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Report of the individual review of the annual submission of Turkey submitted in 2010*

* In the symbol for this document, 2010 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 2010 annual submission of Turkey, coordinated by the UNFCCC secretariat, in accordance with decision 19/CP.8. The review took place from 20 to 25 September 2010 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Paul Filliger (Switzerland) and Mr. Manfred Ritter (Austria); energy – Mr. Cesar Bermudez (Spain), Mr. Simon Eggleston (United Kingdom of Great Britain and Northern Ireland) and Mr. Sergiy Skybyk (Ukraine); industrial processes – Ms. Pia Forsell (Finland), Ms. Maria Jose Lopez (Belgium) and Ms. Siriluk Chiarakom (Thailand); agriculture – Mr. Sorin Deaconu (Romania), Ms. Hongmin Dong (China) and Mr. Chemendra Sharma (India); land use, land-use change and forestry (LULUCF) – Ms. Jennifer Jenkins (United States of America) and Ms. Tracy Johns (United States of America); and waste – Ms. Maryna Bereznitska (Ukraine) and Mr. Hiroyuki Ueda (Japan). Ms. Dong and Mr. Eggleston were the lead reviewers. The review was coordinated by Mr. Tomoyuki Aizawa (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 made no comment on it.

B. Emission profiles and trends

3. In 2008, the main greenhouse gas (GHG) in Turkey was carbon dioxide (CO_2), accounting for 81.1 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (14.8 per cent) and nitrous oxide (N_2O) (3.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 0.9 per cent of the overall GHG emissions in the country. The energy sector accounted for 75.8 per cent of total GHG emissions, followed by the waste sector (9.3 per cent), the industrial processes sector (8.1 per cent), and the agriculture sector (6.8 per cent). Total GHG emissions amounted to 366,502.15 Gg CO_2 eq and increased by 96.0 per cent between 1990 and 2008.

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 2008

	Gg CO_2 eq							
Greenhouse gas	*1990*	*1995*	*2000*	*2005*	*2006*	*2007*	*2008*	*Change 1990–2008 (%)*
CO_2	141 362.41	173 899.96	225 432.27	259 605.48	276 716.43	307 915.64	297 123.94	110.2
CH_4	33 497.80	46 866.56	53 299.87	52 353.79	53 327.20	55 583.04	54 294.83	62.1
N_2O	11 565.62	16 224.33	16 616.95	14 182.21	15 550.07	12 350.53	11 570.85	0.0
HFCs	NA	NA	818.43	2 379.00	2 729.75	3 174.30	2 669.43	NA
PFCs	603.43	516.43	515.12	487.76	404.62	C, NA, NE	C ,NA, NE	NA
SF_6	NA, NE	NA, NE	322.89	858.73	911.11	952.11	843.10	NA

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

Table 2
Greenhouse gas emissions by sector and activity, 1990 to 2008

	Gg CO_2 eq							
Sector	*1990*	*1995*	*2000*	*2005*	*2006*	*2007*	*2008*	*Change 1990–2008 (%)*
Energy	132 128.43	160 787.57	212 546.33	241 754.45	258 563.97	288 691.32	277 706.97	110.2
Industrial processes	15 442.26	24 206.65	24 373.81	28 750.51	30 691.98	29 261.76	29 829.90	93.2
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	26 501.70	26 310.26	25 042.97	–15.9
LULUCF	–44 870.53	–61 836.21	–67 557.57	–69 532.60	–75 935.42	–76 274.00	–80 579.71	79.6
Waste	9 681.77	23 834.04	32 715.80	33 522.87	33 881.54	35 712.27	33 922.31	250.4
Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**142 158.73**	**175 671.08**	**229 447.97**	**260 334.36**	**273 703.76**	**303 701.61**	**285 922.44**	**101.1**
Total (without LULUCF)	**187 029.26**	**237 507.29**	**297 005.53**	**329 866.96**	**349 639.18**	**379 975.61**	**366 502.15**	**96.0**

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

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

5. The 2010 annual inventory submission was submitted on 13 April 2010; it contains a complete set of common reporting format (CRF) tables for the period 1990–2008 and a national inventory report (NIR), which was submitted on the same date. The annual 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 previous years' submissions during the review.

7. During the review, Turkey provided the ERT with additional information and documents which are not part of the inventory submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in the annex to this report.

Completeness of inventory

8. Turkey provided an inventory for the years 1990–2008 that is complete in terms of years and geographical coverage. The inventory covers all source and sink categories but a number of categories are reported as not estimated ("NE"). These include:

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

(b) CO_2 emissions from a number of categories in the industrial processes sector, such as actual emissions of PFCs, potential emissions of HFCs and PFCs and a number of activities resulting in SF_6 emissions;

(c) N_2O emissions from pasture, range and paddock manure, and nitrogen (N) leaching and run-off in the agriculture sector;

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

(e) CO_2 and N_2O emissions from forest land and soils, and CO_2 emissions from litter in forest land in the LULUCF sector.

9. The ERT noted that Turkey improved the completeness of its submission in 2010 by reporting direct soil emissions, as well as CH_4 and N_2O emissions from domestic and commercial wastewater, for the first time. The ERT welcomes these improvements and recommends that Turkey estimate emissions for all categories previously reported as "NE" in the next inventory submission, for which methods and/or EFs are available in the revised 1996 Intergovernmental Panel on Climate Change (IPCC) guidelines and/or the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance).

10. In the industrial processes sector, a number of categories are reported as confidential ("C") and are therefore not included in the national total. The ERT recommends that

Turkey estimate these emissions and report them at the most disaggregated level possible, while ensuring that they are included in the national total and, further, that the Party provide transparent information in the NIR as to where these emissions have been reported as part of aggregated values.

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

Overview

11. The ERT concluded that the institutional arrangements continued to perform their functions. However, Turkey uses mainly 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.

12. In the 2009 review report (para. 26), it was noted that the institutional capacity of Turkey was still lacking, but that the Party planned to allocate more human and financial resources. In response to a question raised by the ERT during the review, Turkey further explained that it is currently studying the possibility of establishing a "national system" and that most of its efforts are focused on this subject. Turkey's institutional capacity is currently being enhanced through national and European Union- (EU) funded projects with the different stakeholders in Turkey. The Turkish Statistical Institute (TurkStat), as the main organization responsible for the preparation of the national inventory, is working on the establishment of an "emissions inventory portal". The ERT commends Turkey for these improvements and recommends that these efforts are followed up and that a description of these changes and the plans to the institutional arrangements is included in the next NIR.

Inventory planning

13. The NIR and additional information submitted by the Party 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). The MARA and the MOEF provide estimates for emissions and removals from the LULUCF sector. TurkStat is responsible for processing the common reporting format (CRF) tables and for the compilation of the NIR.

14. Category-specific quality assurance/quality control (QA/QC) and verification procedures are mentioned in the NIR, with references to the more general QA/QC procedures performed in Turkey. Further information on specific responsibilities within the inventory planning and preparation process (such as the choice of methods and data collection of AD and emission factors (EFs) from other entities) is not provided in the NIR. In response to a question raised by the ERT, Turkey acknowledged that the QA/QC procedures have been only partially implemented and that no overall QA/QC management system has yet been set up. Turkey further explained that in the future, the results from the key category analysis will be used as a driving factor for improving the inventory. The ERT commends Turkey for its improvements to sector-specific QA/QC and recommends that the Party follow up the plans for developing a formal QA/QC system in accordance with the IPCC good practice guidance, and that it provide further detail on its general QA/QC procedures in the next NIR.

