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**COMPLIANCE COMMITTEE**

**CC/ERT/ARR/2008/1  
20 October 2008**

**Report of the individual review of the greenhouse gas inventories of Greece  
submitted in 2007 and 2008**

**Note by the secretariat**

The report of the individual review of the greenhouse gas inventories of Greece submitted in 2007 and 2008 was published on 17 October 2008. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2008/GRC, contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.





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**Report of the individual review of the greenhouse gas inventories of Greece  
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\* In the symbol for this document, 2008 refers to the year in which the inventory was submitted, and not to the year of publication.

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## I. Executive summary

1. This report covers the in-country review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Greece, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 8 to 13 September 2008 in Athens, Greece, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Mario Contaldi; energy – Mr. Takeshi Enoki (Japan); industrial processes – Mr. Philip Acquah (Ghana); agriculture – Mr. Leonard Brown (New Zealand); land use, land-use change and forestry (LULUCF) – Mr. Nagmeldin Elhassan (Sudan); and waste – Mr. Sabin Guendehou (Benin). Mr. Brown and Mr. Elhassan were the lead reviewers. The review was coordinated by Mr. Matthew Dudley (UNFCCC secretariat).
2. In accordance with the “Guidelines for review under Article 8 of the Kyoto Protocol” (decision 22/CMP.1), a draft version of this report was communicated to the Government of Greece, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.
3. In 2006 (as contained in the 2008 inventory submission), the main GHG in Greece was carbon dioxide (CO<sub>2</sub>), accounting for 82.4 per cent of total GHG emissions<sup>1</sup> expressed in CO<sub>2</sub> equivalent (CO<sub>2</sub> eq), followed by nitrous oxide (N<sub>2</sub>O) (7.8 per cent), and methane (CH<sub>4</sub>) (6.3 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) collectively accounted for 3.5 per cent of the overall GHG emissions in the country. The energy sector accounted for 78.6 per cent of the total GHG emissions, followed by industrial processes (9.8 per cent), agriculture (8.7 per cent), waste (2.7 per cent) and solvents and other product use (0.1 per cent). Total GHG emissions amounted to 133,116.4 Gg CO<sub>2</sub> eq and increased by 24.5 per cent between the base year<sup>2</sup> and 2006. In 2005 (as contained in the 2007 inventory submission), total GHG emissions amounted to 139,241.7 Gg CO<sub>2</sub> eq. The shares of gases and sectors in 2006 (2008 inventory submission) were similar to those of 2005 (2007 inventory submission).
4. Tables 1 and 2 show GHG emissions by gas and by sector, respectively.

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<sup>1</sup> In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO<sub>2</sub> eq excluding LULUCF, unless otherwise specified.

<sup>2</sup> Base year refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The base year emissions do not include any possible emissions from deforestation; however, these are taken into account for the purpose of calculating the assigned amount.

**Table 1. Greenhouse gas emissions by gas, 1990–2006<sup>a</sup>**

Greenhouse gas emissions	Gg CO <sub>2</sub> eq								Change Base year–2006 (%)
	Base year <sup>b</sup>	1990	1995	2000	2003	2004	2005	2006	
CO <sub>2</sub>	82 492.4	82 492.4	87 056.1	103 683.5	109 901.1	110 201.9	110 499.5	109 666.0	32.9
CH <sub>4</sub>	8 984.6	8 984.6	9 065.0	8 843.4	8 340.3	8 284.4	8 264.6	8 406.8	–6.4
N <sub>2</sub> O	12 003.0	12 003.0	10 988.1	11 091.2	10 904.6	10 791.3	10 413.7	10 320.5	–14.0
HFCs	3 336.7	935.1	3 336.7	4 486.0	4 286.0	4 373.3	4 580.0	4 648.0	39.3
PFCs	83.0	257.6	83.0	148.4	77.3	71.7	71.7	70.5	–15.0
SF <sub>6</sub>	3.6	3.1	3.6	4.0	4.3	4.5	4.5	4.5	24.7

<sup>a</sup> Greece submitted revised emission estimates for the period 1990–2006 after the in-country review on 30 September 2008.

<sup>b</sup> Base year refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The base year emissions do not include any possible emissions from deforestation; however, these are taken into account for the purpose of calculating the assigned amount.

**Table 2. Greenhouse gas emissions by sector, 1990–2006<sup>a</sup>**

Sectors	Gg CO <sub>2</sub> eq								Change Base year–2006 (%)
	Base year <sup>b</sup>	1990	1995	2000	2003	2004	2005	2006	
Energy	77 696.2	77 696.2	81 992.7	98 804.9	105 323.5	105 565.8	105 433.0	104 685.1	34.7
Industrial processes	11 073.1	8 845.6	11 465.5	13 005.6	12 669.6	12 806.7	13 181.8	13 087.5	18.2
Solvent and other product use	169.7	169.7	154.6	157.3	155.5	155.9	157.7	159.6	–5.9
Agriculture	13 519.2	13 519.2	12 486.2	12 357.8	11 998.6	11 936.7	11 734.0	11 644.9	–13.9
LULUCF	NA	–3 213.9	–4 389.3	–2 979.6	–5 549.2	–5 423.0	–5 235.2	–5 198.7	NA
Waste	4 445.0	4 445.0	4 433.4	3 931.0	3 366.3	3 261.8	3 327.4	3 539.1	–20.4
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF)</b>	NA	101 461.8	106 143.2	125 276.9	127 964.3	128 304.0	128 598.7	127 917.7	NA
<b>Total (without LULUCF)</b>	106 903.2	104 675.7	110 532.5	128 256.5	133 513.5	133 727.0	133 833.9	133 116.4	24.5

*Abbreviations:* LULUCF = land use, land-use change and forestry; NA = not applicable.

<sup>a</sup> Greece submitted revised emission estimates for the period 1990–2006 after the in-country review on 30 September 2008.

<sup>b</sup> Base year refers to the base year under the Kyoto Protocol, which is 1990 for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and 1995 for HFCs, PFCs and SF<sub>6</sub>. The base year emissions do not include any possible emissions from deforestation; however, these are taken into account for the purpose of calculating the assigned amount.

5. Greece reported its 2008 annual submission under a new national system (see chapter IX.1). The expert review team (ERT) met with practically all staff from the Ministry of Environment, Physical Planning and Public Works (MINENV), the National Technical University of Athens (NTUA) and other institutions that are involved in inventory preparation and in managing the archiving system in MINENV, and had an in-depth discussion on all the aspects of the national system. The ERT concludes that this national system is performing its required functions, as set out in the annex to decision 19/CMP.1 with respect to the institutional, legal and procedural arrangements necessary to perform these functions; that the institutional, legal and procedural arrangements established and formalized by the ministerial circular “Structure of the national GHG inventory – roles and responsibilities”<sup>3</sup> are fully operational; and that Greece has in place the institutional and procedural arrangements and the capacity, including the arrangements for the technical competence of the staff involved in the national system, to plan, prepare and manage inventories and their timely submission to the secretariat (see chapter II.C.6).

6. Greece has also established procedures that will mitigate the risk of impacts on inventory compilation and institutional arrangements during a period of transition of the national system, including procedures for archiving all inventory information within the office of the single national entity with overall responsibility for the inventory (MINENV) (see chapter II.C.7). It has also allocated sectoral responsibilities for the staff in MINENV’s climate change team and alternates to cover staff turnover, and established formal focal points in other ministries and institutions within the national system (see chapter II.C.6). During the in-country visit, the ERT also observed the close involvement of MINENV staff in sector-based discussions with the ERT and the collegial relationship between the MINENV and NTUA. Continued involvement of MINENV staff over the contract period with NTUA will ensure the continuity of inventory compilation during periods of transition.

7. The ERT concludes that the 2008 annual submission is a considerable improvement on previous submissions. In addition, Greece was able to provide specific additional information during the in-country review upon request by the ERT.

8. The inventory is generally prepared in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), 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 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 identified instances of under- and over-estimations of emissions (see paras. 93, 95, 113, 114, 153 and 157 below). The inventory is generally complete and covers all sectors and most categories (see para. 16 below), all years of the inventory time series, and geographic coverage.

9. The ERT recommends that Greece further improve completeness, transparency and time-series consistency in its next annual submission under the Kyoto Protocol. Additionally, the ERT recommends that Greece improve the reporting of cross-cutting information in its national inventory report (NIR), specifically on key category analysis (see para. 13 below), uncertainty analysis (see para. 29 below), quality assurance/quality control (QA/QC) (see para. 31 below) and description of methodologies (see para. 21 below). During the in-country review Greece provided relevant additional information to the ERT. The ERT recommends that Greece include all or part of the additional information in its next annual submission under the Kyoto Protocol.

10. The ERT recommends that Greece further improve knowledge and understanding of preparing and reporting emissions by sources and removals by sinks of activities under Article 3, paragraph 3, and activities elected under Article 3, paragraph 4, of the Kyoto Protocol within the institutions involved directly in the identification of areas of land and areas of land-use change. Greece should also ensure

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<sup>3</sup> Document dated 21 April 2008.



that the schedule of work and allocation of resources specified in the project plan sighted by the ERT during the in-country review in relation to the above-mentioned task of identifying areas of land is implemented. Implementation of the plan is critical for Greece meeting the mandatory reporting of activities under Article 3, paragraphs 3, and activities elected under Article 3, paragraph 4, of the Kyoto Protocol, commencing with its 2010 submission (see chapter VII). The ERT also recommends that Greece explore the opportunity of centralizing the reporting of LULUCF under the Convention and under the Kyoto Protocol in one institution.

## **II. Overview**

### **A. Inventory submission and other sources of information**

11. The 2008 annual submission was submitted by Greece on 7 April 2008 (common reporting format (CRF) tables) and 14 April 2008 (NIR). The submission comprises a complete set of CRF tables for the period 1990–2006. This is in line with the reporting requirements established by decision 15/CMP.1. Greece indicated that the 2008 annual submission is also its voluntary submission under the Kyoto Protocol.<sup>4</sup> In its 2007 submission, Greece included a complete set of CRF tables for the period 1990–2005 and an NIR. The 2007 submission was submitted on 23 November 2007, after the due date established under the Convention. Greece officially submitted a revised 2008 CRF submission on 30 September 2008 in response to questions on the completeness of the inventory raised by the ERT during the course of the in-country review. This resubmission shows increased total GHG emissions for the base year and 2006 of 73.1 and 4.0 Gg CO<sub>2</sub> eq, respectively (from 106,830.1 to 106,903.2 Gg CO<sub>2</sub> eq in the base year, and from 133,112.3 to 133,116.4 Gg CO<sub>2</sub> eq in 2006).

12. During the review, Greece provided the ERT with additional information. The documents concerned are not part of the inventory submission, but are in some cases referenced in the NIR. The full list of materials used during the review is provided in the annex to this report.

### **B. Key categories**

13. Greece has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2008 annual submission. However, Greece did not report the analysis for the latest inventory year (2006). During the in-country review, Greece provided the ERT with a key category analysis for 2006. This analysis produced similar results to those of the corresponding analysis performed by the secretariat.<sup>5</sup> Greece has included the LULUCF sector in its key category analysis in accordance with the IPCC good practice guidance for LULUCF. The ERT encourages Greece to include in an annex to its NIR a list of key categories in the format of tables 5.4.2 and 5.4.3 in chapter 5 of the IPCC good practice guidance for LULUCF, and to report on the analysis for the latest inventory year. Greece reported a key category analysis also in its 2007 submission; however, this analysis was reported only for the 2004 inventory year. The ERT recommends that Greece report, in its next annual submission, a key category analysis for 1990 that does not include the Kyoto base year (1995) for the fluorinated gases (F-gases), and to also report on the key category analysis for the latest inventory year. In addition, the ERT recommends that Greece report results of the key category analysis in table 7 of the CRF Reporter for all years of the inventory time series.

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<sup>4</sup> Parties may start reporting information under Article 7, paragraph 1, of the Kyoto Protocol, from the year following the submission of the initial report, on a voluntary basis (decision 15/CMP.1).

<sup>5</sup> 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. 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.

14. The following key categories were identified in the 2008 annual submission but not in the 2007 submission: stationary combustion – liquid fuel ( $\text{N}_2\text{O}$ ), cropland remaining cropland –  $\text{CO}_2$ ; and the following key categories were identified in the 2007 submission but not in the 2008 annual submission: stationary combustion – solid fuel ( $\text{N}_2\text{O}$ ), nitric acid production – ( $\text{N}_2\text{O}$ ) and iron and steel production (2C1) –  $\text{CO}_2$ . These differences were explained by Greece during the in-country review as being the result of changes made in the 2008 inventory in response to the request of the previous ERT (stationary combustion (liquid and solid fuels) –  $\text{N}_2\text{O}$ ); the increased market share of natural gas in electricity production; and the assumption that nitric acid production in 2006 is the same as reported in 2005 due to a lack of data.

15. During the in-country review, Greece informed the ERT that it will use the key category analysis to prioritize improvement of its inventory. The ERT recommends that Greece consider the output of the key category analysis, along with output from QA/QC procedures and the uncertainty analysis, to schedule improvements of the inventory, particularly for prioritizing the development of higher tier methods for key categories pursuant to IPCC good practice guidance.

