analysis to prioritize the improvements of the inventory in its next inventory submission.

Inventory management

18. Turkey does not have a centralized archiving system, but as indicated in the NIR it is finalizing the implementation of a database with emission estimates, EFs, AD, choice of methodological tiers and other relevant information. This is the first of three stages in order to create an archiving system which will appear as a national emissions inventory portal, integrating into one system the aforementioned database, a web-based data collection system and a documentation and archiving system, which will include internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. During the review, in response to questions raised by the ERT, Turkey informed the ERT that the database is ready and functional for all sectors and calculations with the exception of the LULUCF sector. As Turkey informed the ERT, the calculation algorithm for the LULUCF sector will be programmed as soon as the responsible expert from MFWA can provide the appropriate information on the methodologies and EFs used. Also, during the review, the person responsible for the emission inventory portal demonstrated to the ERT the database, which is located on the servers of TurkStat but is accessibly remotely in 'read-only' mode. The data input is possible only by a designated person from the TurkStat Information Technology Department and the database complies with standard security and backup procedures as for other national databases in TurkStat. The ERT concluded that the database conforms to all features described in the NIR (e.g. it contains emission estimates

for the entire time series, as well as AD and EFs, etc.) and encourages Turkey to finalize its implementation in time for the next inventory submission.

19. Also, during the review, in response to questions raised by the ERT, Turkey showed the ERT an array of files and Excel spreadsheets with AD, emission calculations and selected EFs for the entire time series located on the TurkStat servers. However, the ERT noted that this archiving system remains decentralized with regard to documentation on sector-specific EFs and AD that have been generated and aggregated for the preparation of emission estimates for those sectors or categories of the inventory prepared by other ministries and submitted to TurkStat for compilation (e.g. public electricity and heat production, transport, consumption of halocarbons and SF_6 and the LULUCF sector). All the corresponding information is archived in the responsible ministries according to the Regulation on State Archive Services: selected EFs, work files, e-mails and official letters are stored on experts' computers, on a network server with restricted access or on an external drive as soft copy, or as hard copy. During the review, the ERT was provided with the requested additional archived information. The ERT encourages Turkey to continue with the implementation of its archiving system, in time for the next inventory submission, paying special attention to the inclusion of the background information and data supplied by other ministries for inventory compilation.

4. Follow-up to previous reviews

20. In its 2014 inventory submission, Turkey has made some improvements since its 2013 inventory submission. The ERT noted that the NIR has been extended to address the following recommendations from the previous review report: the inclusion of more information on the process for final approval of the inventory submission; information on organizations responsible for uncertainty analysis; information on the implementation of recommendations from the previous review report (included in annex 3 to the NIR); and the development of a QA/QC plan that was approved in May 2014.

21. Recommendations from previous reviews that have not yet been implemented, as well as issues the ERT identified during the 2014 inventory review, are discussed in the relevant sectoral chapters of the report and in table 7.

B. Energy

1. Sector overview

22. The energy sector is the main sector in the GHG inventory of Turkey. In 2012, emissions from the energy sector amounted to 308,604.26 Gg CO_2 eq, or 70.2 per cent of total GHG emissions. Since 1990, emissions have increased by 132.2 per cent. The key drivers for the rise in emissions are: the increase in electricity production (a fourfold increase from 34,315 GWh in 1990 to 174,091 GWh in 2012); the increase in road transportation activities (vehicle stock in 2012 was about 4.8 times larger than it was in 1990); and the population increase (by 37.1 per cent in the period 1990–2012). Within the sector, 38.8 per cent of the emissions were from energy industries, followed by 22.3 per cent from other sectors, 19.9 per cent from transport and 18.2 per cent from manufacturing industries and construction. Fugitive emissions from fuels accounted for 0.8 per cent. The remaining 0.00002 per cent were from other.

23. Turkey has made recalculations between the 2013 and 2014 inventory submissions for this sector. The two most significant recalculations made by Turkey between the 2013 and 2014 inventory submissions were in the following categories: public electricity and heat production and petroleum refining. The recalculations were made to reflect improved fuel consumption data. Compared with the 2013 inventory submission, the recalculations

increased emissions in the energy sector by 88.25 Gg CO_2 eq (0.03 per cent), and increased total national emissions by 0.02 per cent in 2011. The recalculations were adequately explained in the NIR.

24. During the review, the ERT identified in the NIR that recalculations have also been made for marine bunkers. Although this did not influence the emission estimates for the navigation category and total GHG emissions, these recalculations (a 67.7 per cent reduction in emissions) were not reflected in CRF tables 1.C or 8(a), and not clearly explained in the NIR. In response to a question raised by the ERT during the review, Turkey explained that in the 2013 inventory submission, the AD for marine bunkers for 2011 were provided by the Energy Market Regulatory Authority (EMRA), and in the 2014 inventory submission the AD for 2011 were provided by MENR; therefore, there was a recalculation in this category for 2011. However, by mistake, the recalculated data were not reported in the relevant CRF tables (see para. 39 below). The ERT recommends that Turkey address this problem by revising the CRF tables, providing sufficient explanation in the NIR and further checking the impact of this change on the emission estimates for navigation and total GHG emissions in its 2015 inventory submission. In addition, the ERT recommends that Turkey include a separate section in the energy chapter of the NIR providing all detailed information on, and the rationale for, recalculations.

25. Despite recommendations made in previous review reports, there is still a lack of sufficient transparency in the NIR for the energy sector. The NIR does not provide sufficient and consistent information on the methodologies used, the sources of AD and EFs used and, particularly, on the underlying reasons and drivers of the change of the AD throughout the time series. Turkey highlighted in the NIR that energy balance tables were presented in annex 8; however, the ERT noted that no such annex was included in the NIR. During the review, in response to a question raised by the ERT, Turkey provided the ERT with the energy balance and made a specific presentation on the information about it. The ERT strongly reiterates the recommendations made in previous review reports that Turkey present detailed data on the EFs and AD for key categories in the NIR of its next inventory submission together with a clear description of the sources of these data, and how and why they change throughout the time series, and provide transparent explanations of the methodologies used to estimate emissions from the energy sector.

26. The ERT noted that Turkey's reporting of emissions from the energy sector is not yet complete in terms of years and categories. The following issues related to completeness were identified by the ERT:

(a) CO_2, CH_4 and N_2O emissions from liquid fuels used as auxiliary fuels in public electricity and heat production are not reported;

(b) CO_2, CH_4 and N_2O emissions from manufacture of solid fuels and other energy industries are reported as included elsewhere ("IE"); however, their inclusion in the inventory under public electricity and heat production is not demonstrated (see para. 42 below);

(c) CO_2, CH_4 and N_2O emissions from other transportation (transport of fuels in pipelines) are reported as not occurring ("NO");

(d) CO_2, CH_4 and N_2O emissions from liquid fuels in petroleum refining are reported as "NA" for 2012 (see para. 47 below);

(e) CH_4 fugitive emissions from distribution of natural gas are reported as "NE" (see para. 62 below);

(f) CO_2, CH_4 and N_2O emissions from other fuels (waste) co-fired in cement industry under manufacturing industries and construction are reported as "NO", although work on performing estimates has been undertaken, as described in the NIR (page 25);

(g) CO_2, CH_4 and N_2O emissions from aviation and marine bunkers are reported as "NA", "NO" and "NE" for the years 1990–2007 (see paras. 38 and 40 below);

(h) CO_2 fugitive emissions from coal mining activities are reported as "NA".

27. The ERT recommends that Turkey include emission estimates for the mandatory categories indicated in paragraph 26 above in its 2015 inventory submission in order to improve the completeness of its GHG inventory, and also encourages the Party to include emission estimates for the non-mandatory categories in its next inventory submission.

28. Turkey estimated emissions from energy activities using default EFs and parameters from the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), except for the categories public electricity and heat production and civil aviation, for which country-specific net calorific values (NCVs) or a tier 2 method were used, respectively. During the review, in response to a question raised by the ERT, Turkey informed the ERT that it has initiated activities to compile specific data on the carbon content of fuels through cooperation between MENR and TurkStat and the energy industries. The ERT commends the Party for these activities and recommends that Turkey use country-specific EFs and parameters for all fuels, in particular for the key categories, in its 2015 inventory submission (see para. 43 below). Particularly, it is critically important to develop country-specific carbon content values for lignite and natural gas for the next inventory submission (see paras. 45 and 46 below).

29. The ERT identified many issues in terms of the time-series consistency of AD, EFs and emission estimates across almost all categories. During the review, the ERT found these inconsistencies to be caused by various problems, in addition to the AD fluctuation caused by world and national economy crises, including: calculation mistakes (see para. 45 below); input errors of original data into the CRF tables (see paras. 35 and 56 below); misallocation of fuel types (see paras. 51 and 55 below); inappropriate choice of NCVs and EFs (see paras. 37, 48 and 50 below); data source changes (see para. 24 above); statistical system changes (see para. 54 below); and shortcomings of the energy balance (see para. 39 below). Therefore, the ERT strongly recommends that Turkey implement strong QC procedures to avoid mistakes and input errors, ensure the correct choice of NCVs and EFs, enable and improve an appropriate data collection system and enhance cooperation among relevant stakeholders to improve the quality of the energy balance.

30. The ERT also noted the incorrect use of notation keys in the CRF tables, and inconsistencies of reported information between the NIR and the CRF tables and within the NIR. For example, mistakes were found in: descriptions in the NIR of the mix of fuels for electricity generation (pages 19 and 20) and total primary energy supply and its disaggregation (page 20); consumption of residual fuel oil for marine bunkers in CRF table 1.C is reported as 28,695.66 TJ for 2012, however in CRF table 1.A(b) it is reported as "NO"; carbon stored and feedstocks and non-energy use of naphtha, bitumen and coking coal are described in the NIR and reported in CRF tables 1.A(b) and 1.A(d), but in CRF table 1.A(c) apparent energy consumption (excluding non-energy use and feedstocks) for all types of fuels is reported as "NA"; and, as indicated in paragraph 26(f) above, emissions from waste co-fired in cement industry are not included in the inventory, therefore in CRF table 1.A(a) emissions from other fuels under the subcategory cement production (other) should be reported as "NE" instead of "NO". The ERT recommends that Turkey revise and correct all these inconsistencies and incorrect uses of notation keys in its 2015 inventory submission.

31. The ERT noted the following improvements in the reporting of the energy sector, implemented in response to the recommendations of the previous review report: reporting of non-energy use and feedstocks of naphtha, bitumen and coking coal (see para. 41 below); emission estimates for waste incineration in energy industries; and inclusion of a table in annex A3 to the NIR highlighting how the Party addressed the recommendations made in the previous review report. The ERT commends Turkey for the progress made; however, progress is still limited, and the ERT considers that Turkey's reporting is not fully in line with the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). Further, the ERT is of the view that Turkey's limited efforts to address individual issues identified in previous review reports over the years has led to a situation where transparency, accuracy, consistency, completeness and comparability of the inventory of the energy sector have not been achieved. The ERT strongly recommends that Turkey strengthen its efforts to address the recommendations made in the previous review reports and implement the recommended improvements in its next inventory submission, to the extent possible.

2. Reference and sectoral approaches

32. Table 5 provides a review of the information reported under the reference approach and the sectoral approach, as well as comparisons with other sources of international data. Issues identified in table 5 are more fully elaborated in paragraphs 33–41 below.

Table 5
Review of reference and sectoral approaches

		Paragraph cross references
Difference between the reference approach and the sectoral approach in 2012	Energy consumption:[a] 601.94 PJ, 15.06% CO_2 emissions: 27 835.75 Gg CO_2 eq, 9.23%	
Are differences between the reference approach and the sectoral approach adequately explained in the NIR and the CRF tables?	No	See paragraphs 33–37 below
Are differences with international statistics adequately explained?	No	See paragraphs 36 and 37 below
Is reporting of bunker fuels in accordance with the UNFCCC reporting guidelines?	No	See paragraphs 38–40 below
Is reporting of feedstocks and non-energy use of fuels in accordance with the UNFCCC reporting guidelines?	No	See paragraph 41 below

Abbreviations: CRF = common reporting format, NIR = national inventory report, UNFCCC 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 inventories".

[a] This value corresponds to the difference with the value of apparent energy consumption including non-energy use and feedstocks of the reference approach, since the values of apparent energy consumption excluding non-energy use and feedstocks for the reference approach are reported as not applicable ("NA").

Comparison of the reference approach with the sectoral approach and international statistics

33. In 2012, total CO_2 emissions estimated using the reference approach were reported as 9.23 per cent higher than those estimated using the sectoral approach. Turkey reported in the NIR and reiterated in response to the ERT's questions during the review that the main reason for this difference is the use of different calorific values and carbon content of fuels in the reference approach and the sectoral approach, where sector-specific NCV data for each fuel are used for the former and average NCV data by type of fuel are used for the latter (see para. 28 above). The ERT considers that the reason for this difference is more complex and may have other causes, such as the incorrect allocation of non-energy use of fuels and feedstocks (see para. 41 below), incomplete coverage of categories in the sectoral approach estimation (see para. 26 above) and the incorrect approach used to obtain the average calorific values (see paras. 45 and 46 below). Noting that this issue of inconsistency between the two approaches has been repeatedly raised in previous review reports, the ERT strongly recommends that Turkey make the necessary efforts to understand all the reasons for the differences in the estimates between the sectoral and reference approaches and correct these estimates where necessary, ensuring that the sectoral approach estimates are complete, consistent and accurate, in its next inventory submission.

34. The ERT noted that the apparent energy consumption (excluding non-energy use and feedstocks) is reported as "NA" in CRF table 1.A(c), whereas carbon stored (non-energy use and feedstocks) has been reported for naphtha, bitumen and coking coal in CRF table 1.A(b). The ERT believes that if the non-energy use and feedstocks are deducted from apparent energy consumption in the reference approach, the difference between the estimates of energy consumption performed using the reference and sectoral approaches would be much smaller than that calculated by the ERT (15.1 per cent). The ERT recommends that Turkey revise its reporting in the relevant cells in CRF table 1.A(c) to improve consistency and comparability in its next inventory submission.

35. The ERT also noted that the difference of CO_2 estimates between the two approaches is 4.27 per cent for 2011 in the 2014 inventory submission, whereas it was 8.11 per cent in the 2013 inventory submission. There is no explanation in the NIR for such a change. In response to a question raised by the ERT during the review, Turkey indicated that an error in the reference approach calculation sheet for 2011 was found, where it referred to values of export, stock change and conversion factor for sub-bituminous coal. Therefore, the ERT recommends that Turkey revise the calculation and include the updated information in its next inventory submission, as well as improve its QC procedures.

36. Apparent consumption in Turkey's reference approach for 2012 does not correspond closely to the International Energy Agency (IEA) data. There is a difference of 5.0 per cent in apparent consumption between the reference approach and the IEA data, with apparent consumption of liquid (9 per cent), solid (4 per cent) and gaseous (3 per cent) fuels higher than the values reported to IEA. The apparent consumption reported in the reference approach by Turkey is within about 5 per cent for all years in the time series, except for 1991 (reference approach lower by 9 per cent) and for the years 2005–2009 (reference approach higher by 9–12 per cent). There are several differences in product allocation between the two data sets, which make it difficult for the ERT to pinpoint precise sources of discrepancies. This is particularly true in the case of liquid fuels, where data on other kerosene, residual fuel oil, bitumen, refinery feedstocks, liquefied petroleum gas, naphtha and other oil products have been reported to IEA for all years, but are reported as "NA" for all or most years in CRF table 1.A(b). In response to previous review stages, Turkey informed the ERT that it is now working on the harmonization of the national energy balance (which is the main source of inventory AD for the energy sector) with the IEA and Eurostat data sets. Turkey also informed the ERT that some petroleum products are reported at an aggregated level under other fuels in the energy balance and that it will

correct the notation key used ("IE") for these fuels in its next inventory submission. The ERT recommends that Turkey investigate further the reasons for discrepancies with the IEA data and minimize them, make good progress on the harmonization of the national energy balance with the IEA and Eurostat data sets and provide information in this regard, and revise the relevant notation keys used in the CRF tables for the reference approach in its next inventory submission.

