COMPLIANCE COMMITTEE

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23 June 2009

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

Note by the secretariat

The report of the individual review of the greenhouse gas inventories of Portugal submitted in 2007 and 2008 was published on 1 June 2009. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2008/PRT 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 Portugal submitted in 2007 and 2008*

* In the symbol for this document, 2008 refers to the year in which the 2008 inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the centralized review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Portugal, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. In accordance with the conclusions of the Subsidiary Body for Implementation at its twenty-seventh session,[1] the focus of the review is on the most recent (2008) submission. The review took place from 22 to 27 September 2008 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Ms. Katarina Marečkova (European Community) and Mr. Philip Acquah (Ghana); energy – Ms. Erasmia Kitou (European Community), Mr. Luis Conde (Mexico) and Mr. Steven Oliver (Australia); industrial processes – Ms. Natalya Parasyuk (Ukraine) and Mr. Riccardo de Lauretis (Italy); agriculture – Mr. Michael Anderl (Austria) and Mr. Marcelo Rocha (Brazil); land use, land-use change and forestry (LULUCF) – Mr. Atsushi Sato (Japan) and Mr. Harry Vreuls (Netherlands); and waste – Mr. Carlos Lopez (Cuba) and Mr. Davor Vešligaj (Croatia). Mr. Acquah and Mr. Vešligaj were the lead reviewers. The review was coordinated by Mr. Javier Hanna (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 Portugal, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Inventory submission and other sources of information

3. The 2008 inventory was submitted on 15 April 2008; it contains a complete set of common reporting format (CRF) tables for the period 1990–2006 and a national inventory report (NIR). This is in line with decision 15/CMP.1. Portugal indicated that the 2008 submission is also its voluntary submission under the Kyoto Protocol.[2] In its 2007 inventory, submitted on 13 April 2007, Portugal included a complete set of CRF tables for the period 1990–2005 and an NIR. After the centralized review, Portugal submitted responses to questions and potential problems raised by the expert review team (ERT) during the review. Where needed, the ERT also used the 2006 submission and additional information provided during the review. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

4. In 2006 (as reported in the 2008 inventory submission), the main GHG in Portugal was carbon dioxide (CO_2), accounting for 77.4 per cent of total GHG emissions[3] expressed in CO_2 eq, followed by methane (CH_4) (14.3 per cent) and nitrous oxide (N_2O) (7.3 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 1.0 per cent of the total GHG emissions in the country. Portugal estimated actual and potential emissions from the production and consumption of HFCs, PFCs and SF_6 for the period 1995–2006 only. The energy sector accounted for 71.6 per cent of the total GHG emissions, followed by agriculture (10.2 per cent), industrial processes (9.6 per cent), waste (8.2 per cent) and solvent and other product use (0.4 per cent). Total GHG emissions amounted to 82,727.53 Gg CO_2 eq and increased by 39.8 per cent between the base year[4] and 2006. In 2005 (as reported in the 2007 inventory submission), total GHG emissions amounted

[1] FCCC/SBI/2007/34, paragraph 104.
[2] 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).
[3] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified.
[4] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

to 85,538.09 Gg CO_2 eq. There are differences between the shares of gases and sectors shown in the 2007 and the 2008 inventory submissions for the latest reported year. The main differences are a 2.0 per cent decrease in the share of CO_2 emissions in the total GHG emissions for 2006 (2008 submission) in comparison with the share in 2005 (2007 submission) and a 1.3 per cent increase in the share of CH_4 emissions in the total GHG emissions for 2006 (2008 submission) in comparison with the share in 2005 (2007 submission). These differences correspond with the 2.2 per cent decrease in the share of the energy sector and the 0.9 per cent increase in the share of the industrial processes sector in 2006 (2008 submission) in comparison with those shares in 2005 (2007 submission).

5. Tables 1 and 2 show GHG emissions by gas and by sector, respectively.

D. Key categories

6. Portugal has reported a tier 2 key category analysis, both level and trend assessment, as part of its 2008 submission. The key category analysis performed by Portugal and that performed by the secretariat[5] produced different results, owing to the high disaggregation of categories used by the Party. Portugal has included the LULUCF sector in the key category analysis of its 2008 submission, in response to recommendations made in the previous review report. The analyses were performed in accordance with 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).

7. The tier 2 approach identified 45 key categories in the 2007 submission and 49 key categories in the 2008 submission. This approach identified a number of minor categories as key, as a result of their high levels of uncertainty. The key categories that were identified in the 2008 submission but not in the 2007 submission were: 1.B.2.b natural gas – CH_4; 1.A.3.a civil aviation – jet fuel – CO_2; 4.C rice cultivation – CH_4; 3.D other – other use of chemicals – CO_2; 1.A.2.f – other – biomass – N_2O; 5.A.1 forest land remaining forest land – CO_2; 5.A.2 land converted to forest land – CO_2; and 5.B.1 – cropland remaining cropland. Portugal also identified key categories in the 2007 submission that were not identified in the 2008 submission, namely: 6.C waste incineration – CO_2 and 2.F.2 consumption of halocarbons and SF_6 – foam blowing – HFCs. The ERT used Portugal's key category analysis to structure the remainder of this report.

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

Table 1. Greenhouse gas emissions by gas, 1990–2006

Greenhouse gas emissions	Gg CO_2 eq								Change base year–2006 (%)
	Base year[a]	1990	1995	2000	2003	2004	2005	2006	
CO_2	43 444.44	43 444.44	53 156.84	63 412.09	64 158.64	66 208.09	68 447.22	63 993.50	47.3
CH_4	10 103.40	10 103.40	11 233.73	11 525.35	12 212.87	11 933.99	12 236.36	11 846.23	17.2
N_2O	5 561.16	5 561.16	5 805.74	6 258.43	5 774.18	5 953.74	5 722.91	6 021.44	8.3
HFCs	52.61	NA,NE,NO	52.61	307.43	607.42	684.26	785.26	850.86	1 517.4
PFCs	NA,NO	NA,NE,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA
SF_6	6.00	NA,NE,NO	6.00	8.33	11.52	13.26	13.71	15.50	158.1

Abbreviations: NA = not applicable, NE = not estimated, NO = not occurring.

