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Report of the individual review of the inventory submission of Turkey submitted in 2011*

* In the symbol for this document, 2011 refers to the year in which the inventory was submitted, and not to the year of publication.

Contents

I. Introduction and summary

A. Overview

1. This report covers the centralized review of the 2011 inventory submission of Turkey, coordinated by the UNFCCC secretariat, in accordance with decision 19/CP.8. The review took place from 19 to 24 September 2011 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Takeshi Enoki (Japan) and Mr. Dennis Rudov (Belarus); energy – Mr. Tomas Gustafsson (Sweden), Ms. Agnieszka Janowska (European Union) and Ms. Inga Valuntiene (Lithuania); industrial processes – Mr. Kiyoto Tanabe (Japan) and Mr. Hongwei Yang (China); agriculture – Ms. Britta Hoem (Norway) and Ms. Tajda Mekinda-Majaron (Slovenia); land use, land-use change and forestry (LULUCF) – Mr. Kevin Black (Ireland) and Mr. Robert de Ligt (Australia); and waste – Ms. Sirinthornthep Towprayoon (Thailand) and Ms. Medea Inashvili (Georgia). Mr. Kiyoto Tanabe and Mr. Hongwei Yang were the lead reviewers. The review was coordinated by Ms. Sevdalina Todorova-Brankova and Ms. Astrid Olsson (UNFCCC secretariat).

2. 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), a draft version of this report was communicated to the Government of Turkey, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Emission profiles and trends

3. In 2009, the main greenhouse gas (GHG) in Turkey was carbon dioxide (CO_2), accounting for 80.9 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (14.7 per cent) and nitrous oxide (N_2O) (3.4 per cent). Hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.0 per cent of the overall GHG emissions in the country. Perfluorocarbons (PFCs) were reported as not estimated ("NE"), confidential ("C") or not applicable ("NA"). The energy sector accounted for 75.3 per cent of total GHG emissions, followed by the waste sector (9.2 per cent), the industrial processes sector (8.6 per cent) and the agriculture sector (7.0 per cent). Total GHG emissions amounted to 369,647.82 Gg CO_2 eq and increased by 97.6 per cent between 1990 and 2009. Emissions for PFCs have not been reported or included in total emissions since 2007 due to confidentiality issues.

4. 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.

[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.

Table 1
Greenhouse gas emissions, by gas, 1990 to 2009

	Gg CO_2 eq							
Greenhouse gas	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Change 1990–2009 (%)*
CO_2	141 362.41	173 899.96	225 432.27	259 605.48	307 915.64	297 123.94	299 106.06	111.6
CH_4	33 497.80	46 866.56	53 299.87	52 384.03	55 583.04	54 294.83	54 367.96	62.3
N_2O	11 565.62	16 224.33	16 616.95	14 182.21	12 350.53	11 570.85	12 531.09	8.3
HFCs	NA,NE	NA,NE	818.43	2 379.00	3 174.30	2 669.43	2 839.25	NA
PFCs	603.43	516.43	515.12	487.76	C, NA, NE	C, NA, NE	C, NA, NE	NA
SF_6	NA,NE	NA,NE	322.89	858.73	952.11	843.10	803.47	NA

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

Table 2
Greenhouse gas emissions by sector, 1990 to 2009

	Gg CO_2 eq							
Sector	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Change 1990–2009 (%)*
Energy	132 128.43	160 787.57	212 546.33	241 754.45	288 691.32	277 706.97	278 330.84	110.7
Industrial processes	15 442.26	24 206.65	24 373.81	28 780.76	29 261.76	29 829.90	31 686.98	105.2
Solvent and other product use	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA
Agriculture	29 776.81	28 679.03	27 369.59	25 839.12	26 310.26	25 042.97	25 695.93	–13.7
LULUCF	–44 870.53	–61 836.21	–67 557.57	–69 532.60	–76 274.00	–80 579.71	–82 528.28	83.9
Waste	9 681.77	23 834.04	32 715.80	33 522.87	35 712.27	33 922.31	33 934.08	250.5
Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**142 158.73**	**175 671.08**	**229 447.97**	**260 364.60**	**303 701.61**	**285 922.44**	**287 119.55**	102.0
Total (without LULUCF)	**187 029.26**	**237 507.29**	**297 005.53**	**329 897.20**	**379 975.61**	**366 502.15**	**369 647.82**	97.6

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

II. Technical assessment of the inventory submission

A. Overview

5. The 2011 annual inventory submission was submitted on 13 April 2011; it contains common reporting format (CRF) tables for the period 1990–2009 and a national inventory report (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).

6. Where necessary, the expert review team (ERT) also used the previous years' submissions during the review. During the review, Turkey provided the ERT with additional information and documents which are not part of the inventory submission. The full list of information and documents used during the review is provided in annex I to this report.

Completeness of inventory

7. Turkey has provided inventory data for the years 1990 to 2009 and included most of the required CRF tables, except tables 5.D, 5.E, 5.F, 5(III). Table 7 has not been reported for 1990. The ERT recommends that Turkey complete the missing tables with the appropriate values and/or notation keys in its next inventory submission.

8. The inventory covers most source and sink categories but a number of categories are still reported as "NE" (see also paras. 32, 47, 67, 80, 94) as in the previous inventory submission. These categories include:

(a) CH_4, N_2O and CO_2 emissions related to fugitive emissions from oil and natural gas in the energy sector;

(b) HFC and PFC emissions from a number of categories in the industrial processes sector, such as actual emissions of PFCs and potential emissions of HFCs and PFCs;

(c) N_2O emissions from pasture, range and paddock manure, and nitrogen (N) leaching and runoff under agricultural soils;

(d) N_2O emissions from industrial wastewater and human sewage in the waste sector;

(e) CO_2 and N_2O emissions from wild fires in forest land in the LULUCF sector.

9. The ERT recommends that Turkey improve the completeness of its next inventory submission, especially for those categories that are known to occur within the country and for which methodologies and/or emission factors (EFs) to estimate the emissions are available in the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines). The ERT also recommends that the Party, when reporting emissions data for the first time for a given category, ensure that emissions data are provided for the entire inventory time series, and that the choice of methods and EFs are clearly explained in the NIR.

10. In addition, there is a series of categories in the industrial processes sector for which the emissions are reported as "C" and are not included in the national totals. The ERT strongly recommends that Turkey include the emissions from these categories in the industrial processes sector at an aggregated level and account for them in the national totals in order to improve the completeness of its inventory (see paras. 55, 57, 58, 62 and 63).

11. The ERT noted that Turkey improved the completeness of its submission in 2011 by reporting emissions of non-methane volatile organic compounds (NMVOCs) for the solvent and other product use sector for the first time. The ERT welcomes this improvement.

1. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Overview

12. The ERT concluded that the institutional arrangements for inventory preparation continue to perform most of their functions. The Turkish Statistical Institute (TurkStat) is responsible for the national inventory as indicated in the Official Statistical Programme (Statistic Law #5429) and as stipulated by decision no. 2009/1 (dated 25.03.2009) of the inter-ministerial Coordination Board on Climate Change (CBCC).

13. Turkey's institutional capacity is currently being enhanced through national and European Union (EU) funded projects with the various stakeholders in Turkey. During the review, Turkey informed the ERT that after June 2011, the organizational structures in many ministries had been changed and the institutional arrangements may, therefore, be revised. The ERT recommends that Turkey explain, in its next NIR, the specific roles and responsibilities of the relevant organizations and to describe the specific capacities strengthened by the EU training activities for the existing inventory team.

14. During the review, the ERT noticed a delay in the Party's response to requests for clarifying inventory information resulting from the different stages of the review process. The ERT encourages Turkey to provide information to requests during the review in a timely manner in future reviews.

Inventory planning

15. The NIR described the institutional arrangements for the preparation of the inventory. TurkStat has overall responsibility for the national inventory. It collects activity data (AD) from the Ministry of Agriculture and Rural Affairs (MARA), the Ministry of Environment and Forestry (MOEF), the Ministry of Transportation and the Ministry of Energy and Natural Resources (MENR). MARA and MOEF provide estimates for emissions and removals from the LULUCF sector. TurkStat is responsible for processing the CRF tables and for the compilation of the NIR.

16. Turkey continues to mainly use lower-tier methods for calculating emissions from the key categories of its inventory. The ERT reiterates the recommendation from previous review reports that Turkey ensure that appropriate methods are used to estimate emissions from the key categories, in accordance with the IPCC good practice guidance.