37. The ERT found that the natural gas consumption data reported in the reference approach are systematically around 10 per cent higher than those reported to IEA for the years 1990–2010. In response to previous review stages, Turkey acknowledged that it used gross calorific value (GCV) instead of NCV when converting mass units of natural gas consumption to energy units, except for 2012. The ERT strongly recommends that Turkey revise the reported data for natural gas and ensure the consistency of these data for the complete time series in its next inventory submission.

International bunker fuels

38. Turkey reported emissions from international bunkers for the period 2008–2012 only. For aviation bunkers, the data in CRF table 1.C for the period 2008–2010 are 70–80 per cent smaller than the data reported to IEA, while for 2011 and 2012, they are up to 150 per cent larger. For marine bunkers, the data in CRF table 1.C for 2008 and 2010 are 35–50 per cent smaller than the data reported to IEA and 12 times higher for 2012, while for 2009 they agree closely. However, the 2011 data are four times higher. During the review, in response to a question raised by the ERT, Turkey clarified that the data on bunker fuels used for the inventory estimates were taken from the energy balance developed by MENR, whereas the bunker fuel data are reported to IEA by the Directorate General of Petroleum Affairs. Therefore, the data may not be consistent. Further, Turkey indicated that it intends to use bunker fuel data from IEA in its inventory reporting in the future. The ERT considers that this approach may not be in line with the relevant IPCC guidance. The ERT strongly encourages Turkey to enhance the coordination between these two agencies together with EMRA, which is the source of the original data for aviation and marine bunkers, in order to enhance the consistency of the data reported to different international organizations. The ERT recommends that Turkey make all the efforts necessary to develop a sound technical and consistent approach for disaggregating fuel use in domestic and international activities, in strict accordance with the relevant IPCC guidance and definitions and the UNFCCC reporting guidelines in its next inventory submission. The ERT also reiterates the recommendation made in the previous review report that Turkey report emission estimates for international bunker fuels for the entire time series.

39. The ERT noted significant inter-annual changes in the bunker fuel emission estimates in the 2014 inventory submission. The significant inter-annual changes for the years 2010–2011 in terms of jet kerosene consumption and CO_2 emissions (both increasing by 1,613.7 per cent) for international aviation were not explained or addressed in the 2014 inventory submission, as recommended in the previous review report. During the review, the ERT found that part of the reason for this issue may be a shortcoming of the energy balance, where the 2010 aviation bunker value may have been mistyped. For marine bunker emissions, a significant discrepancy was identified between the NIR and CRF tables 1.C and 8(a) for the year 2011: in the NIR it is reported that a recalculation has been performed for marine bunkers due to a change of data source; however, this recalculation is not reflected in CRF tables 1.C and 8(a), where old data have been reported (see para. 24 above). The ERT found that, though such unreported revision improves somewhat the time-series consistency of the marine bunker estimates for the years 2008–2012, the fluctuations in terms of both energy consumption and CO_2 emissions are still significant; for example, the inter-annual change between 2010 and 2011 is still as high as 161.8 per cent. The ERT strongly recommends that Turkey determine a reliable data source for international bunker

fuels and improve time-series consistency in line with the relevant IPCC guidance in its next inventory submission. In addition, the ERT noted that the CH_4 and N_2O implied emission factors (IEFs) of liquid fuels for both aviation and marine bunkers fluctuated significantly: the IEFs of CH_4 and N_2O for kerosene change between 0.5 kg/TJ and 5 kg/TJ, and 0.6 kg/TJ and 8.3 kg/TJ, respectively; the IEFs of CH_4 and N_2O for residual oil change between 3 kg/TJ and 5 kg/GJ, and 0.3 kg/TJ and 0.6 kg/TJ, respectively. These were not consistent with the IPCC default values (for kerosene in aviation, the EFs of CH_4 and N_2O are 0.5 kg/TJ and 2 kg/TJ, respectively; for oil used in ocean-going ships, the EFs of CH_4 and N_2O are 7 kg/TJ and 2 kg/TJ, respectively). During the review, Turkey recognized that it had made a mistake in selecting EFs for both aviation and marine bunkers. The ERT strongly recommends that Turkey revise the EFs and calculation inputs for its emission estimates for aviation and marine bunkers for the whole time series in its next inventory submission.

40. The ERT also identified some inconsistencies between the information on international bunker fuels reported in the CRF tables. In CRF table 1.C, bunker fuel emissions for the period 1990–2007 are reported as "NE", but in CRF table 1.A(b), international bunkers are reported as "NA"; and in CRF table 1.C, consumption of residual fuel oil for marine bunkers is reported as 28,695.66 TJ for 2012, but in CRF table 1.A(b) this consumption is reported as "NO". The ERT recommends that Turkey improve the consistency between these tables, harmonize and correct the information reported in these tables and apply QC measures for the estimates in its next inventory submission.

Feedstocks and non-energy use of fuels

41. In the 2014 inventory submission, a significant amount of naphtha and bitumen, as well as a smaller amount of coal oils and tars (from coking coal), were reported for 2012 under feedstocks and non-energy use of fuels, but only gas/diesel oil was reported for the period 1990–2011, while other fuels were reported as "NA". In response to a question raised by the ERT during the review, Turkey stated that fuels used for non-energy purposes include lubricants, bitumen and solvents, and that gas/diesel oil is generally not used for non-energy uses in Turkey, but as non-energy use of fuels is not given separately in the energy balance, non-energy use of fuels has been estimated and allocated artificially to gas/diesel oil. However, for the 2014 inventory submission, data provided by MENR for 2012 were used. These data contain data on naphtha and aggregated data for all other non-energy uses that were reported as bitumen. Turkey did not include relevant information on the use of coking coal as feedstock in the NIR. Therefore, the ERT encourages Turkey to make all necessary efforts to disaggregate the non-energy use by fuel instead of allocating all of them under bitumen to improve the comparability and transparency of its reporting, and to review the estimates for non-energy use and feedstocks for the years 1990–2011 to improve the time-series consistency of its estimates. If this is not possible, the ERT recommends that Turkey, in its next inventory submission, revise its use of the notation key "NA" (e.g. use the notation key "IE" in CRF tables 1.A(d) and 1.A(b) for fuel types that are known to be used as feedstock but because their respective AD are not possible to disaggregate, they are reported aggregated, such as lubricants) and provide relevant information in the additional information boxes of these CRF tables, in order to improve the transparency of its reporting. In addition, the ERT recommends that Turkey provide information on feedstocks and non-energy use of coking coal in its next inventory submission.

3. Key categories

Stationary combustion: liquid, solid and gaseous fuels – CO_2

42. The reporting under public electricity and heat production in Turkey's inventory includes emissions from auto-producers. Further, it is briefly mentioned in the NIR that

emissions from manufacture of solid fuels and other energy industries were included under public electricity and heat production. The ERT noted that this is not in line with the Revised 1996 IPCC Guidelines and that there is no further explanation in the relevant sections of the NIR. During the review, the ERT found that the energy statistics for the coking industry are available to separate these emissions. Therefore, the ERT recommends that Turkey disaggregate emissions from these categories in its next inventory submission in line with the relevant IPCC guidance, and, if this is not possible, provide a clear description and explanations in the NIR and relevant CRF tables, including CRF table 9(a).

43. Turkey stated that a tier 2 method was used to estimate emissions from public electricity and heat production by using plant-specific NCV data collected through questionnaires. Also, Turkey reported in the NIR that the carbon content and oxidation factors were taken from the Revised 1996 IPCC Guidelines. The ERT considers that this is not fully in line with the IPCC good practice guidance, because using a combination of plant-specific NCVs and IPCC default carbon content values will only add uncertainty to the estimates. In its comments on the draft review report, Turkey explained that studies on the carbon content and oxidation rates of specific fuels are ongoing and that it will apply a higher-tier method for the main fuels in the key categories in its next inventory submission. Therefore, the ERT strongly recommends that Turkey use country-specific carbon content factors consistent with the country-specific NCVs for the fuels used in this category, and in the energy sector activities in general, in its next inventory submission.

44. The ERT noted that plant-specific NCV data were not reported in the NIR, which prevented the ERT from undertaking a comparison with IPCC default values. In response to a question raised by the ERT during the review, Turkey provided data and background information for lignite (see para. 46 below). Further, the ERT noted that the NIR (page 19) reported that fuel consumption data are gathered from every single power plant, whereas on the next page it is mentioned that the AD for fuels are taken directly from the energy balance. During the review, Turkey clarified that the AD are obtained from plant questionnaires covering fuel consumption and NCVs. The ERT strongly recommends that Turkey include all information on the country-specific data used in the estimates to improve transparency and enhance its efforts to ensure the consistency of the NIR of its next inventory submission.

45. The ERT identified generally unstable and unusual trends for the CO_2 IEFs for liquid, solid and gaseous fuels in public electricity and heat production. Many of the CO_2 IEF values are lower than the IPCC default values or ranges. For example, the CO_2 IEF for liquid fuels for 2008 is 61.66 t/TJ, well below the IPCC default value range (63.07–100.83 t/TJ); the CO_2 IEFs for solid fuels for the period 1990–2004 (ranging from 76.52 t/TJ to 86.87 t/TJ) are lower than the IPCC default range (94.6–106.7 t/TJ); the CO_2 IEFs for gaseous fuels for the years 2000–2002 (ranging from 53.04 t/TJ to 53.72 t/TJ), for 2011 (60.76 t/TJ) and for 2012 (58.37 t/TJ) are alternatively lower and higher than the IPCC default value (56.1 t/TJ). In response to a question raised by the ERT during the review, Turkey explained that the calorific values and the carbon content of the indigenous solid fuels and gaseous fuels are variable and may lead to such instability. During the review, the ERT identified that the problems were mainly caused by calculation mistakes. Therefore, the ERT strongly recommends that Turkey revise the emission estimates for this category and substantially improve the corresponding QC procedures in its 2015 inventory submission.

46. The ERT noted that a significant amount of lignite was consumed under the category public electricity and heat production. The data provided by Turkey during the review, in response to a question raised by the ERT, show that the country-specific NCV of lignite is in the range 4,186–5,023 kJ/kg (1,000–1,200 kcal/kg), which is much lower than the IPCC default range (5,500–21,600 kJ/kg), and much lower than the data Turkey reported to IEA

(6,879 kJ/kg). The ERT also found that the NCV reported in the reference approach is 9,438 kJ/kg, which is substantially higher than the value used in the sectoral approach. During the review, Turkey clarified that the NCV of lignite used in the calculations of the inventory was updated with new data provided by private companies after MENR sent data to IEA. Having checked the fuel analysis by plant provided by Turkey during the review, the ERT considers that Turkey may have made an error by using the NCV of raw lignite instead of the NCV of air-dried lignite, which may result in an underestimation of the NCV value to be used. Therefore, the ERT strongly recommends that Turkey carefully re-examine the values used, provide transparent explanations and revise its emission calculations for this category in its 2015 inventory submission.

47. The ERT noted that a significant amount of liquid fuels were reported as consumption in the petroleum refining category for the years 1990–2011, but consumption of liquid fuels is reported as "NO" for 2012. The ERT recommends that Turkey carefully check the energy consumption in this category to avoid any omission, revise its estimates and provide clear explanations in the NIR of its 2015 inventory submission.

48. The ERT noted that the CO_2 IEF of gaseous fuels for 2011 (61.90 t/TJ) in petroleum refining, which is much higher than the value reported for 2012 (55.82 t/TJ), is among the highest of reporting Parties (ranging from 53.60 to 83.22 t/TJ) and is also higher than the IPCC default value for natural gas (56.1 t/TJ). During the review, in response to a question raised by the ERT, Turkey clarified that an error had been found in the consumption values (TJ) used for natural gas for 2011. The ERT strongly recommends that Turkey correct the mistake in its next inventory submission and improve its QC procedures.

49. The ERT found a significant decrease of CO_2 emissions from manufacturing industries and construction (a sharp decline of 30.3 per cent from 2007 to 2012), which has been repeatedly pointed out in previous review reports and has not been addressed or explained in the NIR. The ERT also found that the trend of CO_2 emissions is decoupled from energy consumption for the period 2009–2012 (energy consumption increased but emissions decreased), whereas no explanation is included in the NIR. The ERT strongly recommends that Turkey check the AD and EFs used in its calculations, in particular for the period 2007–2012, and provide information on trends and any explainable changes (e.g. the global financial crisis in 2008) in its next inventory submission.

50. The ERT noted unusual inter-annual changes for the CO_2 IEFs for gaseous fuels in most subcategories under manufacturing industries and construction. Taking the iron and steel subcategory as an example, the inter-annual change between 1999 and 2000 is 12.8 per cent, between 2000 and 2001 is –4.1 per cent and between 2007 and 2008 is –6.0 per cent; in comparison, the CO_2 IEFs for the years 2000–2007 (with the exception of 2003 when it is reported as "NO") are the highest or the second highest among the reporting Parties for these years (ranging from 54.12 t/TJ to 62.97 t/TJ for the time series) and also higher than the IPCC default value (56.1 t/TJ). In response to a question raised by the ERT, Turkey acknowledged that an error had been found in the consumption values (in TJ) of natural gas in the years when unusual CO_2 IEFs are observed. The ERT strongly recommends that Turkey correct the mistakes, check all AD relevant to gaseous fuels across the inventory, and revise these systematic problems in its 2015 inventory submission to improve the time-series consistency and accuracy of the emission estimates.

51. The ERT also noted significant inter-annual changes or unusual values for the CO_2 IEFs for liquid and solid fuels in some subcategories under manufacturing industries and construction. For example: for iron and steel, the inter-annual change of the CO_2 IEFs of solid fuels for the period 1990–1991 was 6.8 per cent and for the period 2007–2011 it ranged between –10.4 and 24.1 per cent; and the values of the CO_2 IEFs for the years 1990, 1992–2009 and 2011–2012 (ranging from 84.27 to 93.68 t/TJ) were well below the IPCC default range (94.6–106.7 t/TJ); for non-ferrous metals, the CO_2 IEF of liquid fuels for

2007 was extremely low (30.24 t/TJ) compared with the IPCC default range (63.07–100.83 t/TJ); the CO_2 IEF of solid fuels for 2011 was extremely high (131.9 t/TJ) compared with the IPCC default range (94.6–106.7 t/TJ); and for chemicals, the CO_2 IEF of solid fuels for the years 1990–1992, 2001, 2003–2007 and 2009–2011 were extremely high (113.80–202.31 t/TJ) or extremely low as in 1997 (17.39 t/TJ) compared with the IPCC default range (94.6–106.7 t/TJ). In its response to a question raised by the ERT during the review, Turkey informed the ERT that the unusual value of the CO_2 IEF for liquid fuels was mainly caused by the misallocation of petroleum coke reported as solid fuel erroneously, and that the inter-annual changes of the CO_2 IEFs of solid fuels were the result of the varying quality of indigenous fuels. The ERT believes that these points may partially explain the issues identified above; however, there may be other factors not considered by Turkey. Therefore, the ERT strongly recommends that Turkey revise the fuel allocation among categories and the EFs and AD used across categories, improve its QC procedures and provide sufficient information on the inter-annual changes in the CO_2 EFs in the NIR of its next inventory submission.