[a] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

Table 2. Greenhouse gas emissions by sector, 1990–2006

Sectors	Gg CO_2 eq								Change base year–2006 (%)
	Base year[a]	1990	1995	2000	2003	2004	2005	2006	
Energy	40 262.15	40 262.15	48 958.60	59 080.49	59 784.87	61 327.69	63 916.43	59 244.02	47.1
Industrial processes	4 669.65	4 611.04	5 808.92	6 190.25	7 202.59	7 535.45	7 725.12	7 911.10	69.4
Solvent and other product se	219.71	219.71	256.27	290.02	317.93	325.01	332.09	338.97	54.3
Agriculture	8 088.34	8 088.34	8 173.55	8 796.71	8 069.67	8 340.09	8 081.16	8 434.13	4.3
LULUCF	NA	1 543.23	–3 830.55	–5 971.92	6 380.79	–3 764.60	–2 975.06	–4 163.58	NA
Waste	5 927.76	5 927.76	7 057.57	7 154.16	7 389.58	7 265.09	7 150.66	6 799.31	14.7
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	60 710.85	60 652.24	66 424.37	75 539.71	89 145.42	81 028.74	84 230.40	78 563.95	29.4
Total (without LULUCF)	59 167.61	59 109.00	70 254.92	81 511.63	82 764.63	84 793.34	87 205.46	82 727.53	39.8

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

[a] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

E. Main findings

8. The inventory is generally in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the IPCC good practice guidance for LULUCF.

9. The 2008 inventory submission is generally of a high quality and covers most sectors and categories. Information on the key category and uncertainty analyses is provided in detail in the NIR. The ERT identified specific categories where Portugal has significantly improved the quality of its inventory in the 2008 submission. Improvements made include: the inclusion of an estimate of emissions from vehicles using biodiesel in road transportation for the first time for 2006; the removal of the estimate of emissions from aluminium production under the industrial processes sector, after the quality assurance and quality control (QA/QC) checks identified that aluminium smelting does not occur in Portugal; changes in the methodology and activity data (AD) used to estimate emissions of fluorinated gases from the operation and disposal of domestic refrigeration equipment, which substantially reduced the uncertainty compared with the 2006 submission; and the estimation of N_2O emissions from human sewage using the IPCC default methodology, which improved the completeness of Portugal's inventory.

10. However, the ERT also identified estimation methodologies that were not consistent with the IPCC good practice guidance for some specific categories, namely: the use of a simple linear interpolation to obtain the AD for most categories (key and non-key) for the period 2001–2006 in the industrial processes sector (see para. 50); and the application of a regression model based on the default IPCC emission factors (EFs) to estimate emissions from enteric fermentation (key category) in the agriculture sector (see para. 60). In addition, in the case of the LULUCF sector, the ERT identified in the NIR the use of a reporting structure which is not consistent with the IPCC good practice guidance for LULUCF (see para. 68), as well as an apparent inconsistency between the information in the NIR on annual land-use change for most land-use categories and the area available for this land-use category as reported in the CRF tables (see para. 69). With regard to the energy sector, the ERT notes that Portugal has made significant efforts to achieve the level of detail required and the separation in domestic and international flights and marine transport in accordance with the IPCC good practice guidance, however this has not yet fully achieved. Therefore, the ERT encourages Portugal to continue in its effort to fully achieve the required level of detail and the separation between domestic and international flights and marine transport, including military fuel consumption, in its next annual inventory submission.

11. During the centralized review, the ERT noted that the lack of formal agreements under the current institutional arrangements in Portugal prevents the full implementation of the national system for performing the functions defined in the guidelines for national systems (decision 19/CMP.1) regarding the provision of data by governmental agencies and other entities within the national system for the preparation of the inventory, particularly for the industrial processes sector. During the centralized review, in response to the questions raised by the ERT, Portugal explained that the existing legal arrangements under the national system do not include agreements between the Portuguese Environment Agency (APA) and the relevant collaborating institutions. The Statistical Council (Conselho Superior de Estatística (CSE)), which is responsible for the coordination of the overall National Statistical System including the evaluation and approval of the confidential data, is committed to considering the legal arrangements for the delivery of this predominantly confidential industrial data at the next meeting of the Permanent Body of Statistical Secret. Portugal hopes to reach a resolution on this problem of the national system by early 2009. The ERT recommended that Portugal implement the detailed steps taken to institute these formal agreements, as submitted in writing to the ERT during the review, in order to address the pending legal arrangements and fully meet the requirements for national systems under decision 19/CMP.1 as regards inventory preparation, and then report on the outcome of these actions in its next annual inventory submission. Additional information provided by Portugal after the centralized

review indicates that the Permanent Body of Statistical Secret, upon a positive deliberation on the use of confidential information for inventory purposes, has approved the provision of required data annually to APA , which will make available updated AD for the inventory compilation from 2010 onwards.

F. Cross-cutting topics

1. Completeness

12. The inventory covers all source and sink categories for the period 1990–2006; it is complete in terms of years and geographical coverage, which includes the two autonomous regions of Madeira and the Azores. Portugal has provided inventory data in a complete set of CRF tables. Portugal reports actual and potential emissions from the production and consumption of halocarbons and SF_6 for the period 1995–2006 only. The ERT notes that Portugal has reported emissions and removals from the LULUCF sector for the autonomous regions of Madeira and the Azores in response to the recommendations made in the previous review report.