Inventory preparation

Key categories

15. Turkey has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2010 submission. The key category analysis performed by the Party and that performed by the secretariat[2] produced different results, owing to the fact that Turkey included the whole LULUCF sector in its key category analysis as one category and not disaggregated as recommended in 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 follow the IPCC good practice guidance for LULUCF and either disaggregate the LULUCF sector for its key category analysis or report on the rationale for the level of category aggregation used in its next inventory submission.

Uncertainties

16. Turkey's tier 1 uncertainty analysis is mainly based on expert judgement, and estimates a total uncertainty of 11.9 per cent for 2008, an increase of 1 per cent from the previous year. The uncertainty analysis conducted by Turkey follows the IPCC good practice guidance, but the ERT recommends that the Party document the rationale for the uncertainty estimates where expert judgement is used.

Recalculations and time-series consistency

17. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that recalculations reported by the Party of the time series 1990–2007 have been undertaken to take into account: revised AD for fuel combustion in iron and steel; a revised methodology for the calculation of emissions from cement production; revised AD for lime production; revised AD for dairy cattle and sheep for enteric fermentation, which has also led to recalculations in manure management; the use of a revised EF for rice cultivation; the inclusion of direct soil emissions; a revised EF for field burning of agricultural residues; and new estimates for domestic and commercial wastewater.

18. The major changes, and the magnitude of the impact, include: an increase in estimated total GHG emissions in 1990 (of 10.0 per cent) and an increase in 2007 (of 2.0 per cent). The rationale for these recalculations is provided in the NIR but not in CRF table 8(b). The ERT recommends that Turkey include these explanations in CRF table 8(b).

Verification and quality assurance/quality control approaches

19. TurkStat is responsible for QA, while QC is performed by the data providers involved in the preparation of the inventory for the various sectors. The NIR mentions category-specific verification procedures for transport, and public electricity and heat production, but includes only very limited information on general QC procedures implemented in the country and no documentation on the QC procedures actually

[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 IPCC good practice guidance for LULUCF. 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.

performed. The ERT welcomes the progress made by Turkey so far and reiterates the recommendation made in the previous review report that the Party:

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

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

(c) Produce better documentation of QC at all stages of the inventory preparation process.

Transparency

20. The structure of the NIR does not yet follow the structure of the NIR provided in the UNFCCC reporting guidelines and only limited information is included on cross-cutting issues such as QA/QC and national institutional arrangements. The rationale for reporting certain categories as "NE" in the inventory is provided in the NIR but not in the CRF tables. However, the information in the NIR is provided only at a highly aggregated level, with terms such as "methods and data availability are studied" or "lack of data". The ERT recommends that Turkey follow the structure of the NIR provided in the UNFCCC reporting guidelines and document the rationale for reporting certain categories as "NE" in the corresponding CRF table 9(a) in further detail.

21. The information given on the methodological choice is often not sufficiently detailed to enable the assessment of the underlying assumptions and the rationale for the choice of data, methods and other inventory parameters. The ERT reiterates the recommendation from previous review reports that Turkey further improve the transparency of its national inventory submission by including: 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 in the inventory preparation process; 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 fluctuations.

Inventory management

22. TurkStat is responsible for the overall preparation of the inventory, but does not yet have a centralized archiving system, which would include the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information should also include internal documentation on QA/QC procedures, external and internal reviews, and documentation on key categories and planned inventory improvements. The ERT encourages Turkey to further improve the inventory management system in such a way as to ensure a consistent level of QA/QC across all sectors.

3. Follow-up to previous reviews

23. Following up from previous review recommendations, the major cross-cutting improvements implemented by the Party include:

(a) The estimation of two categories that were previously reported as "NE" (N_2O emissions from direct soil emissions, and CH_4 and N_2O emissions from domestic and commercial wastewater);

(b) A revision of the key category analysis, which now includes a trend assessment.

24. However, the implementation of a number of cross-cutting issues is still pending, including:

(a) The calculation and reporting of emissions currently reported as "NE" and for which methods exist in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as 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 and EFs used;

(d) The development of an inventory improvement plan;

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

(f) The creation of a QA/QC management system based on the QA/QC plan.

4. Areas for further improvement

Identified by the Party

25. In response to questions raised by the ERT, Turkey informed the ERT that it is planning a number of 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 establishment of a permanent team to work on LULUCF studies and the improvement of the capacity of the staff and institutions concerned;

(c) The improvement of the completeness of reporting through the reconsideration of the cooperation between TurkStat and the other members of the Climate Change Coordination Board;

(d) The revision of the use of notation keys, in particular for representing confidential data and for N_2O emissions from pasture, range and paddock manure and indirect emissions from agricultural soils;

(e) The collection of international and domestic fuel data for international aviation and navigation;

(f) The collection of more detailed AD in the transport sector, such as: the annual age distribution in the vehicle fleet; the technology penetration in a larger number of vehicle subcategories; country-specific EFs that consider local traffic-flow conditions; improved vehicle mileage estimates for calculating fuel consumption with greater accuracy, both regionally and cumulatively; and more accurate and detailed fuel consumption and EF data for marine vessels;

(g) The establishment of a national forest inventory and a carbon accounting system to monitor national forest carbon stocks;

(h) The collection of further country-specific data on carbon stock changes in forest soils and litter from the Turkish Western Blacksea Forestry Research Directorate.

Identified by the expert review team

26. The ERT identified the following cross-cutting issues for improvement:

(a) The follow-up of national plans to further improve the national institutional arrangements in order to ensure consistency across all sectors;

(b) The development of a formal QA/QC system in accordance with the IPCC good practice guidance (see para. 19 above);

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

(d) The follow-up of national plans to establish a permanent working team for the LULUCF sector, and to establish a national forest inventory and collect country-specific data for carbon stock changes;

(e) The disaggregation of the LULUCF sector for its key category analysis or the reporting on the rationale for the level of category aggregation used in the next annual submission;

(f) The documentation of the rationale for the uncertainty estimates where expert judgement is used in the next annual submission;

(g) Following the structure of the NIR outlined in the UNFCCC reporting guidelines more closely;

(h) Further improvement of the transparency of the national inventory by including the following: 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 fluctuations.

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

B. Energy

1. Sector overview

28. The energy sector is the main sector in the GHG inventory of Turkey. In 2008, emissions from the energy sector amounted to 277,706.97 Gg CO_2 eq, or 75.8 per cent of total GHG emissions. Since 1990, emissions have increased by 110.2 per cent. The key driver for the rise in emissions is changes occurring in energy industries, other sectors, manufacturing industries and construction, and transport. Within the sector, 38.3 per cent of the emissions were from energy industries followed by 23.6 per cent from other sectors, 20.3 per cent from manufacturing industries and construction and 17.2 per cent from transport. The remaining 0.7 per cent were from fugitive emissions from solid fuels.

29. The CRF tables include emission estimates of all gases and most categories in the energy sector. However, fugitive emissions from oil and natural gas are reported as "NE". Emissions from the category other (fuel combustion) are reported as not applicable ("NA") and not occurring ("NO"). During the previous review, Turkey had acknowledged that emissions from the military use of fuels (normally reported under other (fuel combustion)) had not been estimated. As indicated in paragraph 38 below, Turkey has provided emission estimates from the use of international bunker fuels for the first time. The ERT appreciates the efforts made by the Party and reiterates previous recommendations that Turkey continue to improve the completeness of its reporting.

30. Although Turkey has made efforts to improve the transparency of its reporting, the reporting of the energy sector is still not sufficiently transparent. The calculation methodologies are not well documented in the NIR, and insufficient background information has been provided to enable the reader to follow the calculations. For instance, the fuel properties used by the country throughout the time series are not clearly described. The ERT recommends that Turkey improve the transparency in the energy sector by including in the NIR a complete list of the values used for the net calorific values (NCVs) and the EFs for CO_2, CH_4 and N_2O, indicating the information sources.