52. Based on the data disaggregation in the energy balance, Turkey allocated combustion emissions from cement production, ceramics, fertilizer, glass and glass products, road motor vehicles, sugar and textiles to the category other (manufacturing industries and construction), where the share of emissions reached 76.3 per cent of total emissions from manufacturing industries and construction. The ERT recommends that Turkey maintain the comparability of CRF table 1.A(a) without too much disaggregation under the category other by reallocating fertilizer to chemicals, road motor vehicles to road transportation and sugar to food processing, beverages and tobacco while at the same time providing information on all these disaggregated subcategories in the NIR of its next inventory submission to improve the transparency of its reporting.

53. The CO_2 emissions from coke used in the iron and steel subcategory were allocated to the industrial processes sector from 2010 onwards, while for the remaining years of the time series the emissions were reported in the energy sector under the iron and steel subcategory under manufacturing industries and construction. This caused additional inconsistencies in both the AD and emissions for the whole time series, except for the inconsistencies that have been identified in paragraph 51 above. Noting that applying a different allocation of emissions from iron and steel across the time series is not in line with the UNFCCC reporting guidelines, the ERT recommends that Turkey revise its allocation of CO_2 emissions by disaggregating combustion and process emissions accordingly, and include in the NIR of its next inventory submission a carbon mass balance for iron and steel production (see para. 78 below).

54. The AD of the subcategory agriculture/forestry/fisheries increased gradually for the period 1990–2011. However, the AD decreased sharply between 2011 and 2012 (by 79.1 per cent), with relevant emissions decreasing sharply as well. There is no explanation in the NIR for this decrease. In response to a question raised by ERT during the review, Turkey clarified that the AD were obtained from the energy balance, in which diesel oil data for the period 1990–2011 were disaggregated into "diesel oil" and "rural diesel" (the latter, used for agricultural purposes), but in 2012, a reporting system change[3] made this

[3] Before 2012, diesel oil was reported in accordance with the following definition: diesel oil (sulphur content up to 10 mg/kg) and rural diesel (maximum sulphur content of 1000 mg/kg). However, the Technical Regulation Notification on Types of Diesel, which entered into force in 2009 restricted the sulphur content to 10 mg/kg in diesel oil. The date for the implementation of this regulation was extended to April 2011. Therefore, after April 2011, it became impossible to separate the different uses of diesel oil and, since 2012, all diesel oil in the energy balance is included in road transportation.

disaggregation impossible. As a result, all diesel oil was simply allocated to road transportation. In this regard, the ERT strongly recommends that Turkey include this information in its next inventory submission and revise its emission estimates by 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 against the total diesel oil used in the country and provide clear explanations in the NIR of its next inventory submission.

Stationary combustion: solid fuels – CH_4

55. The ERT noted that the CH_4 IEFs for the years 1990–2012 (ranging from 301.70 kg/TJ to 2,244.00 kg/TJ) for the subcategory residential are much higher than the IPCC default range (150–300 kg/TJ). The 2012 value (301.70 kg/TJ) is 74.6 per cent lower than the 1990 value (1,187.00 kg/TJ). The CH_4 IEF trend fluctuates significantly from 436 kg/TJ to 2,244.00 k/TJ, and is unstable until 2005. In response to a question raised by the ERT during the review, Turkey realized that CH_4 emissions from wood and residues of animals and plants were aggregated under solid fuels instead of biomass before 2005, but the AD for the biomass were not included in the solid fuel totals. Therefore, the ERT strongly recommends that Turkey correct this error and revise the CH_4 emission estimates in its 2015 inventory submission to improve the accuracy and consistency of this category.

Civil aviation: liquid fuels – CO_2

56. The ERT noted that the inter-annual changes of the AD for civil aviation for the whole time series are significant; for example, increases of 33.4 per cent in the period 1992–1993 and 66.2 per cent in the period 1994–1995 followed by decreases of 13.4 per cent in the period 1998–1999 and 67.7 per cent in the period 2001–2002 and then an increase of 149.6 per cent in the period 2002–2003. Similar significant inter-annual changes of AD occur for navigation (an increase of 20.3 per cent in the period 2010–2011 and a decrease of 20.54 per cent in the period 2011–2012). During the review, in response to questions raised by the ERT, Turkey clarified that these data come from the energy balance and input errors of the original data occurred when transferring the results into the CRF tables. The ERT recommends that Turkey improve its QC procedures by further checking the AD to avoid any mistyping and input errors and provide more supporting information to explain fluctuations in AD, such as passenger and freight turnover, across the time series in its next inventory submission.

57. The ERT noted that the CO_2 IEFs of jet kerosene for 2002 and 2003 are extremely high (245.36 t/TJ and 108.34 t/TJ) compared with the IPCC default value (72.00 t/TJ). Turkey clarified during the review that a mistake had occurred, caused by data input errors. The ERT strongly recommends that Turkey revise its estimates and improve its QC procedures to avoid this kind of mistake in its next inventory submission.

Road transportation: liquid fuels – CO_2, CH_4 and N_2O[4]

58. In its NIR, Turkey stated that CO_2 emissions were calculated using a tier 1 approach based on energy consumption. The tier 2 method results were compared with the tier 1 method results for validation, whereas emissions other than CO_2 were calculated using a tier 2 approach. However, after reviewing the CRF tables, the ERT identified that CH_4 and N_2O emissions were also calculated using the tier 1 method. During the review, in response to a question raised by the ERT, Turkey clarified that the tier 2 method was also used to validate the CH_4 and N_2O emissions calculation, but the tier 1 results were reported. In this

[4] Not all emissions related to all gases under this category are part of the key category, particularly CH_4 and N_2O emissions. However, since the calculation procedures for issues related to this category are discussed as a whole, the individual gases are not assessed in separated sections.

regard, the ERT strongly recommends that Turkey: use country-specific NCVs and carbon content factors for the fuels used in the country in order to estimate CO_2 emissions from this category; move to a higher-tier method for calculating N_2O (and CH_4) emissions, as it is likely that it will be a key category if using appropriate EFs; and improve the transparency of the NIR of its 2015 inventory submission.

59. Although tier 1 results are reported for non-CO_2 emissions in the CRF tables, Turkey reported equations, EFs and other parameters for the tier 2 method in the NIR. The ERT commends Turkey for this effort. However, the ERT noted that vehicle-kilometres travelled by different type of vehicle was estimated by an algorithm and the consistency of the calculated vehicle-kilometres travelled across the time series is poor; for example, gasoline use in cars is considered to have the highest mileage in 1990 (18,400 km) and lowest in 2012 (4,700 km), changing from 6,580 km in 2010 to 4,885 km in 2011. The ERT considers that these figures are very unlikely to occur in a country with such a growing economy as Turkey. The ERT also considers that the consistency of the data reported for diesel cars is even worse, following the reallocation of rural diesel oil to road transportation for 2012. The ERT recommends that Turkey revise and improve the way it estimates vehicle-kilometres travelled and all the other parameters to be used when a higher-tier method is to be applied to its estimates.

Coal mining and handling: solid fuels – CH_4 and CO_2

60. The ERT noted that the data source of coal production is unclearly reported in the NIR. During the review, in response to a question raised by the ERT, Turkey stated that coal production from surface mining and underground mining was estimated using expert judgement. The ERT notes that this is not in accordance with the IPCC good practice guidance and gives the estimates high uncertainty and very low reliability. In order to improve the accuracy of the estimates, the ERT strongly recommends that Turkey use statistical data available in the Directorate General of Mining Affairs and Lignite Authority or any other relevant source in its next inventory submission.

4. Non-key categories

Oil and natural gas: liquid and solid fuels – CO_2 and CH_4

61. For oil and gas systems, CO_2 and CH_4 emissions are reported for some of the subcategories in CRF table 1.B.2, but the corresponding AD and IEFs are reported as "NE" and "NA". In response to a question raised by the ERT during the review, Turkey provided the relevant available AD supporting the calculations. The ERT strongly recommends that Turkey include all this information in the CRF tables and the NIR in its next inventory submission to improve transparency.

62. The ERT noted that fugitive emissions from the distribution of natural gas are reported as "NE" and transmission CH_4 emissions are significantly low (0.30 Gg) in 2012. Since the natural gas consumption in Turkey in 2012 amounted to 47.4 billion m^3 and pipe length is over 12,000 km, fugitive emissions from these activities have high potential to be significant and part of a key category. Therefore, the ERT strongly recommends that Turkey initially estimate and recalculate fugitive emissions for these activities by using tier 1 EFs in its 2015 inventory submission, and encourages Turkey to move to a higher-tier method if it is confirmed that this category is key.

C. Industrial processes and solvent and other product use

1. Sector overview

63. In 2012, emissions from the industrial processes sector amounted to 62,773.50 Gg CO_2 eq, or 14.3 per cent of total GHG emissions, while emissions from the solvent and other product use sector were reported as "NA" and "NE" (only emissions of non-methane volatile organic compounds (NMVOCs) are reported in this sector). Since 1990, emissions have increased by 306.5 per cent in the industrial processes sector. This high increase is partly due to the inclusion of emissions from the iron and steel production category for 2012 but not for 1990. Overall, the key driver for the rise in emissions in the industrial processes sector is the increase in cement production to cover the rise in demand for cement for domestic construction activities. Within the industrial processes sector, 55.2 per cent of the emissions were from mineral products, followed by 31.7 per cent from metal production, 9.0 per cent from consumption of halocarbons and SF_6 and 4.0 per cent from other. The remaining 0.1 per cent were from chemical industry.

64. Turkey has made recalculations between the 2013 and 2014 inventory submissions for the industrial processes sector. The recalculations made by Turkey between the 2013 and 2014 inventory submissions were in the following categories: CO_2 emissions from ammonia production, N_2O emissions from chemical industry and PFC emissions from aluminium production that were included under the category "Other & Undifferentiated Production" (other) in the 2014 submission for the first time for the period 2007–2012. Compared with the 2013 inventory submission, the recalculations increased emissions in the industrial processes sector by 2,404.74 Gg CO_2 eq for 2011 (by 4.3 per cent for the sector and by 0.6 per cent for the total national emissions). The recalculations were not adequately explained in the NIR. The ERT recommends that Turkey improve the explanations and transparency of the information provided on recalculations in its next inventory submission.

65. The ERT noted that Turkey does not report emissions for whole or parts of the following categories:

(a) CO_2 emissions from captive lime of sugar facilities (although CO_2 emissions from marketed lime are reported) under lime production;

(b) CO_2 emissions from soda ash production;

(c) CO_2 emissions from iron and steel production from 1990 to 2009 (only CO_2 emissions from pig iron are reported in the energy sector during this period, while emissions from steel production in electric arc furnaces are not reported);

(d) CO_2 emissions from ferroalloys production;

(e) SF_6 emissions from SF_6 used in aluminium and magnesium foundries;

(f) HFC and PFC emissions from foam blowing, fire extinguishers, aerosols/metered dose inhalers, solvents, other applications using ozone-depleting substance substitutes and semiconductor manufacture under consumption of halocarbons and SF_6;

(g) CO_2 and N_2O emissions from solvent and other product use.

66. During the review, in response to questions raised by the ERT, Turkey informed the ERT that it is elaborating emission estimates for new categories occurring in the country for which methodologies are now available and plans to collect more accurate and extensive data on fluorinated gases (F-gases). The ERT recommends that Turkey establish data

collection methods for those categories currently missing or partly missing from the inventory indicated in paragraph 65 above, estimate and report emissions for these categories and implement the plans on new categories and F-gases in its next inventory submission. The ERT also encourages Turkey to estimate CO_2 and N_2O emissions from solvent and other product use.

67. The ERT noted that the methods, EFs and AD used for the emission estimates are not well documented in the NIR. In particular, the AD and emission estimates are in general not transparent in this sector due to confidentiality restrictions from 2007 onwards, but the ERT considers that the allocation of the estimates and the information provided in the NIR could be easily improved. Therefore, the ERT recommends that Turkey improve its documentation on the industrial processes sector inventory by providing a clear explanation of the methods, EFs and AD applied for all categories, especially for the key categories and the categories reported as "IE" and/or as confidential ("C") and replace, as far as possible, the notation keys used in the CRF tables with values. For the categories which are confidential and the emissions or AD that are reported as "IE" (when it probably should be "C"), the ERT also recommends that Turkey include information on and explanations of the trends and the AD (e.g. in relative values) as well as a description of the methods and EFs and the sources of information in the NIR of its next inventory submission, and encourages Turkey to aggregate, in the CRF tables, confidential subcategories under the industry branch in which they occur.

68. During the review, the ERT noted that default EFs and tier 1 methods are applied for most categories, in general resulting in overestimated emissions (e.g. not taking into account technological developments and abatement technologies). The ERT recommends that Turkey continue its efforts to improve the accuracy of its inventory and use higher-tier methods for the key categories.

69. During the review, the ERT noted that Turkey has implemented limited QC procedures and not implemented any QA activities in the industrial processes sector. Therefore, the ERT recommends that Turkey implement QA/QC activities in the industrial processes sector by:

(a) Cross-checking the emission estimates on an annual basis against independent sources (e.g. by comparing the AD with related national statistics);

(b) Recording the results of such comparisons, including explanations for any discrepancies;

(c) Creating additional tools for QC (e.g. automatic generation of graphs with trends to detect significant or unusual changes);

(d) Using staff not involved in the inventory compilation process to undertake checks, including external additional checks by industry or industrial associations.

2. Key categories

Cement production – CO_2

70. Turkey has estimated CO_2 emissions from cement production based on the aggregated country-specific clinker production data obtained from the Turkish Cement Manufacturers' Association. Default values for the calcium oxide (CaO) content of clinker (a weight fraction of 65.0 per cent), which result in an EF of 0.51 t CO_2/t clinker, and a correction factor of 1.02 for cement kiln dust (CKD) were applied for all years of the time series. Since cement production is a key category, the ERT recommends that Turkey use a tier 2 method and reiterates the recommendation made in the previous review report that Turkey collect plant-specific data (CaO content in clinker, and if possible CKD, and

corresponding country-specific EFs) in its estimate of CO_2 emissions from cement production.

Lime production – CO_2

71. Turkey has estimated CO_2 emissions from lime production based on the production data from the Turkish Lime Association. Due to confidentiality reasons associated with displaying emissions from dolomite use in industrial activities, Turkey reported the CO_2 emissions from dolomite use under lime production. The addition of emissions from dolomite use to lime production from 2002 onwards has led to large fluctuations in the CO_2 IEFs over the time series (from 0.66 to 0.70 t/t). In addition, the ERT noted that applying a different allocation of emissions across the time series is not in line with the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines. During the review, in response to questions raised by the ERT, Turkey confirmed that there are no confidentiality restrictions in the reporting of emissions from lime production. In order to improve the time-series consistency of the emission estimates and the comparability with other Parties' inventories, the ERT recommends that Turkey report CO_2 emissions from lime production separately from the dolomite use estimates in its next inventory submission.