17. During the review, Turkey informed the ERT that an 'emissions inventory portal' was still in the process of being developed. The portal is planned to have three components: a database including AD, EFs and calculation sheets, such that when AD are loaded the emissions will be estimated, and the key category/trend/uncertainty analysis will be performed automatically; web-based data collection, where all responsible organizations

involved in the emission inventory will enter their AD to the system via the Internet with a password; and a documentation and archiving system. The ERT commends Turkey for its efforts to establish this foundation for GHG inventory preparation and recommends that Turkey continue its efforts to establish the portal and to include a description of the portal in its next inventory submission.

18. Turkey does not report an improvement plan in the NIR. During the review, Turkey explained its plans in this regard to the ERT. The ERT recommends that Turkey use the results of the key category assessment and uncertainty analysis to prepare an improvement plan and include information on how the key category assessment and uncertainty analysis are used to prepare an improvement plan, a description of what improvements are planned, including actions to address specific recommendations made by inventory reviews and a schedule for the improvements to be made.

Inventory preparation

Key categories

19. Turkey has reported a key category tier 1 analysis, both level and trend assessments, as part of its 2011 submission. The key category analysis (level assessment) performed by Turkey and that performed by the secretariat[2] produced different results because Turkey has included the LULUCF sector as a whole in its key category analysis, which is not in accordance with the IPCC good practice guidance and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). The ERT recommends that Turkey perform the key category analysis following the category aggregation level and guidance in chapter 5.4 of the IPCC good practice guidance for LULUCF (particularly table 5.4.1 of that chapter). In addition, the ERT noted that CRF table 7 and the annex to the NIR provide only a level assessment key category analysis and in two cases qualitative assessment is used. The ERT recommends that Turkey ensure consistency of statements and presented information and to report a 1990 key category analysis and trend analysis for the most recent inventory year both in the CRF table 7 and in the NIR in its next inventory submission. The ERT further recommends that Turkey use the key category analysis for its methodological choices and for prioritizing inventory improvements. The ERT used the secretariat's key category analysis to determine the key categories and to structure the remainder of this report.

Uncertainties

20. Turkey uses a tier 1 uncertainty analysis, estimating a total uncertainty (with LULUCF) of 12.1 per cent for 2009, an increase of 0.2 per cent since the previous year. The NIR indicates that the uncertainty analysis is mainly based on expert judgement. However, there are no further references and documentation on the values used in the analysis. The ERT reiterates the recommendation from the previous review report that Turkey: document the rationale for uncertainties for all sectors when an expert judgement is used; take into account the results of the uncertainty analysis in its inventory improvement

[2] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

plan; and update uncertainty estimates for categories that are recalculated. The information on the uncertainties is provided only in an annex and not in the relevant sectoral chapters of the NIR. The ERT recommends that Turkey improve the transparency of the uncertainty analysis by providing information on uncertainties at the category level in the NIR of its next inventory submission.

Recalculations and time-series consistency

21. Recalculations have been performed for limestone and dolomite use and for chemical industry for some previous years and reported in accordance with the IPCC good practice guidance both in the CRF table 8 and in the NIR. The ERT noted that the recalculations reported by Turkey of the time series 1990–2008 have been undertaken to take into account the emissions of NMVOCs from the solvent and other product use sector. The ERT also noted that recalculations have been reported to take into account the change in AD for CO_2 emissions from lime production for 2002 to 2008; however, a numerical change can be observed only for 2002. The ERT recommends that Turkey further improve the explanations provided for the recalculations undertaken and include numerical information on their magnitude and impact in its next NIR.

Verification and quality assurance/quality control approaches

22. The NIR includes only limited information on general quality control (QC) procedures implemented and no documentation on quality assurance/quality control (QA/QC) performed. The NIR chapter on QA/QC remains unchanged since the previous NIR. The ERT reiterates the recommendation made in previous review reports that Turkey:

(a) Establish a formal QA/QC plan in accordance with the IPCC good practice guidance;

(b) Clearly define all responsibilities of institutions/experts with regard to their contribution to the national GHG inventory, including QA/QC, and document this in its next NIR;

(c) Improve the QC at all stages of inventory preparation and enhance the documentation of QC implemented.

23. In response to questions raised by the ERT during the review, Turkey informed the ERT that a draft version of the QA/QC plan is almost ready. The ERT recommends that Turkey finalize the draft QA/QC plan and include it in its next inventory submission.

24. The ERT recommends that sector-specific QA/QC goals are set which will help to improve the quality of reported data at sectoral level.

Transparency

25. The information in the NIR is still incomplete and is partially unclear in all sectors (see paras. 33, 48, 68, 81, 82, 95). The reporting is mainly at the aggregated level and does not include specific information on the rationale of the choice of methods, description of the methods, assumptions and AD. Furthermore, it does not include references to the external sources used for inventory preparation, information on uncertainties, QA/QC procedures, and planned improvements. The ERT reiterates the recommendation from previous review reports that Turkey further improve the transparency of its national inventory submission by including detailed methodological information and further explanation of the EFs, AD and emission trends for all sectors and key categories, especially in the case of significant fluctuations, explanations on the national circumstances and all references to the external sources used for inventory preparation. The ERT also

noted that the reporting in the CRF tables could be further improved by: making better use of the notation keys (e.g reducing the use of the notation key "NA" and replacing it with the relevant notation keys "NO", "NE" or "included elsewhere" ("IE"); explaining all the instances where the notation keys "IE" and "NE" are used (thus populating CRF table 9(a)); and providing relevant additional information in the tables (e.g. CRF tables 4.D and 6.B)).

Inventory management

26. Turkey has no centralized archiving system. It is planned as part of the inventory portal (see para. 17). The ERT encourages Turkey to develop a centralized archiving system containing: disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated; all underlying calculation sheets, as well as all cited literature; internal documentation on QA/QC procedures, external and internal reviews; and documentation on annual key categories and key category identification and planned inventory improvements.

2. Follow-up to previous reviews

27. Following up from previous review recommendations, Turkey has implemented a few improvements, such as improved the transparency in the energy sector and the correction of some notation keys in the industrial processes sector. The pending cross-cutting issues include:

(a) The calculation and reporting of emissions currently reported as "NE" and for which methods exist in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance;

(b) The use of higher-tier methods to estimate emissions from the key categories;

(c) The improvement of transparency by structuring the NIR so that it follows more closely the UNFCCC reporting guidelines and by providing: more precise descriptions of the methods, AD, EFs and parameters used; more detailed information on the choice of all methodologies, AD, EFs, parameters and assumptions and on the national circumstances; all references to the external sources used for inventory preparation; more detailed information on the national energy balance; and further explanation of the EFs, AD and emission trends for all sectors and key categories, especially in the case of significant fluctuations;

(d) The assessment of time-series consistency, carrying out recalculations where necessary and providing the corresponding rationale in the NIR;

(e) The creation of a QA/QC management system based on a QA/QC plan;

(f) The development of an inventory improvement plan;

(g) The documentation of the rationale for the uncertainty estimates where expert judgement is used;

(h) The disaggregation of the LULUCF sector for its key category analysis or reporting on the rationale for the level of category aggregation used;

(i) Ensuring that the rationale for the categories reported as "NE" is documented in detail in CRF table 9(a).

3. Areas for further improvement

Identified by the Party

28. The 2011 NIR does not identify areas for improvement. In response to questions raised by the ERT, Turkey informed the ERT that it is planning improvements regarding both cross-cutting and sectoral issues, including:

(a) The establishment of a national system by enhancing institutional capacity through a number of national and international projects;

(b) The development of a QA/QC plan;

(c) The establishment of a permanent team to work on LULUCF studies and the improvement of the capacity of the staff and institutions concerned.

Identified by the expert review team

29. During the review, the ERT identified cross-cutting issues for improvement. These are listed in paragraph 107 below.

30. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

B. Energy

1. Sector overview

31. The energy sector is the main sector in the GHG inventory of Turkey. In 2009, emissions from the energy sector amounted to 278,330.84 Gg CO_2 eq, or 75.3 per cent of total GHG emissions. Since 1990, emissions have increased by 110.7 per cent. The key driver for the rise in emissions is an increase in energy consumption occurring in energy industries, other sectors, manufacturing industries and construction, as well as in transport. Within the sector, 36.9 per cent of the emissions were from energy industries, followed by 25.4 per cent from other sectors, 19.9 per cent from manufacturing industries and construction and 17.0 per cent from transport. The remaining 0.7 per cent were from fugitive emissions from solid fuels.