13. Portugal has provided explanations for the categories reported as not estimated ("NE") and for the categories reported as included elsewhere ("IE") in CRF table 9(a). This information has not, however, been summarized in the NIR. Among the categories reported as "NE" are: 1.A.3.e other transportation – CO_2, CH_4 and N_2O; 3.D.1 use of N_2O for anaesthesia – N_2O; and 3.D.3 N_2O from aerosol cans – N_2O. In addition, CO_2 emissions from grassland remaining grassland have been reported as "NO", which is probably not the correct notation key to have been used. The ERT recommends that Portugal make efforts to develop the sources of data necessary to estimate emissions for the categories reported as "NE" for which the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance provide methodologies, taking into account that estimating emissions for such categories would avoid potential problems leading to adjustments in future reviews. Portugal should also make every effort to provide the assessment of the completeness of emissions and removals excluded from the inventory in annex 5 of its NIR, in accordance with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines), in its next annual inventory submission.

2. Transparency

14. Portugal has used notations keys extensively in the CRF tables as well as in the documentation boxes, where applicable. Portugal has also provided overview tables and summarized the methodologies and EFs adopted in sectoral inventories in the NIR of the 2008 submission, in response to recommendations made in the previous review report. The detailed and consistent information in the NIR and CRF tables makes the inventory very transparent.

15. The ERT welcomes the well-structured and detailed description of the methodologies for the agriculture sector, but recommends that Portugal further improve the transparency of the NIR, in its next annual inventory submission, by providing more supporting information on how inputs based on expert judgement and other basic input parameters used for the agriculture sector have been derived.

16. The ERT noted that the structure of the chapter on LULUCF in the NIR did not make it easy to understand the assumptions, calculations and national circumstances for most of the categories in this sector. The ERT recommends that Portugal restructure this chapter of the NIR, in accordance with the UNFCCC reporting guidelines and the IPCC good practice guidance for LULUCF, with the aim of improving the explanations and the transparency of the calculations, in particular for the key categories in the sector.

17. The ERT also noted that some sections of the NIR may not have been included or may have been misplaced in the table of contents; for instance, ES.3 and ES.4 (executive summaries) have not been

included, while "Chapter 6 – Agriculture" reads as "Chapter 1 – Agriculture". As a result, the subsequent chapters have all been misplaced. Also, Annex 2 "Detailed discussion of methodology and data for estimating CO_2 emissions from fossil combustion" and Annex 5 "Assessment of completeness and (potential) sources and sinks of GHG emissions and removals excluded" have not been reported. Furthermore, the three headings "Bibliography", "Key categories" and "Uncertainty" appear throughout the NIR without any text – presumably they have been misplaced – and some references are missing (e.g. road transportation, p.112 of the NIR). The ERT recommends that Portugal check and rectify these problems in the NIR of its next annual inventory submission.

3. Recalculations and time-series consistency

18. The ERT noted that recalculations reported by Portugal of the 1990–2005 time series have been undertaken to take into account updated AD, revised EFs, and corrections of errors detected by its elaborate tier 1 and tier 2 QC checks under its unique Methodological Development Programme (PDM), which identifies areas for improvement in terms of the planning and preparation of its inventory. The rationale for these recalculations has been provided in the NIR and in CRF table 8(b) in a consistent manner. Among the categories for which recalculations were made, the more important include: energy industries; military fuel use accounted for in the category other (1.A.5), which was previously not estimated; CO_2 emissions from iron and steel production; CO_2 from aluminium production, which has been removed since process emissions do not occur in the country; HFCs from consumption of halocarbons (substitutes for ozone-depleting substances) in commercial refrigeration, industrial air conditioning and metered dose inhalers; N_2O from direct soil emissions; CO_2 emissions/removals from forest land; CH_4 emissions from solid waste disposal on land, owing to the revision of the fraction of degradable organic carbon (DOC) dissimilated (DOC_F); and CH_4 emissions from industrial wastewater.

19. The recalculations in the 2008 submission resulted, overall, in a 1.36 per cent decrease in estimated emissions for 1990 and an increase by 1.95 per cent in the estimated emissions for 2005. When the LULUCF sector is included, the impact of the recalculations is more significant: for 1990, a decrease in estimated emissions by 4.86 per cent and a 5.84 per cent decrease in estimated emissions for 2005.

4. Uncertainties

20. Portugal has reported a detailed uncertainty analysis in its 2008 submission. Uncertainties have been estimated for all categories by gas using the IPCC tier 1 methodology and for the inventory as a whole in accordance with the IPCC good practice guidance. Overall uncertainty reduced over the time series from 12.9 per cent (1990) to 8.5 per cent in 2005 and 9.9 per cent in 2006. The ERT notes that uncertainties are generally estimated on the basis of expert judgement or using IPCC default values. The ERT also notes that independent national experts have been involved in the estimation of uncertainties for various categories, in response to recommendations made in the previous review report, as part of the QA procedures. However, Portugal has not yet defined a timeline for the application of a tier 2 method for its uncertainty analysis, as was recommended in the previous review report. The ERT recommends that Portugal use a tier 2 method to calculate and improve the uncertainty estimates in its next annual inventory submission, considering that Portugal already achieved a high level of quality in its inventory.

5. Verification and quality assurance/quality control approaches

21. A brief overview of the QA/QC system has been provided in the NIR. Portugal indicated that the QA/QC system is elaborated in a QA/QC programme and a procedures manual. The ERT notes the Party's systematic approach to identifying areas for improvement of the inventory as part of its national system and QA/QC procedures under the PDM referred to in paragraph 18 above as well as in cooperation with the sectoral experts and focal points from the institutions involved in preparing the inventory.