### **C. Cross-cutting topics**

#### **1. Completeness**

16. The inventory generally covers all sectors and most source and sink categories, and is complete in terms of years, gases and geographic coverage. Greece has provided an NIR based on the structure set out in 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), and submitted CRF tables for all years of the inventory time series. However, a number of gaps in the reporting have been identified by the ERT. The ERT identified gaps in or a lack of data to: estimate several relevant country-specific activity parameters in the LULUCF (see paras. 129 and 130 below) and waste (see paras. 145, 150, 151, 153 and 157 below) sectors; report a land-use change matrix (see para. 124 below); and reporting of emissions as ‘not estimated’ (NE) for activities confirmed by Greece during the in-country review as occurring in the country (e.g. oil and natural gas (1.B.2) for 1990–2003) (see para. 19 below).

17. The ERT recommends that Greece: improve the completeness of the inventory by addressing gaps in CRF tables 7 (key categories), 8(b) (recalculation explanations), and 9(a) (completeness); provide more detailed explanation on the rationale of recalculations in the NIR; identify data in support of reporting of a number of activity parameters (e.g. waste parameter estimates for solid waste composition and percentage of sewage treated anaerobically (see para. 157 below)); report emissions for activities that do occur in Greece, but are currently reported as NE; and provide a description of the completeness of the inventory in an annex to the NIR, in accordance with the UNFCCC reporting guidelines. Even if emissions for those categories reported as NE are considered by Greece to be minor, these activities do occur in the country; Greece is encouraged to explore simple and reasonable approaches, utilizing expert judgement as necessary, to estimate emissions from these categories.

18. Greece reports potential emissions of F-gases as NE, whereas actual emissions of F-gases are provided for the period 1990–2006.

19. In response to questions on completeness raised by the ERT during the course of the in-country review, Greece submitted emission estimates for a number of activities reported as NE in the 2008 annual submission, namely oil and natural gas (1B2) for 1990–2003 and road transportation – gaseous fuels.

#### **2. Transparency**

20. Greece’s inventory is generally transparent; this is aided to a great extent by the structure of the NIR, which is prepared in accordance with the UNFCCC reporting guidelines, with the exception of the

requirement for an annex on the completeness of the inventory and category-specific detail on uncertainty in the energy and agriculture sectors. The ERT concludes that the transparency of the inventory could be improved by providing more detailed information in the NIR, and by further use of the CRF documentation boxes and table 9(a) (completeness).

21. The ERT identified that the NIR does not provide information that is sufficiently detailed on methodologies, references to these methodologies, assumptions used in compiling emission estimates, data sources, general background information, QA/QC procedures implemented during preparation of the inventory, and rationale for recalculations and assumptions underpinning quantitative estimates of uncertainty. Greece gave the relevant information to the ERT during the in-country review. In addition, the ERT identified that the CRF submission does not utilize to the extent possible the documentation boxes for providing additional information (e.g. CRF table 2(I).A–G on units and quantities of activity data (AD)), or include information for 2005 and 2006 on the use of notation keys NE and ‘included elsewhere’ in table 9(a)), owing to CRF Reporter compilation problems.

22. The use of the ‘confidential’ notation key is rather limited and mainly associated with data used to prepare emission estimates in the industrial processes sector.

23. Greece is commended for the timely provision of detailed additional information, materials and explanations to the ERT during the in-country review to facilitate understanding by the ERT of the inventory in all of its components (such as inventory planning, preparation and management, and institutional and legal arrangements).

24. The ERT recommends that Greece incorporate all or part of the above-mentioned elements identified by the ERT in its next annual submission under the Kyoto Protocol as a means to improve the transparency of the NIR and CRF.

### 3. Recalculations and time-series consistency

25. The national system generally ensures that recalculations of previously submitted emission estimates are prepared in accordance with the IPCC good practice guidance. The ERT found that Greece has performed recalculations for all years of the inventory time series for key categories, and predominantly for the years 1990, 2005 and 2006 for non-key categories. The ERT identified that time-series consistency is an issue in the energy (see para. 55 below) and the industrial processes (see para. 88 below) sectors, for which data from European Union emissions trading scheme (EU ETS) reports have been used from 2005 onward. Recalculations and explanations for these recalculations are provided in CRF tables 8(a) and 8(b), respectively, and also provided in the NIR. Explanations for other recalculations are provided in CRF table 8(b); however, the list is not complete. The NIR does not provide detailed information on the rationale for recalculations, including information on data sources, the emission factor (EF) and/or the methodology underpinning a recalculation. During the in-country review, Greece explained that the main reason for these omissions was reduced time available for the 2008 annual submission as the contract with NTUA to provide inventory compilation services was signed in February 2008. The Party intends to recalculate all years of the time series, and improve documentation in the NIR and CRF table 8(b).

26. The ERT noted that recalculations reported by Greece of the inventory time series 1990–2005 have been performed to take into account plant-specific EFs and/or data derived from EU ETS reports (energy and industrial processes). It also noted the recalculations resulting from implementation of recommendations from the previous ERT (energy) and the recalculations arising from general inventory improvement (industrial processes) and correcting errors in CRF compilation (energy and agriculture). Recalculations reported by Greece in its submission of 30 September 2008 (i.e. including revised estimates) have resulted in a decrease of 3.7 per cent in total GHG emissions in 1990 and the base year, and a decrease of 3.9 per cent in 2005. The ERT concludes that the recalculations performed by Greece

in this submission have improved the quality of the inventory. The sector sections of this report contain specific information on recalculations performed.

27. EU ETS data are available from 2005 onward and the ERT recommends that Greece recalculate all inventory years pursuant to IPCC good practice guidance and time-series consistency. The Party may consider using recalculation techniques prescribed by IPCC good practice guidance (e.g. extrapolation).

28. The ERT recommends that for the next annual submission under the Kyoto Protocol, Greece report improved information on the rationale behind any recalculations and perform recalculations, where applicable (e.g. energy sector), for all years of the inventory pursuant to the IPCC good practice guidance.

#### 4. Uncertainties

29. Greece has reported an IPCC tier 1 quantitative estimate of uncertainty for most categories. Uncertainty estimates on AD are based on IPCC defaults using expert judgement in most cases except for agriculture (4A, 4B) where livestock statistics are used. The ERT concludes that this analysis has been performed in accordance with the IPCC good practice guidance; however, Greece has included the Kyoto base year (1995) for the F-gases in the 1990 analysis. Greece is encouraged not to include the Kyoto base year (1995) for the F-gases in the 1990 uncertainty analysis in its next annual submission under the Kyoto Protocol. The quantitative estimates of uncertainty are provided in the NIR, but no information on the rationale or the assumptions for uncertainty parameters is reported. The Party did, however, provide the ERT with some information on the underlying assumptions during the in-country review, and the ERT recommends that Greece include this information in its next annual submission under the Kyoto Protocol.

30. The ERT recommends that Greece include information on sector-specific or category-specific uncertainties under the description of each category in the NIR in line with the UNFCCC reporting guidelines. In addition, the ERT recommends that Greece coordinate the uncertainty assessment with the main data providers and report country-specific assumptions and other documentation in the NIR. The ERT also recommends that Greece extend the uncertainty analysis to cover all source and sink categories and to incorporate the results of the uncertainty analysis (along with the results of QA/QC procedures and the key category analysis) into an inventory improvement plan.

#### 5. Verification and quality assurance/quality control approaches

31. The QA/QC system of Greece was established in April 2004; it is based on the ISO 9001:2000 standard, and has been developed in line with the IPCC good practice guidance. During the in-country review the ERT was provided with a copy of this plan that also included planned improvements. The NIR states that the plan was first reviewed internally in June 2004, and Greece informed the ERT that a further internal review was undertaken in May 2008. To support the implementation of this system Greece has developed a quality management handbook that covers processes and procedures embedded in the QA/QC plan, namely QA/QC system management, quality control, archiving inventory information, quality assurance, estimation of uncertainties and inventory improvement. The Party provided the ERT with the forms that accompany the handbook; these are to be completed by staff during inventory preparation and management. The ERT was informed by Greece that the QA/QC plan and the quality management system (QMS) are being developed further. The ERT acknowledged the progress of Greece in developing its QA/QC system. The ERT encourages Greece to establish specific procedures to underpin the periodic review of the QA/QC plan and the QMS, utilizing information obtained from the implementation of its QA/QC programme, including from independent audit, as a means to improve the QA/QC plan and subsequently the inventory. Greece informed the ERT that internal audits are scheduled by MINENV between September and November of 2008 according to procedure QM 05, and that NTUA will also schedule an independent audit early in 2009. The ERT also encourages Greece to

explore the inclusion in the NIR of elements of the QA/QC plan and the quality management system and its forms, along with any planned improvements of this plan.

32. The ERT identified a number of instances of inconsistent use of notation keys and discrepancies between the CRF and the NIR, and inconsistent emissions time series (e.g., energy and industrial processes sectors). During the in-country review Greece informed the ERT that many of the identified inconsistencies in the use of the notation keys had been identified in accordance with its QA/QC procedures after the official submission of the inventory, and that these will be rectified in the next annual submission. Greece confirmed the identification of these inconsistencies by providing the ERT with the N°51 “Corrective and preventive actions” form from the quality management handbook. This form was compiled and signed by relevant experts, and confirmed that Greece had already identified many of the inconsistencies identified by the ERT and in the 2008 annual status report. The ERT recommends that Greece extend the QA/QC procedures to check inconsistencies between the CRF and NIR, and to develop procedures that link with the CRF Reporter software to identify time-series inconsistencies in AD, EFs and estimated emissions.

33. The ERT recommends that Greece improve QC procedures by exploring the development of category-specific QC procedures (tier 2) for all key categories and for those categories in which significant methodological and/or data changes have occurred, and to integrate these procedures into the QA/QC plan and the quality management handbook.

#### 6. Institutional arrangements

34. In the 2008 annual submission Greece has provided detailed information on the new institutional, legal and procedural arrangements that underpin its national system, consistent with the ministerial circular that formalized these arrangements. The 2008 annual submission is the first submission of this Party under these new arrangements.

35. MINENV is designated by Law 3017/2002 (Kyoto Protocol ratification) as the competent authority for the implementation of the Kyoto Protocol, and by joint ministerial decision 54409/2632/2004 for the implementation of the emissions trading scheme in Greece (which includes the national registry of Greece). Article 2 of Law 3017/2002 designates MINENV as the coordinator of other competent ministries and public and private bodies for the implementation of the Kyoto Protocol and for the development and monitoring of national climate change programmes; it also establishes the legal basis of the coordination role of MINENV in the implementation of the Kyoto Protocol and as the single national entity with overall responsibility for the national inventory. Greece has legislation to obtain data in support of compiling emission estimates for a number of categories, while agencies and companies are required to report data to MINENV (e.g., Law 3017/2002 (KP), JMD 54409/2632/2004 (emissions trading reporting) and JMD 11014/703/104/2003 (environmental permits)), or to other ministries within the national system via other legislation.

36. In 2007, Greece reorganized its national system to improve the institutional, legal and procedural arrangements. Within MINENV, the reorganization resulted in the establishing of a climate change team comprising nine experts with an increased role in inventory planning, preparation and management. Furthermore, the reorganization established designated focal points within other ministries that have an important role (e.g. data providers) in the national system, such as the Ministries of Development, Economy and Finance (National Statistical Service of Greece (NSSG)), Transport and Communications, and Rural Development and Food, and for each there were clearly defined roles and responsibilities. An important outcome of the reorganization was the contracting of NTUA to provide technical and scientific support with regard to the compilation of the inventory, including the preparation of the NIR, the CRF tables and other documentation. A ministerial decision in 2007 established the contract with NTUA (team of six experts). The contract runs for five years from February 2008. NTUA is well known and has established itself in the technical community with respect to cooperation with national and

international institutions on emissions, emissions inventories and air quality studies. When required, MINENV or NTUA can use experts from other institutions in support of their tasks. A component of the contract with NTUA is the provision of support to enhance inventory knowledge of staff in the MINENV climate change team.

37. The ERT was provided with a copy of the ministerial circular that formalized the new institutional arrangements within the national system. This circular clearly defines the division of responsibilities of actors (ministries and institutions) within the national system, and outlines procedures to ensure the continuity of the inventory compilation process. The ERT found that the defined roles and responsibilities of actors within this system were specific (e.g. provision of data, technical expertise, improvements in data), and that procedures defined by the circular would allow the Party to continue compiling inventories through a period of transition, thus ensuring timely submission of the annual inventory. The ERT noted that much of the information contained within this ministerial circular was included in the latest submission of the NIR.

38. The ERT confirmed that the transfer of information and data from the institution responsible for inventory preparation and management in the previous national system was completed in March 2008. The ERT welcomes this development (see chapter II.C.7).