32. The CRF tables include emission estimates for all gases and most categories in the energy sector. The ERT commends Turkey for reporting for a second year the emission estimates from the use of international bunker fuels. However, fugitive emissions from oil and natural gas are reported as "NE" in the CRF tables with an explanation that there are no AD available, and the methodology for emission estimation is not clear. The ERT recommends that Turkey improve the completeness of the inventory by including the fugitive emission estimates using the default EF suggested by the IPCC good practice guidance. Emissions from the category other (fuel combustion), where the emissions from military use are to be allocated, are reported as "NA" and "NO". In response to the draft inventory review report, Turkey stated that emissions from military use are allocated under the transport sector. The ERT recommends that Turkey improve the transparency of its reporting by correctly allocating the emissions (e.g. by allocating emissions from military use under other (fuel combustion)) or by ensuring the proper use of the notation keys (e.g. using the notation key "IE" for the category other (fuel combustion) with relevant explanations in CRF table 9(a)).

33. Although Turkey strives to improve its reporting, information provided in the NIR and CRF tables is not sufficiently transparent. The methodologies applied are not well documented and there are inconsistencies between the information provided in the NIR and the CRF tables, such as the information on the fugitive emissions from oil and natural gas. It is also not clear which EFs are used to calculate the emissions in the energy sector, because the NIR refers to IPCC default values in one instance and the use of country-specific values in another (see para. 42). During the review Turkey clarified that the EFs used are the IPCC default values with the exception of the values for public heat and power generation, where plant-specific EFs and net calorific values (NCVs) were used to calculate emissions. The ERT reiterates the recommendation in the previous review report that Turkey improve the transparency of its reporting in the energy sector by including in the NIR a complete list of the values used for the NCVs and amend the list of the EFs for CO_2, CH_4 and N_2O, indicating the information on their sources. In addition, the ERT noted the use of notation key "IE" for different fuels under different subcategories (e.g. under manufacturing industries and construction, other sectors) whereas there is no information provided in CRF table 9(a) where these emissions have been included. The ERT recommends that Turkey improve the transparency of its reporting and include additional information on the use of the notation keys in the NIR and CRF table 9(a), as appropriate.

34. The ERT noted significant fluctuations in the implied emission factor (IEF) values for liquid and solid fuels. For example, the CO_2 IEFs used for solid fuels in public electricity and heat production for 1990–2004 ranging from 76.52 to 86.87 t/TJ, which are among the lowest reported by Parties (ranging from 76.52 to 133.25 t/TJ) and lower than the IPCC default values (ranging from 94.6 to 106.7 t/TJ)); and the inter-annual changes for CH_4 IEF for chemicals for solid fuels ranging between –82.8 and +498.3 per cent. However, the NIR does not include any explanations for these inconsistencies. The ERT recommends that Turkey improve the transparency of its reporting and include, in the next inventory submission, explanations for the large fluctuations in the trends of the AD and inter-annual changes of the IEFs.

35. During the review, Turkey informed the ERT that the recommendations from the previous review report had been noted but that no recalculations had been performed for the current submission. Given the lack of implementation of the recommendations from the previous review report in the 2011 submission, most of the recommendations are reiterated in the current inventory review report. Thus, the ERT reiterates the recommendation that Turkey recalculate the emissions, where necessary, in order to correct the time-series inconsistencies in the category manufacturing industries and construction in its next inventory submission.

2. Reference and sectoral approaches

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

36. CO_2 emissions were calculated using the reference approach and the sectoral approach. The time series of the difference in the CO_2 emissions shows great variability throughout the whole period (1990–2009), with the lowest point in 1991 (–4.4 per cent) and the highest in 2008 (+10.9 per cent). The 2009 difference is 9.03 per cent. Turkey reports in the NIR and in CRF table 1.A(c) that the main reason for these differences is that the reference approach uses average values for the carbon content and NCV of hard coal, lignite and oil, whereas, for the sectoral approach, specific values of carbon content and NCV are used in each category. During the review Turkey informed the ERT that the difference in the estimates is mainly a result of gaps in the reporting of fuel consumed by power generation facilities. The ERT considers the explanation provided by the Party to be insufficient and reiterates the recommendation of the previous review report that Turkey

investigate other possible factors, such as statistical differences in the energy balance, missing information or double counting in the reference or sectoral approaches, report on its findings and correct any identified errors in the next inventory submission.

37. In CRF table 1.A(b) Turkey reports imports and exports of some oil products and solid fuels as "NA". However, these values are aggregated under crude oil, lignite and hard coal. Such use of notation keys is not in line with the UNFCCC reporting guidelines. A notation key "IE" is used for petroleum coke but without any further explanation. The ERT reiterates the recommendation of the previous review report that Turkey apply the notation keys in line with the UNFCCC reporting guidelines and use of the notation key "IE" including the relevant explanations.

38. There are several differences between the data reported in the CRF tables and those reported to the International Energy Agency (IEA). For instance, the 1990–2009 growth rate of the total apparent consumption is 126 per cent in the CRF tables, while it is 103 per cent according to the IEA data. In 2009, the total apparent consumption was 8.5 per cent higher in the CRF tables, mainly due to differences in crude oil imports, not reporting international bunkers in the CRF tables and the possible inclusion of natural gas on a gross caloric value basis. The ERT reiterates the recommendation of the previous review report that Turkey investigate in detail the differences between the data used for the inventory and that reported to the IEA and provide more information in this regard in its next inventory submission.

International bunker fuels

39. Turkey reported emissions from international aviation and navigation starting with its 2010 submission. Emissions are reported for the years 2008 and 2009. The ERT commends the Party for providing these emission estimates and reiterates the encouragement included in the previous review report to provide, in the NIR, information relating to the methods and assumptions used. In addition, the ERT recommends that Turkey provide the entire time series in its next inventory submission.

40. In the current submission, emissions from bunkers are reported in CRF table 1.C for gas/diesel oil, jet kerosene and residual oil, but are not included in CRF table 1.A(b). The ERT recommends that Turkey report consistently bunker fuel use in CRF table 1.A(b) and table 1.C in its next inventory submission.

Feedstocks and non-energy use of fuels

41. Turkey has reported feedstocks and non-energy use of fuels only for the carbon stored in gas/diesel oil in CRF table 1.A(d). However, the NIR states that naphtha is the only fuel used as a feedstock in the petrochemical industry, that natural gas is used as a feedstock in the fertilizer industry and that other oil products such as asphalt, lube oil and heavy vacuum gas oil are mostly used for non-energy purposes. During previous reviews, Turkey had indicated that it would be impossible to disaggregate the corresponding AD. The ERT reiterates the recommendation from previous review reports that Turkey explore the possibility to collect data on the amount of feedstocks and non-energy use of fuels. The ERT further recommends Turkey to revise its use of notation keys and use the appropriate notation keys (e.g. "NE") in CRF table 1.A(d) and 1.A(b), as well as to make use of the additional information fields to CRF table 1.A(d) to improve the transparency of its reporting. The ERT recommends that the Party clearly explain in the NIR the allocation of fuels used as feedstocks and for non-energy use between the energy and industrial processes sectors.

3. Key categories

Stationary combustion: solid, liquid and gaseous – CO_2

42. Turkey states that emissions from the energy sector are estimated on the basis of the IPCC tier 1 approach, with the exception of road transportation and public electricity and heat production where tier 2 or tier 3 methodologies are applied. As already stated in the review report of 2010 (para. 41), the sources of the EFs used for the estimation of emissions from public electricity and heat production are unclear because the information provided in section 3.1.1 of the NIR (table 3.2) mentions the use of country-specific EFs, while section 3.1 (table 3.1) indicates EFs consistent with the IPCC default values, and no sources are provided as regards EFs listed in annex 2 of the NIR. During the review the Party confirmed that the data are based on plant-specific information. The ERT recommends that Turkey include further information on, for example, the data sources and methodologies used for calculating the EFs at plant level in its next inventory submission.

43. In CRF table 1.A(a) under non-ferreous metals (solid fuels) Turkey uses the notation key "NA" for 2008 whereas for all other years, including 2009, data are available. The ERT recommends that Turkey investigate the reason for the use of this notation key and provide, in its next inventory submission, estimates for 2008, if they are available, or correct the notation key as appropriate.

Road transportation: solid, liquid and gaseous fuels – CO_2

44. The NIR states that emissions from road transportation are estimated using the COPERT model with some changes according to country specifications related to the availability of data. The previous review report encouraged Turkey to: specify the version of the COPERT model used as the basis for the country-specific model; explain the modifications that were carried out to adapt this model to the national circumstances; and improve the description of the role of data providers in the NIR, particularly for liquid fuels for the transport categories. As Turkey did not include this information in the current NIR, the ERT reiterates the encouragements and the recommendation of the previous review report. During the review, Turkey clarified that the method used to estimate emissions from road transportation is only similar to COPERT and that CO_2 emissions are estimated based on the IPCC tier 1 approach, whereas non-CO_2 emissions are calculated using the IPCC tier 2 approach. The ERT strongly recommends that, in its next inventory submission, Turkey improve the documentation of the methods applied and provide all EFs, assumptions and AD used in the estimates.