22. The ERT commends Portugal's attempt through the PDM to show that it has addressed various comments made in the previous review report by making improvements to its inventory compilation process and QA/QC procedures, and involving sectoral experts in the independent review of the national inventory. The ERT notes that the PDM has significantly enhanced the identification of areas for improvement. For instance, as a result of the programme, Portugal identified that aluminium production is limited to rolling and fabrication plants and, consequently, has removed process emissions from aluminium smelting from the industrial processes sector in its 2008 inventory submission. The ERT recommends, however, that Portugal provide information on the outcome of the tier 1 and tier 2 QC procedures that have already been implemented or are to be implemented in the future under the QA/QC programme and that it report on these procedures in the sectoral chapters of the NIR in its next annual inventory submission.

6. Follow-up to previous reviews

23. The ERT noted that Portugal followed most of the recommendations from the previous review and improved the transparency and completeness of the inventory and the NIR. The ERT notes that Portugal has reported emissions and removals from the LULUCF sector for the autonomous regions of Madeira and the Azores in response to the recommendations made in the previous review report and improved completeness of its inventory. Portugal has also provided overview tables and summarized the methodologies and EFs adopted in sectoral inventories in the NIR of the 2008 submission, in response to recommendations on transparency made in the previous review report.

24. Furthermore, Portugal has continued to improve the quality of its data for the LULUCF sector in its 2008 submission, making several major improvements in response to recommendations made in the previous review report. The ERT also notes that independent national experts have been involved in the estimation of uncertainties for various categories, as part of the QA procedures.

25. The ERT noted that the recalculations reported by Portugal in its 2008 submissions for the 1990–2005 time series have been undertaken to take into account recommendations made in the previous review report and that the rationale for these recalculations has been provided in the NIR and in CRF table 8(b) in a consistent manner. The ERT noted that Portugal through the PDM showed that it has addressed various comments made in the previous review report by making improvements to its inventory compilation process and QA/QC procedures, and involving sectoral experts in the independent review of the national inventory.

G. Areas for further improvement

1. Identified by the Party

26. In its NIR, Portugal identifies a number of areas to be improved further in its next inventory submission. These areas include: streamlining AD and EFs collected from traditional statistical sources and the European Union emissions trading scheme (EU ETS); improving the time-series consistency of the estimates of emissions from geothermal production, in cooperation with the autonomous regional government of the Azores; and improving data collection in order to apply a higher-tier methodology to estimate emissions from natural gas transport, by collaborating with the General Directorate for Energy and Geology (DGEG) and Transgas (a major Portuguese company responsible for natural gas transport). Additional information provided by Portugal after the centralized review indicates that improvements in geothermal production time-series consistency and natural gas transport AD (currently under development) should be addressed and included in the 2010 annual inventory submission. Also, Portugal informed the ERT that it intends to apply the COPERT IV model to estimate emissions from road transportation in future submissions and to use more realistic AD from the vehicle inspection centres to derive kilometres driven by vehicle type.

27. The other areas where Portugal also intends to make efforts for improvements include: addressing inconsistencies in the LULUCF sector through the planning of a new land-cover cartography (Carta de Ocupação do Solo (COS)) as well as by improving the methodology that will be used to report emissions under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The improvements planned for the LULUCF sector will also lead to the revision of the reporting under the Convention in order to ensure consistency between the two reports. The ERT recommends that Portugal provide an adequate summary of the outcome of updating the information for the years after 2000 of the coordination of information on the environment (CORINE) Land Cover project on the LULUCF sector, in its next annual inventory submission.

2. Identified by the expert review team

28. The ERT identified some potential areas for methodological improvements in accordance with the IPCC good practice guidance. Portugal should make efforts:

(a) To collect AD at plant level, if possible, to replace the simple linear interpolation and extrapolation of values currently used for most categories (key and non-key) in the industrial processes sector or use updated AD that would become available through the ongoing industrial surveys of the National Statistics Institute (INE);

(b) To develop and utilize country-specific livestock characterization data for the entire time series, in line with the IPCC good practice guidance, in its estimations of CH_4 emissions from enteric fermentation, which is a key category, instead of using a regression model based on the default IPCC EFs;

(c) To prioritize the construction of a consistent land-use matrix and improve the consistency of the land-use information based on information from the National Forest Inventory (NFI) and information of the CORINE Land Cover project, which is being developed to ensure that Portugal is ready to report on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

29. The ERT also identified the following cross-cutting issues for improvement relating to the Party's emission estimates. Portugal should make every effort:

(a) To improve the completeness of its inventory by estimating emissions for all categories currently reported as "NE" for which the Revised 1996 IPCC Guidelines and the IPCC good practice guidance provide estimation methods;

(b) To improve the estimates in the LULUCF sector for the autonomous regions of Madeira and the Azores;

(c) To include information on sector-specific QC in all sectoral chapters of the NIR;

(d) To improve the description of recalculations for some categories; for example, HFC emissions in the industrial processes sector, which Portugal intends to accomplish in its 2010 annual inventory submission, and CH_4 emissions from industrial wastewater handling in the waste sector;

(e) To develop a tier 2 uncertainty analysis for inventory estimates in order to further enhance the already high level of quality of its inventory.

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

II. Energy

A. Sector overview

31. In 2006, emissions from the energy sector amounted to 59,244.02 Gg CO_2 eq, or 71.6 per cent of total GHG emissions. Fuel combustion accounted for 97.5 per cent of the emissions from the energy sector, while fugitive emissions accounted for the remaining 2.5 per cent. Emissions of CO_2 accounted for 96.4 per cent of sectoral GHG emissions, with CH_4 and N_2O emissions contributing 2.0 per cent and 1.6 per cent, respectively. Within the sector, the major categories were energy industries, transport, and manufacturing industries and construction, which contributed 36.9 per cent, 33.6 per cent and 16.8 per cent of emissions, respectively. Emissions from energy use in the category other sectors contributed 10.0 per cent of sectoral GHG emissions, while the category other accounted for 0.1 per cent.