31. The emissions from waste facilities recovering energy as electricity are reported under energy industries in the NIR. Information is provided in the NIR, stating that cement plants can co-incinerate waste and that the corresponding emissions are included in the energy sector. While the provision of such background information answers the question raised by the ERT, the relevant information provided is not transparently documented in the NIR. The ERT recommends that Turkey explain in a more detailed manner the methodology and data used to estimate emissions from energy use of waste.

32. According to annex 9 to the NIR, Turkey has performed some recalculations in manufacturing industries and construction for the years 2005–2007. However, the ERT noted that Turkey has not resolved the time-series inconsistencies identified in the previous review report. The ERT reiterates the recommendation made in the previous review report that Turkey amend these time-series inconsistencies and recalculate the corresponding emissions in its next inventory submission.

33. Quantitative estimates of the uncertainties in the energy sector continue to be based on expert judgement, but the NIR does not provide background information on, or the assumptions used for, this expert judgement. The ERT recommends that Turkey report this information in its next NIR.

2. Reference and sectoral approaches

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

34. CO_2 emissions were calculated using the reference approach and the sectoral approach. For 2008, the difference was +10.9 per cent. The time series of this difference shows a great variability during the whole period (1990–2008), with the lowest point in 1991 (–4.4 per cent) and the highest in 2008. 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. The ERT recommends that Turkey use the same EFs and NCV values for the sectoral approach and the reference approach and investigate other possible factors, such as statistical differences in the energy balance and missing information in the reference or sectoral approaches.

35. In CRF table 1.A(b), Turkey has reported imports and exports of some oil products and solid fuels as "NA". However, these values are aggregated under crude oil, lignite and hard coal. This use of the notation key is not in line with the UNFCCC reporting guidelines. The ERT recommends that the Party assess whether these data should be reported using the notation key "IE" (included elsewhere) and provide additional information in the NIR and CRF table 9(a).

36. In CRF table 1.A(c), the apparent energy consumption is reported as "NA", but this is not an appropriate use of the notation key. Therefore, the difference in energy consumption for all fuels reported by Turkey is –100 per cent. The ERT recommends that Turkey report the apparent consumption for the reference approach in the CRF tables.

37. There are several differences between the data reported in the CRF tables and those reported to the International Energy Agency (IEA). For instance, the 1990–2008 growth rate of the total apparent consumption is 130 per cent in the CRF tables, while in the tables provided to the IEA it is 107 per cent. The ERT encourages the Party to investigate the differences between the data used for the inventory and that reported to the IEA.

International bunker fuels

38. Turkey has estimated emissions from international aviation and navigation for the first time for the year 2008. The NIR includes a table with the data on fuel consumption and the associated emissions, but does not provide any information about the methodology used and relevant assumption. The ERT commends Turkey for having determined the emissions from the use of international bunker fuels and encourages the Party to include in the NIR information relating to the estimation methods and assumptions.

Feedstocks and non-energy use of fuels

39. 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 feedstock in the petrochemical industry, that natural gas is used as feedstock in the fertilizer industry, and that other oil products such as asphalt, lube oil and heavy vacuum gas oil (HVGO) are mostly used for non-energy purposes. During the previous review, 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 future data collection efforts for quantifying the amount of feedstocks and non-energy use of fuels, and that the Party make use of the documentation box in CRF table 1.A(d) in future inventory submissions.

3. Key categories

Stationary combustion: solid, liquid and gaseous fuels – CO_2

40. Turkey states that emissions from the energy sector are estimated using the IPCC tier 1 approach, except for road transportation, where a tier 2 or tier 3 approach is used. According to annex 8.2 to the NIR, the basic source for EFs for public electricity and heat production is the IPCC default values. The ERT reiterates recommendations in previous review reports that Turkey develop country-specific EFs from the data that are already collected by the MENR for the public electricity and heat production category. For the remaining energy sector key categories, the ERT reiterates recommendations in previous review reports that Turkey make efforts to develop country-specific EFs.

41. The information provided in the NIR is not clear and is, in some cases, contradicts the CRF tables. For instance, for public electricity and heat production, table 3.2 (page 15 of the NIR) states that country-specific EFs have been used, while annex 8.2 to the NIR (page 111) indicates that IPCC default EFs have been used to calculate emissions. In addition, some subcategories show a significant variation in emissions between 2007 and 2008 (e.g. CO_2 emissions from residential increased by 41.6 per cent between 2007 and 2008, and CO_2 emissions from non-ferrous metals decreased by 97.3 per cent). The NIR does not provide any explanation for these abnormal trends. The ERT recommends that Turkey improve the transparency of the NIR and the consistency between the NIR and the CRF tables.

42. The CO_2 implied emission factors (IEFs) for all fuels for the category public electricity and heat production continue to show significant inter-annual changes. For solid fuels, the CO_2 IEFs for the period 1990–2004 (ranging from 76.52 to 86.87 t/TJ) are the lowest of the values reported for each year by the reporting Parties and lower than the IPCC

default values (ranging from 94.6 to 106.7 t/TJ). In addition, there are large inter-annual fluctuations for the whole time series, except for 1996–1997 and 2005–2008. Regarding liquid fuels, the 1990–2004 CO_2 IEFs (ranging from 66.1 to 68.4 t/TJ), and the 2008 CO_2 IEF (61.66 t/TJ) are among the lowest of all reporting Parties and vary considerably. For natural gas, the Party has used CO_2 IEFs (ranging from 53.1 to 54.1 t/TJ) for the period 2000–2004 only, which are lower than the IPCC default value (56.1 t/TJ). A similar observation was made in the previous review report. The ERT recommends that Turkey provide an explanation for the fluctuation of the IEFs.

43. Following the recommendations of the previous review report, Turkey has revised the AD of iron and steel for the years 2005–2007. The ERT appreciates the efforts made by Turkey to revise the AD. The 2007 CO_2 IEF of liquid fuel for non-ferrous metals continues to show an atypically low value (30.2 t/TJ), which is outside the range of the IPCC default values (from 63.1 to 100.8 t/TJ). The ERT recommends that Turkey investigate the reason for the atypical IEF and provide information on this in the next NIR.

44. Turkey has reported, in CRF table 1.A.(a) the 2008 emission estimates from non-ferrous metals for solid fuels using the notation key "NA", while for the rest of the time series (1990–2007) numerical data have been provided. The ERT recommends that the Party use the notation key "NO" instead of "NA", in accordance with the UNFCCC reporting guidelines.

45. The CO_2 IEF for gaseous fuels for the subcategories chemicals and other (manufacturing industries and construction) shows unexpected fluctuations in the period 2000–2007 (ranging from 57.40 to 62.97 t/TJ). Considering that natural gas is the only fuel used in the country and the IPCC default EF (56.1 t/TJ) is used for the estimation, these variations are strange. This issue was also raised in the previous review report. The ERT reiterates the recommendation of the previous review report that Turkey review the choice of AD, EFs and the methodology used to determine these emissions and, if necessary, that the Party perform the corresponding recalculations in its next inventory submission.

46. With regard to CO_2 IEFs for residential, solid and liquid fuels display significant inter-annual fluctuations. For solid fuels, the CO_2 IEFs (122.3–140.7 t/TJ) are outside the IPCC default range (94.6–106.7 t/TJ). In addition, these values are the highest among all reporting Parties for the whole time series (1990–2008). The ERT recommends that Turkey provide an explanation for the fluctuation of the IEFs.