72. During the in-country review, Turkey informed the ERT that there is captive lime production in sugar production facilities in the country, but the captive lime production has not been included in the lime production estimates. The ERT recommends that Turkey include captive lime production emissions in the estimates of this category in its next inventory submission.

Iron and steel production – CO_2

73. The ERT noted that Turkey has estimated process emissions from iron and steel production (steel and coke subcategories) for the period 2010–2012 only. For the years 1990–2009, Turkey reported CO_2 emissions as "IE" and "NA" in CRF table 2(I).A–G and reported these emissions under the energy sector. These CO_2 emissions represent on average around 18,000 Gg annually for the years 2010–2012; however, the decrease of emissions in the iron and steel category in the energy sector for the years 2010–2012 represents only around 3,000 Gg from the average level of emissions for the years 1990–2009, showing a gap of around 15,000 Gg annually. During the review, the ERT noted that emissions from steel produced in electric arc furnaces are completely missing for the period 1990–2009. Process emissions are calculated using data and ratios provided by the three integrated plants in the country and using the tier 2 method from the IPCC good practice guidance. During the review, in response to questions raised by the ERT, Turkey explained that process emissions from coke used as a reducing agent for the period 1990–2009 are included under the iron and steel category in the energy sector. For the period 2010–2012, coke used as a reducing agent was deducted from the energy sector AD and its related process emissions were reported for pig iron and steel production under the iron and steel production category.

74. The ERT noted that applying a different allocation of emissions from iron and steel production across the time series is not in line with the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines. In addition, process emissions from steel production are not reported at all for the period 1990–2009 in either the energy sector or in the industrial processes sector. During the review, Turkey informed the ERT that studies to collect the necessary AD to estimate emissions for iron and steel production for the years prior to 2010 are ongoing. The ERT recommends that Turkey carefully revise the time series for the iron and steel production category in both sectors (energy and industrial processes) in its next inventory submission, allocating the emissions in accordance with the UNFCCC reporting guidelines. The ERT also recommends that Turkey include, in the NIR

of its next inventory submission, an emission trend analysis once the entire time series of iron and steel production process emissions has been revised and estimated.

75. Turkey reported CO_2 emissions from coke as "IE" for the years 1990–2009, and reported actual emissions for the years 2010–2012 in CRF table 2(I).A–G as well as AD on coke. During the review, in response to questions raised by the ERT, Turkey clarified that these emissions and AD refer to coke consumption as a reducing agent used in blast furnaces to produce pig iron. The amount of coke consumption is calculated by applying a factor to the liquid iron provided by the plants and deducted from the amount of coke reported in the energy sector. As this amount is bigger than the amount reported in the energy balance, Turkey assumed that the total amount of coke is used as a reducing agent and the emissions are therefore reported only in the industrial processes sector. The ERT considers that the AD reported in the CRF tables may come from the energy balance, but the AD provided by the plants, which are different, were not reported in the CRF tables. The ERT recommends that Turkey ensure that the energy and industrial processes experts compiling the inventory for this category work together and use a single and common data source with the most accurate data available, sharing information on questionnaires from individual plants, and elaborate the estimates accordingly in the next inventory submission.

76. In addition, the ERT noted that the AD for coke have decreased from 3,387.52 kt in 2004 to 4.07 kt in 2012, while for the years 2005–2009 the AD were reported as "IE". During the review, in response to questions raised by the ERT, Turkey explained that the value for 2012 was an error that will be corrected in the next inventory submission. The ERT recommends that Turkey implement this correction, ensure time-series consistency and implement QA/QC procedures, in particular for this key category.

77. The ERT noted that clear information on the coke production emissions was not provided in the NIR and the CRF tables. During the review, in response to questions raised by the ERT, Turkey confirmed that coke is produced on-site in the integrated plants and explained that the AD and emission estimates from the production of coke are reported in the energy sector under transformation industries. The ERT recommends that Turkey reallocate CO_2 emissions from coke production from this category to the category manufacture of solid fuels and other energy industries in the energy sector in its next inventory submission, and clearly explain the reallocation in the NIR in order to improve the transparency of its reporting.

78. The ERT noted that CO_2 emissions from sinter are reported as "NA" (for the period 1990–2011) and "NE" (for 2012); however, Turkey confirmed that sinter is used in the integrated iron and steel plants. In response to a request from the ERT during the review to provide a carbon mass balance, Turkey confirmed that this information was already provided by one of the three integrated plants and the request to the other two plants had already been sent. Turkey also explained to the ERT that emissions from sinter production and other new parameters will be included in its next inventory submission, by using the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines). The ERT commends Turkey for its efforts to obtain more accurate data and improve the estimates of this category. However, the ERT recommends that, in the NIR of its next inventory submission, Turkey provide a quantitative and qualitative carbon mass balance for its three integrated production plants showing all inputs and outputs to the different processes related to iron and steel production, with the aim of clearly demonstrating which reducing agents and fuel sources are consumed for coke, sinter, and iron and steel production, demonstrating that no double counting or omission of emissions have occurred and improve the transparency of its reporting.

3. Non-key categories

Limestone and dolomite use – CO_2

79. Turkey reports CO_2 emissions from limestone and dolomite used in cement and lime production under the categories corresponding to these industry sectors. Turkey estimates and reports only dolomite use under this category and aggregates the resulting CO_2 emission estimates within the lime production category; all other uses of limestone that produce CO_2 emissions are not estimated. The ERT recommends that Turkey report emissions from the consumption of carbonates in the category where the carbonates are consumed and the CO_2 is emitted, in accordance with the relevant IPCC guidance. If Turkey has to maintain the confidentiality for other sources using dolomite and limestone, the ERT recommends that Turkey report the estimates from these other sources within the category other (mineral products) in its next inventory submission. The ERT also recommends that Turkey provide more information in the NIR on the methodology applied, data sources used and assumptions made for estimating emissions, including graphical representations of trends (in relative values if the information is confidential) to improve the transparency of its next inventory submission.

Soda ash production and use – CO_2

80. In the CRF tables, Turkey reports CO_2 emissions from soda ash use as "NA" for the whole time series and from soda ash production as "IE" for the period 2007–2012. The NIR indicates that emissions from soda ash production and use are confidential and reported aggregated with other categories under "Other & Undifferentiated Production" (other) for the period 2007–2012. These emission estimates were provided to the ERT during the review. When assessing the confidential information provided by the Party, the ERT noted that the notation key used ("IE") is wrong for soda ash production and use, that CO_2 emissions from soda ash production were not estimated for the period 2007–2012 and that CO_2 emissions from soda ash use decreased by 99.3 per cent between the levels of 1990–2009 and 2010–2012. Turkey did not provide the rationale/explanation for this decrease.

81. During the review, in response to a question raised by the ERT, Turkey informed the ERT of its plans to provide estimates for soda ash production in its next inventory submission. The ERT commends Turkey for this planned improvement and recommends that Turkey report these estimates and provide information in the NIR on the data sources used, methodology applied and assumptions made for estimating emissions in its next inventory submission.

82. The ERT recommends that Turkey check the AD and revise the estimates for soda ash use, if necessary, or provide an explanation of the emission trend in the NIR of its next inventory submission.

83. Turkey also informed the ERT that it is elaborating CO_2 emission estimates for glass production and plans to include them in its next inventory submission. The ERT recommends that Turkey allocate emissions from soda ash use in glass production to the respective subcategory in the CRF tables and allocate emissions from soda ash use to other end-use industrial activities under the soda ash use subcategory. If Turkey has to maintain the confidentiality of data for other sources using soda ash, the ERT recommends that Turkey report these estimates within the category other (mineral products) in its next inventory submission. The ERT also recommends that Turkey provide more information in the NIR on the methodology applied, data sources used and assumptions made for estimating emissions, including graphical representations of trends (in relative values if the information is confidential) in order to improve the transparency of its next inventory submission.

Ammonia production – CO_2

84. Turkey reported CO_2 emissions from ammonia production for the years 1990–2006. CO_2 emissions are reported as "C" for the years 2007–2008 and 2011–2012 and "NO" for 2009. The ERT noted that in response to recommendations in previous review reports, Turkey changed the notation key for this category from "NA" for 2009 to "NO", reflecting the fact that, in that year, Turkey relied on imports of ammonia to meet domestic needs and no production occurred in the country. The ERT welcomes this improvement.

85. Due to confidentiality reasons, the CO_2 emissions from ammonia production are reported aggregated with other categories under "Other & Undifferentiated Production" (other) for the years mentioned in paragraph 84 above. These emission estimates were provided to the ERT during the review. CO_2 emissions from ammonia production are estimated using the amount of ammonia produced and a default EF. The ERT noted that the CO_2 emission trend fluctuates considerably, but no explanations were provided to the ERT. In order to increase the transparency and comparability of the inventory, the ERT recommends that Turkey allocate these estimates under other (chemicals) in the CRF tables of its next inventory submission. The ERT also recommends that Turkey provide more information in the NIR on the data sources used, methodology applied and assumptions made for estimating emissions in its next inventory submission, including graphical representations of trends (in relative values if the information is confidential).

86. During the review, Turkey explained to the ERT that natural gas used as feedstock is not subtracted from the total natural gas reported in the energy sector. The ERT concluded that there is a potential double counting of emissions from natural gas used as feedstock for ammonia production in the inventory. Therefore, the ERT recommends that Turkey collect information on natural gas used as feedstock and as fuel in the ammonia production plant and separate the process and combustion emissions in its next inventory submission.

Nitric acid production – N_2O

87. Turkey reported N_2O emissions from nitric acid production as "C" for 2007 onwards and allocated them aggregated with other categories under "Other & Undifferentiated Production" (other). In order to increase the transparency and comparability of the inventory, the ERT recommends that Turkey report these confidential emissions aggregated under other (chemical industry) in its next inventory submission.

88. According to the NIR, N_2O emissions from nitric acid production were recalculated for the whole time series to update EFs but in the CRF tables recalculated emissions were not reported (instead, the AD and EFs were changed to keep N_2O emission estimates constant). During the review, Turkey explained to the ERT that this was a mistake. Therefore, the ERT recommends that Turkey correct the mistake in the CRF tables, report the corresponding revised estimates and implement QA/QC procedures in its next inventory submission. These confidential emission estimates were provided to the ERT during the review. The ERT noted that N_2O emissions from nitric acid production are estimated using a default EF measured in 1996 by a Norwegian medium-pressure plant. The ERT considered that N_2O emissions from nitric acid production are probably overestimated, as the tier 1 method used to prepare the estimates does not take into account abatement technologies that Turkey maybe is using. The ERT recommends that Turkey investigate the use of abatement technologies in the industrial plants and prepare accurate emission estimates accordingly in its next inventory submission.

89. The ERT also recommends that Turkey provide more information in the NIR on the data sources used, methodology applied and assumptions made for estimating emissions, including graphical representations of trends (in relative values if the information is confidential) in its next inventory submission.

Carbide production – CO_2

90. Due to confidentiality reasons, the CO_2 emissions from calcium carbide are reported aggregated with other categories under "Other & Undifferentiated Production" (other) from 2009 to 2012. The ERT recommends that Turkey reallocate these emission estimates under other (chemicals) in the CRF tables to increase the transparency and comparability of its reporting in its next inventory submission. The ERT also recommends that Turkey provide, in its next inventory submission, more information in the NIR on the methodology applied, data sources used and assumptions made for estimating these emissions, for example including graphical representations of trends (in relative values if the information is confidential).

91. Turkey reported CO_2 emissions from calcium carbide production for the period 1990–2004; however, Turkey reported the notation key "NO" for the period 2005–2008 and "IE" for the period 2009–2012, when these emissions became confidential. These confidential emission estimates were provided to the ERT during the review. However, during the review, Turkey did not provide any explanation for the missing estimates from carbide production for the period 2005–2008. Therefore, the ERT recommends that Turkey validate and double-check the AD for the complete time series, provide the missing estimates if they occurred in the country and include explanations for the trend of emissions in the NIR of its next inventory submission.

Other (chemical industry) – CO_2 and CH_4

92. According to the NIR, CO_2 emissions from the following subcategories are reported under "Other & Undifferentiated Production" (other): carbon black, ethylene, dichloroethylene, styrene, methanol and other chemicals. To increase the transparency of the inventory while maintaining confidentiality, the ERT recommends that Turkey provide in the NIR of its next inventory submission more information on the methodology applied, the assumptions made for estimating emissions and the data sources used, including graphical representations of trends (in relative values if the information is confidential), as well as allocate these emissions under other (chemical industry) in the CRF tables. In response to a question raised by the ERT, these confidential emission estimates were provided, by chemical, to the ERT during the review. The ERT noted that emissions from styrene production were reported as "IE" but in reality they were not estimated for the period 1991–2006. Turkey was not able to provide an explanation for this issue. Therefore, the ERT recommends that Turkey validate and double-check the AD on styrene production for the complete time series, provide the missing estimates if they occurred in the country and include explanations for the trend of emissions in the NIR of its next inventory submission.

Ferroalloys production – CO_2

93. Turkey reports CO_2 emissions from ferroalloys production as "IE" for the whole time series. The ERT noted that, in the NIR, it is not clearly explained whether process-related emissions from ferroalloys production are reported under the energy sector and which method is used to estimate CO_2 emissions from this category. In response to a question raised by the ERT during the review, Turkey explained that emissions from fuel consumption are reported in the energy sector under manufacturing industries and construction. Turkey also informed the ERT that process emissions from ferroalloys production will be reported in its next inventory submission for the complete time series. The ERT commends Turkey for this planned improvement. However, in order to improve the transparency and completeness of the inventory, the ERT recommends that Turkey report the missing estimates, clearly describe in the NIR where combustion and process-related emissions are reported and also describe the methods, EFs and AD used for the estimates in its next inventory submission.

Aluminium production – CO_2 and PFCs

94. Due to confidentiality reasons, CO_2 and PFC emissions from aluminium production are reported aggregated with other categories under "Other & Undifferentiated Production" (other) for the period 2007–2012. To increase the transparency and completeness of the inventory while maintaining confidentiality, the ERT recommends that Turkey allocate the emissions under the category other (metal production). These emission estimates were provided to the ERT during the review. The ERT noted that the trend of the PFC IEFs is unstable at the beginning of the time series (ranging from 1.19 to 1.93 kg/t for perfluoromethane (CF_4) and from 0.05 to 0.09 kg/t for perfluoroethane (C_2F_6)). During the review, in response to a question raised by the ERT, Turkey informed the ERT that PFC emissions from aluminium production are estimated using a tier 3 methodology with plant-specific data. Turkey also explained that the quality of the coal tar influences the anode effects and thus the IEFs. The ERT noted that this may happen but does not justify the fluctuation at the beginning of the time series. The ERT recommends that Turkey clearly describe the methods, EFs and AD used for its estimates of both CO_2 and PFC emissions, as well as provide an explanation of the trend of the IEFs in the NIR of its next inventory submission, in order to improve the transparency of its reporting.

SF_6 used in aluminium and magnesium foundries – SF_6

95. The NIR states that SF_6 emissions from aluminium and magnesium foundries are reported aggregated with other categories under "Other & Undifferentiated Production" (other) and are included in the inventory, but the ERT noted that SF_6 emissions are reported as "NA" under this category. In addition, in CRF table 2(II).C, SF_6 emissions from aluminium foundries are reported as "NE" and SF_6 emissions from magnesium foundries are reported as "NA". During the review, Turkey did not confirm whether there are magnesium foundries in the country. Therefore, the ERT recommends that in its next inventory submission Turkey estimate and report complete SF_6 emissions from aluminium and magnesium foundries, aggregated if necessary, or separately if possible. The ERT recommends that, if no estimates can be reported, Turkey, at a minimum, correct the notation key for SF_6 emissions from magnesium foundries from "NA" to "NE" in its next inventory submission.