32. Overall, the inventory for the energy sector is reported in a transparent manner. Emissions have been estimated and reported for practically all categories, except for N_2O from flaring. Descriptions of the methods used, sets of EFs and energy content values have been included in the NIR. However, the energy balance has not been included, as recommended in the previous review report. After the centralized review, Portugal informed the ERT that the 2007 energy balance has been made available in the NIR of the 2009 submission.

33. The recalculations reported in the 2008 submission have been well explained in the NIR and the CRF tables. Recalculations were performed for the category energy industries owing to the update of AD for some large point sources. Furthermore, as recommended in the previous review report, emissions from military fuel use (previously a missing category) were estimated, and the values reported under international bunkers were revised in order to improve consistency between the national bottom-up approach and the top-down energy balance data. No sector-specific QA/QC procedures have been reported in the NIR. The ERT recommends that Portugal develop and present in its next annual inventory submission sector-specific QA/QC procedures. Uncertainties have been assessed for all categories in the sector using the tier 1 approach and following the recommendations of the IPCC good practice guidance. The ERT recommends that Portugal make efforts to use a tier 2 method for its uncertainty estimates in its next annual inventory submission, with the aim of building upon the improvements already made by using country-specific EFs and higher-tier methods.

34. A number of changes were identified in Portugal's 2008 inventory submission as compared with the 2007 submission: for example, the inclusion of emissions from the use of biodiesel in road transportation; the inclusion of emissions from military fuel use; changes in EFs owing to the use of data from the EU ETS; and the adoption of top-down calibrations of data for the navigation and aviation sectors.

B. Reference and sectoral approaches

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

35. The estimates for CO_2 emissions in 2006 are 1.72 per cent higher when using the reference approach than with the sectoral approach. By type of fuel, the differences between the approaches are 2.70 per cent for liquid fuels, 2.05 per cent for solid fuels and 4.81 per cent for gaseous fuels. Portugal has provided detailed explanations in the NIR as regards the observed differences between the two approaches, which are due, among other things, to differing estimates for large point sources and feedstock emissions.

2. International bunker fuels

36. In Portugal the classification of international/domestic fuel in the national energy balance is made according to the flag of the owner of the ship/aircraft, which is not in accordance with the IPCC

good practice guidance criteria. However, following the recommendations made in the previous review report, in its 2008 inventory submission, Portugal has calculated the domestic fuel consumption on the basis of the origin and destination of the aircrafts and ships movements between domestic airports and seaports and has considered the remaining fuel to be international: total fuel - domestic fuel = international fuel. This approach has been used for the entire time series 1990–2006. The ERT recommends that Portugal continue its efforts to achieve complete consistency in its estimates of emissions from bunker fuels in accordance with the IPCC good practice guidance.

3. Feedstocks and non-energy use of fuels

37. As regards feedstocks and non-energy use of fuels, Portugal has reported that emissions from mineral oil used as lubricant and from bitumen used in road paving are included in the reference approach but are not part of the sectoral approach. The ERT reiterates the recommendation made in the previous review report that Portugal continue to make efforts to improve its estimates of emissions from the use of feedstocks and include estimates of combustion emissions from feedstock fuels in the sectoral approach in its next annual inventory submission.

C. Key categories

1. Stationary combustion: solid and liquid fuels – CO_2

38. Portugal uses various plant-specific data on fuel consumption to estimate a proportion of the CO_2 emissions from energy industries and from manufacturing industries and construction (including CH_4 and N_2O). The ERT encourages Portugal to continue its efforts to incorporate plant-specific data into its inventory and recommends that Portugal continue to provide detailed explanations, in its next annual inventory submission, on how exactly these data have been incorporated, the resulting changes and its efforts to maintain time-series consistency.

39. The CO_2 implied emission factors (IEFs) for solid fuels for public electricity and heat production for 1990–2006 (ranging from 90.16 to 90.60 t/TJ) were found to be below the IPCC default range (94.6 to 106.7 t/TJ). The value of 90.16 t/TJ was kept constant for the period 1998–2006. During the centralized review, Portugal explained that 1997 was the year in which an old coal power plant was decommissioned in northern Portugal. The EFs used for this power plant differed from those applied to the other two plants, hence the variation in the IEF from 1990 to 1997. Since, for the remaining two coal power plants, the CO_2 EFs used were the same (values validated with direct monitoring data), the CO_2 IEFs remained constant between 1998 and 2006. The net calorific value (NCV) varied from plant to plant and within the period 1990–2006. Taking into account this information, the ERT considers that CO_2 EFs cannot be constant. The ERT recommends that Portugal provide clear trend-related explanations and revise its estimates, if necessary, in its next annual inventory submission.

40. As regards the category manufacturing industries and construction, the inter-annual changes in CO_2 IEFs for liquid fuels (ranging from –0.9 to +2.4 per cent) for some years in the time series have been identified as unusual. Overall, a significant increase of 13.1 per cent was observed in CO_2 IEFs between 1990 and 2006. During the centralized review, Portugal explained that the consumption of liquid fuels in the subcategories included under this category dropped faster for fuels with higher CO_2 carbon content. For example, the consumption of diesel oil and fuel oil in the construction industries fell at a faster rate than the consumption of liquefied petroleum gas (LPG) and gasoline; gasoline consumption even slightly increased over this period 1990 and 2006. The ERT recommends that Portugal provide these trend-related explanations in its next annual inventory submission.