4. Non-key categories

Stationary combustion: biomass – CH_4 and N_2O

45. Biomass consumption is reported in the CRF tables under other sectors (residential) and road transportation. The energy balance shows that biomass covers mainly animal and vegetal waste and wood and is reported under the residential sector. For biomass reported under road transportation, the NIR only mentions the use of biodiesel without further explanation. The ERT recommends that Turkey improve the completeness and transparency of its reporting by providing information in the NIR on the types of biomass used in the energy sector. The ERT also recommends that Turkey provide information on how waste (biogenic and non-biogenic) is represented in the energy sector estimates.

C. Industrial processes and solvent and other product use

1. Sector overview

46. In 2009, emissions from the industrial processes sector amounted to 31,686.98 Gg CO_2 eq, or 8.6 per cent of total GHG emissions, and emissions from the solvent and other product use sector were reported as "NA", "NE". Since 1990, emissions have increased by 105.2 per cent in the industrial processes sector. The key drivers for the rise in emissions in the industrial processes sector are an increase in cement production and an increase in the consumption of HFCs for refrigeration and air-conditioning equipment, due to economic development. Within the industrial processes sector, 88.4 per cent of the emissions were from mineral products, followed by 11.5 per cent from consumption of halocarbons and SF_6 and 0.1 per cent from chemical industry.

47. The ERT noted several issues with regard to completeness in the industrial processes sector of Turkey's inventory, for example, Turkey reported "NE" for many categories, including CO_2 emissions from chemical industry – other (ethylene), as well as both actual and potential emissions of HFCs, PFCs and SF_6 emissions from several subcategories under consumption of halocarbons and SF_6. The ERT recommends that Turkey collect relevant information to estimate these emissions and report estimates of them in its next inventory submission. The ERT also noted that Turkey misuses notation keys for some categories. For example: "NA" is used instead of "NE" for CO_2 emissions from soda ash use and "NA" is used instead of "NO" or "NE" for CO_2 and CH_4 emissions from carbide production, as pointed out in the previous review report; "NA" is used instead of "NO" for CO_2 emissions from ammonia production as explained in paragraph 54 below; and "NA" is used instead of "IE" for N_2O emissions from adipic acid production. The ERT strongly recommends that Turkey reconfirm the meaning of each notation key and use them correctly in accordance with the UNFCCC reporting guidelines. On the other hand, the ERT noted that Turkey improved the completeness by reporting NMVOC emissions for the solvent and other product use sector for the first time.

48. The ERT noted several issues with regard to the transparency of reporting, as explained in the following paragraphs on specific categories. Most of these issues are related to confidentiality of the data used for estimating emissions from industries where only a few plants are in operation. In such cases, Turkey reported the emissions as "C" and did not include them in the total emissions from the sector, which results in an underestimate of the national total emissions. During the review week, Turkey explained to the ERT that the confidential data must be treated strictly in accordance with Turkish Statistical Law No: 5429 and, therefore, cannot be disclosed. The ERT appreciates this explanation given by Turkey, and recognizes the difficulties facing Turkey's inventory compilers. However, the ERT also noted Turkey's explanation about an additional item (25/11/2008-5813/2 item) in Turkish Statistical Law No: 5429, which stipulates that confidential data can be published only when combined with other data so as not to allow any direct or indirect identification. The ERT considers the confidentiality issues in this sector can be solved in light of this additional item, so that the completeness of the inventory can be improved and so that the national total is not underestimated. Specific recommendations are provided in the paragraphs on each category below.

49. Turkey has applied recalculations for the industrial process sector, for CO_2 emissions from lime production due to the change in AD (from consumption of carbonates in the production of lime) for the years 2002–2008. However, this recalculation has not resulted in changes in national total emissions except for the year 2002.

50. The recommendations of the previous review report were not implemented in the 2011 submission. Therefore, the ERT reiterates the recommendations from the previous

review report, with some additional advice for each category, as set out in the paragraphs below.

2. Key categories

Cement production – CO_2

51. Turkey calculates CO_2 emissions from cement production using the IPCC tier 2 method based on data of clinker production collected from the Turkish Cement Manufacturers' Association, the EF (0.51 tonne CO_2/tonne clinker produced) and cement kiln dust (CKD) correction factor (1.02). The ERT noted that the EF value is the same as the IPCC default EF, although Turkey explained in the NIR that the EF is based on the estimation of country-specific calcium oxide (CaO) content. The ERT also noted that the value of the CKD correction factor is the same as the IPCC default, about which there is no explanation in the NIR. This category is considered to be the most important key category in this sector, because it accounts for 88.4 per cent of total emissions of the sector in 2009 and the emissions increased significantly from 1990 to 2009 (by 142.0 per cent). In view of this fact, the ERT considers that Turkey should make further efforts to improve the transparency and accuracy of emission estimates for this category. The ERT, therefore, recommends that Turkey provide further explanation about how the country-specific EF was derived in its next NIR, and the ERT also reiterates the previous recommendation that Turkey collect data for a country-specific CKD correction factor.

Lime production – CO_2

52. Turkey calculates CO_2 emissions from lime production using production data collected from the Turkish Lime Association following the IPCC good practice guidance. The default EF (0.75 tonne CO_2/tonne lime produced) is used for the whole time series. The ERT recommends that Turkey collect data to develop a country-specific EF to replace the default EF for this key category. The unit of this EF was mistakenly shown as kg CO_2/tonne in annex 2 to the NIR and should be corrected in the NIR of the Party's next inventory submission.

53. The ERT noted that the IEFs fluctuated from 2002 although Turkey states in the NIR that the time series of EFs were consistent throughout the years 1990–2009. In response to questions raised by the ERT during the review, Turkey explained that this is because the data on limestone and dolomite use are added to this category for reasons of confidentiality after the year 2001. Turkey only briefly mentioned the aggregation of these two categories in the NIR without explaining that it was the case only for 2002–2009 and not for the whole of the time series. This means that Turkey's inventory is less transparent than it could be. The ERT recommends that, in its next inventory submission, Turkey elaborate on the reason for the fluctuation of the IEFs and include an explanation of how the time-series consistency is ensured.

Ammonia production – CO_2

54. Turkey explains in the NIR that CO_2 emissions from this category have been calculated using ammonia production quantity. Nevertheless, in CRF table 2(I).A-G for 2009 it is reported as "NA". In response to questions raised by the ERT during the review, Turkey stated that ammonia production did not take place in the country and the necessary ammonia for industry was provided by imports in 2009. The ERT considers that, if that is the case, CO_2 emissions from this category for 2009 should be reported as "NO" in accordance with the UNFCCC reporting guidelines. The ERT recommends that, in its next

inventory submission, Turkey use "NO" instead of "NA" for this category for the years when production of ammonia did not take place.

55. CO_2 emissions from this category are reported as "C" for the years 2007 and 2008 and are not included in the total emissions from the industrial processes sector for those years. The ERT reiterates the recommendation from the previous review report that Turkey report these emissions in an aggregated manner to ensure confidentiality and the completeness of the inventory. One possible solution is to aggregate CO_2 emissions from this category with those from carbide production and those from aluminium production, and to report the aggregated amount of CO_2 emissions in the category other (industrial processes (2.G)) (see also paras. 62 and 63 below).

Consumption of halocarbons and SF_6 – HFCs

56. The only emissions reported in this category are actual emissions of HFC-134a from refrigeration and air-conditioning equipment. No information on the AD and IEF used in the calculation is provided in the sectoral background data table 2(II).F. In the NIR, Turkey states that the methodology was based on the IPCC guidelines and IPCC good practice guidance, but provides no further explanation on the methods used. In this situation, it is difficult for the ERT to confirm that Turkey actually followed the IPCC good practice guidance. The ERT strongly recommends that Turkey improve the transparency of its reporting by including information on the AD (whether they include only the import of raw gas or gas in products) and by providing more information about the methods used to calculate emissions for this category, for example by explaining whether the bottom-up approach or top-down approach was used.