Road transportation: solid, liquid and gaseous fuels – CO_2

47. 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, and to explain the modifications that were carried out to adapt this model to the national circumstances. Moreover, the previous review report recommended that Turkey 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 2010 NIR, the ERT repeats the encouragements and the recommendation of the previous ERT.

4. Non-key categories

Stationary combustion: solid fuels CH_4

48. For the subcategory residential, the CH_4 IEFs for the period 1990–2004 (ranging from 1.13 to 2.24 t/TJ) are outside of the IPCC default range and are the highest among all reporting Parties (ranging from 0.0004 to 2.24 t/TJ). Turkey reports in its NIR (table A.2.1,

page 67) the use of the IPCC default CH_4 EF (300 kg/TJ). The ERT recommends that Turkey investigate the fluctuation of this IEF and provide information thereon in the next NIR.

Coal mining and handling – CH_4

49. Turkey uses a tier 1 method with the IPCC default EF to estimate fugitive emissions from solid fuels. The ERT noted that the 2008 CH_4 emission value (92.24 Gg) is the highest of the whole time series and that the emissions from this category have increased by 57.6 per cent in the period 2004–2008. The ERT also notes that if this increase continues, this category may become a key category and therefore encourages the Party to consider any improvements to the estimation method.

C. Industrial processes and solvent and other product use

1. Sector overview

50. In 2008, emissions from the industrial processes sector amounted to 29,829.90 Gg CO_2 eq, or 8.1 per cent of total GHG emissions, and emissions from the solvent and other product use sector were reported as "NE" or "NA". Since 1990, emissions have increased by 93.2 per cent in the industrial processes sector. The key driver for the rise in emissions in the industrial processes sector is cement production (a 120.9 per cent increase since 1990). Within the industrial processes sector, 88.0 per cent of the emissions were from mineral products, followed by 11.8 per cent from consumption of halocarbons and SF_6 and 0.2 per cent from chemical industry. The ERT noticed that all emissions from iron and steel production are included in the energy sector and CO_2 emissions from ammonia, N_2O emissions from nitric acid, CO_2 emissions from carbide production and CO_2 emissions from aluminium production are reported as "C" for the years 2007–2008.

51. The following emissions were reported as SF_6 emissions from aluminium foundries; HFC, PFC and SF_6 emissions from aerosols/metered dose inhalers, solvents, other applications using ozone-depleting substitutes (ODS) and semiconductor manufacture; potential emissions of HFCs and PFCs; and "NE": CO_2 emissions from asphalt roofing and ethylene. The ERT recommends that Turkey estimate the emissions from these categories in the next annual submission, for which methods and/or EFs are available in the revised 1996 IPCC guidelines and the IPCC good practice guidance.

52. The ERT noted that several categories were reported as "C" for the years 2007–2008, including CO_2 emissions from limestone and dolomite use, soda ash production, ammonia production, carbide production, N_2O emissions from nitric acid production and CO_2 and PFC emissions from aluminium production. The ERT acknowledges that national confidentiality requirements prevent Turkey from providing information on categories where there are less than three plants. The NIR does not determine clearly if these confidential emissions are aggregated elsewhere. The ERT recommends that Turkey report all confidential emissions at an aggregated level and indicate clearly in the NIR where the emissions of these confidential categories are reported as part of aggregated values.

53. The ERT noted that the notation key "IE" has been used in several categories, but no explanation has been provided as to where those emissions are actually included, either in CRF table 9(a) or in the NIR. The ERT recommends that Turkey provide an explanation for where those emissions and/or AD are included for all categories reported as "IE".

54. For the industrial processes sector, the estimation methods, AD and emission trends were not sufficiently transparently described. The ERT recommends that Turkey improve transparency by describing the methodologies used and explaining the fluctuations in emission trends in all categories in its next NIR.

55. The ERT noted that Turkey has reported recalculations of emissions from cement, lime and iron and steel production. The recalculation of cement production was due to the use of a tier 2 method, the recalculation of lime production was due to a change of AD, and the recalculation of iron and steel production was conducted in order to prevent double counting, which had been noticed by the previous ERT. The recalculations increased the total GHG emissions in 1990 by 1.0 per cent and by 0.8 per cent in 2007. Turkey has provided a sufficient rationale for the recalculations in the NIR.

2. Key categories

Cement production – CO_2

56. Turkey has recalculated emissions of cement production and applied a tier 2 methodology with AD received from the Turkish Cement Manufacturers' Association and the default EF, and has also used the default cement kiln dust (CKD) correction factor. The ERT commends Turkey for its effort to move to a tier 2 method, and noted the Party's use of the default EF and CKD factor for this key category. The ERT recommends that Turkey develop country-specific EFs after collecting data on the calcium oxide (CaO) and magnesium oxide (MgO) content of clinker and collecting data for a country-specific CKD correction factor in accordance with the IPCC good practice guidance.

Lime production – CO_2

57. Turkey has recalculated emissions from lime production using production data collected from the Turkish Lime Association and the default EF for the whole time series. The IEF fluctuates during the time series (2002–2008) because the AD and emissions from limestone and dolomite use are included in this category due to confidentiality reasons. The ERT recommends that Turkey describe the methodology used and explain the reason for the fluctuations in the IEF and AD in its next NIR.

Consumption of halocarbons and SF_6 – HFCs, PFCs and SF_6

58. For the HFC emissions from consumption of halocarbons, only HFC-134a emissions from refrigeration and air-conditioning equipment have been reported, because it is the only species of HFC for which import data are available. Emission estimates have been calculated for the years 2000–2008. During the review week, Turkey explained that the use of HFCs began in Turkey only after the beginning of ODS phase-out policies; therefore, no consumption appeared prior to 2000.

59. Actual emissions of SF_6 from electrical equipment have been estimated in the NIR. The latest three years (2006–2008) have been estimated using extrapolation based on annual growth rates in Turkey due to a lack of import data. The ERT recommends that Turkey explore possibilities of collecting sufficient data to estimate these emissions and that it describe the calculation methods in its next NIR.

3. Non-key categories

Limestone and dolomite use – CO_2

60. Turkey reported that limestone and dolomite use are included under lime production. Data on the production and use of limestone are confidential. The ERT encourages Turkey to explore wider possible uses of limestone and dolomite, for example in glass production, tile and ceramic production and in the energy industry for sulphur dioxide control to ensure the completeness of the inventory.

Soda ash production and use – CO_2

61. CO_2 emissions from soda ash production are reported as "C". These emissions do not appear to have been included in the total emissions from the industrial processes sector. The ERT recommends that Turkey report these emissions in an aggregated manner to ensure confidentiality and completeness of the inventory and that the Party explain the reasons for doing so in the next NIR.

62. CO_2 emissions from soda ash use are reported as "NA". The ERT recommends that Turkey report CO_2 emissions from soda ash use; otherwise, the notation key should be changed from "NA" to "NE".

Ammonia production – CO_2

63. CO_2 emissions from ammonia production are reported as "C". The ERT recommends that Turkey report these emissions in an aggregated manner to ensure confidentiality and completeness of the inventory and that the Party explain the reasons for doing so in its next NIR.

64. Turkey has applied a tier 1b methodology based on the use of data on ammonia production and default EFs to estimate emissions from ammonia production. The ERT encourages Turkey to use the method which is based on the consumption and carbon content data of natural gas. Further, the ERT encourages Turkey to subtract the used amount of natural gas used in ammonia production from the total energy use in order to prevent double counting, if the method based on the consumption of natural gas is applied.