39. The ERT concludes that the institutional, legal and procedural arrangements established and formalized by the ministerial circular are fully operational, and that Greece has the capacity, including relevant arrangements for the technical competence of staff within the national system, to plan, prepare and manage inventories and their timely submission to the secretariat. Greece has also established relevant institutional procedures that will ensure continuity of inventory compilation during a period of transition, including procedures for archiving of all inventory information within the office of the single national entity with overall responsibility for the inventory (MINENV) (see chapter II.C.7). It has also established formal focal points in other ministries and institutions within the national system, and allocated sectoral responsibilities for the staff in MINENV's climate change team and alternates to cover staff turnover. During the in-country visit, the ERT observed the close involvement of MINENV staff in sector-based discussions and the collegial relationship between MINENV and NTUA. The ERT noted that the continued involvement of MINENV staff over the five years of the current contract with NTUA will ensure the continuity of inventory compilation during periods of transition.

40. The ERT found that the knowledge and understanding of the requirements for the preparation and reporting of emissions by sources and removals by sinks of activities under Article 3, paragraph 3, and activities elected under Article 3, paragraph 4, of the Kyoto Protocol need to be improved within the institution responsible (Ministry of Rural Development and Food) for identifying areas of land and areas of land-use change (see chapter VII). In addition, the ERT recommends that Greece explore the opportunity of centralizing the reporting of LULUCF under both the Convention and the Kyoto Protocol in one institution as a means of avoiding duplication of efforts and to ensure consistency and accuracy of reporting.

## 7. Inventory management

41. Greece has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, documentation on how these factors and data have been generated and aggregated for the preparation of the inventory, and all underlying calculation sheets as well as all cited literature. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements.

42. The centralized archive system resides in MINENV. At the commencement of each inventory compilation cycle MINENV provides a copy of the archived "Centralized inventory file" (CIF) to NTUA in accordance with the procedure defined in chapter B of the ministerial circular. Upon completion of

the inventory NTUA submits the CIF to MINENV updated with all information, data, documentation, etc. used in the compilation of the national inventory. The ERT established that contributing institutions and experts have their own independent archiving system; however, information used for the purpose of inventory compilation is always archived in the CIF. The ERT commends Greece for establishing an archiving process that will assist the Party to ensure continuity of inventory compilation.

#### 8. Follow-up to previous reviews

43. The ERT found that the new institutional, procedural and legal arrangements have allowed Greece to take into account fully the recommendations from the previous reviews. In addition, Greece has applied recalculations to the inventory time series in response to problems identified by the previous review (e.g. energy sector), and has improved documentation of its inventory in the NIR.

### **D. Areas for further improvement**

#### 1. Identified by the Party

44. The 2008 NIR identifies several areas for improvement in response to issues raised in the previous expert review, and through Greece's own activities relating to inventory improvement. These improvements include:

- (a) Recalculations pursuant to IPCC good practice guidance and time-series consistency;
- (b) Obtain improved data in support of estimating emissions from road transportation;
- (c) Investigate the carbon content of fuels in the navigation subsector;
- (d) Investigate a higher tier method for aviation and navigation;
- (e) Resolve gaps in AD time series and fluctuations in trends for a number of industrial processes categories (e.g. cement production);
- (f) Explore the collection of data on feedstocks and non-energy use of fuels in ammonia production (2B1);
- (g) Calculate CH<sub>4</sub> emissions from iron and steel production;
- (h) Explore the opportunity to obtain data from consumption of F-gases (e.g. aerosols);
- (i) Explore the availability of data for carriage of a tier 1 (potential emissions) method to estimate F-gas emissions;
- (j) Update AD and investigate the application of a tier 2 method to estimate CH<sub>4</sub> emissions from enteric fermentation;
- (k) Collaborate with other research institutions to characterize animal waste management systems (AWMS);
- (l) Reduce the uncertainty of emission estimates from solid waste disposal sites by obtaining improved data on municipal solid waste disposed and its composition, and amount of biogas emitted. MINENV are to establish a database that will contain much of the above information;
- (m) Improve the completeness of CRF tables;
- (n) Further develop its QA/QC plan and the quality management handbook.

## 2. Identified by the expert review team

45. The ERT identified the following cross-cutting issues for improvement by the Party:
- (a) Enhance knowledge and understanding within the national system on the preparation and reporting of emissions by sources and removals by sinks of activities under Article 3, paragraph 3, and activities elected under Article 3, paragraph 4, of the Kyoto Protocol;
  - (b) Improve QA/QC procedures to ensure consistency between the NIR and the CRF, and develop tier 2 category-specific QC procedures for all key categories and for those categories in which significant methodological and/or data changes have occurred;
  - (c) Improve the completeness of the national inventory to ensure that emissions by sources and removals by sinks are included in the national inventory, and, if they are not, that sufficient explanation is provided in the NIR (in the annex on completeness);
  - (d) Complete all CRF tables with required data, notation keys and information (e.g. key category analysis and documentation boxes) and explanations (e.g. recalculations and completeness);
  - (e) Enhance the transparency of the inventory by providing more detailed information in the NIR on choice of methodology (particularly country-specific and higher tier methods), assumptions underpinning choice of methodology and uncertainty assessment, references to these methodologies, data sources, rationale for recalculations, and information in the CRF documentation boxes, where applicable;
  - (f) Improve the time-series consistency (energy and industrial processes);
  - (g) Coordinate the uncertainty assessment with the main data providers;
  - (h) Improve the reporting on key category analysis in the NIR and in the CRF;
  - (i) Provide documentation in the NIR on actions undertaken to address recommendations from previous expert reviews;
  - (j) Develop an inventory improvement plan that establishes a process to manage the improvement of the national inventory by addressing recommendations from previous expert reviews and using output of key category analysis, uncertainty analysis, and QA/QC procedures, as a basis to prioritize improvement in the national inventory;
  - (k) Streamline the preparation and reporting of LULUCF under the Convention and under the Kyoto Protocol within a single institution to minimize duplication of efforts and ensure consistency and accuracy of reported data and information.
46. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

## **III. Energy**

### **A. Sector overview**

47. In 2006, the energy sector accounted for 78.6 per cent (104,685.1 Gg CO<sub>2</sub> eq) of total GHG emissions. Emissions from this sector decreased by 0.7 per cent between 2005 and 2006, and increased by 34.7 per cent between the base year and 2006. A key driver for the trend between the base year and 2006 is the 29.1 per cent (12,385.4 Gg CO<sub>2</sub> eq) increase in emissions from energy industries, and a 64.6 per cent (9,471.8 Gg CO<sub>2</sub> eq) increase over the same time period in the transport sector.



Energy industries was the major category in 2006, contributing 52.5 per cent to total sector emissions, while transport, other sectors, and manufacturing industries and construction contributed 23.0, 13.7 and 9.3 per cent, respectively. Fugitive emissions from fuels contributed 1.5 per cent. CO<sub>2</sub> is the dominant GHG, contributing 97.2 per cent to total sector emissions, and 92.8 per cent to total GHG emissions. CH<sub>4</sub> and N<sub>2</sub>O contributed 1.7 and 1.1 per cent, respectively, to total sector emissions.

48. Greece submitted revised estimates and information to the ERT in response to questions raised by the ERT on the completeness of reporting on the energy sector. The revised estimates were submitted for the period 1990–2006 and resulted in an increase of 0.1 per cent (73.1 Gg CO<sub>2</sub> eq) in sector emissions in the base year, and an increase of 0.004 per cent (4 Gg CO<sub>2</sub> eq) in 2006.

49. Greece has established a formal framework for collaboration between MINENV, NTUA and other ministries, ensuring timely provision of the energy balance from the Ministry of Development. This improvement arises from new institutional arrangements described in the ministerial circular, that, in part, provides evidence that these new institutional arrangements are effective. NTUA is also working in collaboration with relevant ministries to obtain more accurate data for biomass consumption, transportation statistics and other data. Greece is commended for its efforts to improve the quality of the inventory, and the ERT strongly encourages the Party to continue this work and to include outcomes in the NIR to improve the transparency of the energy sector.

50. Greece submitted recalculations for those categories adjusted under Article 5, paragraph 2, of the Kyoto Protocol by the previous ERT, and implemented most of the recommendations of the previous review report.

### 1. Completeness

51. The CRF tables are complete except for a few categories that are reported as NE when the activity does actually occur within Greece. The ERT highlighted examples of such categories, including: road transportation – gaseous fuels (CH<sub>4</sub> and N<sub>2</sub>O) for the period 1990–2001; oil (1B2a) – CO<sub>2</sub>; venting (1B2c (i. and ii.)) – CO<sub>2</sub> for the period 1990–2003; and flaring (1B2c (i and ii)) – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O for the period 1990–2003. Greece informed the ERT that for the period 1990–2001 the notation key NE was incorrectly attributed to road transportation – gaseous fuels; it should have been reported as not occurring (NO). During the in-country review, Greece informed the ERT that its QC procedure (QM6 “Non compliance – Corrective and preventive actions”) had identified most of the above-mentioned categories as completeness issues, and subsequently submitted to the ERT revised estimates for each category. The ERT recommends that Greece submit a complete inventory for the energy sector in its next annual submission under the Kyoto Protocol.

### 2. Transparency

52. The energy sector is generally transparent, but transparency could be improved further by providing more detailed information in the NIR. The ERT recommends that Greece provide: more detailed information on the rationale underpinning the choice of methodology; description of the methodology and assumptions; the rationale of recalculations (e.g. for stationary combustion); and information on developments in ongoing projects and planned improvements in the energy sector. Much of this information is available as it was given to the ERT during the in-country review.

### 3. Recalculations and time-series consistency

53. The recalculations reported by Greece in its 2008 annual submission were achieved through the use of improved data (e.g. EU ETS reports, plant-specific EFs and AD) and implementation of recommendations of the previous ERT; for example, Greece performed recalculations following the identification of CRF compilation problems in the 2007 submission (see para. 57 below). Greece has obtained improved data from EU ETS reporting for 2005 and 2006 to estimate CH<sub>4</sub> and N<sub>2</sub>O emissions,

and these reports also provide a basis for deriving plant-specific EFs. The ERT commends Greece for using verified EU ETS reports to estimate N<sub>2</sub>O emissions from solid and liquid fuels for all years of the inventory time series, and gaseous fuels for 2005 and 2006. However, neither the methodology nor the rationale for using the methodology is sufficiently explained in the NIR. During the in-country review Greece provided the ERT with an analysis of the comparison between emission estimates using the previous methodology and those using the methodology reported in the 2008 annual submission. The ERT recommends that Greece include in its next annual submission under the Kyoto Protocol more detailed information on the methodology used, clearly explaining the rationale for its selection. Additionally, the ERT recommends that Greece perform recalculations for the N<sub>2</sub>O emissions from gaseous fuels for the period 1990–2004 pursuant to IPCC good practice guidance and time-series consistency.

54. Recalculations have been reported for the following categories: public electricity and heat production (solid fuel (lignite)) – CO<sub>2</sub> for the period 1990–2005; energy industries (solid and liquid fuels) – N<sub>2</sub>O for the period 1990–2005; energy industries (solid and liquid fuels) – CH<sub>4</sub> for 2005; manufacturing industries and construction (solid and liquid fuels) – N<sub>2</sub>O for the period 1990–2005; other sectors (all fuels) – CH<sub>4</sub> and N<sub>2</sub>O for 2005; chemicals (solid fuel (lignite)) – CO<sub>2</sub> for 1990; residential (biomass) – CH<sub>4</sub> and N<sub>2</sub>O for the period 1990–2005; correction of 2005 AD for consumption of gaseous fuels; civil aviation (liquid fuel) – all gases for the period 1990–2003; road transportation (liquid fuel) – CO<sub>2</sub> for the period 1990–2005; and navigation (liquid fuel) – CO<sub>2</sub> for 2005. The result of these recalculations is a decrease in base year emissions of 4.9 per cent (3,993.1 Gg CO<sub>2</sub> eq) and a decrease in 2005 emissions of 3.6 per cent (3,908.6 Gg CO<sub>2</sub> eq).

55. The ERT noted that the recalculations performed for a number of categories are not time-series consistent: public electricity and heat production (solid fuel) – CO<sub>2</sub>; energy industries (solid and liquid fuels) – N<sub>2</sub>O; manufacturing industries and construction (solid and liquid fuels) – N<sub>2</sub>O; chemicals (solid fuel) – CO<sub>2</sub>; civil aviation (liquid fuel) – all gases; road transportation (liquid fuel) – CO<sub>2</sub>; and residential (1A4b) (biomass) – CH<sub>4</sub> and N<sub>2</sub>O. The ERT found that Greece, as a consequence of adjustments applied in the previous review, has applied the conservativeness factor to the recalculated base year emission estimates. The ERT recommends that Greece recalculate the base year emissions consistent with other years of the inventory time series, and does not apply the conservativeness factor. The ERT also recommends that Greece perform recalculations of CH<sub>4</sub> emissions from all fuels for the period 1990–2004, and N<sub>2</sub>O emissions from gaseous fuels for the period 1990–2004, pursuant to IPCC good practice guidance and time-series consistency.