3. Non-key categories

Soda ash production and use – CO_2

57. CO_2 emissions from soda ash production are reported as "C" and not included in the total emissions from the industrial processes sector. This results in an underestimation of the total emissions from Turkey. The ERT reiterates the recommendation in the previous review report that Turkey report these emissions in an aggregated manner to ensure confidentiality and the completeness of the inventory. One possible solution is to aggregate CO_2 emissions from soda ash production with those from lime production, as Turkey has already done for CO_2 emissions from limestone and dolomite use.

Nitric acid production – N_2O

58. N_2O emissions from this category are reported as "C" and not included in the total emissions from the industrial processes sector. The ERT reiterates the recommendation in the previous review report that Turkey report these emissions in an aggregated manner to ensure confidentiality and the completeness of the inventory. The ERT noted, however, that this category is the only dominant source of N_2O emissions in the industrial processes sector. (Adipic acid production is another source, but N_2O emissions from that category are almost zero, according to the NIR.) Under this situation, one possible solution is to aggregate N_2O emissions from this category with CH_4 emissions from the subcategory other (chemical industry) on a CO_2-equivalent mass basis, and report the aggregated amount of emissions in the column for CO_2 in the category other (chemical industry), with clear explanation of this in both the relevant CRF tables and the NIR.

59. The ERT noted that Turkey has used the highest EF (19 kg N_2O/t nitric acid) from the Revised 1996 IPCC Guidelines to calculate N_2O emissions from nitric acid production

for the whole time series. In the NIR, Turkey has stated that a constant value should be used for consistency, even if some abatement methods were installed during the period. The ERT recommends that Turkey take into account emission reductions due to the non-selective catalytic reduction abatement technology. The ERT reiterates the recommendations in the previous review report that Turkey provide, in its next NIR, information on the type and age of the technology used in nitric acid plants in order to justify the EF used.

Adipic acid production – N_2O

60. The N_2O emissions are reported as "NA" in the CRF tables, while Turkey explained in the NIR that those emissions are almost zero throughout the years and, therefore, they are included in the category for nitric acid production. The ERT recommends that Turkey use "IE" instead of "NA" for N_2O emissions from this category in the CRF tables to make them consistent with the NIR. The ERT noted that N_2O emissions from nitric acid production are not included in the total emissions from the industrial processes sector (see para. 58). This also means that N_2O emissions from adipic acid production are not included in the total emissions from the industrial processes sector, because Turkey explains that these emissions are included in the category for nitric acid production. This leads to an underestimation of total emissions from Turkey. The ERT reiterates the recommendation made in paragraph 58 above to solve this issue.

Carbide production – CO_2

61. The AD and emissions of CO_2 and CH_4 for silicon carbide are reported as "NA". The ERT reiterates the recommendation in the previous review report that Turkey change the notation key from "NA" to "NO", if it can be clarified that such activities are not occurring in the country, otherwise it should be changed to "NE".

62. CO_2 emissions from calcium carbide production are reported as "C" and not included in the total emissions from the industrial processes sector. The ERT reiterates the recommendation in the previous review report that Turkey report these emissions in an aggregated manner to ensure confidentiality and the completeness of the inventory. One possible solution is to aggregate CO_2 emissions from this category with those from ammonia production and those from aluminium production, and to report the aggregated amount of CO_2 emissions in the category other (industrial processes).

Aluminium production – CO_2 and PFCs

63. CO_2 and PFCs emissions from this category are reported as "C" and not included in the total emissions from the industrial processes sector. The ERT reiterates the recommendation in the previous review report that Turkey report these emissions in an aggregated manner to ensure confidentiality and the completeness of the inventory. One possible solution is to aggregate CO_2 emissions from this category with those from ammonia production and those from carbide production, and to report the aggregated amount of CO_2 emissions in the category other (industrial processes) and to aggregate PFCs emissions from this category with those from consumption of halocarbons and SF_6, which are currently reported as "NE", and report the aggregated amount of emissions of PFCs in the category other (industrial processes).

64. In the NIR Turkey states that it calculates emissions of PFCs from this category using the tier 3 method. However, no further information on the method used is provided in the NIR. The ERT reiterates the recommendation from the previous review report that Turkey improve the descriptions of the method used, for example, by including the information on EFs used. Further, the ERT recommends that, in its next NIR, Turkey

include the explanation about this category in chapter 4.4.3 on aluminium production, not in chapter 4.6 on consumption of halocarbons and SF_6 as is currently the case.

Consumption of halocarbons and SF_6 – SF_6

65. Actual emissions of SF_6 from electrical equipment are reported in Turkey's inventory (0.03 Gg in 2009). Actual emissions of SF_6 from fire extinguishers are also reported, but are very small (0.001 Gg in 2009) when compared with those from electrical equipment. According to the NIR, for the latest four years (2006–2009) the actual emissions of SF_6 from electrical equipment have been estimated using extrapolation based on annual growth rates in Turkey due to a lack of import data. The previous review report recommended that Turkey explore the possibilities of collecting sufficient data to estimate these emissions for recent years and recommended that the Party describe the calculation methods in its NIR. However, this recommendation has not yet been implemented by Turkey. During the review week, Turkey informed the ERT that the Ministry of Environment and Urbanization will implement an EU project which is planned to be completed in 2015 in order to improve the data collection and emission estimations. The ERT welcomes this effort being made by Turkey. The ERT recommends that Turkey include up-to-date information on the progress in this project in its next NIR. The ERT also encourages Turkey to recalculate SF_6 emissions from this category based on the data obtained from this project as early as possible in the future inventory submissions.

D. Agriculture

1. Sector overview

66. In 2009, emissions from the agriculture sector amounted to 25,695.93 Gg CO_2 eq, or 7.0 per cent of total GHG emissions. Since 1990, emissions have decreased by 13.7 per cent. The key drivers for the fall in emissions are a decrease in the number of livestock and a decrease in the amount of synthetic fertilizer applied to soils. Within the sector, 57.8 per cent of the emissions were from enteric fermentation, followed by 27.2 per cent from agricultural soils, 13.2 per cent from manure management and 1.0 per cent from field burning of agricultural residues. The remaining 0.8 per cent were from rice cultivation.

67. The ERT noted that Turkey still fails to provide estimates for the following subcategories under agricultural soils for which there are IPCC default methodologies: cultivation of histosols; pasture, range and paddock; and indirect emissions from agricultural soils currently reported as "NE" or "NA". The ERT recommends that the Party enhance the completeness by providing these estimates in its next inventory submission.

68. Turkey's NIR has been updated with new figures for 2009 and some information about crop data used in the calculations for emissions from N-fixing crops and crop residues. Apart from this, no changes have been made to the NIR text since the last submission, and explanations of emission trends are still missing. The ERT reiterates the recommendation of the previous review report that Turkey provide detailed documentation on the selection of methods, EFs and AD and an explanation of the emission trends in its NIR, as suggested in the UNFCCC reporting guidelines. The ERT also noted some inconsistencies and incorrect use of notation keys in the CRF tables. The notation key "NA" is used instead of "NO" for CH_4 and N_2O emissions for some of the crop types in CRF table 4.F and for cultivation of histosols and atmospheric deposition in table 4.D. The additional tables to CRF table 4.B(a) and 4.D are not filled in. The ERT recommends that Turkey rectify the use of notation keys in the tables, using the appropriate notation keys

("NO" or "NE") and make use of the documentation boxes and additional information boxes in the CRF tables in order to improve the transparency of its reporting.

69. During the review the Party provided the ERT with a description of the subgroups "domestic" dairy cattle and "cultural" dairy cattle, and the sheep categories "domestic" sheep and "merino" sheep used in the categories enteric fermentation and manure management. The Party also provided an overview of how these subgroups are distributed across the climate regions "cool" and "temperate". The ERT welcomes this information and recommends that Turkey include it in the NIR of its next inventory submission to enhance the transparency of livestock characterization used.

70. No changes of methodology or AD have been made in the inventory since the submission of 2010 in the agriculture sector and no previous recommendations have been implemented.

2. Key categories

Enteric fermentation – CH_4

71. Turkey uses a tier 1 method for the estimation of emissions from all livestock species with a combination of IPCC default EFs for Asia and Eastern Europe, taking into account different climate regions. Given that CH_4 from enteric fermentation is identified as a key category, the ERT reiterates the recommendation from previous review reports that Turkey estimate the emissions from significant livestock using a tier 2 method and an enhanced livestock characterization, in accordance with chapter 4.1 of the IPCC good practice guidance.

72. During the review, Turkey informed the ERT that there are no statistics for gross energy intake for cattle and sheep that could be used for developing tier 2 EFs for enteric fermentation. The ERT reiterates the recommendation of the previous review report that Turkey present national data on the milk productivity of dairy cattle in the NIR to verify the selection of relevant default EFs from the Revised 1996 IPCC Guidelines (Reference Manual, table 4.4).