Nitric acid production – N_2O

65. Total N_2O emissions from the industrial processes sector are reported as "C, NA". Total national N_2O emissions amount to 12,350.54 Gg CO_2 eq, which consists of 1,586.63 Gg CO_2 eq from the energy sector, 9,050.00 Gg CO_2 eq from the agriculture sector, 0.004 Gg CO_2 eq from the LULUCF sector and 1,713.90 Gg CO_2 eq from the waste sector. The sum of these emissions from each sector is equal to the total national N_2O emissions. This implies that N_2O emissions from the industrial processes sector are not included in the national total because they are reported as "C". According to the UNFCCC reporting guidelines, the emissions should be aggregated to the minimum extent possible to maintain confidentiality. The ERT recommends that Turkey report N_2O emissions in the total for the industrial processes sector at the least.

66. 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. Turkey has argued in the NIR 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 (NSCR) abatement technology. The ERT reiterates the recommendation of the previous review report that Turkey provide, in the next NIR, information on the type of technology used in nitric acid plants and on their age in order to justify the EF used.

Adipic acid production – N_2O

67. The AD for this category are reported as "IE", while N_2O emissions are reported as "NA". The ERT recommends that Turkey calculate N_2O emissions and report them as part of the total N_2O emissions from the industrial processes sector.

Carbide production – CO_2

68. The AD and emissions of CO_2 and CH_4 for silicon carbide are reported as "NA". The ERT recommends 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".

69. The AD and CO_2 emissions from calcium carbide are reported as "C". These emissions do not appear to have been included in the total emissions from the industrial processes sector. The ERT recommends that Turkey report these emissions in an aggregated manner to ensure confidentiality and that it explain the reasons for doing so in its next NIR.

Aluminium production – CO_2 and PFCs

70. CO_2 emissions from aluminium production are reported as "C". These emissions do not appear to have been included in the total emissions from the industrial processes sector. The ERT recommends that Turkey report these emissions in an aggregated manner to ensure confidentiality and completeness of the inventory and that it explain the reasons for doing so in its next NIR.

71. The ERT welcomes the fact that Turkey has calculated PFC emissions for the years 1990–2004, which were missing from the previous inventory. The range of EFs for tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6) was quite wide during the years 1990–1995. During the review week, Turkey explained that the reason for the fast reduction in PFC EFs is because of the improved quality of tar used in aluminium production. The ERT also recommends that Turkey improve the descriptions of the methodologies used and explain the fluctuations in emission trends.

72. The PFC emissions from aluminium production are reported as "C" in the CRF tables while the NIR provides information on the method used. These emissions do not appear to have been included in the total emissions from the industrial processes sector. The ERT recommends that Turkey report these emissions in an aggregated manner to ensure confidentiality and completeness of the inventory and that it explain the reasons for doing so in its next NIR.

Solvent and other product use – N_2O

73. The ERT welcomes Turkey's effort to determine whether there are available data to estimate emissions from solvent and other product use. During the review week, Turkey informed the ERT that N_2O emissions from solvent and other product use will be included in the Turkish NIR in the near future.

D. Agriculture

1. Sector overview

74. In 2008, emissions from the agriculture sector amounted to 25,042.97 Gg CO_2 eq, or 6.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 15.9 per cent. The key driver for the fall in emissions is the decrease in the number of livestock and in the amount of N synthetic fertilizer applied to soils. Within the sector, 60.9 per cent of the emissions were from enteric fermentation, followed by 23.9 per cent from agricultural soils, 13.5 per cent from manure management and 0.9 per cent from field burning of agricultural residues. The remaining 0.8 per cent were from rice cultivation.

75. The completeness of Turkey's inventory has been improved since the previous submission, as estimates of N_2O emissions from the subcategories N-fixing crops and crop

residue under agricultural soils have been provided for the first time. The ERT welcomes this development. However, there is room to improve the completeness of reporting, by providing estimates for the following subcategories under agricultural soils: cultivation of histosols; pasture, range and paddock; and indirect emissions from agricultural soils.

76. The NIR does not contain detailed documentation on the selection of methods, EFs and AD, such as the number of livestock and an explanation of the emission trends. During the review, the Party provided the ERT with additional documentation on the AD and EFs used. The ERT reiterates the recommendation made in 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.

77. The NIR provides charts for the GHG emissions in this sector. The transparency of reporting could be improved through the provision of background information on the emissions trend of this sector. The ERT therefore encourages Turkey to provide an explanation of the emissions trend.

78. The documentation boxes of the CRF tables have not been filled in. The ERT recommends that Turkey provide relevant information in the documentation boxes in the CRF tables in order to improve the transparency of its reporting.

79. Some data and information included in the CRF tables are inconsistent with those in the NIR. The ERT recommends that Turkey improve the consistency of the information between the CRF tables and the NIR.

80. Turkey has provided data on its uncertainty analysis in annex 7 to the NIR. However, the results of the uncertainty analysis at the category level for this sector and the assumptions selected as a basis for expert judgement are not clearly provided in the NIR. The ERT recommends that Turkey improve the transparency of the uncertainty analysis by providing information on uncertainties at the category level in its next NIR.

2. Key categories

Enteric fermentation – CH_4

81. Turkey uses a tier 1 method for the estimation of emissions from all livestock species. The EFs used are a combination of IPCC default EFs for Asia and Eastern Europe, taking into account Turkey's specific climate zones. In order to improve consistency, Turkey conducted recalculations for the period 1990–2007 due to the disaggregation of dairy cattle into "domestic" and "cultural" cattle, and the disaggregation of sheep into "domestic" and "merino" types.

82. Given that CH_4 from enteric fermentation is identified as a key category, the ERT reiterates the recommendation from the previous review report 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.

83. During the review, the Party provided data on the milk productivity of dairy cattle in response to a question raised by the ERT. The ERT recommends that Turkey include the milk productivity data for dairy cattle, as a basis for the selection of relevant EFs in its NIR. The ERT further recommends that Turkey implement verification of the EFs selected for significant livestock by comparing these values with the values of other reporting Parties, and by considering the milk productivity data in the section for category-specific QA/QC and verification in its NIR.

Manure management – N_2O

84. The ERT welcomes the recalculations undertaken by Turkey for the period 1990–2007, which ensures completeness of the whole time series. However, the description of the method used is still not sufficiently transparent, as pointed out in the previous review report. The ERT reiterates the recommendation from the previous review report that Turkey provide the corresponding background information on the methodology used, such as the data used for the emission calculations, in order to ensure transparency, as defined in the UNFCCC reporting guidelines.[3]

85. Turkey has calculated the N_2O emissions based on data on livestock numbers, the amount of N synthetic fertilizer used and crop production, which are provided by TurkStat. The ERT welcomes that transparency of the estimates, which has been significantly improved by the provision of background data and information used for the emission calculations in the NIR and the CRF tables. However, the emission factors and methods used are not reported in the NIR. The ERT therefore reiterates the recommendation of the previous review report that Turkey provide more information on the estimation process to enable the reader to replicate these calculations.

86. The ERT noted that the completeness of 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. The ERT reiterates the previous recommendation 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.

87. The ERT also welcomes the recalculations conducted by Turkey for the period 1990–2007, which have enhanced the completeness of the time series.

3. Non-key categories

Rice cultivation – CH_4

88. In the 2009 annual review report, the ERT noted that while in the CRF (table 4.C) data were reported under "Intermittent Flooding: Single Aeration" in the NIR the method described is for "Continuous Flooding". In this submission this is still the case but the implied annual emission factor has been halved (from $20 g/m^2$ to $10 g/m^2$). The ERT recommends that the Party explain clearly in the NIR the type of rice cultivation ("Continuous Flooding" or "Intermittent Flooding: Single Aeration"), the use of organic amendments, if any, and, in the CRF, report the emissions in the same subcategory.