56. The ERT recommends that Greece improve the reporting of notation keys throughout the time series for the following categories: other (1A5) (all fuels) – all gases; underground mines (1B1a(i)) – CO<sub>2</sub> and CH<sub>4</sub>; transport (1B2a(iii)) – CO<sub>2</sub>; distribution of oil products (1B2a(v)) – CO<sub>2</sub>; combined (1B2c(iii)) – CO<sub>2</sub>; and flaring (1B2c(iii)) – all gases. Currently the use of notation keys for the above-mentioned categories is not time-series consistent.

57. Greece informed the ERT that the reported recalculations in the 2007 CRF submission was a result of errors in CRF compilation, and not a result of changes in methodology or data. Greece also informed the ERT that the errors in the CRF compilation were identified through its internal QC procedures after the 2007 inventory was submitted. The ERT recommends that these QC procedures be applied prior to a submission of the CRF tables.

#### 4. Uncertainties

58. Uncertainties of energy categories have been quantified using expert judgment and IPCC defaults, and are documented in annex IV to the NIR. The ERT also noted that category-specific detail on uncertainty is not provided in the relevant category section of the NIR, as required by the UNFCCC reporting guidelines. Greece is encouraged to implement this requirement and to provide more detailed

information on the rationale for the selection of uncertainty values in its next annual submission under the Kyoto Protocol.

#### 5. Verification and quality assurance/quality control approaches

59. During the in-country review, Greece informed the ERT that QC procedure QM6 “Non compliance – Corrective and preventive actions” had identified many of the completeness and time-series consistencies issues after the official submission of the 2008 inventory. The ERT was informed that Greece intends to recalculate the entire time series and to correct the inconsistent use of notation keys. The ERT recommends that Greece implement QC procedures before the final approval of the official submission and subsequent submission.

### **B. Reference and sectoral approaches**

#### 1. Comparison of the reference approach with the sectoral approach and international statistics

60. The reference approach was 2.7 per cent lower than the sectoral approach in 2006 in terms of apparent consumption. In 2003 the reference approach was reported as 5.2 per cent lower than the sectoral approach that is explained by Greece to be attributable to considerable statistical differences in the consumption of liquid fuels. The difference in CO<sub>2</sub> between the approaches is 0.7 per cent in 2006, and ranges between –2.24 and 1.85 per cent in the period 1990–2006.

61. Apparent consumption corresponds closely to data reported by the Party to the International Energy Agency (IEA), within 2.6 per cent for all years except 2006 (–4.2 per cent), with CRF data systematically higher than IEA data.

#### 2. International bunker fuels

62. Greece has used a tier 2a method to estimate CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions from aviation bunkers, and a default EF for CO<sub>2</sub> and tier 2a EFs for CH<sub>4</sub> and N<sub>2</sub>O. A CORINAIR method and EFs have been used to estimate emissions from marine bunkers. The ERT concludes that emissions are estimated in accordance with the IPCC good practice guidance. However, the IPCC good practice guidance recommends that a Party should use an IPCC tier 1 approach for CO<sub>2</sub> that is based on fuel consumption by fuel type, the carbon content of fuel, and the fraction of fuel left unoxidized. The ERT recommends that Greece implement this IPCC tier 1 approach for CO<sub>2</sub>; if not it should include in the NIR the rationale for using the CORINAIR methodology and a discussion on the accuracy of the two approaches.

63. During the in-country review, the Party informed the ERT that inconsistencies have been identified between the time series of fuel consumption and the corresponding landing and take-off (LTO) data. In addition, Greece explained that the reason for the inconsistencies can be attributed to the smuggling of fuel for domestic aviation use which is subsequently not captured in the national energy balance. Greece informed the ERT of an ongoing collaborative study between MINENV and the Greek Civil Aviation Organization (GCAO) to understand the known discrepancies in the fuel consumption data by analysing taxation data on the split of fuels (domestic and international). The ERT commends Greece for this effort to resolve the discrepancy in the national energy balance in relation to aviation data. Furthermore, the ERT recommends that any update or resolution of this matter is to be reported in the annual submission and should include the recalculation of the inventory time series, and supporting documentation on the methodology and assumptions.

#### 3. Feedstocks and non-energy use of fuels

64. IPCC default values for the fraction of carbon stored in non-energy use of bitumen, lubricants, naphtha, natural gas, other oil products and petroleum coke are used in both the reference approach and the sectoral approach. The ERT noted that energy from bitumen used for paving roads is included in AD under other (1A2f), whereas the carbon stored in bitumen is excluded from emissions. However, this

bitumen is used in a manner which causes most of the carbon content to enter long-term storage. The ERT recommends that Greece exclude energy from bitumen used for paving roads from emission calculations in accordance with the Revised 1996 IPCC Guidelines (and footnote (4) of the CRF table 1A(c)).

65. The ERT recommends that Greece reallocate process emissions from the energy sector to ammonia production (2B1) that arises from the use of lignite and natural gas as feedstock. In addition, any other relevant process emissions reported in the energy sector should be allocated to the industrial processes sector.

### C. Key categories (*fuel combustion and fugitive emissions*)

#### 1. Stationary combustion: solid fuel – CO<sub>2</sub>

66. CO<sub>2</sub> emissions from lignite in the public electricity and heat production category dominate CO<sub>2</sub> emissions from solid fuels. Greece reported a recalculation of CO<sub>2</sub> emissions from lignite for the entire time series, as requested by the previous expert review, using an EF based on data from a study on the estimation of the CO<sub>2</sub> EFs for the lignite used by the Greek Public Power Corporation.<sup>6</sup> This study examined the estimation of CO<sub>2</sub> EFs for lignite, based on the installed capacity and the characteristics of electricity production plants. The ERT recommends that Greece provide a summary of the main aspects of this study in the NIR, along with a discussion on its results and an explanation on the comparability of the carbon content of the lignite mined in Greece with similar types of coal mined within the European region. The ERT also encourages Greece to collect more information on the carbon content of lignite as a means to update the EF.

67. Greece recalculated the CO<sub>2</sub> emissions from chemicals (1A2c) in the base year, as requested by the previous ERT. Greece now estimates the amount of lignite consumption for ammonia production by using data from the *Statistical Yearbook of Greece 1990–1991*.<sup>7</sup> However, Greece did not recalculate emissions for 1991, when lignite was still used as a feedstock. The ERT recommends that Greece estimate emissions for 1991 using the same methodology.

#### 2. Stationary combustion: liquid fuel – CO<sub>2</sub>

68. The ERT noted that the implied emission factor (IEF) of liquid fuels in petroleum refining in the period 1990–2005 is relatively constant, ranging between 72.8–74.0 t/TJ; a 15.1 per cent decrease is observed between 2005 and 2006. Greece informed the ERT that the reported CO<sub>2</sub> emission for 2006 was incorrect (4,134.9 Gg CO<sub>2</sub> instead of 3,709.3 Gg CO<sub>2</sub>) owing to an error in CRF compilation. The ERT recommends that Greece implement QC procedures before the official submission of the inventory in order to eliminate errors in future CRF compilations.

#### 3. Stationary combustion: liquid fuel – N<sub>2</sub>O

69. The ERT encourages Greece to investigate the basis of the trend in the N<sub>2</sub>O IEF for the category other (1.A.2.f) as the fluctuations in this are not explained. The ERT also encourages Greece to explore how to disaggregate the AD and emissions from this category according to type of manufacturing industry.

#### 4. Civil aviation – CO<sub>2</sub>

70. Greece has recalculated CO<sub>2</sub> emissions from aviation gasoline and jet kerosene for the period 1990–2003, as requested by the previous ERT. Greece now extrapolates data on aviation gasoline and jet

<sup>6</sup> Study on the estimation of CO<sub>2</sub> emission factors for lignite used by the Public Power Corporation (PPC, 1993). Only available in Greek.

<sup>7</sup> Published in 1994 by the General Secretariat of the National Statistical Service of Greece, Athens.

kerosene consumption by using LTO data as the driver. The ERT recommends that Greece collaborate with the Ministry of Development and GCAO to resolve the known discrepancies, recalculate the inventory time series, and to document the resolution and supporting information in the next annual submission under the Kyoto Protocol.

71. Greece informed the ERT during the in-country review that the 2004 values of the CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions for both aviation gasoline and jet kerosene were incorrect owing to a CRF compilation error. The ERT recommends that Greece implement QC procedures before the official submission of the inventory in order to eliminate errors in future CRF compilations.

#### 5. Road transportation – CO<sub>2</sub>

72. AD are based on the national energy balance provided by the Ministry of Development, while CO<sub>2</sub> emissions are estimated from the COPERT IV model. In explaining the high reported implied EFs for automotive diesel oil for 2005 and 2006 (79.4 and 77.4 t CO<sub>2</sub>/TJ, respectively), Greece stated that these high values are a result of discrepancies in fuel consumption between the national energy balance and the COPERT IV model, and that NTUA is trying to resolve this. The ERT noted the efforts of Greece to investigate this issue in cooperation with the Ministry of Transport, and recommends that Greece include a description of this issue and/or its resolution in the NIR, along with recalculations of the time series.

73. Greece has recalculated CO<sub>2</sub> emissions from the combustion of lubricants for the period 1990–2005, as requested by the previous ERT. Greece now estimates the amount of lubricants combusted in road transportation by taking the average of lubricant–fuel ratios from a cluster of countries (Germany, Romania and the United Kingdom of Great Britain and Northern Ireland). Greece informed the ERT that it is working closely with the Department of Transport to collect improved data on lubricants.

74. The ERT commends the efforts of Greece to improve data and their collection, namely on the number of liquified petroleum gas vehicles, mopeds and heavy duty vehicles, and also the updating of mileage data across the age spectrum of cars. The ERT recommends that Greece include a description of this issue and/or its resolution in the NIR, along with recalculations of the time series.

#### 6. Navigation – CO<sub>2</sub>

75. A default methodology from CORINAIR is used by Greece to estimate emissions from navigation. However, the IPCC good practice guidance recommends that a Party should use the tier 1 approach based on fuel consumption by fuel type, carbon content of fuel and the fraction of fuel left unoxidized. The ERT recommends that Greece implement this approach; if this is not possible it should include in the NIR the rationale for using the CORINAIR methodology and a discussion on the accuracy of the two approaches.

### **D. Non-key categories (*fuel combustion and fugitive emissions*)**

#### Stationary combustion: biomass – CH<sub>4</sub>, N<sub>2</sub>O

76. Greece has performed a recalculation in the residential category (1A4b), as requested by the previous ERT. Greece now uses the amount of fuelwood reported by the Food and Agriculture Organization of the United Nations (FAO) as the total amount of biomass used in the residential sector, instead of using the constant value provided in the national energy balance. Greece informed the ERT that it is in the process of collecting improved biomass data in collaboration with certain agencies. The ERT commends the efforts of Greece to improve data and their collection, and recommends that Greece include a description of this issue and/or its resolution in the NIR, along with recalculations of the time series.

## **E. Areas for further improvement**

### **1. Identified by the Party**

77. Greece has identified, in response to issues raised in the previous expert review process, and through its own activities relating to inventory improvement, the following areas for improvement:

- (a) Timely provision of the national energy balance;
- (b) Further exploitation of EU ETS reports;
- (c) Improved data in support of estimating emissions from road transportation;
- (d) Investigation of carbon content of fuels in the navigation sector;
- (e) Investigation of a higher tier method for aviation and navigation;
- (f) Investigation of the availability of measurements that can be used to form the basis for calculating a national EF.

78. During the in-country review, Greece informed the ERT that it will perform recalculations pursuant to IPCC good practice guidance and time-series consistency.

### **2. Identified by the expert review team**

79. The ERT recommends that Greece:

- (a) Use IPCC methodology to estimate emissions from navigation, including international navigation;
- (b) Improve documentation of its methodologies with a focus on the rationale behind the choice of method, underlying assumptions and sources of data;
- (c) Improve time-series consistency of AD and emission estimates;
- (d) Continue collaborative work with stakeholders to continually improve the quality of the inventory by ensuring the most appropriate data are used to estimate emissions.

## **IV. Industrial processes and solvent and other product use**

### **A. Sector overview**

80. In 2006, the industrial processes sector accounted for 9.8 per cent (13,087.5 Gg CO<sub>2</sub> eq) of total GHG emissions. Emissions from this sector decreased by 0.7 per cent between 2005 and 2006, and increased by 18.2 per cent between the base year and 2006. Mineral products was the major category in 2006, contributing 55.0 per cent to total sector emissions, driven by cement production, which contributed 49.4 per cent (6,460.8 Gg CO<sub>2</sub> eq) to total sector emissions. Consumption of halocarbons and SF<sub>6</sub>, production of halocarbons and SF<sub>6</sub>, chemical industry and metal production contributed 18.0, 17.5, 4.8 and 4.6 per cent, respectively. Solvent and other product use accounted for 0.1 per cent (159.6 Gg CO<sub>2</sub> eq) of total GHG emissions in 2006, and decreased 5.9 per cent between the base year and 2006. CO<sub>2</sub> is the dominant GHG, contributing 59.1 per cent to total sector emissions, and 7 per cent to total GHG emissions. HFCs and N<sub>2</sub>O contributed 35.5 and 4.8 per cent, respectively, to total sector emissions.