2. Road transportation: liquid fuels – CO_2 and N_2O

41. CO_2 emissions in this category are estimated using country-specific lower-heating values and default hydrogen–carbon ratios calculated by the COPERT III model. The ERT reiterates the

recommendation made in the previous review report that Portugal improve the consistency of its inventory by using the country-specific carbon content for each fuel that corresponds to the country-specific lower-heating value. After the centralized review, Portugal informed the ERT that it will improve consistency of its inventory by using country-specific lower-heating values under the implementation of the COPERT IV model in the future.

42. Portugal estimates N_2O emissions in this category using the COPERT III model, which indicates an important increase in these emissions over the period 1990–2006 (by 455.2 per cent), reflecting the increasing use of vehicles with catalytic converters. As indicated above, Portugal is planning to use the COPERT IV model, which may imply a significant change in N_2O EFs and in the resultant emission estimates. The ERT recommends that Portugal provide in its next annual inventory submission information on the migration to COPERT IV and present any resulting changes clearly.

3. Oil and natural gas – CO_2 and CH_4

43. There are significant fluctuations in the trends of CO_2 and CH_4 emissions from natural gas (e.g. ranging from –42.2 to +207.6 per cent for CH_4 emissions). In its response to questions raised by the ERT, Portugal noted that natural gas was not introduced in Portugal until 1996 and its use has grown rapidly since. Inter-annual fluctuations reflect inter-annual variations in consumption, as well as the share of thermo-electric production, which is dictated by the availability of hydropower resources. The ERT recommends that Portugal provide this information in the NIR of its next annual inventory submission and that it check the consistency between the AD reported and the corresponding emissions.

D. Non-key categories

1. Civil aviation: liquid fuels – CO_2, CH_4 and N_2O

44. The CO_2 IEFs for the period 1990–2006 for jet kerosene from civil aviation (ranging from 69.08 to 69.17 t/TJ) are lower than the IPCC default value (72.8 t/TJ). These values are the lowest of the reporting Parties for the complete time series (ranging from 69.08 to 75.47 t/TJ). During the centralized review, Portugal informed the ERT that it has already requested its national energy authority to check these values and provide a country-specific NCV and the carbon content of the jet kerosene used in civil aviation, which will be applied in its future annual submissions.

45. Portugal uses a tier 2b approach to estimate emissions from aviation, which is applied at the level of individual aircraft types. However, in making its estimations, Portugal was still not able to achieve the required level of detail and separation needed between domestic and international flights which is specified in the IPCC good practice guidance. Currently, flights are separated exclusively according to the location of the airports of departure and arrival, with the flights classified as domestic if both airports are in national territory. The ERT recommends that Portugal make an effort to achieve the required separation between domestic and international flights as specified in the IPCC good practice guidance in its next annual inventory submission.

46. The ERT would like to acknowledge Portugal's efforts to include in its 2008 inventory submission emissions from military fuel use under the category other (1.A.5). However, the ERT notes that Portugal was not able to split these emissions between domestic and international fuel consumption. The ERT recommends that Portugal make an effort to obtain the AD necessary to achieve the required split between domestic and international emissions in its next annual inventory submission.

2. Navigation: liquid fuels – CO_2, CH_4 and N_2O

47. Portugal uses an improved tier 1 approach to estimate emissions from navigation according to the EMEP/CORINAIR methodology. The methodology is similar to that employed for estimating emissions from civil aviation. However, in making its estimations, Portugal was still not able to achieve the required level of detail and the separation needed between domestic and international marine transport

which is specified in the IPCC good practice guidance, owing to a lack of complete information available on passenger and freight movements. The ERT recommends that Portugal make an effort to achieve the required split between domestic and international marine transport as specified in the IPCC good practice guidance in its next annual inventory submission.

3. Other transportation: gaseous and liquid fuels – CO_2 and N_2O

48. Under other transportation, Portugal has reported AD and emissions as "NO". However, the ERT considers that emissions should be occurring under this category, for example emissions from compressor stations for natural gas transport. During the centralized review, in response to the questions raised by the ERT, Portugal explained that the reason for reporting the AD and emissions as "NO" is that the current fuel balance does not make a distinction between road transportation and other transportation and there is no official AD on other transportation within the national system. Portugal indicated, however, that it will take this issue into the forum of its National System for the Estimation of Emissions by Sources and Removals by Sinks of Air Pollutants (SNIERPA) in order to consider the possibility of estimating emissions for this particular category in the future. After the centralized review, Portugal informed the ERT that after contacts with the DGEG it was concluded that specific data for other transportation could not be obtained separately, as consumption of fuel under this category is accounted in the energy balance together with other sectors like services, commercial and institutional, and manufacturing industry (non-cogeneration fuel consumption). The ERT recommends that Portugal use the notation key "IE" for this category as opposed to "NO" and provide the relevant explanations in the NIR of its next annual inventory submission, as well as continue its efforts to report estimates for this category in future annual inventory submissions.

4. Coal mining and handling – CO_2 and CH_4

49. Emissions of CO_2 and sulphur oxides may occur as a result of mining activity when burning of coal deposits occurs or when flaring is used to control air emissions or recover energy. Currently, Portugal reports the occurrence of coal burning on-site and flaring in its mines as unknown and hence emissions of these gases for this category are not included in the inventory. The ERT recommends that Portugal make an effort to acquire the related AD in order to be able to include estimates of the corresponding emissions in its next annual inventory submission.