Consumption of halocarbons and SF_6 – HFCs and SF_6

96. Under this category, Turkey has reported approximate estimates of HFC-134a emissions for refrigeration and air conditioning equipment only. The calculation is based on import and export data of HFC-134a due to a lack of detailed data, making these estimates only potential. The ERT recommends that Turkey establish sound data collection methods to estimate and report actual emission estimates of different F-gas applications under this category in its next inventory submission and investigate the possibility of moving to a higher-tier method for refrigeration and air conditioning equipment, which may be necessary due to the increasing trend in the use of HFCs and corresponding emissions from this category. If Turkey does not have enough data to implement a higher-tier method, the ERT reiterates the recommendation made in the previous review report that Turkey improve the transparency of its reporting by including information on the AD and by providing more information about the method used to calculate emissions for this category in its next inventory submission.

97. During the review, in response to a question raised by the ERT, Turkey explained to the ERT that a Ministerial regulation on F-gases is in preparation and will be implemented in 2015. With this regulation, Turkey expects to collect data at the equipment level as well as more disaggregated data, such as import and export at the equipment/gas levels. The ERT commends Turkey for this planned improvement and recommends that Turkey

implement this mandatory data collection system as planned and increase the completeness and the overall data quality of the inventory for this important category.

98. The ERT noted that Turkey is the only Party reporting SF_6 emissions from fire extinguishers. However, HFC emissions are reported as "NA" under this subcategory. During the review, in response to a question raised by the ERT, Turkey explained that the estimates are based on the results of a project undertaken in 2006 to collect and estimate F-gas emissions. Estimates were elaborated based on the extrapolation of these data and the gross domestic product trend for this subcategory. The ERT concluded that these estimates are not sufficiently reliable and transparent and recommends that, in its next inventory submission, Turkey investigate and document the occurrence of different F-gas species use in different applications in the country and in particular from fire extinguishers.

99. The ERT also recommends that, in its next inventory submission, Turkey increase the accuracy and improve the completeness of the emission estimates under this category by using more appropriate proxies when actual AD are not available for the elaboration of the emission estimates.

Solvent and other product use – CO_2 and N_2O

100. CO_2 and N_2O emissions for the period 1990–2012 for all categories in this sector have been reported as "NE" and "NA". Turkey reports estimates of NMVOCs under this sector for paint application and chemical products manufacturing and processing. During the review, in response to a question raised by the ERT, Turkey explained that CO_2 and N_2O emissions for this sector will be reported in its next submission using the 2006 IPCC Guidelines. The ERT commends Turkey for its plans to elaborate CO_2 and N_2O emission estimates for this sector including all likely occurring emissions in the sector, such as N_2O emissions from use for anaesthesia and other applications, and recommends that Turkey report all likely occurring emissions in the sector in its next inventory submission to improve the completeness of the inventory.

D. Agriculture

1. Sector overview

101. In 2012, emissions from the agriculture sector amounted to 32,280.78 Gg CO_2 eq, or 7.3 per cent of total GHG emissions. Since 1990, emissions have increased by 6.2 per cent. The key driver for the increase in emissions is the increase in the livestock population. Within the sector, 60.2 per cent of the emissions were from enteric fermentation, followed by 24.6 per cent from agricultural soils and 13.7 per cent from manure management. Rice cultivation accounted for 0.8 per cent and field burning of agricultural residues accounted for 0.8 per cent.

102. Turkey has not made recalculations between the 2013 and 2014 inventory submissions for the agriculture sector.

103. The ERT commends Turkey for improving the transparency of its NIR in the 2014 inventory submission, including the information on the contribution of gases and categories within the agriculture sector to total sectoral and total national emissions. However, the ERT reiterates the recommendation made in the previous review report that Turkey provide tables showing the time series for the emissions by category in its NIR, including the interpretation of emission trends, inter-annual changes in emissions and the main drivers of emissions, to improve the transparency of its next inventory submission.

104. The ERT noted that the population size for cattle and buffalo reported in the CRF tables is different from the data provided by TurkStat in its publications. In response to a question raised by the ERT during the review, Turkey explained that the TurkStat data,

which are not fully consistent with the IPCC categories, have been redistributed to IPCC animal categories. Also, the ERT noted that Turkey has included dairy buffalo under dairy cattle without an explanation in the NIR about the reason supporting this decision. These actions generated inconsistencies in the AD reported in both of these sources. The ERT recommends that Turkey explain the redistribution of animal populations and report dairy buffalo separately from dairy cattle to improve the transparency and consistency of the information in the NIR of its next inventory submission.

105. The ERT noted that Turkey has not reported in the NIR national data on milk productivity, gross energy intake and average animal mass used to support the application of default EFs for enteric fermentation and manure management for significant livestock categories. However, during the review, in response to a question raised by the ERT, Turkey provided to the ERT national data on milk productivity and average animal mass for significant livestock categories. The ERT recommends that Turkey use these national data to improve the accuracy of its emission estimates in its next inventory submission.

106. In the previous review report, it was recommended that Turkey provide more transparent information in annexes 3 and 7 to the NIR, including information on the sources of the uncertainties, any issues affecting time-series consistency and category-specific QA/QC and verification procedures for all categories in the agriculture sector. The ERT noted that in the NIR of its 2014 inventory submission, Turkey has included information on "recommendations identified by the expert review team" in a table in annex 3, but no additional information has been reported regarding the recommendations indicated above. Therefore, the ERT reiterates the recommendation made in the previous review report that Turkey provide more transparent information in annexes 3 and 7 to the NIR and, in addition, the ERT recommends that Turkey provide tables showing the time series of the EFs and AD by category used in the estimates, as well as detailed documentation supporting the choice of EFs, including information when default EFs are applied, in order to improve the transparency of its next inventory submission.

107. The recommendations made in the previous review report also included a request that Turkey provide information on category-specific planned improvements in its inventory submission. In response to a request made by the ERT during the review to provide information on these issues, Turkey explained that the inventory quality will be improved by applying a QA/QC plan that is almost ready for application. However, Turkey did not provide information on a category-specific improvement plan in its response. The ERT strongly recommends that Turkey implement the indicated QA/QC plan in its next inventory submission and provide information on category-specific planned improvements for the agriculture sector.

2. Key categories

Enteric fermentation – CH_4

108. Turkey continued to use a tier 1 method to estimate emissions from enteric fermentation using default EFs from the Revised 1996 IPCC Guidelines. In Turkey, there are two types of dairy cattle: culture and domestic. For the dairy cattle (culture) EF, an average value (68.5 kg CH_4/head/year) calculated from the IPCC default values for Asia (56.0 kg CH_4/head/year) and Eastern Europe (81.0 kg CH_4/head/year) was used, while for the dairy cattle (domestic) EF, the IPCC default value for Asia (56.0 kg CH_4/head/year) was chosen. Sheep are categorized as: merinos and domestic. For sheep (domestic) Turkey has used an IPCC default EF for developing countries (5.0 kg CH_4/head/year), while for sheep (merinos) it has used an average value (6.5 kg CH_4/head/year) from the IPCC default EFs for developing countries (5.0 kg CH_4/head/year) and developed countries (8.0 kg CH_4/head/year). In response to a request made by the ERT during the review to provide documentation supporting the choice of EFs, Turkey explained that the chosen average

values were based on expert judgement. However, because CH_4 emissions from enteric fermentation is a key category, the ERT strongly recommends that Turkey, in its next inventory submission, estimate emissions from significant livestock categories using the tier 2 method, including enhanced livestock population characterization, taking into account the relevant IPCC guidance. If this is not possible, the ERT reiterates the recommendation made in the previous review report that Turkey provide documentation supporting any expert judgement (e.g. country-specific studies or research articles) regarding estimation assumptions, taking into account that this category is key. In addition, the ERT recommends that Turkey provide disaggregated time-series data for the dairy cattle population (culture and domestic).

Manure management – CH_4

109. Turkey estimated CH_4 emissions from manure management using a tier 1 method and default EFs for Asia from the Revised 1996 IPCC Guidelines. The ERT noted that the CH_4 IEF for dairy cattle fluctuates over the entire time series (ranging from 8.2 kg/head/year in 1992 to 10.6 kg/head/year in 1999). In response to a question raised by the ERT during the review, Turkey explained that the fluctuations are linked to the variation in the number of animals. The ERT disagrees with such an explanation and, since CH_4 emissions from manure management is a key category, the ERT strongly recommends that Turkey estimate the emissions from significant livestock categories using the tier 2 method with country-specific EFs, including enhanced livestock population characterization, taking into account the relevant IPCC guidance, and provide clear and solid explanations for any fluctuations of the CH_4 IEFs in its next inventory submission.

Manure management – N_2O

110. Turkey reported in the NIR that N_2O emissions from manure management are estimated using a tier 1 method and default EFs from the Revised 1996 IPCC Guidelines. The ERT noted that in CRF table 4.B(b) for N_2O emissions from manure management, Turkey reported nitrogen (N) excretion (Nex) for poultry, camels and llamas, horses, and mules and asses as "NE". Also, Turkey reported the Nex per animal waste management system (AWMS) and the IEFs using notation keys ("NO", "NE" and "NA") only; however, N_2O emissions from liquid systems, solid storage and dry lot and other AWMS have been reported with numerical values. During the review, in response to a question raised by the ERT, Turkey explained that the emissions have been estimated using default values from the 2006 IPCC Guidelines, and provided information supporting its estimations. However, the ERT noted that this information contains mathematical errors and there is a lack of consistency in the animal manure balance used for the emission estimates. Therefore, since N_2O emissions from manure management is a key category, the ERT strongly recommends that Turkey revise its emission estimates by applying national values for Nex and AWMS distribution to improve the accuracy and completeness of its next inventory submission. Moreover, the ERT reiterates the recommendation made in the previous review report that Turkey include documentation on Nex per AWMS, or information on the distribution of AWMS used for the different animal groups to improve the transparency of its next inventory submission.

Direct soil emissions – N_2O

111. Turkey reported in the NIR that N_2O emissions from direct soil emissions are estimated using a tier 1 method and default EFs from the Revised 1996 IPCC Guidelines. The ERT noted that in the table of additional information of CRF table 4.D, Turkey has reported all fractions of N inputs used for the calculations as "NE". Also, the ERT noted that the N_2O IEFs for synthetic fertilizers and animal manure applied to soils for all years of the time series (0.0064 kg N_2O-N/kg N) are the lowest or the second lowest values among reporting Parties (0.0057–0.0142 N_2O-N/kg N) and (0.0040–0.0250 N_2O-N/kg N),

respectively, whereas the N_2O IEFs for crop residue (0.6364 kg N_2O-N/kg N) are the second highest among reporting Parties (0.0091–12.50 kg N_2O-N/kg N). In response to a question raised by the ERT during the review, Turkey explained that these emissions have been estimated using default EFs from the 2006 IPCC Guidelines (0.01 kg N_2O-N/kg N). Also, Turkey stated that a transcription error had been found related to this issue, and N_2O-N emissions were reported in CRF table 4.D instead of N_2O emissions. During the review, Turkey provided the ERT with revised emission estimates. However, the ERT identified mathematical errors in the revised values for animal manure applied to soils and crop residue emissions. The ERT recommends that Turkey report revised emission estimates for synthetic fertilizers, animal manure applied to soils, crop residue and other relevant subcategories for the complete time series in its next inventory submission, considering the methods of the relevant IPCC guidance, as N_2O direct soil emissions is a key category, and in addition improve its QC procedures.

3. Non-key categories

Indirect emissions – N_2O

112. Turkey reported in the NIR that N_2O emissions from indirect emissions are estimated using a tier 1 method and default EFs from the Revised 1996 IPCC Guidelines. During the review, in response to a question raised by the ERT, Turkey explained that these emissions have been estimated using default EFs from the 2006 IPCC Guidelines for N volatized (0.01 kg N_2O-N/kg N) and N leaching and run-off (0.0075 kg N_2O-N/kg N). The ERT noted that the N_2O IEF for N leaching and run-off reported for 2012 (7,500 kg N_2O-N/kg N) is the highest among reporting Parties (0.007–7,500 kg N_2O-N/kg N) and does not correspond to the mentioned default EF. The ERT noted that the previous review report stated that Turkey had informed the previous ERT that a transcription error had been found relating to this issue, but the value of 0.0075 kg N_2O-N/kg N had been used for the estimations. However, the ERT identified mathematical errors in the emission estimates from both N volatilized and N leaching and run-off. The ERT recommends that Turkey revise the emission estimates for this category and report the results in its next inventory submission, considering the methods of the relevant IPCC guidance, and in addition improve its QC procedures.

E. Land use, land-use change and forestry

1. Sector overview

113. In 2012, net removals from the LULUCF sector amounted to 59,815.01 Gg CO_2 eq. Since 1990, net removals have increased by 35.7 per cent. The key driver for the rise in removals is a 35.5 per cent increase in net carbon stock changes in forest since 1990, attributed to improvements in sustainable forest management, afforestation, reforestation on forest land and the conversion of coppices to productive forests in forest land remaining forest land. Within the sector, 60,787.47 Gg CO_2 eq of net removals were from forest land, followed by 116.32 Gg CO_2 eq from cropland. Net emissions were reported from grassland (1,088.77 Gg CO_2 eq). Wetlands, settlements and other land were reported as "NA", "NE" and/or "NO".

114. Turkey has made recalculations between the 2013 and 2014 inventory submissions for this sector. The most significant recalculation made by Turkey between the 2013 and 2014 inventory submissions was in the cropland remaining cropland category. The recalculation was made in response to recommendations by an external expert to modify the growth parameters and maximum biomass carbon stocks of perennial crops. A transcription error in the data on land management changes was simultaneously corrected, although the impact of this correction is not documented. Compared with the 2013 inventory submission, the recalculations decreased cropland emissions in 2011 by 14,879.72 Gg CO_2

(100.8 per cent; changing from emissions to removals) and in 1990 by 24,176.20 Gg CO_2 (101.8 per cent). Compared with the 2013 inventory submission, the recalculated estimates increased net removals in the LULUCF sector by 28,689.15 Gg CO_2 eq (186.5 per cent) in 1990 and by 17,186.01 Gg CO_2 eq (39.4 per cent) in 2011. The methodological recalculations were adequately explained in the NIR, but the correction of the transcription error and its effect were not adequately explained. The ERT recommends that Turkey increase the transparency of its descriptions of the causes and effects of recalculations in its next inventory submission.

115. As noted in several previous review reports, the LULUCF chapter of the NIR lacks transparency; the structure is confusing and there are repetitions in different sections of the chapter. The ERT was informed by Turkey during the review that MFWA is responsible for producing the estimates and the NIR text on forest land, and the Ministry of Agriculture, Food and Livestock (MAFL) is responsible for producing the text and estimates on all other land categories. MAFL transfers the information to MFWA, which assembles the LULUCF chapter and sends it to TurkStat. The ERT found that this information is added but not integrated in the NIR, which explains the obvious disconnection between the components prepared by the two Ministries. The ERT strongly recommends that Turkey strengthen its institutional arrangements to improve the inventory preparation process, specifically the integration of the data and information in the LULUCF sector and the preparation of a more coherent and transparent LULUCF chapter of the NIR in its next inventory submission, in accordance with the outline contained in the UNFCCC reporting guidelines.