81. The ERT commends Greece for implementing significant improvements to the selection of methods; this is largely underpinned by the availability of detailed information from EU ETS reports, namely plant-level data, reports on raw materials and energy flows, unit operations and production

processes, and the capability of the new institutional arrangements to provide confidential business information. Greece has used this information to estimate emissions using higher tier methods for 2005 and 2006 consistent with IPCC good practice guidance. The ERT recommends that Greece address the time-series consistency for the period 1990–2004 introduced by using new data that are available only from 2005 onward (e.g. from EU ETS) for its next annual submission under the Kyoto Protocol.

82. Greece informed the ERT that it has almost concluded a joint ministerial decision for the implementation of specific EU or national regulation that would, inter alia, provide a mandate for the entity-level reporting of data on the production, trade, export, import, recovery and recycling of F-gases or utilization of halocarbons. The ERT considers that this decision would facilitate the initialization of a national project to establish a data collection and management system, and to provide the required AD for development of a methodology consistent with the IPCC good practice guidance to estimate F-gas emissions and ultimately improve the completeness of the inventory. The ERT recommends that developments in this project are reported in the NIR.

### 1. Completeness

83. The ERT recommends that Greece include in its inventory improvement plan a process to develop emission estimates for those categories where emissions do occur in the country but which are currently reported as NE, by using simple, reasonable approaches and utilizing expert judgement as necessary; this should be done even if the emissions are minor. However, priority to estimate these emissions should be given to key subcategories (e.g. consumption of halocarbons and SF<sub>6</sub>) for which a methodology exists in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance (e.g. CH<sub>4</sub> from iron and steel production). Country-specific methods that meet the requirements of these IPCC documents could also be explored by Greece. The ERT encourages Greece to report relevant developments in the NIR.

84. The CRF tables are complete except for a few categories that are reported as NE by Greece in the 2006 CRF table 9(a) and the NIR, namely: CO<sub>2</sub> emissions from soda ash use, asphalt roofing and road paving with asphalt; CH<sub>4</sub> from iron and steel production, ferroalloys production, aluminium production and aluminium foundries; actual emissions of HFCs, PFCs and SF<sub>6</sub> from foam blowing, fire extinguishers, aerosols and metered dose inhalers, solvents and semiconductor manufacture (due to a lack in AD); and potential emissions of HFCs, PFCs and SF<sub>6</sub>. The ERT recommends that Greece provide an explanation of the use of the notation key NE in CRF table 9(a) and in its next annual submission under the Kyoto Protocol to improve transparency and consistency with the NIR.

85. The ERT noted Greece obtained new AD data from the NSSG for hydraulic lime. Greece informed the ERT that, starting from its next annual submission, it will use new data to estimate emissions from nitric acid production that are now available, albeit under confidentiality provisions, within the new institutional arrangements. In addition, the Party informed the ERT that it is currently investigating the availability of destruction data to further improve emissions estimation from nitric acid production. The ERT recommends that Greece report the information referred to above in its next annual submission, in line with the requirements of the IPCC good practice guidance.

### 2. Transparency

86. In response to recommendations of the previous ERT, Greece has significantly improved the transparency of the inventory by reporting improved information in the NIR on sources of AD, rationale of methodological choice, assumptions, emission trends and uncertainties. The ERT encourages Greece to further enhance transparency by providing an explanation in the relevant CRF documentation box on the reporting of AD and country-specific methodological choice (e.g., carbonates instead of clinker for estimation of emissions in cement production). The ERT recommends that Greece include in its next annual submission the information given to the ERT during the in-country review (e.g. summary of the

EU ETS coverage of categories in Greece's inventory, and the percentage of this coverage of the total activity); this would significantly improve the transparency of the inventory.

### 3. Recalculations and time-series consistency

87. The recalculations reported by Greece in its 2008 annual submission were achieved through the use of improved data and the implementation of recommendations of the previous ERT. The Party has obtained improved AD for the period 2005–2006 to recalculate cement production – CO<sub>2</sub>, lime production – CO<sub>2</sub>, glass production – CO<sub>2</sub>, and iron and steel production – CO<sub>2</sub>. In addition, improved data have been obtained from market surveys and from the Ministry of Transport on the consumption of halocarbons and SF<sub>6</sub> (HFC-134a) used in mobile refrigeration and air-conditioning equipment for the period 1993–2006. The impact of these recalculations is a decrease in base year emissions of 0.01 per cent (81.1 Gg CO<sub>2</sub> eq), and a decrease in 2005 emissions of 0.1 per cent (1,715.0 Gg CO<sub>2</sub> eq).

88. The ERT identified that recalculations performed for cement production – CO<sub>2</sub>, lime production – CO<sub>2</sub>, glass production – CO<sub>2</sub> and iron and steel production – CO<sub>2</sub> for the period 2005–2006 are not time-series consistent. Greece has implemented a tier 3 approach to estimate emissions using new AD available only for 2005–2006; other years of the inventory time series are not based on a consistent method or AD (e.g., limestone and dolomite emissions based on carbonate content (CaCO<sub>3</sub> and MgCO<sub>3</sub>) instead of the oxide content (CaO and MgO)). Greece is recommended to ensure time-series consistency in all its recalculations, and where methods and data do not permit this, to explore the use of recalculation techniques set out in the IPCC good practice guidance.

### 4. Uncertainties

89. Greece has reported quantitative estimates of uncertainty in its NIR. These estimates have been reported only for key categories. The ERT recommends that Greece expand the coverage of this analysis to all categories within this sector, and to provide improved documentation on the assumptions and expert judgement.

90. The ERT recommends that Greece continue to improve the accuracy and the certainty of the inventory by exhausting all avenues to obtain improved data within the new institutional arrangements.

### 5. Verification and quality assurance/quality control approaches

91. During the in-country review Greece provided the ERT with additional information on the coverage of EU ETS data in the industrial processes inventory, and informed the ERT that these data are subject to verification by accredited and certified private bodies. The ERT commends Greece for utilizing verified data in its inventory as this adds value to the QA/QC procedures of Greece, and recommends that the next annual submission under the Kyoto Protocol include the above-mentioned additional information given to the ERT.

## **B. Key categories**

### 1. Cement production – CO<sub>2</sub>

92. A tier 3 method has been used by Greece to estimate emissions from this category for 2005 and 2006. This method is in line with the IPCC good practice guidance, and is based on the consumption of carbonates instead of clinker production. Plant-specific AD obtained under EU ETS reporting is used for 2005 and 2006; however, Greece has reported clinker production in the CRF. The ERT recommends that Greece report AD as equivalent carbonates, and to use the corresponding EF. Greece is also recommended to improve the time-series consistency of the emission estimate by using plant-specific carbonates-to-clinker ratios reported under the EU ETS for clinker production to recalculate the period 1990–2004, in line with the IPCC good practice guidance.



## 2. Iron and steel production – CO<sub>2</sub>

93. A tier 3 method has been used by Greece to estimate emissions from this category for 2005 and 2006. This method is in line with the IPCC good practice guidance, and is based on tracked carbon oxidation throughput of the production processes in electric arc furnace operation. Greece has improved the detail of information in the NIR in response to the previous ERT by including information on the methodology and underlying assumptions. Additional information was provided during the in-country review that substantiated material and energy flows used by the Party to identify all process steps and corresponding consumption of reducing agents. The ERT noted that Greece has accounted for residual carbon in slag. The aggregate country-specific CO<sub>2</sub> EF was estimated to be 0.242 t/t steel in 2006 compared with the 1990 value of 0.203, that represents a 19.2 per cent potential underestimation of the base year emission. Greece is encouraged to use the EU ETS reports to determine the fraction of total carbon consumption used for the estimation of emissions accounted as residual carbon in slag. If this fraction is found not to be significant, Greece could consider using the CO<sub>2</sub> IEF for 2005-2007 for the estimation of the entire time series.

## C. Non-key categories

### 1. Ammonia production – CO<sub>2</sub>

94. CO<sub>2</sub> emissions associated with the use of lignite and natural gas used as feedstock are currently reported in the energy sector. The ERT recommends that Greece allocate these emissions to the ammonia production category in line with the Revised 1996 IPCC Guidelines. Additional information provided by Greece during the in-country review suggests that Greece has at its disposal data on plant-level ammonia (NH<sub>3</sub>) production, fuel input per unit of NH<sub>3</sub> (GJ/tonne ammonia) and the carbon content factor of the feedstock/fuel used (kg C/GJ). The ERT encourages Greece to explore using this new information to estimate emissions from this category for all years of the inventory time series, using methods prescribed by the Revised 1996 IPCC Guidelines or the IPCC good practice guidance. Alternatively, Greece can use the default EF in the IPCC good practice guidance for natural gas input per unit of ammonia, and couple this with country-specific carbon content to estimate the CO<sub>2</sub> emission.

### 2. Aluminium production – CO<sub>2</sub>

95. The activity data for aluminium production is reported in the CRF table as confidential (vis-à-vis one aluminium plant in operation in Greece), that is consistent with the provisions of the UNFCCC reporting guidelines on the reporting of confidential data. Greece estimated the CO<sub>2</sub> emissions from aluminium production process in 2006 based on the consumption of petroleum coke. This tier 1c method from the Revised 1996 IPCC Guidelines may lead to an overestimation of emissions if the gross consumption of petroleum coke has been used without accounting for the proportion of petroleum coke that is recycled from the residual carbon anode in the alumina reduction process. The ERT recommends that Greece obtain plant-specific AD for the net anode carbon consumption as a reducing agent for the CO<sub>2</sub> emissions estimation as opposed to using the tier 1a method based on a default emission factor (tonne carbon per tonne aluminium) and aluminium production data; and that the Party apply this methodology to estimate emissions from this category for the period 1990–2006 to address time-series consistency.

96. The ERT concludes that the considerable variations in the reported PFC emissions from this category require plant-level QA/QC to verify the trend. The ERT recommends that Greece endeavour to obtain information on the functioning or otherwise of the anode effect termination system in place for the control of PFCs as a means of verifying these variations.

## **D. Areas for further improvement**

### **1. Identified by the Party**

97. Planned sector improvements identified by Greece include:

- (a) Obtain AD from industry, particularly for those categories that are not subject to EU ETS reporting ( e.g. aluminium production – CO<sub>2</sub>, ammonia production – CO<sub>2</sub>, nitric acid production – N<sub>2</sub>O and hydrochlorofluorocarbon production and consumption);
- (b) Provide explanation in the NIR of variations in AD and emission trends identified for specific categories;
- (c) Use data obtained in June 2008 on nitric acid activity, and consider using plant-level measurements when the category becomes a key category, in response to a previous review recommendation;
- (d) Apply higher tier methods with improved data reporting under the new institutional arrangements and recalculate emissions for the period 1990–2004 pursuant to IPCC good practice guidance and time-series consistency.

### **2. Identified by the expert review team**

98. Greece is encouraged to further improve the transparency and completeness (e.g. by reporting soda ash use, consumption of halocarbons and SF<sub>6</sub>) of the inventory.

99. Greece is recommended to:

- (a) Report AD in the CRF for cement production based on carbonates to improve the consistency between the NIR and CRF tables;
- (b) Obtain plant-specific AD on the consumption of anode carbon as a reducing agent and its purity to estimate CO<sub>2</sub> emissions from aluminium production.

## **V. Agriculture**

### **A. Sector overview**

100. In 2006, the agriculture sector accounted for 8.7 per cent (11,644.9 Gg CO<sub>2</sub> eq) of total GHG emissions. Emissions decreased by 0.8 per cent between 2005 and 2006, and decreased by 13.9 per cent between the base year and 2006. A key driver for the trend between the base year and 2006 is the decrease of 18.9 per cent (1,846.6 Gg CO<sub>2</sub> eq) in emissions from agricultural soils. Agricultural soils was the major category in 2006, contributing 67.9 per cent to total sector emissions, and 5.9 per cent to total GHG emissions. Enteric fermentation and manure management contributed 24.3 and 6.7 per cent, respectively, of sector emissions. N<sub>2</sub>O is the dominant GHG, contributing 70.4 per cent to total sector emissions, with CH<sub>4</sub> contributing the remainder (29.6 per cent).

101. Agricultural soils is the key driver of the trend in emissions within this sector. The greatest change was in the emissions from the application of synthetic fertilizers – a decrease of 45.7 per cent (1,070.9 Gg CO<sub>2</sub> eq) in the period 1990–2006. There was a related decrease in indirect emissions from nitrogen leaching and run-off. The NIR states that the driver for the decrease in N<sub>2</sub>O emissions from agricultural soils was a reduction in the use of nitrogenous fertilizers. During the in-country review, the ERT discussed reasons for the change with experts from the NSSG and the Ministry of Rural Development and Food. The ERT was informed that the decrease could probably be attributed to an increase in organic farming, the price of fertilizer and the impact of initiatives to promote good practice

in fertilizer use. The ERT encourages Greece to provide more of the contextual information in the NIR to facilitate understanding of the changes in the sector.

102. The key categories identified by Greece are enteric fermentation ( $\text{CH}_4$ ), agricultural soils – direct emissions ( $\text{N}_2\text{O}$ ), agricultural soils – animal production ( $\text{N}_2\text{O}$ ) and agricultural soils – indirect emissions ( $\text{N}_2\text{O}$ ). All of these categories are identified based on level and trend assessment. The analysis is consistent with the secretariat's analysis. The reporting of emissions from the agriculture sector is complete.