III. Industrial processes and solvent and other product use

A. Sector overview

50. In 2006, the industrial processes sector accounted for 7,911.10 Gg CO_2 eq, or 9.6 per cent of total GHG emissions, and the solvent and other product use sector accounted for 338.97 Gg CO_2 eq, or 0.4 per cent of total GHG emissions. Between 1990 and 2006, emissions from the industrial processes sector increased by 71.6 per cent, while for the solvent and other product use sector emissions increased by 54.3 per cent. Most of the emissions came from cement production, which accounted for 45.5 per cent of the emissions from industrial processes, while ammonia production accounted for 24.1 per cent, consumption of halocarbons and SF_6 for 11.0 per cent, nitric acid production for 7.8 per cent and lime production for 6.0 per cent.

51. The ERT noted that for almost all of the non-key categories statistical AD are available for the period 1990–2000 only (e.g. for limestone and dolomite use, road paving, glass production, etc.). For some of these categories only data for 1990 have been used for the whole time series (e.g. for ferroalloys production and other production). This is also a problem among the key categories, in some cases for reasons of confidentiality. For the period 2001–2006, a simple linear interpolation and extrapolation has been used to determine the AD; however, interpolation of AD may lead to an overestimation or underestimation of emissions. The ERT also noted that the lack of formal agreements under the current institutional arrangements for inventory preparation prevents the provision of data by

the relevant governmental agencies and other entities within the national system, particularly for the industrial processes sector, where AD are predominantly considered as confidential.

52. In its response to questions raised by the ERT, during the centralized review Portugal indicated that the Permanent Body of Statistical Secret will address the issue of confidentiality in its next meeting in order to ensure the availability of AD and EFs for the preparation of its next annual inventory submission. The ERT considers that further work on collecting AD and EFs is critical for the improvement of Portugal's emission estimates and the transparency and time-series consistency of its inventory and recommends that Portugal make the necessary efforts to collect the required AD and EFs for its next annual inventory submission. For some categories in the industrial processes sector Portugal can take advantage of the EU ETS to obtain verified plant-level AD and EFs for its next annual inventory submission. The ERT welcomes the additional information provided after the centralized review and notes that Portugal, in its 2010 annual inventory submission, will use updated AD for the period 2001–2008 that would become available through the ongoing industrial surveys of the INE.

B. Key categories

1. Cement production – CO_2

53. Data on clinker production for the period 1990–2003 were received from each plant directly. For 2004, the total production of clinker was received from the National Statistical Database. The values for 2005 and 2006 were estimated using simple linear interpolation on the data available for the period 1990–2004. Such estimations could lead to an overestimation or underestimation of emissions. The ERT recommends that Portugal make efforts to continue using plant-specific data for the whole time series and report its emission estimates made using these data in its next annual inventory submission. After the centralized review, Portugal informed the ERT that in its 2009 annual inventory submission, it will use plant-specific AD for this category for the whole time series.

2. Lime production – CO_2

54. Data on the production of lime in industrial plants were available for the period 1989–2000 from the INE and were collected from industrial surveys. Production data for the period 2001–2006 were estimated using simple linear forecasts from the available statistical time series. Such estimations could lead to an overestimation or underestimation of emissions. The ERT recommends that Portugal make efforts to continue using the statistical data from the INE for the whole time series and report its emission estimates made using these data in its next annual inventory submission.

3. Ammonia production – CO_2

55. There is only one industrial plant for ammonia production in operation in Portugal; therefore, AD are confidential for this category. Data on the total production of ammonia available for the period 1990–2000 were used to construct the full time series. AD for after 2001 were estimated using simple linear interpolation. Such estimations could lead to an overestimation or underestimation of emissions. The ERT recommends that Portugal make efforts to continue using the statistical data from the INE for the whole time series or, if possible, use plant-specific data and report its emission estimates made using these data in its next annual inventory submission. The ERT welcomes the additional information provided after the centralized review and notes that Portugal, in its 2010 annual inventory submission, will use plant-specific AD for the period 2001–2008.

4. Nitric acid production – N_2O

56. There are three industrial plants which produce nitric acid in operation in Portugal. AD are confidential for this category. To obtain data for the complete time series, AD for years after 2001 were estimated using simple linear interpolation based on data for the total production of nitric acid in Portugal which were available for the period 1990–2000 from different sources. Such estimations could

lead to an overestimation or underestimation of emissions. The ERT recommends that Portugal make efforts to continue using statistical data from the INE for the whole time series, avoiding using different data sources, or, if possible, use plant-specific data and report its emission estimates made using these data in its next annual inventory submission.

5. Iron and steel production – N_2O

57. AD for the estimation of emissions from iron and steel production were available for the period 1990–2001 for coke production. For some products (sinter, pig iron and steel production in blast furnaces, scrap use and lime consumption), AD were available from plants for the period 1990–1994 only. Data on steel production in basic oxygen furnaces (BOF) and electric arc furnaces (EAFs) in the Seixal iron and steel plant were estimated on the basis of production data for both oven types in 1990 and forecast for the complete time series thereafter using the fuel consumption of the electric power plant as surrogate data. Data on steel production and scrap use in the EAF in the Maia steel plant were available for 1990, 2002 and 2003, and were interpolated between these years to obtain data for these parts of the time series. In almost all cases, there were no real plant-specific data available for the period after 2001; therefore, AD for the years after 2001 were estimated using simple linear extrapolation. Such estimations could lead to an overestimation or underestimation of emissions. Therefore, the ERT strongly recommends that Portugal make efforts to find appropriate statistical data for the whole time series, avoiding the use of different incomplete data sources, or, if possible, use plant-specific data and report its emission estimates made using these data in its next annual inventory submission.