116. The description of land categories in the NIR lacks transparency, as noted in previous review reports. The two major sources of land-use category data are the legal forest land definition and the time series of CORINE land-cover information; however, these two data sources have not been harmonized – the legal forest definition and the land-cover data have not been adapted to provide a coherent land framework that would ensure that there are no omissions or double counting of land areas. In response to questions raised by the ERT during the review, Turkey acknowledged that confusion probably exists between several land-use categories, notably between forest land and grassland, as well as between grassland and annual crops in cropland. The ERT further noted large and unexplained discontinuities in land-use areas and consequently in the estimates. The extrapolation of land area data beyond 2006 is not explained in the NIR and Turkey was not able to demonstrate that the spatial integrity is maintained in the data set. Overall, the ERT found that the treatment of land information is not transparent and the reported information appears to be inconsistent, resulting in unreliable estimates in all land categories, especially in cropland and grassland.

117. The ERT strongly recommends that Turkey clarify the description of land categories and check the integrity of the total land area over the entire time series and report its findings in its next inventory submission. Also, the ERT recommends that, using domestic data and information, Turkey 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 in its next inventory submission.

118. The ERT noted that several mandatory categories are not estimated (reported as "NE", "NA" or "NO"): the carbon stock changes in mineral soils from cropland converted to forest land and from grassland converted to forest land; the carbon stock changes in mineral soils from grassland; CO_2 emissions/removals from forest land converted to grassland (all pools); the carbon stock changes from wetlands converted to grassland (biomass and mineral soils pools); CO_2 emissions/removals from forest land converted to wetlands (all pools); CO_2 emissions/removals from forest land, cropland and grassland converted to settlements (all pools); CO_2 emissions/removals from forest land and cropland

converted to other land (all pools); N_2O emissions from disturbance associated with land-use conversion to cropland; CO_2 emissions from agricultural lime application; CO_2 emissions from biomass burning on land converted to forest land; and CH_4 and N_2O emissions from biomass burning on land converted to forest land. In addition, Turkey does not report emissions from the conversion of forest to other land categories, although during the review Turkey provided the ERT with official statistics reporting that in 2012 only, 20,000 ha of forest land were affected by development activities for fossil fuel extraction (6,336 ha), construction of energy facilities (6,730 ha) and various other uses (6,902 ha). The ERT recommends that Turkey use existing data and make all the necessary efforts to collect new data and, in its next inventory submission, report estimates for the mandatory categories, subcategories and pools indicated above, in particular the conversion of forest land to other land-use categories and the carbon stock changes in mineral grassland soils.

119. The ERT noted several instances of incorrect use of notation keys in the CRF tables. For instance, the notation key "NA" is reported for conversion of forest land to cropland; conversion of forest land, settlements and other land to grassland; conversion of settlements and other land to wetlands; conversion of wetlands and settlements to other land; and in the other land category. The notation key "NE" is used when an activity is not expected to occur, such as the conversion of settlements and other land to cropland. Multiple notation keys are used for the same category: for example, CRF table 5.D reports "NO" for the area of cropland and grassland conversion to wetlands, but the carbon gains in the biomass pool are reported as "NE", while the carbon losses are reported as "NO". The ERT recommends that Turkey consistently use the notation key "NO" when an activity does not occur and the notation key "NE" when an activity occurs but emissions are not estimated, such as all land conversions to other land reported in the land-use change matrix in the LULUCF chapter of the NIR.

120. The ERT noted that uncertainty values were provided for forest land parameters and variables and for uncertainty estimates for land-use change emissions as a whole (except for forest-related land-use change) in the LULUCF chapter of the NIR. However, no uncertainty estimate is provided for any of the LULUCF categories in annex 7 to the NIR, where the uncertainty analysis of the inventory is reported, including the whole LULUCF sector (a 40 per cent uncertainty for the AD and 10 per cent for the EFs of the entire LULUCF sector is derived from undocumented expert judgement and reported in the annex). The ERT recommends that Turkey calculate uncertainty estimates for each LULUCF category and for the total sector according to the relevant IPCC guidance in its next inventory submission.

2. Key categories

Forest land – CO_2

121. Forest land emission/removal estimates entirely dominate the emissions and removals in the LULUCF sector. Turkey uses a combination of tier 1 methods (soil pool) and tier 2 methods (biomass and dead organic matter pools) to estimate emissions and removals from forest land. The ERT noted that the NIR provides several forest statistics but does not explain how the forest statistics are used to estimate the carbon stock changes in forest land. During the review, in response to questions raised by the ERT, the Party provided the ERT with access to detailed quantitative information on Turkey's forests, including the significant changes that have occurred in forest management practices over the past several decades. However, Turkey was not able to provide the ERT with adequate explanations of the estimation calculations. The findings of a study completed in the Department of Forest Engineering and communicated to the ERT during the review suggest that there may be incomplete carbon tracking in the living biomass and dead organic matter pools, and that removals in forest land are perhaps overestimated due to the failure to

incorporate the impact on biomass carbon stocks of all human and natural disturbances, including illegal harvesting.

122. The ERT recommends that Turkey: conduct a thorough scientific assessment of its estimation methods used for forest land, ensuring a comprehensive and balanced approach to calculating carbon inputs and outputs in each pool; revise its estimates if needed; and provide clear and complete information in the NIR of its next inventory submission on its data sources and estimation methodology. The ERT further recommends that Turkey assess, in its next inventory submission, the impact on emissions and removals since 1990 of the important changes that occurred in forest management practices, including the rehabilitation of degraded coppice and high forests, the replanting of trees on bare forest land and the increase in harvesting levels.

Cropland – CO_2

123. Turkey uses a tier 2 approach to estimate the carbon stock changes on cropland. Cropland is divided into: perennial crops (fruit and olive orchards, vineyards and poplar plantations); and annual crops (cereals, legumes and horticultural crops). Compared with the 2013 inventory submission, Turkey reported in its 2014 inventory submission a reduced biomass accumulation rate in perennial crops, from 2.1 Mg C/ha/year to 1.0 Mg C/ha/year; Turkey also revised the maximum carbon stocks in the biomass pool from 81.2 Mg C/ha to 10.0 Mg C/ha. During the review, the ERT noted that Turkey assumes that annual crops have permanent standing biomass carbon stocks of 5 Mt/ha, although there is no perennial woody biomass on annual cropland and crops are planted and harvested annually. The ERT concluded that this assumption was not supported by evidence; it further concluded that the use of this assumption resulted in an underestimation of emissions from the conversion of grassland to annual crops under cropland and from perennial to annual crops under cropland, and an underestimation of removals associated with the conversion from annual crops to perennial crops. The ERT strongly recommends that Turkey assume biomass carbon stocks of 0 Mt/ha (tier 1) for annual crops in its next inventory submission and until sufficient evidence is obtained to support a revision of this assumption.

3. Non-key categories

Wetlands – CO_2

124. Turkey has reported emissions from land conversion to wetlands in all years except 2012, where the notation key "NO" is used. The NIR states that emissions from the conversion of both cropland and grassland to wetlands are estimated and that the IPCC gain–loss method is used, but it does not describe the source of AD. The ERT recommends that Turkey explain the trends in AD, taking into consideration the recommendations in paragraph 117 above on consistent land-use information and paragraph 119 above on the proper use of notation keys.

F. Waste

1. Sector overview

125. In 2012, emissions from the waste sector amounted to 36,215.19 Gg CO_2 eq, or 8.2 per cent of total GHG emissions. Since 1990, emissions have increased by 272.5 per cent. The key drivers for the rise in emissions are the increasing population and the significant economic growth in the country, which have had a dramatic impact on the growth of waste generation and resultant landfilling. Within the sector, 90.5 per cent of the emissions were from solid waste disposal on land, followed by 9.5 per cent from wastewater handling. Waste incineration emissions were reported as "IE".

126. Turkey has made recalculations between the 2013 and 2014 inventory submissions for this sector. The recalculations made by Turkey between the 2013 and 2014 inventory submissions were in the solid waste disposal on land and wastewater handling categories. The recalculations were made following changes in AD, such as the use of updated data for CH_4 recovery for 2011 and 2012 in solid waste disposal sites, the update of population data for the years 2000–2012 and new information from surveys of biogas recovery from domestic wastewater facilities for the period 1998–2012 in wastewater handling and the use of new information from facilities for the period 2003–2012 in waste incineration. Compared with the 2013 inventory submission, the recalculations decreased emissions in the waste sector by 817.87 Gg CO_2 eq (2.3 per cent), and decreased total national emissions by 0.2 per cent in 2011. The recalculations had no impact on the emissions for 1990. The recalculations were adequately explained in the NIR.

127. The ERT noted that the transparency of the information in the waste sector is insufficient, as the NIR provides limited explanations and references for the AD, EFs and parameters used in the estimates for all categories of the sector. During the review, Turkey provided the ERT with the data used in the higher-tier calculation for solid waste disposal on land for both the AD and EFs, which the previous review report recommended be included in the NIR, but which had not been reported in the 2014 inventory submission (see para. 133 below). The ERT recommends that Turkey increase the transparency of the information in the NIR by providing clear and comprehensive explanations of the AD, EFs and parameters used in the estimates for all categories of the waste sector, including the provision of figures with detailed information, informative tables, information on the AD acquisition process and choice of EFs, specifically:

(a) For solid waste disposal on land: the number of landfill sites with gas recovery by year, the calculation approach used for the waste generation rate and the source of the population data;

(b) For wastewater handling: details of the weighted average of CH_4 EFs by treatment technology, and data and details of recovery facilities;

(c) For waste incineration: the types of waste incineration facilities and sources of AD.

128. In the waste chapter of the NIR, Turkey reported that the uncertainties of the EFs and AD are determined by expert judgement at TurkStat and the combined uncertainty results of the analysis for the sector are provided in annex 7 to the NIR in detail. However, the ERT noted that annex 7 to the NIR does not contain any information supporting the determination of the uncertainty values by expert judgement for the waste sector and only contains the uncertainty values of the EFs and AD and the values of the combined uncertainty results in tabular format for all categories and sectors of the inventory. During the review, in response to a question raised by the ERT, Turkey informed the ERT that the uncertainty values for all categories are the result of expert judgment. The ERT noted that for its emission estimates in the waste sector, for solid waste disposal on land Turkey uses questionnaire surveys, which are compiled by TurkStat, to provide AD on the quantity and composition of waste to estimate emissions. The ERT recommends that Turkey estimate the country-specific uncertainties of the data obtained from the questionnaire surveys and report the results of the uncertainty analysis together with the supporting data and information in its next inventory submission. If expert judgement is still to be used, the ERT recommends that Turkey include the missing information regarding the determination of the uncertainty values by expert judgement for the waste sector and its validation in accordance with the relevant IPCC guidance in the NIR of its next inventory submission.

129. The ERT noted that the NIR did not provide detailed explanations of QA/QC procedures, as recommended in the previous review report. During the review, Turkey

explained to the ERT that a QA/QC plan for all categories is being prepared and will be implemented in its next inventory submission. The ERT considers that QA/QC improvements are the first step to ensure the accuracy of the estimations and welcomes the planned QA/QC improvements in the waste sector as described by Turkey during the review. Nevertheless, the ERT recommends that Turkey make its best efforts to implement the procedures of the QA/QC plan as planned. Since most of the AD used in the inventory are from the questionnaire surveys, the ERT encourages Turkey to set up reliable QC procedures for the process of retrieving data from the questionnaire surveys for the inventory preparation, including increasing internal cross-checking of data transference from raw data to calculation worksheets in its next inventory submission.

130. The ERT noted that CH_4 and N_2O emissions from industrial wastewater are reported as "NE" (see para. 136 below). The ERT strongly reiterates the recommendation made in the previous review report that Turkey improve the completeness of the waste sector in its next inventory submission, by providing emission estimates for industrial wastewater.

131. The ERT found some inconsistencies and lack of transparency in the NIR and CRF tables of the waste sector inventory, such as the provision of explanations in the NIR on sludge under industrial wastewater, which is reported as "NE" in the CRF tables, and the reporting of total population as "NA" in the additional information table of CRF table 6.A with no data or explanations in the NIR regarding this use of notation keys. The ERT reiterates the recommendation made in the previous review report that Turkey increase the transparency and consistency of the inventory information and strengthen its QC activities during the inventory preparation process for its next inventory submission.

2. Key categories

Solid waste disposal on land – CH_4

132. Turkey used the tier 1 method and default EF values from the Revised 1996 IPCC Guidelines to estimate CH_4 emissions from solid waste disposal on land. The AD are based on the questionnaire surveys (see para. 128 above) and elaborated by TurkStat. As CH_4 emissions from solid waste disposal on land is a key category, the ERT strongly reiterates the recommendation made in previous review reports that Turkey calculate and report the results of the emission estimates from this category using the first-order decay (FOD) method in its next inventory submission, using existing AD and the necessary parameters (see para. 133 below).

133. During the review, Turkey showed the ERT the emission estimation results for this category using the IPCC waste model and implementing the FOD method for the whole time series. The ERT welcomes the trial use of the FOD method. The ERT noted that Turkey has good background data from the questionnaire surveys, which are disaggregated by province and by waste disposal method. These data were obtained from the questionnaire surveys conducted every two years. The reporting system is in accordance with the Official Statistics Programme based on the Turkish Statistics Law No. 5429. Turkey has classified two disposal methods in the waste model: managed landfills and uncategorized landfills. The ERT recommends that Turkey make the best use of the disaggregated data available from the questionnaire surveys by considering the real situation of waste disposal types and categorize this information according to the IPCC disposal types, in particular considering municipal dumping sites. In addition, the ERT commends Turkey for providing the information on its plan to segregate composting from landfill disposal and estimate emissions from biological treatment for the whole time series. The ERT noted that Turkey used the default value for the share of solid waste disposal sites in the IPCC waste model (85 per cent). The ERT recommends that Turkey assess the disaggregated data from the questionnaire surveys and use the real share of solid waste

disposal sites existing in the country for its calculations in the IPCC waste model in its next inventory submission.

134. The ERT noted that Turkey used a degradable organic carbon (DOC) value of 0.15 for the whole time series of its reported tier 1 emission estimates. In response to a question raised by the ERT, Turkey explained that owing to the lack of waste composition data for all years it had adopted this value according to the information on composition of 64 per cent of food waste for the year 1993.[5] The ERT considers that waste composition is a key factor for the CH_4 emission estimates in solid waste disposal sites and the reliability of the waste composition data is very important. Turkey explained, during the review, that the FOD method used available data on waste composition for only two years (1993 and 2006). The ERT encourages Turkey to improve its acquisition of waste composition data by:

(a) In the short term: making additional questions in the questionnaire surveys to the municipalities on waste composition, reviewing the available literature on waste composition in Turkey and assessing its appropriateness to represent the waste composition in the country;

(b) In the long term: conducting field measurements of waste composition across the country.