103. The ERT noted that many potential questions about the agriculture inventory were resolved via the additional information and clarifications provided by staff of MINENV, NTUA, NSSG and the Ministry of Rural Development and Food during the in-country review. The ERT encourages Greece to include the additional information on methodologies and agriculture in its next annual submission under the Kyoto Protocol.

#### 1. Completeness

104. The CRF includes estimates of all gases and categories of emissions from the agriculture sector, as recommended by the Revised 1996 IPCC Guidelines. The activities of prescribed burning of savanna and growing sugar cane do not occur in Greece.

#### 2. Transparency

105. The NIR contains a basic description of the methodologies used. However, the documentation was insufficient to thoroughly assess the accuracy of the estimates or the relevance of IPCC default EFs to estimate emissions from Greece's agricultural systems. During the in-country review, the ERT was provided with additional information from Greek experts that clarified issues; for example, NSSG provided valuable contextual information about Greek agriculture that explained the difficulties in obtaining data in a country with 800,000 farms with an average size of 4 ha. The ERT recommends that Greece include additional detail on the rationale for selecting methodologies and EFs, and relevant contextual information about its national circumstances in the next annual submission under the Kyoto Protocol.

#### 3. Recalculations and time-series consistency

106. The recalculations reported by Greece in its 2008 annual submission were performed to resolve identified errors in the previous CRF compilation. Greece has corrected an error in animal population data for 2005 to recalculate enteric fermentation –  $\text{CH}_4$ ; manure management –  $\text{CH}_4$ ; and agricultural soils –  $\text{N}_2\text{O}$ . The impact of these recalculations is an increase in 2005 emissions of 1.9 per cent (215.7 Gg  $\text{CO}_2$  eq); no recalculations were performed on the base year.

#### 4. Uncertainties

107. Uncertainties of agricultural categories have been quantified using statistical surveys of population data, expert judgment and IPCC defaults, and are documented in annex IV to the NIR. The ERT also noted that category-specific detail on uncertainty is not provided in the relevant category section of the NIR, as required by the UNFCCC reporting guidelines. The ERT encourages Greece to implement this requirement in its next annual submission under the Kyoto Protocol and to provide more detailed information on the rationale for the selection of uncertainty values.

### **B. Key categories**

#### 1. Enteric fermentation – $\text{CH}_4$

108. In 2006, enteric fermentation accounted for 24.3 per cent (2,831.9 Gg  $\text{CO}_2$  eq) of total sector emissions, and 2.1 per cent of total GHG emissions. Sheep is the major category in enteric fermentation,

accounting for 48.2 per cent of enteric fermentation emissions. The next largest categories are goats (20.1 per cent), non-dairy cattle (16.6 per cent) and dairy cattle (13.1 per cent). Consistent with IPCC good practice guidance, Greece applies an enhanced livestock classification and a tier 2 methodology for emissions from sheep; the NIR details the input assumptions. The ERT noted that the calculated average feed intake reported in the NIR is 22.3 MJ/day. This value was corrected to 20.1 MJ/day during the in-country review. This revised value is similar to the 20 MJ/hd/day for sheep in developed countries specified in the Revised 1996 IPCC Guidelines. The ERT recommend that Greece include in the NIR the results of the specific QA/QC procedures elaborated in section 4.1.3 of the IPCC good practice guidance.

109. Emissions from dairy and non-dairy cattle are calculated using the IPCC default EFs for Eastern Europe for all years in the time series (81 kg CH<sub>4</sub>/hd/yr for dairy cattle and 56 kg CH<sub>4</sub>/hd/yr for non-dairy cattle). Greece explained that values for Eastern Europe are applied for dairy cattle because milk production values are similar to the 2,550 kg/hd/yr value for Eastern Europe in the Revised 1996 IPCC Guidelines. However, the NIR notes that available data from FAO on milk production shows that it increased from 2,500 kg/hd/yr in 1990 to an estimated 3,800 kg/hd/yr in 2006. The estimate for 2006 is closer to the 4,200 kg/hd/yr for Western Europe. The ERT recommends that Greece estimate and report the increased emissions that would be associated with the increase in milk production. The ERT considers it would be appropriate to use the default EF for Western Europe (100 kg CH<sub>4</sub>/hd/yr) for dairy cattle in future inventories or interpolate a value between the Eastern and Western Europe values based on milk production data. This change to the Western Europe value should also be made for non-dairy cattle. The ERT commends Greece in exploring the development of a tier 2 estimate for cattle and encourages it to continue with this work and collect the necessary input parameters.

## 2. Direct soil emissions – N<sub>2</sub>O

110. In 2006, direct soil emissions accounted for 14.6 per cent (1,699.0 Gg CO<sub>2</sub> eq) of total sector emissions, and 1.3 per cent of total GHG emissions. The category is dominated by emissions from synthetic fertilizers, which accounted for 74.9 per cent (1,271.9 Gg CO<sub>2</sub> eq) of total emissions from this category. The NIR states that AD for synthetic fertilizers was obtained from FAO for the period 1990–2002, but was extrapolated for subsequent years owing to a lack of data. During the in-country review, the ERT was informed by NSSG of plans to significantly improve the information on fertilizer use through the NSSG survey and census procedures. The ERT was also informed that although there are limited data on fertilizer use available, information from the NSSG survey is cross-checked against import/export figures. The ERT encourages Greece to include the updated data in the inventory when they become available and to ensure collaboration with NSSG to obtain the required information.

111. The FRAC<sub>NCRO</sub> value reported by Greece is 0.005, compared with the IPCC default of 0.015. The ERT verified the tier 1b calculation used by Greece and confirmed that the value of 0.005 is an average generated by the large proportion of wheat (38 per cent of cereal production) and maize (50 per cent of cereal production). Wheat has a FRAC<sub>NCRO</sub> value of 0.0028 and maize has a FRAC<sub>NCRO</sub> value of 0.0081. The ERT recommends that Greece include detailed descriptions in the NIR to enhance transparency.

## 3. Pasture, range and paddock manure – N<sub>2</sub>O

112. In 2006, pasture, range and paddock was the dominant source of emissions in the agriculture sector, accounting for 29.1 per cent (3,387.0 Gg CO<sub>2</sub> eq) of total sector emissions, and 2.5 per cent of total GHG emissions. The category is dominated by emissions from goats, which accounted for 62.4 per cent (2,112.7 Gg CO<sub>2</sub> eq) of emissions from excreta deposited on pasture, followed by sheep at 30.3 per cent. Greece uses default nitrogen excretion (Nex) values for all livestock classes including sheep and goat. As Greece is already calculating an energy requirement for sheep as part of the tier 2 methodology for enteric CH<sub>4</sub>, the ERT encourages the Party to investigate the protein content of feed and products, in order to develop an accurate, country-specific Nex value for sheep.

113. Greece uses a Nex value of 12 kg N/hd/yr for sheep and 40 kg N/hd/yr for goats. These values are the defaults in the Revised 1996 IPCC Guidelines for sheep and other animals for Mediterranean countries. The ERT pointed out that the value for goats appears very high compared with the value for the similar-sized sheep and considers this as a potential over-estimation of emissions. The ERT recommends that Greece undertake work to identify the suitability of the 40 kg N/hd/yr value for goats or develop a country-specific value.

114. Greece also uses Nex values for Mediterranean countries (and Eastern Europe) from the Revised 1996 IPCC Guidelines for dairy cattle (70 kg N/hd/yr) and non-dairy cattle (50 kg N/hd/yr). As dairy milk production has now increased to levels similar to those of Western Europe, the ERT recommends that Greece evaluate whether the default Nex for Mediterranean countries and Eastern Europe is still applicable to cattle in Greece. The ERT noted that the values for Western Europe at 100kg N/hd/yr for dairy cattle and 70 kg N/hd/yr for non-dairy cattle are higher than those of Eastern Europe and therefore emissions are potentially underestimated. The ERT recommend that Greece provide justification of the lower values, or, if it cannot provide this, change to the defaults for Western Europe or interpolate a Nex value consistent with the enteric fermentation category.

#### 4. Indirect emissions – N<sub>2</sub>O

115. In 2006, indirect emissions accounted for 24.2 per cent (2,816.3 Gg CO<sub>2</sub> eq) of total sector emissions, and 2.1 per cent of total GHG emissions. Nitrogen leaching and run-off is the dominant category accounting for 82.2 per cent (2,314.9 Gg CO<sub>2</sub> eq) of indirect emissions. Greece uses the default EF of 0.025 kg N<sub>2</sub>O/kg N and the default values of the fractional parameters FRAC<sub>GASM</sub> (0.2), FRAC<sub>GASF</sub> (0.1) and FRAC<sub>LEACH</sub> (0.3). The ERT considers that the recommendations in other related sections of this report, that is, improving the AD on fertilizers and Nex values, will have a considerable impact on this category.

### C. Non-key categories

#### Manure management – CH<sub>4</sub>

116. Solid storage is the main AWMS for cattle, whereas pasture, range and paddock is the dominant AWMS for sheep and goats. The NIR states that the available official information related to the allocation of waste to various manure management systems is an area where Greece intends to collect improved information. The ERT was informed by Greece that this will be in collaboration with other research institutes (e.g. an agricultural university). The ERT encourages Greece to continue with these plans. The recommendations from related categories (e.g. enteric fermentation) will also have an impact on this category.

### D. Areas for further improvement

#### 1. Identified by the Party

117. Greece has identified several plans to further improve the agriculture inventory. These plans encompass incorporating updated AD on animal populations, synthetic fertilizer use and the allocation of animals to different AWMS, and developing a tier 2 methodology for CH<sub>4</sub> emissions from enteric fermentation.

#### 2. Identified by the expert review team

118. The collaboration between agriculture sector experts, NSSG and the experts from the Ministry of Rural Development and Food during the inventory planning and review phases has been significantly improved. The ERT concludes that the outcome of this collaboration will lead to further and continuous improvement in the transparency and accuracy of the inventory. The sectoral expertise should also be

used to support the rationale for selecting particular methodologies and IPCC EFs, and also in developing relevant information about the national circumstances of Greek agriculture.

## **VI. Land use, land-use change and forestry**

### **A. Sector overview**

119. In 2006, the LULUCF sector in Greece amounted to a net sink of 5,198.7 Gg CO<sub>2</sub> eq; the LULUCF sector in 2005 was also shown as a net sink in the 2007 submission. The 2006 net sink offset 4.1 per cent of Greece's total GHG emissions. The net sink decreased by 0.7 per cent between 2005 and 2006, and increased by 61.8 per cent between the base year and 2006. The key drivers for this trend are attributed mainly to the reduction in forest harvesting, the afforestation programmes that commenced in 1994, and smaller areas being burnt by wildfires in recent years. There are considerable fluctuations in the LULUCF sector that the NIR explains is due to changes in the extent of forest land burnt by wildfires.

120. In 2006, GHG removals from the forest land category accounted for 85.0 per cent of the LULUCF sector removals, while cropland accounted for the remaining removals. Grassland was a net source of about 0.2 Gg CO<sub>2</sub> eq in 2006. Greece has identified three key categories for the LULUCF sector: forest land remaining forest land – CO<sub>2</sub> (level and trend); land converted to forest land – CO<sub>2</sub> (level and trend); and cropland remaining cropland – CO<sub>2</sub> (trend). The living biomass pool has been identified as the significant pool within these key categories.

121. The NIR provides valuable information about LULUCF in Greece. The ERT noted that the definition of forest used in the national inventory excludes poplar plantations. Forest plantations consisting mainly of poplar trees are considered as cropland. These croplands account for a small area of about 10 000 ha. The ERT also noted that Greek laws prohibit the land-use change of forest land. Forest land burnt by wildfires is considered to be reforestation.

#### **1. Completeness**

122. The CRF tables are generally complete. Greece reports the notation key NE in CRF table 9(a) for the following categories without providing an explanation: grassland converted to forest land; land converted to wetlands; land converted to settlements; and land converted to other land. The ERT was informed during the in-country review that this is owing to a lack of data. The ERT recommends that Greece investigate all sources of available land-use data in order to provide an estimate of the categories reported as NE. If data cannot be found, Greece should provide further supporting information in the NIR and CRF table 9(a) explaining why data cannot be obtained for these categories. During the in-country review Greece explained that land converted to cropland and activities such as application of lime and fertilizers do not occur in Greece and are therefore reported as NO.

123. The ERT identified a discrepancy between the total land area of Greece and the sum of the areas of land-use categories reported in the CRF tables, and concludes that this is probably because a source or sink activity has been omitted, and is a direct result of the fact that Greece has not reported consistent land representation in accordance with IPCC good practice guidance for LULUCF. The ERT recommends that Greece ensure a consistent land representation, and to check the total land area reported in the CRF to avoid potential double counting or an omission of a source or sink category.