Field burning of agricultural residues – CH_4 and N_2O

89. Turkey changed the value of the fraction of crop residue burned ($Frac_{BURN}$) from 0.25 to 0.1, but did not provide any rationale for this recalculation in the NIR. The ERT recommends that Turkey provide the rationale for changing the $Frac_{BURN}$ value from 0.25 to 0.1 in its next NIR.

[3] "Transparency means that the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information." (para. 4 of the UNFCCC reporting guidelines (FCCC/SBSTA/2006/9).)

E. Land use, land-use change and forestry

1. Sector overview

90. In 2008, net removals from the LULUCF sector amounted to 80,579.71 Gg CO_2 eq Since 1991 (the first year of reporting for cropland remaining cropland), net removals have increased by 43.1 per cent. The key drivers for the rise in removals are net carbon stock changes in forest land remaining forest land, and carbon in living biomass in cropland remaining cropland. Within the sector, 71.5 per cent of the removals were from forest land, followed by 22.5 per cent from cropland and 6.1 per cent from grassland. The wetlands and settlements categories are not reported for the year 2008 and no notation keys are included in the relevant CRF tables. Wildfires on forest land were the only source of emissions reported and amounted to a small share of sectoral emissions (0.01 Gg CO_2 eq).

91. As stated in previous review reports, the reporting of the LULUCF sector remains incomplete. Several CRF tables are left blank, either for the entire time series or for those years for which estimates were not calculated. Turkey did not provide any estimates or the appropriate notation keys for wetlands, settlements, other land, CO_2 emissions from liming and N_2O emissions from disturbance associated with land-use conversion to cropland. The ERT notes that the notation key "NO" has been used for N_2O emissions from drainage of wetland soils. AD are missing for all CRF tables for cropland, grassland and wetlands. Without complete AD, a thorough review of these categories is not possible. The ERT recommends that Turkey ensure the completeness of its reporting by either providing data or using the appropriate notation keys for all categories.

92. The ERT notes with concern that Turkey has not provided a complete and consistent representation of its land use, despite this recommendation being made in previous review reports. The ERT strongly reiterates the recommendation that Turkey make progress towards providing a complete representation of land use that is consistent with the IPCC good practice guidance for LULUCF. This is the foundation for appropriate AD and complete reporting in this sector. The ERT further notes that land converted from forest land to other land is not reported at all due to this lack of AD, and that this omission is likely to result in significant underestimation of removals or emissions in the LULUCF sector.

93. The NIR that was submitted to the UNFCCC secretariat as part of the 2010 inventory submission contained documentation for the forest land categories only; information about all other land categories had not been provided. During the review, the ERT requested that Turkey provide a complete NIR, but there was no response to this request. Therefore, the ERT was not able to review any changes made to the inventory in these categories since the 2009 submission, and all of the recommendations for these categories are necessarily reiterated.

94. The ERT reiterates the recommendation from the previous review report that Turkey continue to improve transparency by including complete descriptions of the methodologies applied, sources of information, relevant parameters and AD used for the LULUCF sector in its NIR, particularly on the rationale for the selection of these methodologies for each LULUCF category. The ERT encourages Turkey to comply with the UNFCCC reporting guidelines by providing transparent descriptions of the methods, data and assumptions selected in the NIR, as well as the required information in the documentation boxes of the CRF tables.

95. Turkey has not conducted any recalculations in the LULUCF sector in the 2010 submission. However, the ERT recommends that Turkey continue to improve the documentation associated with recalculations, if they are conducted. For example, in the 2009 submission, non-CO_2 emissions from biomass burning on forest land were

recalculated and, although a limited explanation is given in the NIR, for transparency purposes a complete discussion on the recalculations specific to the LULUCF sector should also be included.

96. No additional information was provided on the uncertainty in non-forest land categories in the 2010 submission. For the forest land remaining forest land and land converted to forest land categories, the uncertainty parameters and values are presented. Although the recommended equations in the IPCC good practice guidance for LULUCF have been applied, the ERT recommends that Turkey improve the transparency of its reporting by providing a complete description of the input parameters and procedures used to develop the uncertainty estimates.

97. The Party has not implemented any category-specific QA/QC procedures for the key categories, as described in the IPCC good practice guidance for LULUCF. The ERT recommends that Turkey consider how it might independently verify the estimates for the categories within the LULUCF sector in order to ensure the quality of its inventory.

2. Key categories

Forest land remaining forest land – CO_2

98. Turkey has applied a tier 2 methodology for net carbon stock changes in above-ground and below-ground biomass and dead wood on forest land remaining forest land. Forest area data, the average annual net increment, basic wood density and the fraction of biomass left in forests after harvesting are all country-specific values. The IPCC default values are used only for the root to shoot ratio and carbon fraction of dry matter.

99. The ERT noted that forest land in Turkey is defined as having a minimum of 1 per cent crown closure, and that "degraded forest", with crown cover between 1 and 10 per cent, amounted to 49.8 per cent of the total forest land in Turkey in 2004. The ERT strongly recommends that Turkey develop separate methods for quantifying the carbon stock change in "normal" and "degraded" forest. As this degraded forest land may also be included in the cropland or grassland categories, the ERT restates the importance of a complete and consistent representation of the land use, as recommended above (see para. 92).

100. In table 7.10 of the NIR, the carbon stock change in forest land remaining forest land and in land converted to forest land is divided into two categories: "managed forest" and "unmanaged forest". The total managed and unmanaged forest land is included in CRF table 5.A. However, the IPCC good practice guidance for LULUCF explains that, in order for Parties to report on anthropogenic emissions only, the carbon stock change in forest land should be reported for managed forest only. The ERT strongly recommends that Turkey review the classification of managed and unmanaged forest land and provide a transparent description of the methodology used to distinguish between managed and unmanaged forest land in its next submission. The ERT further recommends that Turkey limit the reporting of forest land in its next inventory submission to managed forest only.

101. In the NIR, Turkey explains that it uses the IPCC default method[4] to calculate the carbon stock change in living biomass in forest land remaining forest land. Using this method, the losses due to felling, fire, and fuelwood harvest are subtracted from the total biomass gain in order to calculate the net carbon stock change. The NIR then mentions equation 3.2.3 of the IPCC good practice guidance for LULUCF, which is method 2 (also called the "stock change method") for calculating the carbon stock change in living biomass in forest land remaining forest land. It is not clear from the NIR which of the two methods

[4] The gain–loss method, as indicated in equation 3.2.1 of the IPCC good practice guidance for LULUCF.

is most appropriate for the AD. If the stock change method is used, then losses due to felling, fuelwood harvest, and fire should not be subtracted from the carbon stock change. The ERT is concerned that these two methods may have been combined in such a way that losses may be double-counted. The ERT recommends 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. The ERT further recommends that Turkey 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.

102. Turkey has used equation 3.2.11 of the IPCC good practice guidance for LULUCF to quantify the carbon stock change in dead wood in forest land remaining forest land, and has calculated the parameter B_{into} from forest management plans and felling residues. The ERT encourages Turkey to provide complete and transparent documentation explaining how this parameter is calculated and applied. In particular, the ERT notes that the carbon stock change in the dead wood pool has doubled from 2007 to 2008, and is concerned that carbon accumulation in dead wood for all years may be overestimated because no information is provided about other uses that might be made for the wood, such as energy use.

103. The ERT commends Turkey for including an explanation of the ENVANIS system for estimating forest carbon stock change in the 2010 NIR. The ERT also recommends that Turkey continue to develop the project to estimate carbon stock changes in forest soils and litter in order to establish country-specific factors, which is described in the planned improvements section of the NIR.