135. Turkey reported CH_4 gas recovery in its 2014 inventory submission with no detailed explanations on gas recovery systems and gas flaring in the NIR. In response to a question raised by the ERT during the review, Turkey stated that data from facilities were received through the questionnaire surveys, which are a legal requirement for operators under law enforcement. All CH_4 recovery facilities obtained a licence to produce electricity. The amount of recovered CH_4 gas and the amount of electricity produced were collected directly from all licensed recovery facilities. The ERT recommends that Turkey explain these and other details on gas recovery in its next inventory submission. Turkey also informed the ERT that it has no official data on landfill gas flaring and that it has plans to include an additional question on landfill gas flaring in the questionnaire surveys. The ERT welcomes this plan and recommends that Turkey report this information and emission estimates in its next inventory submission.

Wastewater handling – CH_4 and N_2O

136. Under wastewater handling, Turkey reports CH_4 emissions from domestic wastewater treatment and N_2O emissions from human sewage. Emissions of CH_4 and N_2O from industrial wastewater are reported as "NE" and emissions of CH_4 from domestic sludge are reported as "NA". In order to complete the emissions from the waste sector, the ERT recommends that, in its next inventory submission, Turkey estimate industrial wastewater emissions, as indicated in paragraph 137 below, and explain the use of the notation key "NA" for domestic sludge. Turkey used the tier 1 method from the 2006 IPCC Guidelines to estimate CH_4 emissions from wastewater handling and N_2O emissions from human sewage with a default EF. Limited explanations are provided in the NIR on AD acquisition or methodological choice, such as population, share of urban and rural population and share of treatment technology between rural and urban areas. During the review, Turkey provided the ERT with detailed emission estimates and AD, and informed the ERT that the share of rural and urban populations has been determined by expert judgement. The ERT considers that the share of rural and urban populations could change year by year and available statistical data should be used to determine this share. The ERT also recommends that Turkey increase the transparency and accuracy of the information

[5] OECD *Environmental Data: Compendium 2006–2008*. Waste. Available at <http://www.oecd.org/environment/indicators-modelling-outlooks/41878186.pdf>.

reported for this category by providing a table of AD used, with detailed explanations, in the NIR of its next inventory submission, including the available statistical data on the rural and urban populations. The ERT noted that population data are reported as "NA" in CRF table 6.B under the subcategory N_2O emissions from human sewage. Therefore, the ERT reiterates the recommendation made in the previous review report that Turkey improve its QC procedures and report the population of the country in CRF table 6.B in its next inventory submission.

137. During the review, Turkey provided the ERT with the calculation of CH_4 emissions from industrial wastewater using the method from the 2006 IPCC Guidelines with AD from TurkStat and default EFs. The ERT welcomed this trial calculation and commends Turkey for its efforts to group industrial types from the Statistical Classification of Economic Activities in the European Community (NACE) system into the IPCC industrial types in order to be in line with the IPCC methodology. Nevertheless, the ERT found some methodological mistakes and recommends that Turkey use the amount of wastewater that enters into the treatment plant instead of the wastewater discharge to the environment in its next inventory submission. Furthermore, the ERT encourages Turkey to estimate the amount of wastewater produced in different industries by converting annual industrial product output to quantity of wastewater produced. Taking into account the fact that CH_4 emissions from wastewater handling is a key category, the ERT also encourages Turkey to increase its efforts on existing data acquisition (such as chemical oxygen demand (COD) concentration by type of industrial wastewater, and fraction of wastewater treated anaerobically) and use default values and expert judgement as the last resort in its estimates for this category in its next inventory submission.

138. The ERT noted that for the first time Turkey reported CH_4 recovery from domestic wastewater handling in the 2014 inventory submission due to new information received, and that CH_4 recovery is a factor influencing the trend of the wastewater handling category. During the review, Turkey informed the ERT that recalculations may be affected by the fact that data are collected from the questionnaire surveys, which are only conducted every two years. The ERT recommends that Turkey increase the consistency of its emission estimates by interpolating data for the missing years for the whole time series.

3. Non-key categories

Waste incineration – CO_2, CH_4 and N_2O

139. Turkey has estimated CO_2, CH_4 and N_2O emissions from waste incineration for the period 1995–2012 using the tier 1 methodology from the 2006 IPCC Guidelines. These emissions are allocated to the energy sector and reported as "IE" in the waste sector. During the review, Turkey provided the ERT with the detail calculation of emissions, including a table of AD and EFs from the 2006 IPCC Guidelines. Turkey has three incinerators, which have incinerated medical waste in 1995 and hazardous waste since 1999 onwards. In response to a question raised by the ERT during the review, Turkey explained that the emission estimates are overestimated because the CH_4 and N_2O EFs used were for biomass burning instead of incineration. The ERT commends Turkey for its efforts to report these emissions, but recommends that Turkey increase the transparency of its emission estimates by including the detailed information provided to the ERT during the review and by using appropriate EFs in its next inventory submission. The ERT encourages Turkey to conduct a detailed survey of AD, including annual quantity of waste incinerated, types of technology used (e.g. continuous stroke type, batch stroke type, etc.) in order to improve the quality of the estimates in its next inventory submission.

III. Conclusions and recommendations

A. Conclusions

140. Table 6 summarizes the ERT's conclusions on the 2014 inventory submission of Turkey, in accordance with the UNFCCC review guidelines.

Table 6
Expert review team's conclusions on the 2014 inventory submission of Turkey

		Paragraph cross references for identified problems
The ERT concludes that the inventory submission of Turkey is not complete with regard to categories, gases and years, but is complete with regard to geographical boundaries and contains both an NIR and CRF tables for 1990–2012		
Energy, industrial processes, solvent and other product use, agriculture and waste[a]	Not complete	26, 65, 100, 130
Land use, land-use change and forestry[a]	Not complete	118
The ERT concludes that the inventory submission of Turkey has been prepared and reported in accordance with the UNFCCC reporting guidelines	Generally	12, 38, 41, 53, 71, 74, 115
Turkey's inventory is in accordance with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF	No	16, 17, 38–40, 42, 43, 60, 71, 74
The institutional arrangements continue to perform their required functions	Yes	

Abbreviations: CRF = common reporting format, ERT = expert review team, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, IPCC good practice guidance for LULUCF = IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*, NIR = national inventory report, Revised 1996 IPCC Guidelines = *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, UNFCCC 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 inventories".

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the IPCC *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

B. Recommendations

141. The ERT identified the issues for improvement listed in table 7. All recommendations are for the next inventory submission, unless otherwise specified.

Table 7
Recommendations identified by the expert review team

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
Cross-cutting	Recalculations	Include detailed information on the performed recalculations in the specific NIR chapter and relevant CRF tables and provide explanatory information, including the rationale for the recalculations	No	9
	Time-series consistency	Consistently use AD, EFs, notation keys and other parameters throughout the inventory, particularly in the energy and LULUCF sectors, as well as correct the allocation of emissions from coke use in iron and steel production and ensure the consistent use of AD between sectors	Yes	10
	QA/QC	Implement the QA/QC procedures envisaged in the QA/QC plan, strengthening the quality of reporting, and pay particular attention to the general and specific QC measures of the inventory and ensure that all the institutions involved in the inventory preparation process realize the importance of the QC procedures and check the quality of their inputs to the inventory	Yes	11
		Fully implement the recommendations on QA/QC from previous review reports	Yes	11
	Transparency	Provide adequate descriptions of the key drivers for the emission trends; fully and transparently describe actions taken and decisions made during the inventory preparation process, as well as expert judgement used for the selection of AD, EF and methodologies; report emissions from the categories with confidential data by aggregating them at a more appropriate category level; and more closely follow the annotated NIR outline, including the provision of appropriate category-specific information	Yes	12
	Key categories analysis	Improve the key category analysis by providing the trend analysis, and adhere closely to the recommendations of the relevant IPCC guidance for example, by including the categories that are currently reported as “NE”, and use the results to prioritize inventory improvements	No	16
		Perform a qualitative key category analysis for the categories currently aggregated in the category other for the industrial processes sector due to confidentiality reasons, and include the results of this analysis	No	16

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
	Uncertainty analysis	Perform the uncertainty analysis both on the total level of emissions and the trend, including and excluding LULUCF, in accordance with the recommendations in the relevant IPCC guidance, in particular by disaggregating the LULUCF sector into the relevant categories and using country-specific uncertainty values or default values, where appropriate, together with adequate expert judgement and transparently documented considerations and assumptions made during the analysis	No	17
		Use the results of the uncertainty analysis to prioritize the improvements of the inventory	No	17
Energy	Overview	Address the problem of the unrecorded recalculation on marine bunkers by revising the CRF tables, providing sufficient explanation in the NIR and further checking the impact of this recalculation on the navigation and GHG emission totals	No	24
		Include a separate section in the energy chapter of the NIR providing all detailed information on, and the rationale for, recalculations	No	24
		Provide detailed data on the EFs and AD for key categories in the NIR with a clear description of the sources of these data, and how and why they change throughout the time series, and provide transparent explanations of the methodologies used to estimate the emissions from the energy sector	Yes	25
		Include emission estimates for the mandatory categories in the energy sector that have been identified with issues related to completeness in the 2014 inventory submission	No	27
		Use country-specific EFs and parameters for all fuels, in particular for the key categories, and develop country-specific carbon content values for critically important lignite and natural gas	Yes	28
		Implement strong QC procedures to avoid mistakes and input errors, ensure the correct choice of NCVs and EFs, enable and improve an appropriate data collection system and enhance cooperation among relevant stakeholders to improve the quality of the energy balance	No	29
		Revise and correct all inconsistencies and incorrect uses of notation keys	Yes	30

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
		Strengthen efforts to address the recommendations made in previous review reports and implement the recommended improvements to the extent possible	Yes	31
	Reference approach	Make the necessary efforts to understand all the reasons for the differences in the estimates between the sectoral and reference approaches, and correct these estimates where necessary, ensuring that the sectoral approach estimates are complete, consistent and accurate	No	33
		Revise the reporting in CRF table 1.A(C) to improve consistency and comparability	No	34
		Revise the reference approach calculation for the year 2011 and include the updated information in the next submission, as well as improve the QC procedures	No	35
		Investigate further the reasons for discrepancies between the inventory data and IEA data	Yes	36
		Revise the calorific value used for natural gas for the period 1990–2010 in the reference approach and ensure the consistency of these data for the complete time series	No	37
	International bunker fuels	Develop a sound technical and consistent approach to disaggregate fuel use in domestic and international activities in strict accordance with the relevant IPCC guidance and definitions and the UNFCCC reporting guidelines	No	38
		Report emission estimates for international bunker fuels for the entire time series	Yes	38
		Determine a reliable data source for international bunker fuels and improve time-series consistency in line with the relevant IPCC guidance	No	39
		Revise the EFs for CH_4 and N_2O and calculation inputs used for the emission estimates for both aviation and marine bunkers	No	39
		Improve the consistency between CRF tables 1.C and 1.A(b) and harmonize and correct the information reported in these tables, and apply QC measures for the estimates	No	40
	Feedstocks and non-energy use of fuels	Revise the use of the notation key “NA” and provide the relevant information in the additional information boxes in the relevant CRF tables	Yes	41

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
		Provide information on feedstocks and non-energy use of coking coal	No	41
	Stationary combustion: liquid, solid and gaseous fuels – CO_2	Disaggregate emissions from auto-producers and manufacture of solid fuels from public electricity and heat production in line with the relevant IPCC guidance, and if this is not possible, provide a clear description and explanations in the NIR and relevant CRF tables, including CRF table 9(a)	No	42
		Use country-specific carbon content factors consistent with the country-specific NCVs for the fuels used in the public electricity and heat production category, and in the energy sector activities in general	Yes	43
		Include all information on the country-specific data used in the public electricity and heat production category, enabling a comparison with the IPCC default value, and improve transparency and enhance efforts to ensure the consistency of the NIR	No	44
		Revise the emission estimates from the public electricity and heat production category, and substantially improve the corresponding QC procedures	No	45
		Carefully re-examine the NCV values used for lignite in the public electricity and heat production category, provide transparent explanations and revise the emission calculation for this category	No	46
		Check the energy consumption (liquid fuel) in the petroleum refining category to avoid any omission, revise the estimates and provide clear explanations in the NIR	No	47
		Correct the consumption values of natural gas in the petroleum refining category, and improve the QC procedures	No	48
		Check the AD and EFs used in the emission estimates for manufacturing industries and construction, in particular for the period 2007–2012, and provide information on trends and any explainable changes	No	49
		Correct mistakes, check all AD relevant to gaseous fuels across the inventory, and revise these systematic problems in the 2015 inventory submission to improve the time-series	No	50

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
		consistency and accuracy of the emission estimates		
		Revise the fuel allocation and EFs and AD used across the categories under manufacturing industries and construction to improve time-series consistency, improve the QC procedures and provide sufficient information on the inter-annual changes of the CO_2 EFs in the NIR	No	51
		Maintain the comparability of CRF table 1.A(a) without too much disaggregation under the category other by moving fertilizer to chemicals, road motor vehicles to road transportation and sugar to food processing, beverages and tobacco, while at the same time providing information on all these disaggregated subcategories in the NIR to improve transparency	No	52
		Revise the allocation of CO_2 emissions from the iron and steel subcategory by disaggregating combustion and process emissions and include in the NIR a carbon mass balance for iron and steel production	No	53
		Include the information on the reasons why rural diesel is allocated to road transportation, and revise the emission estimates by reallocating the diesel oil used for agriculture purposes to the subcategory agriculture/forestry/fisheries and provide clear explanations in the NIR on the assumptions used	No	54
	Stationary combustion: solid fuels – CH_4	Correct the errors and revise the CH_4 emission estimates from the subcategory residential to improve accuracy and consistency	No	55
	Civil aviation: liquid fuels – CO_2	Improve the QC procedures by further checking the AD to avoid any mistyping and input errors, and provide more supporting information to explain fluctuations in AD	No	56
		Revise the CO_2 EFs for jet kerosene for 2002 and 2003 and improve the QC procedures	No	57
	Road transportation: liquid fuels – CO_2, CH_4 and N_2O	Use country-specific NCVs and carbon content factors for the fuels used in the country in order to estimate CO_2 emissions; move to a higher-tier method for calculating N_2O (and CH_4) emissions using appropriate EFs; and improve transparency in the NIR	No	58

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
		Revise and improve the method used to estimate vehicle-kilometres travelled and all the other parameters to be used when a higher-tier method is to be applied to its estimates	No	59
	Coal mining and handling: solid fuels – CH_4 and CO_2	Use statistical data available in the Directorate General of Mining Affairs and Lignite Authority or any other relevant source	No	60
	Oil and natural gas: liquid and solid fuels – CO_2 and CH_4	Include all specific AD and IEFs in CRF table 1.B.2 and the NIR to improve transparency	No	61
		Estimate and recalculate fugitive emissions from natural gas distribution by using tier 1 EFs	No	62
Industrial processes and solvent and other product use	Overview	Improve the explanations and transparency of the information provided on recalculations	No	64
		Establish data collection methods for those categories currently missing or partly missing from the inventory, estimate and report emissions for these categories and implement the plans on new categories and F-gases	No	66
		Provide a clear explanation of the methods, EFs and AD applied for all categories, especially for the key categories and the categories reported as “IE” and/or as “C”	No	67
		For the categories which are confidential and the emissions or AD are reported as “IE”, include in the NIR information on and explanations of the trends and the AD (e.g. in relative values) as well as a description of the methods and EFs and the sources	No	67
		Continue efforts to improve the accuracy of the inventory, and use higher-tier methods for the key categories	No	68
		Implement QA/QC activities in the industrial processes sector such as cross-checking the emission estimates on an annual basis against independent sources (e.g. by comparing the AD with related national statistics); recording the results of such comparisons, including explanations for any discrepancies; creating additional tools for QC (e.g. automatic	No	69