#### **2. Transparency**

124. The LULUCF inventory is generally transparent; however the transparency of the inventory can be improved by providing more detailed information in the NIR in line with the requirements of the IPCC good practice guidance for LULUCF. The ERT recommends that Greece include the following in its next annual submission:

- (a) National (actual) definitions of land use;
- (b) A description of how national land use categories are mapped to the classification schema of the IPCC good practice guidance for LULUCF;
- (c) A land use and land-use change matrix in line with the IPCC good practice guidance for LULUCF;
- (d) Improved documentation on AD (e.g. area of most land uses and land-use changes), and approaches and methods used for developing the land use representation for Greece;
- (e) Description and explanation on the assumptions used in the LULUCF inventory (e.g. substantiation of the assumption regarding the value of 35 years used for regrowth of vegetation after wildfires).

125. The ERT concludes that the primary required improvement for the LULUCF sector is to obtain improved data on the representation of land use in the country. In developing the land-use data, Greece should consolidate efforts to utilize all existing sources of data and available expertise.

### 3. Recalculations and time-series consistency

126. The ERT noted that CO<sub>2</sub> removals and CH<sub>4</sub> and N<sub>2</sub>O emissions from the forest land, cropland and grassland categories were recalculated for 2005. The NIR explains that the recalculation for forest land is a result of the availability of updated AD for 2005 on the areas burnt by wildfires. There is no further explanation concerning the source of the new data. In the cropland category, the NIR explains that provisional statistics on the area of perennial woody crop plantations were provisional for 2000–2005 and that in the 2006 inventory, updated AD were used. The CRF shows that only the 2005 inventory was recalculated. The ERT recommends that Greece recalculate all years where new AD are available.

### 4. Uncertainties

127. There is no discussion of sector-specific or category-specific uncertainties in the LULUCF chapter of the NIR. LULUCF is included in the overall analysis but there is no detail supporting the values used by Greece. The ERT recommends that Greece include substantially more information in the NIR to support its uncertainty calculation.

### 5. Verification and quality assurance/quality control approaches

128. The NIR states that “specific quality assurance and quality control procedures outlined in the IPCC good practice guidance for LULUCF were followed in the preparation of this inventory”; however, these checks are not elaborated or the results reported in the NIR. The ERT recommend that these specific QA/QC checks are presented in the relevant category in line with the UNFCCC reporting guidelines.

## **B. Key categories**

### 1. Forest land remaining forest land – CO<sub>2</sub>

129. GHG removals from the forest land remaining forest land category are generally consistent with the IPCC good practice guidance for LULUCF. A mix of IPCC tier 1 and 2 methodologies has been applied by Greece. Carbon stock change in living biomass is estimated using a mix of the IPCC default and country-specific sources of AD, EFs and other parameters. Default IPCC data have been used to estimate changes in soil carbon. During the in-country review Greece informed the ERT that soil maps and data may be available in the Ministry of Rural Development and Food. The ERT recommends that

Greece investigate the soil data and assess their suitability for use in the reporting of changes in soil carbon.

## 2. Land converted to forest land – CO<sub>2</sub>

130. The methodologies, EFs and other parameters used in the estimation of GHG net removals in the category of land converted to forest land are generally consistent with the IPCC good practice guidance for LULUCF. The NIR indicates that a mix of IPCC tier 1 and tier 2 approaches has been used to estimate living biomass. The ERT noted that in the tier 2 equation to estimate carbon stock change in living biomass, the parameter for the change in biomass due to actual conversion has been set to zero. Use of a zero value automatically changes the approach from a tier 2 to a tier 1 approach. The ERT recommends that Greece use country-specific data in support of applying tier 2 approaches for this key category and in particular estimate the value of the changes in biomass due to conversion.

## 3. Cropland remaining cropland – CO<sub>2</sub>

131. The methodologies, EFs and other parameters used for cropland remaining cropland are generally in line with the IPCC good practice guidance for LULUCF.

132. Greece reported soil carbon stock change from cropland converted to grassland and cropland converted to forestland. This is not in line with IPCC good practice guidance for LULUCF. During the in-country visit, Greece explained that the methodology it uses does not allow reporting consistent with this guidance. However, the ERT investigated the methodology and concluded that it does allow for such reporting. The ERT recommends that emissions and removals should be reported under their actual categories of sources and sinks to avoid the possibility of double counting. The ERT also recommends that Greece investigate using a tier 2 approach for estimating soil carbon stock change in cropland.

# C. Non-key categories

## 1. Grassland remaining grassland – CO<sub>2</sub>

133. The estimate of emissions of CH<sub>4</sub> and N<sub>2</sub>O from wildfires was based on tier 1 methods. Greece uses default data from the IPCC good practice guidance for LULUCF supplemented by some country-specific values, for example average biomass stock. Carbon stock change in soil has been reported under the category cropland remaining cropland. As stated in the cropland remaining cropland category, the ERT recommends that Greece report carbon stock change in soil from grassland categories under the correct categories of sources and sinks.

## 2. Land converted to grassland – CH<sub>4</sub>, N<sub>2</sub>O

134. The emissions estimate is based on the default method and the assumption that no change occurs in the biomass carbon stock. Soil carbon stock change is estimated and incorrectly reported under the cropland remaining cropland category. Non-CO<sub>2</sub> emissions from wildfires on lands converted to grassland are reported under the category grassland remaining grassland. Reporting of this category in the NIR does not provide sufficient information to check what has been reported in relation to wildfires. The recommendation on consistent reporting of emissions and removals under their actual categories of sources or sinks is also relevant here.

# D. Areas for further improvement

## 1. Identified by the Party

135. There are no planned improvements identified in the NIR.



## 2. Identified by the expert review team

136. ERT recommends that Greece consider the following improvements:

- (a) Establish a team comprising suitable experts to address the issue of consistent land representation and develop a methodology to allow annual updating of the GHG inventory;
- (b) Ensure that higher tier methods and country-specific data are used, at least for estimation of all significant subcategories in a key category;
- (c) Ensure complete reporting of all the mandatory land-use categories, using best available data and default methods;
- (d) Maintain consistent reporting with UNFCCC reporting guidelines and IPCC good practice guidance for LULUCF and ensure that all sources and sinks are reported under their actual categories and CRF tables;
- (e) Maintain active participation and involvement of relevant institutions and data providers in all stages of inventory preparation.

## **VII. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol**

137. Greece elected not to submit on a voluntary basis information required under Article 7, paragraph 1, of the Kyoto Protocol with respect to activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

138. During the in-country review, the ERT discussed with Greece considerations involved in the reporting of such information. The findings and some recommendations that stem from this discussion are presented in this section of the report; these relate mostly to the requirement of the national system with respect to identifying areas of land and areas of land-use change, as set out in paragraph 20 of the annex to decision 16/CMP.1.

139. The Ministry of Rural Development and Food is the competent body designated by MINENV as responsible for the identification of areas of land and areas of land-use change and the measurement and estimation of emissions by sources and removals by sinks for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. Within the Ministry, two experts from the Forest Directorate have been assigned the responsibility for activities under Article 3, paragraphs 3 and 4, with one member designated as the focal point within the national system for MINENV.

140. Greece informed the ERT that a project has been initiated to develop methodologies for estimation of emissions by sources and removals by sinks for activities under Article 3, paragraph 3, and activities elected under Article 3, paragraph 4, of the Kyoto Protocol. This project is also intended to improve the LULUCF inventory for reporting under the Convention. The project established a technical team that comprises relevant expertise, and is tasked with, inter alia, the following:

- (a) Review reporting requirements under the Kyoto Protocol and assess current LULUCF reporting requirements under the Convention;
- (b) Take stock of data currently available and develop a methodology for the identification of areas of land and areas of land-use change for the carriage of reporting information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol;

- (c) Provide recommendations on the above and suggested improvements to the national system in support of reporting information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

141. This project has been assigned specific tasks and schedules for completing the work, and has also been allocated financial resources. The ERT commends Greece in establishing this project, and encourages it to include updates on progress in its next annual submission under the Kyoto Protocol.

142. The ERT, in its discussions with the representatives of the Ministry of Rural Development and Food, concluded that there is strong expertise in forestry issues within the national system. However, it identified limitations in knowledge and understanding of the specific aspects of the reporting of information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. This is not deemed by the ERT to be a significant concern now, but it recommends that Greece address this issue expeditiously (i.e. before it commences preparing and reporting estimates of emissions by sources and removals by sinks under the Kyoto Protocol). Additionally, the ERT encourages MINENV and NTUA to explore developing in-house expertise on this reporting.

143. The ERT concludes that Greece has the capacity to identify areas of land and areas of land-use change, as stipulated in paragraph 20 of the annex to decision 16/CMP.1, before the first annual report of the first commitment period is due (2010). This conclusion is subject to Greece meeting specified timelines and allocation of resources to the project.

## **VIII. Waste**

### **A. Sector overview**

144. In 2006, the waste sector accounted for 2.7 per cent (3,539.1 Gg CO<sub>2</sub> eq) of total GHG emissions. Emissions from the sector increased by 6.4 per cent between 2005 and 2006, and decreased by 20.4 per cent between the base year and 2006. The key driver for the decrease in emissions between the base year and 2006 is the treatment in anaerobic conditions of an increasingly large amount of wastewater. Solid waste disposal on land was the major category in the waste sector, contributing 74.8 per cent of total sector emissions; emissions from wastewater handling contributed 25.2 per cent. CH<sub>4</sub> is the dominant GHG gas, contributing 89.5 per cent to total sector emissions, while N<sub>2</sub>O contributed 10.5 per cent. Waste incineration is a minor category in this sector.

#### 1. Completeness

145. The CRF includes estimates of most gases and categories of emissions from the waste sector, as recommended by the Revised 1996 IPCC Guidelines. Categories not included in the inventory are waste incineration (clinical waste) – CH<sub>4</sub> and N<sub>2</sub>O (there is no available methodology to estimate such emissions); industrial wastewater – N<sub>2</sub>O, (again, no available methodology); and historical emissions from open burning of solid waste. Emissions from these categories are considered to be minor, but these activities do occur in Greece and the ERT recommends that the Party explore simple, reasonable approaches, utilizing expert judgement as necessary, to estimate such emissions. The information provided in the NIR is in general complete.

#### 2. Transparency

146. The submission is in general transparent. However, additional information and clarifications were provided during the in-country review with regard to the application of methodologies (e.g. first order decay model), data compilation and use of some assumptions (e.g. waste generation rate). The ERT recommends that Greece include in the NIR all or part of the information made available to the ERT during the in-country review.

### 3. Recalculations and time-series consistency

147. The inventory is in general consistent. Greece reported in the NIR that no recalculation has been carried out in the waste sector and identified that CO<sub>2</sub> emissions from landfill gas flaring have been removed from the inventory, and emissions from sewage sludge are now included in the estimates of the 2008 annual submission. During the in-country review Greece informed the ERT that this information will be reported in the next annual submission under the Kyoto Protocol. The ERT recommends that Greece include this information in its next annual submission as well as any recalculations performed.

### 4. Uncertainties

148. Information on EFs and AD are not provided in the NIR. During the in-country review Greece explained that uncertainties have been combined in the waste sector. The ERT recommends that Greece include this information in its next annual submission under the Kyoto Protocol. Furthermore, the ERT identified that the uncertainty in the waste sector could be higher than reported for many reasons: lack of data; lack of information on the classification of landfills between managed and unmanaged; lack of information on classification of wastewater handling systems between aerobic and anaerobic; basing the amount of solid waste generated and landfilled mostly on assumptions; and inappropriate use of some parameters (degradable organic carbon for wood and paper, methane correction factor for landfills, methane conversion factor for anaerobic systems). The ERT recommends that Greece implement the data collection plan provided during the in-country review so as to reduce the uncertainty associated with the current waste inventory.

### 5. Verification and quality assurance/quality control approaches

149. No category-specific QA/QC procedure has been implemented in addition to the general QA/QC procedures. The ERT recommends that Greece implement a tier 2 QA/QC for key categories in waste.

## **B. Key categories**

### 1. Solid waste disposal on land – CH<sub>4</sub>

150. As required by the IPCC good practice guidance, Greece used the first order decay model to estimate the emissions of methane from solid waste disposal on land. To apply the model, Greece used a combination of country-specific data, IPCC default data and assumptions. The spreadsheets developed and the assumptions used (to estimate the amount of solid waste generated) were explained during the in-country review. The ERT identified a lack of data on the amount of waste generated and landfilled, and the composition of waste. Greece informed the ERT during the in-country review that official data on the amount of waste generated and landfilled are available from the waste management sector of MINENV and will be used in the next annual submission under the Kyoto Protocol. Additionally, as far as the composition of waste is concerned, Greece informed the ERT that it has tried to obtain information for the managed and the unmanaged sites from a number of sources, including within MINENV, NSSG and the operators of the managed solid waste disposal sites. If no such data are available from these institutions, Greece has indicated that it will collect data from neighbouring countries to use for estimating emissions. The ERT encourage Greece to also explore the possibility of using population figures and/or the gross domestic product as a driver (if this would lead to a more accurate estimate of historical data).