Cropland remaining cropland – CO_2

104. The cropland category was a net sink of 18,113.86 Gg CO_2 eq in 2008. Turkey applied a tier 1 approach to estimate the net carbon stock change in mineral soils. Organic soils were not considered, as this area represents only 0.3 per cent of all soils in Turkey. Given the contribution of cropland removals to total LULUCF removals, the ERT reiterates the 2009 recommendation that Turkey report on this category using a higher-tier approach, with country-specific factors. In its NIR, Turkey has indicated that no country-specific carbon stock change factors are available. The ERT again encourages the Party to develop such data.

105. In 2009, the ERT noted that the total area of cropland in Turkey was not taken into consideration in the GHG inventory. Only net carbon stock changes associated with lands converted from annual crop to permanent crop each year were estimated (an annual average of 2.3 kha), only accounting for around 9 per cent of total cropland. Because it cannot discern whether changes to this system have been made in 2010, the ERT again recommends that Turkey collect information in this regard in order to achieve completeness in the reporting of this land-use category. In addition, the ERT strongly recommends that Turkey fill in all gaps in the CRF tables, using all relevant AD.

106. In the 2010 submission, cropland estimates are reported for all years except 1990 but the CRF tables do not include AD for any of the years. The ERT strongly recommends that Turkey provide a complete time series of AD for cropland in Turkey and that it describe the calculations in the NIR completely and transparently.

107. The time series for cropland reporting begins in 1991, and the Party states that data are not available for 1990. The ERT suggests that the Party consider how it might be possible to extrapolate the missing data for 1990 in order to provide a complete time series for this category.

Grassland remaining grassland – CO_2

108. Turkey has reported that grassland accounted for a removal of 4,890.31 Gg CO_2 eq in 2008. This included net carbon stock changes in living biomass and in soils (mineral soils only). In the NIR submitted in 2009, it was stated that estimates for this category cover only areas of land being rehabilitated under a government programme, with a maximum area of 81,613.8 ha in 2007. The ERT noted that this reporting is not complete. 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 again recommends that Turkey either explain why organic soils are not included in the estimates or include them in the next inventory submission.

109. As with the cropland category, very limited information was given in the 2010 NIR, similarly to the NIR submitted in 2009, for the grassland category on the methods and assumptions used and the choice of EFs. The ERT again recommends that Turkey provide this information in its next inventory submission. The NIR indicates that default carbon stock change factors were applied. The ERT recommends that Turkey use country-specific carbon stock change factors.

110. In the 2010 submission, grassland estimates are reported for limited years from 2000 to 2008, but the CRF tables do not include AD for any of the years. The ERT reiterates the recommendation in the previous review report that Turkey report on the whole time series and prepare a more transparent description of the methods used for the estimates.

Wetlands – CO_2

111. In the 2009 submission, Turkey reported that it estimates carbon stock changes in living biomass only from lands converted to flooded lands. A complete time series was not reported; in 2009, estimates were only provided for the periods 1992–1997 and 1999–2002. In the 2010 submission, estimates are included for the years between 1992 and 2002. As in 2009, information on areas of reservoirs is not provided in the 2010 CRF tables. The 2010 NIR could not be examined for background information on the procedures for conducting these calculations or for filling in missing data. In the NIR, it was not clear if the estimates include only above-ground biomass or both above-ground and below-ground biomass pools. The ERT reiterates the recommendation of the 2009 review report that Turkey provide a clear description of the AD and choice of method in the NIR and a complete time series in its next inventory submission.

112. Carbon stock changes in living biomass from conversion to flooded land result in a net removal; however, if the activity involved is a conversion of land to reservoirs, then a net emission (i.e. a decrease in biomass and other carbon stocks) should be expected. The ERT reiterates the recommendation of the previous review report that Turkey investigate this issue and report thereon or provide an explanation in its next inventory submission.

Settlements – CO_2

113. CO_2 removals by living biomass in urban trees were reported only for the period 1991–2000. It was explained in the 2009 NIR that the crown area of urban trees was determined in 2000; this was presumably the reason for the lack of reporting for the years after 2000. AD have not been included in the CRF tables, and the appropriate notation keys have not been used in the CRF tables for non-reported years (1990 and 2001–2008. The ERT reiterates the recommendation from the previous review report that Turkey report the complete time series in its next submission or, if the complete time series cannot be reported, that it include the appropriate notation keys for particular years that are reported as “NE”.

F. Waste

1. Sector overview

114. In 2008, emissions from the waste sector amounted to 33,922.31 Gg CO_2 eq, or 9.3 per cent of total GHG emissions. Since 1990, emissions have increased by 250.4 per cent. The key driver for the rise in emissions is the growth of CH_4 emissions from solid waste disposal on land (SWDL). Within the sector, 88.9 per cent of the emissions were from SWDL, followed by 11.1 per cent from wastewater handling.

115. In response to a recommendation from the previous review report, CH_4 and N_2O emissions from domestic and commercial wastewater handling were reported for the first time for the years 1990–2008. The ERT commends Turkey for improving the completeness of its reporting. The amount of CH_4 and N_2O emissions were 2,018.56 Gg CO_2 eq and 1,733.98 Gg CO_2 eq, respectively. As a result of the key category analysis, both CH_4 and N_2O emissions from domestic and commercial wastewater handling became key categories. The default methodology contained in the Revised 1996 IPCC Guidelines was used to estimate CH_4 and N_2O emissions. However, the information on EFs, AD and relevant parameters and the justification of the choice of methodology are not provided in the NIR. The ERT recommends that Turkey provide all this information in the NIR in order to improve transparency. In addition, the ERT recommends that Turkey estimate CH_4 emissions using the IPCC method with default or country-specific parameters, in accordance with the decision tree contained in the IPCC good practice guidance (figure 5.2), because CH_4 emissions were identified as a key category.

116. The NIR does not provide sufficient information on waste and wastewater management practices, the data collection process, and the selection of methodologies, EFs and parameters, both in the SWDL and in the wastewater handling categories. The emissions trend in the waste sector is not explained in the NIR. The ERT reiterates previous recommendations that Turkey provide an explanation for the GHG emissions trend in the waste sector in order to improve transparency.

117. The results and procedures of the uncertainty analysis for the waste sector were not explained in the NIR. The ERT recommends that Turkey provide an explanation for the uncertainty analysis in its next inventory submission.

118. The elaboration of the QA/QC plan for the waste sector is unclear. The ERT reiterates previous recommendations that Turkey provide further explanation for the data collection procedures and sector-specific QA/QC in its next annual submission.

2. Key categories

Solid waste disposal on land – CH_4

119. Turkey has been encouraged in previous reviews to use a tier 2, first order decay method, for estimating CH_4 emissions from this category. However, the NIR shows that Turkey still uses a tier 1 methodology due to a lack of data from municipalities. The ERT recommends that Turkey make efforts to estimate these emissions using a tier 2 approach in accordance with the IPCC good practice guidance, because this category is a key category.

120. The quadratic and cubic models used for extrapolation of landfilled waste in the early 1990s may not adequately represent the normal growth in the rate of waste generation (e.g. a negative value for 1990 with the cubic model). In response to a question raised by the ERT during the review, Turkey explained that revised AD will be officially published. The ERT recommends that Turkey revise this regression analysis in accordance with the IPCC good practice guidance.