Manure management – N_2O

73. The N_2O emissions have been reported per animal waste management system (AWMS). However, only notation keys ("NO", "NA" and "NE") are included for N_2O excretion per AWMS and for the IEFs, respectively. There is no documentation of the country-specific N_2O emissions per manure management system given in the NIR, and also no information about the distribution of manure management systems used for the different animal groups. Turkey explained that the estimates used EFs based on expert judgement, because there were no other available data. The ERT recommends that Turkey use default values for AWMS distribution and default EFs or provide transparent documentation of the country-specific values. In addition, the ERT recommends that Turkey improve the completeness and transparency of its reporting by including the relevant information and documentation both in the CRF tables and in the NIR of its next inventory submission.

Agricultural soils – N_2O

74. Turkey has reported N_2O emissions from synthetic fertilizer applied, manure spread, N-fixing crops and from crop residues returned to soils. Country-specific EFs were used for all categories. AD for N-fixing crops were provided by TurkStat, but for the other categories sources of AD are not described in the NIR. The ERT noted that the

completeness of the reporting could be improved by estimating emissions from pasture, range and paddock, and indirect emissions from agricultural soils. These emissions can be estimated with data already available in the Party's GHG inventory and the IPCC default values (e.g. the EF for pasture, range and paddock can be taken from IPCC good practice guidance table 4.12 and the default EF for atmospheric deposition and leaching and runoff is given in IPCC good practice guidance table 4.18). The ERT reiterates the recommendation of the previous review report that Turkey estimate the emissions from the categories mentioned above, for which methods exist in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance.

75. The IEFs for direct N_2O emissions from agricultural soils for synthetic fertilizer applied (6.36 kg N_2O-N/kg N), for manure spread and N-fixing crops (0.00636 kg N_2O-N/kg N) and for crop residues returned to soils (0.636 kg N_2O-N/kg N) reported in CRF table 4.D differ significantly from the IPCC default value for the EF of 0.0125 kg N_2O-N/kg N for all these three subcategories and indicate incorrect reporting of the data in the table. During the review, Turkey informed the ERT that the Revised IPCC 1996 Guidelines is the main source for its calculation and that the EF used is 0.01 kg N_2O/kg N. The ERT recommends that Turkey provide, in the NIR, detailed methodological information, as well as data on the AD for the entire time series and recheck the values (and their units) reported in CRF table 4.D and rectify them as appropriate in its next inventory submission.

76. The information about fractions in the CRF additional information table have been reported as "NE". However, in CRF table 4.F $Frac_{BURN}$ is given as 0.1. Information about $Frac_{NCRO}$ and $Frac_R$ can also be taken from information reported in CRF table 4.F. Values for $Frac_{NCRBF}$ are given in the NIR, table 6.6. The ERT recommends that Turkey report these fractions in CRF table 4.D in its next inventory submission.

3. Non-key categories

Rice cultivation – CH_4

77. Rice cultivation is reported as intermittently flooded, single aeration in the CRF table 4.C and described as continuously flooded in the NIR. During the review, the Party informed the ERT that the correct reporting is continuously flooded. The ERT recommend that Turkey report the emissions under the category continuously flooded in CRF table 4.C in its next inventory submission.

E. Land use, land-use change and forestry

1. Sector overview

78. In 2009, net removals from the LULUCF sector amounted to 82,528.28 Gg CO_2 eq. Since 1990, net removals have increased by 83.9 per cent. The key driver for the rise in removals is related to improvements in sustainable forest management, afforestation on forest land and the conversion of coppice to productive forest in forest land remaining forest land. There has also been an increase of biomass removals in cropland and grassland due to land abandonment and a decrease in grazing. Within the sector, net removals of 57,364.74 Gg CO_2 eq were from forest land, followed by 18,529.14 Gg from cropland and 6,634.39 Gg from grassland. Wetlands, settlements and other land categories are not reported for the time series 1990–2009. Apart from carbon stock changes, the only other category reported for the sector is a small amount of CH_4 and N_2O emissions from wildfires on forest land (0.01 Gg CO_2 eq).

79. The ERT acknowledges the lack of key AD for consistent representation of land areas for the LULUCF reporting and the efforts made by the Party to report information on forest land. However, the Party's reporting of the LULUCF sector remains incomplete and there is a lack of area data for key categories, such as forest land converted to other lands, cropland and grassland. The ERT noted that planned improvements to the LULUCF sector in the NIR do not include the development of a national land-use change tracking system. The ERT reiterates the recommendations from the previous review report that Turkey put in place an action plan to develop and implement a system for the complete representation of land areas that is consistent with the IPCC good practice guidance for LULUCF. The ERT encourages the Party to consider the use of regional data sources, such as Coordination of Information on the Environment, (CORINE). Although there is no 1990 CORINE dataset for Turkey, land cover maps for 2000 and 2006 are available through the European Environment Agency (EEA) and projects such as Eionet.[3]

80. As noted in previous review reports, several CRF tables (e.g. tables 5.D, 5.E, 5.F, 5(III) in 2009) and cells are left blank (e.g. parts of tables 5(II), 5(IV) and 5(V)), the time series for cropland and grassland are incomplete; there are no estimates reported for wetlands, settlements or other land, fertilizer application to forest and other land, drainage of wetlands and disturbance due to conversion to cropland. In the NIR, the Party provides a table listing reasons why these categories are not reported. In most cases the activities are not occurring or AD are not available. The ERT encourages the Party to improve transparency by using the notation keys "NO" or "NE" in the CRF tables, instead of blank cells or notation key "NA", and provide the relevant explanations in CRF tables and in the NIR. In addition, the ERT recommends Turkey to amend the tables with information on planned measures to collect the missing AD and to develop methods to report these categories when AD become available.

81. The methodologies used to derive estimates of emissions/removals from forest land are transparently documented. Most input parameters used are derived from expert judgement and the ERT reiterates the recommendations from the previous review report that Turkey transparently document how input parameters are derived using empirical approaches. Where expert judgement is used, the Party is encouraged to provide supporting documentation.

82. The ERT noted that there are no sections in the NIR describing the methods used to derive biomass and soil carbon stock changes in cropland and grassland, although there are estimates for some years. For these land categories emission/removals are reported in the CRF tables, but the associated areas are reported as "NA". This is not in line with IPCC good practice guidance for LULUCF. The ERT noted that in some cases information on the AD is also available in international data sources (see para. 90). In response to a question raised by the ERT, Turkey indicated that a complete time series for AD for cropland, grassland and settlements will be reported based on new remote sensing and back extrapolation techniques. The ERT welcomes this planned improvement and encourages Turkey to provide further information on land-use categories in the NIR of its next inventory submission. The ERT recommends that Turkey improve the transparency of its documentation on how the emissions/removals for relevant areas are derived and provide information on the AD, EFs, other parameters and underlying assumptions in separate sections in the NIR.

83. In the NIR, Turkey has stated that recalculations for the LULUCF sector between the 2010 and 2011 submissions (for wildfire and to correct calculation errors for forest biomass) were made in response to the 2010 annual review report. However, the ERT

[3] See <http://www.eea.europa.eu/data-and-maps/figures/land-cover-2006-and-changes>.

found that there is no difference in the emissions/removals of forest biomass or emissions from wildfires, when the data in 2010 and 2011 submissions are compared. The ERT recommends that Turkey improve the transparency of its documentation of how recalculations are made and provide an analysis of their impacts on emissions/removals from the LULUCF sector. These recalculations should be reflected in the CRF tables of its next inventory submission.

84. Numerous recommendations in the 2010 annual review report relating to the improvement of transparency and consistency with the IPCC good practice guidance for LULUCF have not been addressed in the current inventory submission and are, therefore, reiterated in the paragraphs below. Despite the recommendations in the previous report, the Party has not yet implemented any category-specific QA/QC procedures within the LULUCF sector. The ERT reiterates the recommendation in the previous review report that the Party consider how it might independently verify the estimates for the categories within the LULUCF sector in order to ensure the quality of its inventory, as described in the IPCC good practice guidance for LULUCF. The ERT welcomes the planned establishment of a permanent working team, improving the capacity of the staff and institutions concerned and the initiation of a project for estimating carbon stock changes in forest soils and litter in the sector.