151. The composition of waste used by Greece is not in line with the IPCC good practice guidance (for e.g. wood and textiles which have different fractions of degradable organic carbon and rates of half life but are not distinguished separately). During the in-country review, Greece indicated that the outcomes of a project which is being implemented in the country to determine the composition of municipal solid wastes will be used for the next annual submission under the Kyoto Protocol. The ERT recommend that Greece use the outcomes of the project to estimate emissions of CH<sub>4</sub> for the period

1990–2007. The ERT also recommends that Greece implement the new data collection system and the schedule for improvements made available to the ERT during the in-country review in time for its next annual submission under the Kyoto Protocol.

152. Greece explained to the ERT that prior to 1990 all landfills were unmanaged, although it reported emissions from managed landfills during this period. The year 1965, used in the 2008 annual submission, should be changed to 1990 and Greece is recommended to recalculate the emissions for all years of the inventory time series in its next annual submission under the Kyoto Protocol.

153. The methane correction factor used ( $MCF = 0.6$ ) for unmanaged landfills, and the oxidation factor ( $OX = 0$ ) applied for managed landfills, are not in line with the IPCC good practice and would overestimate emissions. The ERT recommends that Greece, in its next annual submission: provide the distribution of landfills between managed, unmanaged and uncategorized; apply the appropriate parameters as required by the IPCC good practice guidance; and recalculate the inventory time series.

154. Greece should also improve consistency between the NIR and CRF tables; the MCF is reported as 0.6 for unmanaged landfills in the NIR, whereas it is reported for uncategorized waste disposal sites in CRF table 6A.

155. During the in-country review the ERT identified that  $CH_4$  recovered from landfill sites is used to generate energy. However, it is not clear where these emissions were reported in the energy sector. The ERT recommends that Greece improve the transparency of the inventory by providing information on the allocation of emissions in the energy sector from the recovery of  $CH_4$ .

## 2. Wastewater handling – $CH_4$

156. Greece used the IPCC methodology together with the IPCC default parameters to estimate  $CH_4$  emissions. Given that this is a key category, Greece should move to the IPCC tier 2 method by using country-specific data on biochemical oxygen demand, chemical oxygen demand for domestic and commercial wastewater and industrial wastewater.

157. It was not clear from the NIR what was included in anaerobic systems. During the in-country review, Greece explained that anaerobic systems include septic tanks and latrines. The ERT identified that using an MCF value of 1 is not in line with the IPCC good practice guidance, and would overestimate emissions as these systems are not 100 per cent anaerobic. The ERT recommends that Greece, in its next annual submission: include the distribution of wastewater handling systems between septic tanks, latrines and other; apply the IPCC method based on the weighted averaged MCF as agreed during the in-country review; and recalculate the inventory time series.

## C. Non-key categories

### Waste incineration – $CO_2$ , $CH_4$ , $N_2O$

158.  $CO_2$  emissions from the incineration of clinical wastes are estimated based on the IPCC default method and parameters. The ERT encourages Greece to estimate and report emissions of  $CH_4$  and  $N_2O$  using EFs published in the existing literature in order to improve the completeness of the report.

## D. Areas for further improvement

### 1. Identified by the Party

159. In the NIR, Greece reported that further improvement is needed with regard to data collection in general, including, for example, the solid waste generation rate, the amount of solid waste sent to landfill and the amount of wastewater treated anaerobically.

## 2. Identified by the expert review team

160. The following areas for improvement have been identified by the ERT:

- (a) Obtain data on the distribution of landfills between managed, unmanaged and uncategorized for the period 1960–2007;
- (b) Obtain data on the distribution of wastewater handling systems between anaerobic (septic tanks, latrines, etc.) and aerobic for the period 1990–2007;
- (c) Compile accurate data on the amount and composition of municipal solid waste generated and landfilled and the amount of landfill gas recovered;
- (d) Use a higher tier method to estimate CH<sub>4</sub> emissions from wastewater and the amount of CH<sub>4</sub> recovered.

## IX. Other issues

### 1. Changes to the national system

161. Greece reported a change in its national system in the 2008 annual submission. The change relates to new institutional, legal and procedural arrangements that underpin its national system. The ERT considers these changes to be in accordance with the requirements of national systems as defined in decision 19/CMP.1. For further details see chapter II.C.6 of this report

### 2. Changes to the national registry

162. Greece reported on a change in its national registry in the 2008 annual submission. The change relates to Mr. Alexandros Karavanas and Ms. Sani Dimitrolopolu given the role of registry system administrator. The ERT considers this change to be in accordance with the requirements of national registries as defined in decision 13/CMP.1.

### 3. Commitment period reserve

163. Greece has not reported its commitment period reserve in the 2008 annual submission. In response to questions raised by the ERT during the review, Greece reported that its commitment period reserve has not changed since the initial report review (601,802,826 t CO<sub>2</sub> eq). The ERT agrees with this figure. The ERT recommends that Greece include information on its commitment period reserve in its next annual submission under the Kyoto Protocol.

## X. Conclusions and recommendations

164. The ERT concludes that the national system, in its institutional, legal and procedural arrangements established and formalized by the ministerial circular, is fully operational, and that Greece has the necessary arrangements in place to ensure the technical competence of the staff within the national system, to plan, prepare and manage inventories and their timely submission to the secretariat.

165. Greece has established procedures that will ensure continuity of inventory compilation during a period of transition, including procedures for the archiving of all inventory information within the office of the single national entity with overall responsibility for the inventory (MINENV) (see chapter II.C.7). It has also established formal focal points in other ministries and institutions within the national system and allocated sectoral responsibilities to the staff in MINENV's climate change team and alternates to cover staff turnover. Continued involvement of MINENV staff in the inventory preparation along with the staff from NTUA will ensure the continuity of inventory compilation during periods of transition.

166. The ERT concludes that the 2008 inventory submission marks a significant improvement on previous submissions. The inventory has been prepared generally in accordance with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The inventory generally covers all sectors and most categories of sources and sinks, and is generally complete in terms of years, gases and geographic coverage. The ERT identified some gaps in the reporting (e.g. industrial processes sector) that the ERT strongly encourages Greece to investigate, but concludes that the inventory is generally transparent, with an NIR based on the structure in the UNFCCC reporting guidelines. The ERT also identified instances of potential under- and over-estimations of emissions, and issues of time-series consistency (e.g. energy and industrial processes sectors).

167. The ERT concludes that the reporting by Greece on the change to its national registry is in accordance with the requirements of section I G of the annex to decision 15/CMP.1.

168. The key recommendations are that Greece:

- (a) Improve the transparency of the inventory by providing detailed information in the NIR on choice of methodology and contextual information to aid understanding of Greece's national circumstances, and all or part of the information made available to the ERT during the in-country review;
- (b) Improve the completeness of the inventory by reporting emissions by sources or removals by sinks for categories that do occur in Greece (e.g. industrial processes and LULUCF sectors);
- (c) Improve the time-series consistency of emission estimates, pursuant to IPCC good practice guidance (e.g. energy and industrial processes sectors);
- (d) Address the identified potential under-estimation of N<sub>2</sub>O emissions for pasture, range and paddock manure emissions to ensure that emission estimates are prepared in accordance with the IPCC good practice guidance;
- (e) Improve the reporting on key category analysis in the NIR by including the analysis for the latest inventory year, and not to include the Kyoto base year (1995) F-gas data in the analysis for 1990;
- (f) Develop tier 2 category-specific QC procedures for all key categories and for those categories in which significant methodological and/or data changes have occurred;
- (g) Develop an inventory improvement plan that establishes a process to manage the improvement of the national inventory by addressing recommendations from previous expert reviews, and the use of key category analysis, uncertainty analysis and output of QA/QC procedures, as a basis to prioritize improvements in the national inventory;
- (h) Implement methodology in line with IPCC good practice guidance to estimate emissions from navigation;
- (i) Obtain plant-specific AD on the consumption of anode carbon as a reducing agent and its purity to estimate CO<sub>2</sub> emissions from aluminium production;
- (j) Review the use of IPCC default EFs for Eastern Europe to estimate emissions from dairy and non-dairy cattle;
- (k) Establish a team comprising suitable experts to address the issue of consistent land representation and develop a methodology to allow annual updating of the LULUCF inventory;

- (l) Explore the opportunity to centralize the reporting of LULUCF under the Convention and under the Kyoto Protocol in one institution;
- (m) Enhance knowledge and understanding within the national system on the preparation and reporting of emissions by sources and removals by sinks of activities under Article 3, paragraph 3, and activities elected under Article 3, paragraph 4, of the Kyoto Protocol. Greece should also ensure that the schedule of work and allocation of resources specified in the project plan to improve the reporting of activities under Article 3, paragraphs 3 and 4, is implemented;
- (n) Obtain improved AD and parameters to estimate emissions in the waste sector;
- (o) Use a higher tier method to estimate CH<sub>4</sub> emissions from wastewater and the amount of CH<sub>4</sub> recovered.

## **XI. Questions of implementation**

169. No questions of implementation were identified by the ERT during the review.

Annex

**Documents and information used during the review**

**A. Reference documents**

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>>.

“Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol”. Decision 19/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>>.

“Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol”. Decision 15/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>>.

“Guidelines for review under Article 8 of the Kyoto Protocol”. Decision 22/CMP.1. Available at <<http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>>.

Status report of the greenhouse gas inventory of Greece for 2008. Available at <<http://unfccc.int/resource/docs/2008/asr/grc.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2007. Available at <[http://unfccc.int/files/national\\_reports/annex\\_i\\_ghg\\_inventories/inventory\\_review\\_reports/application/pdf/sa\\_2007\\_part\\_i\\_final.pdf](http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/sa_2007_part_i_final.pdf)>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2008. Available at <[http://unfccc.int/files/national\\_reports/annex\\_i\\_ghg\\_inventories/inventory\\_review\\_reports/application/pdf/sa\\_2008\\_part\\_i\\_final.pdf](http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/sa_2008_part_i_final.pdf)>.

FCCC/ARR/2006/GRC. Report of the individual review of the greenhouse gas inventory of Greece submitted in 2006. Available at <<http://unfccc.int/resource/docs/2007/arr/grc.pdf>>.

FCCC/IRR/2007/GRC. Report of the review of the initial report of Greece. Available at <<http://unfccc.int/resource/docs/2007/irr/grc.pdf>>.



## **B. Additional information provided by the Party**

Responses to questions during the review were received from Mrs. E. Politi, Mrs. A. Kotidou, Mrs. C. Moraiti, Mr. D. Ballas, Mrs. N. Efthymiou and Ms. C. Koromila, Ms. A. Gryllia from the Ministry of Environment, Physical Planning and Public Works (MINENV); Prof. I. Ziomas, Mr. I. Sempas, Ms. S. Ntemiri, Mr. L. Kallinikos and Mrs. A. Progiou from the National Technical University of Athens (NTUA), Mrs. V. Benaki from the National Statistical Service of Greece (NSSG), the designated focal points of the competent Ministries and other representatives from the Ministry for the Environment, Ministry of Development, Ministry of Rural Development and Food and the Forestry Institute, including additional material on the methodology and assumptions used. The following documents were also provided by Greece:

Circular 918/21-4-2008. Structure and operation of the National Greenhouse Gases Emissions Inventory System – Roles and Responsibilities.

Ethnike Statistike Yperesia. 1994. Statistical yearbook of Greece, 1990–1991. Athens.

Joint Ministerial Decision 54409/2632/2004. Establishment of emissions trading scheme in Greece in compliance with Directive 2003/87/EC.

Joint Ministerial Decision 9267/468/2007. Amendment of JMD 54409/2632/2004 concerning the flexible mechanisms of the Kyoto Protocol in compliance with Directive 2004/101/EC.

Joint Ministerial Decision 11014/703/104/2003. Procedures for approving environmental permits.

Joint Ministerial Decision 114218/1997. Elaboration of the framework for specifications and general programmes of solid waste management. National planning of solid waste management (General guidelines of SW management policy).

Joint Ministerial Decision 4951/1424/1986. Compliance with the directive 75/442/EU for solid waste.

Joint Ministerial Decision 37411/1829/E103 concerning the competed authorities and the needed measures and processes for the implementation of the Regulation 2037/2000 on substances that deplete the ozone layer (ODS).

Law 1650/1986. Environmental protection.

Law 3017/2002. Ratification of the Kyoto Protocol.

Ministry of Environment, Physical Planning and Public Works. Report on the National Strategy for the management of biodegradable waste. 2002.

Ministry of Rural Development and Food. First National Forest Inventory (1st NFI) prepared by the General Secretariat of Forests and Natural Environment. GSFNE, 1992, 1994.

Ministry of Rural Development and Food. 2006. Afforestation registry and statistics.

National Statistical Service of Greece. Agricultural Statistics of Greece - Annual Census.

National Statistical Service of Greece. Distribution of the Country's Area by Basic Categories of Land Use (Decennial survey. 1999/2000). National Definitions of Land Use Areas.

Presidential Decree 51/1988. Organization of the Ministry for the Environment, Physical Planning and Public Works.

Public Power Corporation. 1993. Study on the estimation of CO<sub>2</sub> emission factors for lignite used by the Public Power Corporation.

Reports for the implementation of directives 75/442/EU and 1999/31/EU submitted to the European Commission.

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