121. Turkey set the methane correction factor (MCF) value for unmanaged landfill at 0.6 without explanation; however, according to the IPCC good practice guidance, the value 0.6 corresponds to uncategorized solid waste disposal sites and the appropriate value for unmanaged landfill is 0.4 ("Unmanaged – deep") or 0.8 ("Unmanaged – shallow"). Since the selection of MCF leads to underestimation or overestimation in this category, the ERT recommends that Turkey collect existing information for the categorization of unmanaged landfill (deep or shallow) referred to in the IPCC good practice guidance and select the appropriate MCF value for the country's unmanaged landfill with reasonable explanation in the NIR. In addition, the ERT reiterates the recommendation in the previous review report that Turkey classify solid waste disposal sites (SWDS) according to the IPCC classification in order to avoid any possible confusion.

122. The previous review report indicated that municipal solid waste data were based on data collected by managed landfill operators and municipalities; therefore, waste which was not part of collected waste is not covered by Turkey's estimation of emissions from the waste sector. Furthermore, industrial waste, sewage sludge, and other organic waste are not included in the AD currently used, according to the information provided to the ERT during the review. The ERT recommends that Turkey collect existing statistical waste data and include all landfilled organic waste in its next inventory submission.

123. In the additional information box in CRF table 6.A.C, Turkey reports the CH_4 generation rate constant (k) as 1.00. However, this parameter is only applicable for the tier 2 method, which was not used by Turkey. The ERT reiterates the recommendations in previous review reports that Turkey correct this value to "NA" in its next annual submission.

124. The degradable organic carbon (DOC) value for food waste is used without considering waste composition. However, the application of the DOC value for food waste of 0.15, the smallest value among waste compositions, leads to underestimation compared with a weighted average DOC value. The ERT reiterates the recommendations in previous review reports that Turkey consider the appropriate DOC value and explain the reason for the choice in its next annual submission.

Wastewater handling – CH_4 and N_2O

125. CH_4 emissions from industrial wastewater handling have not been estimated. The ERT recommends that Turkey estimate CH_4 emissions with chemical oxygen demand (COD) data from the three or four most important industries, according to the decision tree contained in the IPCC good practice guidance (figure 5.4). In addition, the ERT recommends that Turkey estimate CH_4 emissions from domestic and commercial sludge using the IPCC default EFs and parameters.

126. CH_4 emissions from domestic and commercial wastewater handling in 2008 decreased by 6.1 per cent since 2007. Turkey explains that the decrease in CH_4 emissions was caused by the decline of the rural population. However, no information has been provided about the urban and rural population and corresponding EFs in the NIR. The ERT recommends that Turkey provide this information with an explanation for the emission trends in the next NIR.

127. In CRF table 6.B, the notation key "NA" has been used for CH_4 emissions from domestic and commercial sludge without explanation. The ERT recommends that Turkey consider estimating CH_4 emissions from sludge handling using the IPCC default EFs and parameters if CH_4 emissions from sludge are not included under wastewater. Further, the notation key "NE" has been used for N_2O emissions from human sewage. The ERT recommends that Turkey report N_2O emissions in N_2O from human sewage instead of under commercial and domestic wastewater handling in its next inventory submission.

3. Non-key categories

Waste incineration – CO_2 and N_2O

128. Turkey has reported emissions from this category as "NA", although there is one hazardous waste incineration plant and one medical waste incineration plant in the country. The ERT reiterates the recommendation in the previous review report that Turkey estimate CO_2 and N_2O emissions using the statistical data of incinerated hazardous and medical waste reported to the MoEF and the default methodology, EFs and parameters in accordance with the IPCC good practice guidance in its next annual submission or otherwise change the notation key from "NA" to "NE".

129. According to the 2008 and 2009 annual review reports, hazardous waste was incinerated as an alternative fuel at 31 licensed cement kilns for several years. The ERT reiterates the recommendations in previous review reports that Turkey estimate these CO_2 and N_2O emissions and report them under the energy sector in its next annual submission.

III. Conclusions and recommendations

130. Turkey made its inventory submission on 13 April 2010. The inventory submission contains the GHG inventory (comprising a complete set of CRF tables and an NIR). This is in line with the UNFCCC reporting guidelines.

131. The ERT concludes that, with the exception of the LULUCF sector, the inventory submission of Turkey has been prepared and reported broadly in accordance with the UNFCCC reporting guidelines. For the non-forest LULUCF categories, the ERT is unable to assess the reported emission and removal estimates, given the absence of activity data in the CFR, methods in the NIR or responses to questions from the ERT. The inventory submission is generally complete, except for the LULUCF sector, and the Party has submitted a set of CRF tables for the years 1990–2008, and an NIR; these are complete in terms of geographical coverage, and generally complete in terms of categories and gases. The categories reported as "NE" include:

(a) All emissions from oil and gas;

(b) SF_6 emissions from aluminium foundries, HFC, PFC and SF_6 emissions from aerosols/metered dose inhalers, solvents, other applications using ODS and semiconductor manufacture, and potential emissions of HFCs and PFCs in the industrial processes sector;

(c) All possible emissions from the solvent and other product use sector;

(d) N_2O emissions from the cultivation of histosols, pasture, range and paddock manure, and indirect emissions from agricultural soils in the agriculture sector;

(e) The carbon stock change in wetlands, settlements and other land, CO_2 emissions from liming and N_2O emissions from disturbance associated with land-use conversion to cropland in the LULUCF sector.

132. The Party's inventory is broadly in line with the UNFCCC reporting guidelines, the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, except for the structure of the NIR. In particular, there is still room for improvement with regard to the transparency of reporting through the provision of more information to enable the reader to replicate the calculation of emission and removal estimates.

133. The institutional arrangements for the preparation of the inventory continue to perform their required functions; however, the ERT found that the institutional capacity is

still lacking, but that there are plans to allocate more human and financial resources. Turkey is currently studying the possibility of establishing a "national system", and most of the Party's efforts are focused on this subject. Turkey's institutional capacity is currently being enhanced through national and EU-funded projects with the different stakeholders in Turkey. TurkStat, as the main organization responsible for the preparation of the national inventory, is working on the establishment of an "emissions inventory portal". The ERT commends Turkey for these improvements and recommends that these efforts are followed up and that a description of these changes and plans to the institutional arrangements is included in the next NIR.

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

(a) Follow up national plans to further improve the institutional arrangements in order to ensure consistency across all sectors;

(b) Develop a formal QA/QC system in accordance with the IPCC good practice guidance (see para. 19 above);

(c) Ensure that the rationale for categories reported as "NE" is documented in more detail in CRF table 9(a);

(d) Follow up national plans to establish a permanent working team for the LULUCF sector, and on national plans to establish a national forest inventory and on country-specific data for carbon stock changes;

(e) Disaggregate the LULUCF sector for its key category analysis or report on the rationale for the level of category aggregation used in its next inventory submission;

(f) Document the rationale for the uncertainty estimates where expert judgement is used in its next inventory submission;

(g) Follow more closely the NIR outlined in the UNFCCC reporting guidelines;

(h) Further improve the transparency of the national inventory by including the following: 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 fluctuations.

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 2010. Available at <http://unfccc.int/resource/docs/2010/asr/ tur.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2010. Available at <http://unfccc.int/resource/webdocs/sai/2010.pdf>.

FCCC/ARR/2009/TUR. Report of the individual review of the greenhouse gas inventory of Turkey submitted in 2009. Available at <http://unfccc.int/resource/docs/2009/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 methodologies and assumptions used.

Annex II

Acronyms and abbreviations

AD	activity data
CH_4	methane
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
EF	emission factor
ERT	expert review team
EU	European Union
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
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1,000 grams)
LULUCF	land use, land-use change and forestry
NA	not applicable
N_2O	nitrous oxide
NIR	national inventory report
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