2. Key categories

Forest land remaining forest land – CO_2

85. The NIR indicates that forest statistics were obtained from the General Directorate of Forestry under the Ministry of Environment and Forestry. There is no standard national forest inventory system in Turkey, so the required data on forest are based on forest management plans. The NIR contains no explicit definition of forest land or the way the land is divided between the categories forest land remaining forest land and lands converted to forest land, apart from the information that Turkey uses a minimum cover of 11 per cent for 'normal' and 1 per cent for 'degraded' forests. The ERT recommends that Turkey provide a definition of forest areas in the NIR of its next inventory submission, to improve the transparency of which lands are reported as forest land.

86. In the NIR, Turkey describes the distribution of forest areas in different climatic zones and reports stock changes for different pools under managed and unmanaged forest. In the CRF tables, however, there is no disaggregation of the forest land remaining forest land category into climatic zones or forest management types. The ERT recommends the Party to use the same subcategories in both the NIR and CRF tables, in order to improve the transparency and consistency of its reporting.

87. Turkey uses a stock change approach (tier 2 method) with country-specific EFs for the calculation of the biomass gains, but refers to the gain–loss (default) method to estimate biomass losses. The previous review report raised concerns that these two methods may have been combined in such a way that losses may be double counted and recommended that Turkey review the approach used for these calculations in order to ensure that they are consistent with the IPCC good practice guidance for LULUCF. However, the Party has not addressed these issues in the current submission. The ERT reiterates these recommendations and further encourages Turkey to provide transparent documentation on the methods and relevant parameters used to calculate the carbon stock change in living biomass in forest land remaining forest land in its next inventory submission. The ERT further recommends that, when recalculations are implemented, the Party apply these consistently for the entire time series and document this in the CRF tables and the NIR.

88. Turkey uses equation 3.2.11 of the IPCC good practice guidance for LULUCF to calculate deadwood stock changes. Given the unusual trend in Turkey in carbon stock change in the pool (e.g. doubling between 2007 and 2008), the previous review report encouraged Turkey to provide complete and transparent documentation explaining how the input parameter for average annual transfer into dead wood (B_{into}) is calculated and applied, because there were concerns that there was a possible overestimation of carbon accumulation in dead wood. Nevertheless, Turkey did not provide such documentation in the NIR in the current submission. The ERT reiterates the previous recommendation.

89. Carbon stock changes in litter are assumed to be zero in line with the IPCC good practice guidance for LULUCF tier 1 assumptions. However, the IPCC good practice guidance for LULUCF encourages the reporting of carbon stock changes in litter to reflect national circumstances and where management could influence these carbon stock changes. The ERT notes that it is good practice to report carbon stock changes for litter pools, particularly because the Party does report on AD which could be used to calculate carbon stock changes for the litter pool (e.g. forest areas and a climatic map). The ERT encourages the Party to consider the use of tier 2 approaches for the estimation of emissions/reductions in the litter pools (using eq. 3.2.13 and default litter data in table 3.2.1 of the IPCC good practice guidance for LULUCF).

Cropland remaining cropland – CO_2

90. The ERT could not find any information relating to the cropland areas in either the NIR or the CRF tables; nor is there any information on the method applied. According to statistics from the United Nations Food and Agriculture Organization (FAO) for Turkey, 26.5 Mha was under cropland in 2004, with only 9 per cent of this area remaining as permanent croplands. Assuming the total crop areas was 26,500 kha in 2009, the IEF for net removals in cropland biomass could be estimated to be 0.18 Mg C/ha. Given the lack of AD and considering the apparent large transitions in this category, the ERT would assume that the cropland remaining cropland areas may be 2.38 kha (9 per cent of 26,500 kha) resulting in an IEF of 2.1 Mg C/ha. Based on these assumptions, and due to the lack of any other transparent data, the biomass removal rate from croplands would be the highest IEF for all reporting Parties (ranging from -0.59 Mg C/ha to 2.10 Mg C/ha), together with Malta (2.10 Mg C/ha). Excluding Malta and Turkey, other reporting Parties report IEFs in the range of –0.59 to +0.35 Mg C/ha. These IEFs are the same as the crop biomass accumulation rate for temperate regions (see tier 1 approach for cropland remaining cropland table 3.3.2, IPCC good practice guidance for LULUCF). Considering that biomass losses from cropland remaining cropland would be similar to gains, as suggested by the IPCC good practice guidance for LULUCF, the ERT considers the estimated IEF for cropland removals to be unreasonable, unless more information can be provided so that these estimates can be reviewed in a transparent manner. The ERT, therefore, reiterates the recommendation from the previous review report that Turkey include cropland area data for the entire time series in the CRF tables and the NIR and provide transparent information on how the estimates are derived. The ERT acknowledges the lack of AD but encourages the Party to use already available resources, such as FAO data or CORINE (see para. 79).

Grassland remaining grassland – CO_2

91. As described above for cropland remaining cropland, there is no information in the NIR on the category grassland remaining grassland and no AD in the CRF tables. The ERT noted that this reporting is not complete or transparent. In the Party's 2009 submission, the NIR provided information on areas under grassland (81,613.8 ha) in 2007. The ERT notes that if the previous reported areas are used to derive an IEF for biomass removal (3 Mg C/ha) these estimates seem unreasonable when compared with other reporting Parties (where the range is –0.005 to +0.5 Mg C/ha). The ERT reiterates the recommendation in the previous review report that Turkey improve the completeness of its inventory for the

grassland category by estimating carbon stock changes for the total managed grassland area in the country. For net carbon stock changes in grassland soils, the ERT recommends that Turkey either explain why organic soils are not included in the estimates or include them in its next inventory submission.

3. Non-key categories

Land converted to forest land – CO_2

92. Forest areas are derived using forest inventory data for 1972 and 2004. Based on these data, the forest area is interpolated to be increasing by 30.9 kha per year. The areas for land converted to forest land appear to be appropriately calculated, where there is an increase from 185.2 kha in 1990 to 618.4 kha in 2004, representing an annual increment of 30.9 kha. However, the ERT notes that there are unexplained fluctuations in land converted to forest land from 2005 to 2009. For example, the rate of annual afforestation for the period 2005 to 2009 varies from –2.12 to 50.5 kha per year. This is further confounded by a 30.9 kha increase in forest land remaining forest land for the period 2005 to 2009. During the review, Turkey explained that after 2004 it has used the ENVANIS system, a forest resources inventory based on forest management plans, which provides yearly data, and this made it possible to calculate the annual forest area increment by comparing the total forest area between two subsequent years. The ERT recommends that the Party include this information in its next inventory submission and ensure a consistent and accurate representation of forest area transition in accordance with IPCC good practice guidance for LULUCF. The ERT further recommends the Party to implement a QA/QC system to reduce the risk of the occurrence of calculation errors.

F. Waste

1. Sector overview

93. In 2009, emissions from the waste sector amounted to 33,934.08 Gg CO_2 eq, or 11.8 per cent of total GHG emissions. Since 1990, emissions have increased by 250.5 per cent. The key driver for the rise in emissions is the increase of generated and disposed solid waste, leading to higher CH_4 emissions from solid waste disposal on land. Within the sector, 88.9 per cent of the emissions were from solid waste disposal on land, followed by 11.1 per cent from wastewater handling.

94. The ERT noted that the NIR does not include information on CH_4 and N_2O emissions from domestic (sludge) and industrial wastewater, N_2O emissions from human sewage or emissions from waste incineration; instead the notation keys “NA” and “NE” are used with the explanation that there is a lack of AD. The ERT recommends that Turkey make efforts to improve the completeness of its inventory in this sector in its next inventory submission.

95. The ERT agrees with previous review reports that the NIR does not provide sufficient information on and justification of methodologies, AD, EFs and parameters for the categories solid waste disposal on land and wastewater treatment, and, therefore, reiterates the recommendation of the previous review report that Turkey provide detailed methodological information and explanation of the trends in its next inventory submission.

96. Turkey reported emissions from solid waste disposal on land and wastewater handling using the tier 1 method and IPCC default values. Both estimated categories are key categories, therefore, the ERT recommends that the Party strive to develop country-

specific EFs and use higher-tier approaches for the estimates for future inventory submissions.

97. As for the other sectors, there were no recalculations performed for the waste sector in the current submission and the recommendations from previous review reports are still pending.

2. Key categories

Solid waste disposal on land – CH_4

98. The emissions are estimated using the IPCC default methodology consistently applied over the time series. The ERT noted that Turkey used the first order decay (FOD) model for verifying the emission estimates. The NIR did not contain detailed information on the calculation and justification of parameters and EFs used in the FOD model. During the review, Turkey provided comprehensive information on the FOD model used in combination with the IPCC default values. The ERT commends Turkey for its effort to calculate emissions using the FOD model. Given that this is a key category, the ERT recommends that Turkey use the FOD model to estimate emissions for reporting in its inventory, rather than for the verification of emission estimates calculated by lower-tier methods.