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
		generation of graphs with trends to detect significant or unusual changes); using staff not involved in the inventory compilation process to undertake checks, including external additional checks by industry or industrial associations		
	Cement production – CO_2	Use a tier 2 method and collect plant-specific data (CaO content of clinker, and if possible CKD, and corresponding country-specific EFs)	Yes	70
	Lime production – CO_2	Report CO_2 emissions from lime production separately from the dolomite use estimates	No	71
		Include captive lime production in the emission estimates	No	72
	Iron and steel production – CO_2	Revise the time series of emissions for iron and steel production, in particular for the years 1990–2009, allocating the emissions in accordance with the UNFCCC reporting guidelines	No	74
		Include an emissions trend analysis in the NIR after the entire time series of iron and steel production process emissions has been estimated	No	74
		Ensure that the energy and industrial processes experts compiling the inventory for this category work together, and use a single and common data source for estimating emissions from iron and steel production in the energy and industrial processes sectors with the most accurate data available, sharing information on questionnaires from individual plants, and elaborate the estimates accordingly	No	75
		Correct the AD for coke for the entire time series, ensure time-series consistency and implement QA/QC procedures	No	76
		Reallocate CO_2 emissions from coke production under iron and steel production (manufacturing industries and construction) to the category manufacture of solid fuels and other energy industries in the energy sector, and clearly explain the reallocation in the NIR	No	77
		Provide a quantitative and qualitative carbon mass balance for all three integrated production plants showing all inputs and outputs to the different processes related to iron and steel production, with the aim of clearly demonstrating which reducing agents and fuel	No	78

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
		sources are consumed for coke, sinter, iron and steel production and that no double counting or omission of emissions have occurred		
	Limestone and dolomite use – CO_2	Report emissions from the consumption of carbonates in the category where the carbonates are consumed and the CO_2 is emitted, in accordance with the relevant IPCC guidance	No	79
		Report the estimates from the other sources, using dolomite and limestone, where confidentiality has to be maintained, within the category other (mineral products)	No	79
		Provide more information in the NIR on the methodology applied, the assumptions made for estimating the AD and emissions and the data sources used, including graphical representations of trends	No	79
	Soda ash production and use – CO_2	Report estimates for soda ash production and provide information in the NIR on the data sources used, methodology applied and assumptions made for estimating emissions	No	81
		Check the AD and revise the estimates for soda ash use, if necessary, or provide an explanation of the emission trend in the NIR	No	82
		Allocate emissions from soda ash use to the end-use sectors where soda ash is used	No	83
		Report the estimates from the other sources using soda ash where confidentiality has to be maintained within the category other (mineral products)	No	83
		Provide information in the NIR on the data sources used, the methodology applied and the assumptions made for estimating emissions	No	83
	Ammonia production – CO_2	Allocate emissions under other (chemicals) in the CRF tables and provide more information in the NIR on the data sources used, the methodology applied and the assumptions made for estimating emissions, including graphical representations of trends	No	85
		Collect information on natural gas used as feedstock and as fuel in the ammonia production plant and separate the process and combustion emissions	No	86

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
	Nitric acid production – CO_2	Report the confidential emissions aggregated under other (chemical industry)	No	87
		Correct the mistake in the CRF tables, report the corresponding revised estimates and implement QA/QC procedures	No	88
		Investigate the use of abatement technologies in the industrial plants and elaborate the estimates accordingly	No	88
		Provide more information in the NIR on the data sources used, methodology applied and assumptions made for estimating emissions, including graphical representations of trends	No	89
	Carbide production – CO_2	Reallocate the estimates under other (chemicals) in the CRF tables and provide more information in the NIR on the methodology applied, the data sources used and the assumptions made for estimating emissions, including graphical representations of trends	No	90
		Validate and double-check the AD for the complete time series, provide the missing estimates if they occurred in the country and include explanations on the trend of emissions in the NIR	No	91
	Other (chemical industry) – CO_2 and CH_4	Provide more information in the NIR on the methodology applied, the assumptions made for estimating emissions and the data sources used, including graphical representations of trends	No	92
		Validate and double-check the AD on styrene production for the complete time series, provide the missing estimates if they occurred in the country and include explanations on the trend of emissions in the NIR	No	92
	Ferroalloys production – CO_2	Report the missing estimates, clearly describe in the NIR where combustion and process-related emissions are reported and also describe the methods, EFs and AD used for the estimates	No	93
	Aluminium production – CO_2 and PFCs	Allocate the whole time series under the category other (metal production) to maintain confidentiality	No	94
		Clearly describe the methods, EFs and AD used for the estimates of both CO_2 and PFC emissions, as well as provide an explanation of the trend of the IEFs in the NIR	No	94

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
	SF_6 used in aluminium and magnesium foundries – SF_6	Estimate and report complete SF_6 emissions from aluminium and magnesium foundries, aggregated if necessary, or separately, if possible	No	95
		Correct the notation key for SF_6 used in magnesium foundries from "NA" to "NE", if the estimation of SF_6 emissions from aluminium and magnesium foundries is not possible	No	95
	Consumption of halocarbons and SF_6 – HFCs and SF_6	Establish sound data collection methods to estimate and report actual emissions of different F-gas applications and investigate the possibility of moving to a higher-tier method for refrigeration and air conditioning equipment	No	96
		Improve the transparency of the reporting by including information on the AD and by providing more information about the method used to calculate the emissions	Yes	96
		Implement the mandatory collection system of data for F-gases and increase the completeness and the overall data quality of the inventory	No	97
		Investigate and document the occurrence of different F-gas species use in different applications in the country and in particular from fire extinguishers	No	98
		Increase the accuracy and improve the completeness of the emission estimates by using more appropriate proxies when actual AD are not available for the elaboration of the emission estimates	No	99
	Solvent and other product use – CO_2 and N_2O	Include all likely occurring emissions in the sector, such as N_2O emissions from use for anaesthesia and other applications, to improve the completeness of the inventory	No	100
Agriculture	Overview	Provide tables showing the time series for the emissions by category in the NIR, including the interpretation of emission trends, emissions, inter-annual changes in emissions and the main drivers of emissions	Yes	103
		Explain the redistribution of cattle and buffalo populations and report dairy buffalo separately from dairy cattle	No	104
		Use the national data on milk productivity, gross energy intake and average animal mass	No	105

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
		Provide more transparent information in annexes 3 and 7 to the NIR 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	Yes	106
		Implement a QA/QC plan and provide information on category-specific planned improvements for the agriculture sector	Yes	107
	Enteric fermentation – CH_4	Estimate emissions from significant livestock categories using the tier 2 method, including enhanced livestock population characterization, taking into account the relevant IPCC guidance. If this is not possible, provide documentation supporting any expert judgement	Yes	108
		Provide the disaggregated time-series data for dairy cattle (culture and domestic)	No	108
	Manure management – CH_4	Estimate the emissions from significant livestock categories using the tier 2 method with country-specific EFs, including enhanced livestock population characterization, and taking into account the relevant IPCC guidance	No	109
		Provide an explanation of the fluctuation of the CH_4 IEFs and estimate the emissions from significant livestock categories using a higher-tier method	No	109
	Manure management – N_2O	Revise the emission estimates by applying national values of Nex and AWMS distribution	No	110
		Include documentation on Nex per AWMS, or information on the distribution of AWMS used for the different animal groups	Yes	110
	Direct soil emissions – N_2O	Report revised emission estimates for synthetic fertilizers, animal manure applied to soils, crop residue and other relevant subcategories for the complete time series, considering the methods of the relevant IPCC guidance and improve the QC procedures	No	111
	Indirect soil emissions – N_2O	Revise and report the emission estimates, considering the methods of the relevant IPCC guidance and improve the QC procedures	No	112
LULUCF	Overview	Increase the transparency of the descriptions of the causes and effects of recalculations	No	114

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
		Strengthen the institutional arrangements to improve the inventory preparation, specifically the integration of the data and information in the LULUCF sector and the preparation of a more coherent LULUCF chapter of the NIR, in accordance with the outline contained in the UNFCCC reporting guidelines	No	115
		Clarify the description of land categories, check the integrity of the total land area over the entire time series and report on the findings	No	117
		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	No	117
		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, in particular the conversion of forest land to other land-use categories and the carbon stock changes in mineral grassland soils	No	118
		Consistently use the notation key “NO” when an activity does not occur, and the notation key “NE” when an activity occurs but emissions are not estimated	No	119
		Calculate uncertainty estimates for each LULUCF category and for the total sector according to the relevant IPCC guidance	No	120
	Forest land – CO_2	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 in each pool; revise the estimates if needed; and provide clear and complete information in the NIR on the data sources and estimation methodology	No	122
		Include the assessment of the impact on emissions and removals since 1990 of the important changes that occurred in forest management practices	No	122

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
	Cropland – CO_2	Assume biomass carbon stocks of 0 Mt/ha (tier 1) for annual crops unless sufficient evidence is obtained to support a revision of this assumption	No	123
	Wetlands – CO_2	Explain the trends in AD, taking into consideration the recommendations on consistent land-use information and on the proper use of notation keys	No	124
Waste	Overview	Provide clear and comprehensive explanations of the AD, EFs and parameters used in the estimates for all categories of the waste sector, including the provision of figures with detailed information, informative tables, information on AD acquisition and choice of EFs used	Yes	127
		Estimate the country-specific uncertainties of the data obtained from the questionnaire surveys and report the results of the uncertainty analysis together with supporting data and information, including the determination of the uncertainty values by expert judgement and its validation in accordance with the relevant IPCC guidance, if expert judgement is still to be used	Yes	128
		Make the best efforts to implement the procedures of the QA/QC plan as planned	No	129
		Estimate industrial wastewater emissions	Yes	130
		Increase the transparency and consistency of the inventory information and strengthen the QC activities during the inventory preparation process	Yes	131
	Solid waste disposal on land – CH_4	Calculate and report emissions from solid waste disposal on land using the FOD method, using existing AD and the necessary parameters	Yes	132
		Make the best use of the disaggregated data from the questionnaire by considering the situation of disposal types in solid waste disposal on land and categorize this information according to the IPCC disposal types, in particular considering municipal dumping sites	No	133
		Assess the disaggregated data from the questionnaire surveys and use the real share of solid waste disposal sites existing in the country for the calculations in the IPCC waste model	No	133
		Explain the landfill gas recovery details and report the information on landfill gas flaring and emission estimates	No	135

Sector	*Category/cross-cutting issue*	*Recommendation*	*Reiteration of previous recommendation?*	*Paragraph cross-references*
	Wastewater handling – CH_4, N_2O	Estimate industrial wastewater emissions and explain the use of the notation key "NA" for domestic sludge	No	136
		Increase the transparency and accuracy of the information by providing a table of AD used, with detailed explanations, in the NIR, including the available statistical data on the rural and urban populations	No	136
		Improve the QC procedures and report the population of the country in CRF table 6.B	Yes	136
		Use the amount of wastewater that enters into treatment plants instead of wastewater discharge to the environment	No	137
		Increase the consistency of the emission estimates for CH_4 recovery from domestic wastewater handling by interpolating data for the missing years for the whole time series	No	138
	Waste incineration – CO_2, CH_4, N_2O	Increase the transparency of the emission estimates by including the detailed information on the calculation of emissions, the AD and the EFs, and by using appropriate EFs	No	139

Abbreviations: AD = activity data, AWMS = animal waste management system, C = confidential, CKD = cement kiln dust, CRF = common reporting format, EF = emission factor, ERT = expert review team, F-gas = fluorinated gas, FOD = first-order decay, GHG = greenhouse gas, IE = included elsewhere, IEA = International Energy Agency, IEF = implied emission factor, IPCC = Intergovernmental Panel on Climate Change, LULUCF = land use, land-use change and forestry, NA = not applicable, NCV = net calorific value, NE = not estimated, Nex = Nitrogen excretion, NIR = national inventory report, NO = not occurring, QA/QC = quality assurance/quality control, UNFCCC 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 inventories".

Annex I

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

Status report for Turkey 2014. Available at <http://unfccc.int/resource/docs/2014/asr/tur.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2014. Available at <http://unfccc.int/resource/webdocs/sai/2014.pdf>.

FCCC/ARR/2013/TUR. Report of the individual review of the inventory submission of Turkey submitted in 2013. Available at <http://unfccc.int/resource/docs/2014/arr/tur.pdf>.

B. Additional information provided by the Turkey

Responses to questions during the review were received from Ms. Aynur Tokel (Turkish Statistical Institute), including additional material on the methodology and assumptions used. The following documents[1] were also provided by Turkey:

Energy:

Electronic WORD document on Bunker definition in Energy Balance Table.

[1] Reproduced as received from the Party.

7 Copies of information on plant-specific NCV and carbon content data from electricity generation and heat production sector.

Industrial processes:

All excel files containing the detailed calculations for the emissions estimates reported as confidential.

Agriculture sector:

4.A Enteric Fermentation & 4.B Manure Management (CH4).xlsx

4.B Manure M.(N2O) & 4.D.1.2 Animal Manure Applied (N2O).xlsx

4.C Rice Cultivation (CH4) & 4.F Field Burning (CH4-N2O).xlsx

4.D.1.1 Synthetic Fertilizers (N2O).xlsx

4.D.1.3 N-fixing Crops (N2O) & 4.D.1.4 Crop Residue (N2O).xlsx

4.D.2 Pasture Range Paddock & 4.D.3 Indirect Emissions (N2O).xlsx

Bovine_Animals_2012.xls

Milk_Yield.xls, File Slaughtered_Weight.xls

N2O_EFs.xlsx

N2O_Pasture, Range and Paddock Manure.xls

N2O_Synthetic Fertilizers.xls

N2O_SYSTEM.xlsx

Nex(T).xlsx

Slaughtered_Weight.xlsx

Typical_Animal_Mass.xlsx

Weight_Sheep.htm

LULUCF:

KARABIYIK, S. Banu 2014 Biomass Carbon Stock of Turkish forests: Comparison of Different Calculation Methods M.Sc. Thesis (abstract). Istanbul University Department of Forest Engineering. Ministry of Forestry and Water Affairs 2014 2012 Forestry Statistics Ankara

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
C_2F_6	hexafluoroethane
C	carbon
C	confidential
CaO	calcium oxide
CF_4	tetrafluoromethane
CH_4	methane
CKD	cement kiln dust
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
ERT	expert review team
FOD	first order decay
F-gas	fluorinated gas
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
GJ	gigajoule (1 GJ = 10^9 joule)
ha	hectare
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
kcal	kilocalorie (1 kcal = 10^3 calorie)
kg	kilogram (1 kg = 1,000 grams)
kJ	kilojoule (1 kJ = 10^3 joule)
LULUCF	land use, land-use change and forestry
m^3	cubic metre
mg	milligram (1,000 mg = 1 gram)
Mt	megatonne (1 Mt = 10^6 tonne)
kt	thousand tonnes
N	nitrogen
NA	not applicable
NE	not estimated
Nex	nitrogen excretion
N_2O	nitrous oxide
NIR	national inventory report
NMVOC	non-methane volatile organic compound
NO	not occurring
NVC	net calorific value
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10^{15} joule)
QA/QC	quality assurance/quality control
SF_6	sulphur hexafluoride

TJ	terajoule (1 TJ = 10^{12} joule)
t	tonne
UNFCCC	United Nations Framework Convention on Climate Change