99. Annual data on municipal solid waste were produced by TurkStat using a statistical survey and interpolation for the missing years. The CH_4 emissions were estimated for managed and unmanaged landfills, with waste composition based on IPCC default data. The ERT recommends that, to improve the quality of its inventory, Turkey collect country-specific data for waste composition by geographical region. Waste composition is related to the degradable organic carbon (DOC) value. Turkey has used the DOC value 0.15 for the entire time series, which is in the lowest end of the possible range suggested by the Revised 1996 IPCC Guidelines, but there is no explanation in the NIR to justify the use of this value. This could lead to an underestimation of CH_4 emissions. The ERT reiterates the recommendation of the previous review report that Turkey use appropriate DOC values and justify the choice made in its next inventory submission.

100. The NIR did not contain information on managed and unmanaged landfills, although those sub-categories are separately reported in the CRF tables. Turkey used the methane correction factor (MCF) 1.0 for managed landfills and 0.6 for unmanaged landfills. The ERT agrees with the previous review report that the appropriate value for unmanaged landfills is 0.4 (unmanaged – deep) or 0.8 (unmanaged – shallow) and reiterates the recommendation that Turkey refer to the IPCC good practice guidance and select the appropriate MCF value for the country, based on the category of unmanaged landfills in the country. The ERT further recommends that the Party include underlying background information supporting the estimates in its next inventory submission.

Wastewater handling – CH_4 and N_2O

101. CH_4 and N_2O emissions were reported for domestic and commercial wastewater treatment using the IPCC default method and EFs across the entire time series. Turkey continues to report emissions from industrial wastewater as “NE”. The ERT reiterates the recommendation of the previous review report that the Party use the data on wastewater flows and chemical oxygen demand of key important industries in accordance with the IPCC good practice guidance and provide the relevant estimates in its next inventory submission. The ERT further recommends that the Party correct the use of notation keys in the CRF tables (e.g. change “NA” to “IE” for sludge) and provide the additional information on sheet 2 of the CRF table 6.B, as well as include in the NIR additional

background information, such as specific protein consumption, number of population connected to treatment plants or septic tanks.

3. Non-key categories

Waste incineration – CO_2, CH_4 and N_2O

102. Turkey continues to report emissions from waste incineration as "NA". The ERT reiterates the recommendation of previous review reports that, in its next inventory submission, Turkey estimate emissions from hazardous waste incineration and medical waste incineration plants that are reported to exist in the country using statistical data for incinerated hazardous and medical waste reported to the MOEF and the default methodology, EFs and parameters in accordance with the IPCC good practice guidance. The ERT also reiterates the recommendations from the previous review report that Turkey report under the energy sector the CO_2 and N_2O emissions of hazardous waste that have been incinerated for several years as an alternative fuel and report notation key "IE" in table 6.C for those emissions in its next inventory submission, as appropriate.

III. Conclusions and recommendations

103. Turkey made its annual inventory submission on 13 April 2011. The annual inventory submission contains the GHG inventory (comprising a set of CRF tables and an NIR). This is in line with the UNFCCC reporting guidelines.

104. The ERT concludes that the preparation and reporting of the Party's inventory submission was not fully in accordance with the UNFCCC reporting guidelines. The inventory submission is generally complete and Turkey has submitted a set of CRF tables for the years 1990–2009 and an NIR, although several tables were left blank (e.g. tables 5.D, 5.E, 5F, 5(III)). These are generally complete in terms of years and sectors, but not complete in terms of categories and gases. Some of the categories were reported as "NE": in the energy sector (e.g. CH_4, N_2O and CO_2 emissions relating to fugitive emissions from oil and natural gas); the industrial processes sector (actual and potential emissions of HFCs and PFCs and emissions from a number of subcategories of consumption of halocarbons and SF_6); the agriculture sector (N_2O emissions from agricultural soils, pasture, range and paddock manure and N leaching and runoff); the LULUCF sector (e.g. carbon stock changes from forest conversions to other land, wetlands, settlements, other land, CO_2 from liming and N_2O from disturbance associated with land-use conversion to cropland) and the waste sector (N_2O emissions from industrial wastewater and human sewage, and waste incineration).

105. Turkey's inventory is not fully in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. For example, Turkey has included the LULUCF sector as a whole in its key category analysis, which is not in line with the IPCC good practice guidance for LULUCF. Also, Turkey did not include emissions for which the AD are confidential in the total emissions in the industrial processes sector, which is not in line with the UNFCCC reporting guidelines or the Revised 1996 IPCC Guidelines.

106. The institutional arrangements implemented by Turkey for the preparation of the inventory continue to perform most of the required functions. However, the ERT identified some issues that need to be addressed, including the lack of an improvement plan, the lack of records of detailed QC activities and the lack of a centralized archiving system. The ERT noted that Turkey has only implemented a few of the recommendations from the previous review report. The ERT notes that the institutional arrangements need to be improved and

enhanced so that the recommendations from previous reviews and other QA activities can be implemented in a timely manner.

107. The ERT identifies the following cross-cutting issues for improvement:

(a) The improvement of the national institutional arrangements in order to ensure the improvement of inventory preparation, planning and management;

(b) The acceleration of the implementation of the inventory portal;

(c) The improvement of the completeness of the inventory, especially for those categories that are known to occur within the country and for which methodologies are available in the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT also recommends that, when reporting emissions data for the first time for a given category, the Party ensure that emissions data are provided for the entire inventory time series, and that the choice of methods and EFs are clearly explained in the NIR;

(d) The use of higher-tier methods to estimate emissions from the key categories;

(e) The improvement of the transparency by including sections for all relevant categories (e.g. cropland, grassland) and the improvement of the category-specific methodological information, providing details on the methodological choice, clear explanations on selected AD, EF, parameters and assumptions used, justifying the expert judgements used in the estimates and for the uncertainty analysis, and providing trend information in the NIR;

(f) The assessment of time-series consistency, carrying out recalculations where necessary and providing the corresponding rationale and documentation in the NIR;

(g) The development of a QA/QC plan;

(h) The development of an inventory improvement plan, including all issues identified in inventory review reports past and present;

(i) The implementation of a key category analysis in line with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF;

(j) The correct use of notation keys, including their use across all entry cells (no empty cells) in the CRF tables.

108. In the course of the review, the ERT formulated a number of recommendations for each sector relating to the completeness, transparency and accuracy of the information presented in Turkey's inventory submission. The key recommendations are that Turkey:

(a) Investigate the differences between the sectoral and reference approaches, ensure accurate and transparent reporting of fuel use across the energy, industrial processes and waste sectors, improve the transparency of reporting by including in the NIR a complete list of the values used for the NCVs and the EFs for CO_2, CH_4 and N_2O, indicating the information on their sources and ensuring consistency between the information reported in the NIR and the CRF tables;

(b) Report emissions associated with confidential data in an aggregated manner in the industrial processes sector to ensure confidentiality and the completeness of the inventory;

(c) Estimate the emissions from significant livestock using a tier 2 method and an enhanced livestock characterization, in accordance with chapter 4.1 of the IPCC good practice guidance;

(d) Implement the plan for the establishment of a permanent working team in the LULUCF sector and report the results of the projects undertaken in the sector; begin reporting all mandatory categories in the sector and provide clear identification of lands and land conversions and precise definitions for forest, 'managed' and 'unmanaged' forests in the NIR;

(e) Use the FOD model to estimate emissions from solid waste disposal on land for reporting in the waste sector of the inventory, rather than using the model for the verification of emission estimates calculated by lower-tier methods.

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 2011. Available at <http://unfccc.int/resource/docs/2011/asr/tur.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2011. Available at <http://unfccc.int/resource/webdocs/sai/2011.pdf>.

FCCC/ARR/2010/TUR. Report of the individual review of the annual submission of Turkey submitted in 2010. Available at <http://unfccc.int/resource/docs/2011/arr/tur.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Ali Can (State Institute of Statistics), including additional material on the methodology and assumptions used.

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
C	confidential
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
EU	European Union
FOD	first order decay
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
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1,000 grams)
LULUCF	land use, land-use change and forestry
MCF	methane correction factor
Mg	megagram (1 Mg = 1 tonne)
N	nitrogen
NA	not applicable
NCV	net calorific values [please adjust the list alignment]
N_2O	nitrous oxide
NE	not estimated
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SF_6	sulphur hexafluoride
TJ	terajoule (1 TJ = 10^{12} joule)
UNFCCC	United Nations Framework Convention on Climate Change