IV. Agriculture

A. Sector overview

58. In 2006, the agriculture sector accounted for 8,434.13 Gg CO_2 eq, or 10.2 per cent of total GHG emissions. Emissions from the sector increased by 4.3 per cent between 1990 and 2006. The key driver for this increase was the increase in emissions from enteric fermentation as a result of increases in the CH_4 EFs of dairy cattle, non-dairy cattle and sheep, as well as the growth in the populations of non-dairy cattle and sheep. Increasing emissions from rice cultivation also contributed to the increasing trend. Within the sector, 38.4 per cent of the emissions were from agricultural soils, followed by 36.1 per cent from enteric fermentation and 20.9 per cent from manure management. Rice cultivation accounted for 4.3 per cent of emissions and field burning of agricultural residues for 0.4 per cent. All relevant categories and GHGs have been reported, except for prescribed burning of savannas which has been reported as "NO".

59. The NIR is well structured and gives a detailed description of the methodologies used. All revisions made in response to recommendations in the previous review report have been well described in the NIR. The ERT welcomes this development, but recommends that Portugal further improve the transparency of its NIR by providing in its next annual inventory submission more supporting information on how inputs based on expert judgement and other basic input parameters are derived.

60. The ERT acknowledges the special effort made by Portugal to resolve the issue of rationalizing the different sheep population numbers provided by the INE and the Food and Agriculture Organization of the United Nations (FAO). This effort resulted in the revision of the numbers from the FAO. The investigation conducted by Portugal into this issue led to a narrowing of the discrepancy between the numbers down to 3.7 per cent for 2006 compared with 64.7 per cent for 2004 as identified during the previous review process. Portugal has provided a detailed description of this issue in its NIR as recommended in the previous review report.

B. Key categories

1. Enteric fermentation – CH_4

61. Portugal uses a regression model based on the default IPCC EFs to estimate emissions for this category. The same digestibility value (60 per cent) is used for dairy cattle for all years in the time series. In the NIR, Portugal has indicated that efforts will be made to generate country-specific parameters. The ERT recommends that Portugal further improve its inventory by developing and applying country-specific livestock characterization data in line with the IPCC good practice guidance and report on the results of this in its next annual inventory submission.

2. Manure management – CH_4

62. The CH_4 IEFs for dairy cattle (2.3 to 4.8 kg/head per year) are among the lowest of the reporting Parties and much lower than the IPCC default values for western Europe (14 kg/head per year for cool regions and 44 kg/head per year for temperate regions). The CH_4 IEFs for non-dairy cattle are also among the lowest of the reporting Parties (1.3 to 1.6 kg/head per year) and much lower than the IPCC default values for western Europe (6 kg/head per year for cool regions and 20 kg/head per year for temperate regions). These discrepancies were found to be due to: (a) the very high percentage of grazed animals; and (b) the use of a methane conversion factor (MCF) of 0 per cent for liquid systems. During the centralized review, the ERT recommended that Portugal document and justify the values for MCF applied in its calculations and provide this information to the ERT. The ERT indicated that, if this were not possible, Portugal should revise its estimates using the values for the MCF of liquid systems given in the IPCC good practice guidance. After the centralized review, Portugal provided information which confirmed that: (a) breeding cows for beef are mostly kept outdoors all year, as the winters are mild in Portugal; and (b) liquid systems refer to "Open pits below animal confinements" as noted in the NIR, that, according to the experts from the Ministry of Agriculture, refer typically to short retention time pits. For this reason an MCF of 0 per cent was used in the estimates following the recommendation in the IPCC good practice guidance for "Pit storage below confinements < 1 month". Nevertheless, the ERT believes that the period for which manure is stored (more or less than one month) has a major effect on the level of CH_4 emissions and recommends that Portugal document this assumption more thoroughly in the NIR of its next annual inventory submission.

63. The distribution of animal waste management systems (AWMS) applied in the Portuguese inventory is based on expert judgement from the Ministry of Agriculture and is predominately a reflection of the situation in 1990. Portugal is aware, however, that the real shares of the different AWMS have changed since then. In the course of the centralized review, Portugal explained to the ERT that an extensive agricultural survey, beginning in 2009 and conducted by the INE, will enable it to monitor the actual situation and future developments. The ERT welcomes Portugal's intention to update this information and recommends that Portugal document the relevant results of this survey in detail in its future NIRs.

3. Manure management – N_2O

64. For the calculation of N_2O emissions from manure management, country-specific nitrogen (N) excretion rates have been applied. Following a recommendation made in the previous review report, a comparison with the IPCC default values has been included in the NIR. Additionally, the derivation of country-specific N excretion rates for swine and sheep has been explained.

65. The ERT noted that the country-specific value for the N excretion rate of dairy cattle (87.6 kg/head per year) applied in Portugal's calculations is lower than the IPCC default value for western Europe (100 kg/head per year) and is held constant for the entire period 1990–2006. As noted in the NIR, this value was established by the INE in the context of the nitrogen balance indicator and reported to the Organisation for Economic Co-operation and Development (OECD) and EUROSTAT.

No reference to the N content of the typical diet of the dairy cattle or the proportion of N lost from different types of forage has been provided in the NIR. During the centralized review, Portugal explained that the coefficients were estimated by means of a systematic comparison with other countries reporting to the OECD, namely France, and were adopted according to national conditions. However, the ERT believes this value to be low when compared with the increased milk yields presented in the chapter on enteric fermentation in the NIR, which could lead to an underestimation of emissions for the most recent years. The ERT encourages Portugal to make efforts to generate country-specific values for the N excretion rate of dairy cattle for each year in the time series, as indicated in the NIR, and, if possible, revise its estimates accordingly in its next annual inventory submission.

C. Non-key categories

Rice cultivation – CH_4

66. Following the recommendations in the previous review report, when making its calculations for this category, Portugal took into account the increased use of straw and stubble as organic amendment. The revised method has been clearly described in the NIR. The ERT commends Portugal on this improvement.

V. Land use, land-use change and forestry

A. Sector overview

67. In 2006, the LULUCF sector was a net sink of 4,163.58 Gg CO_2 eq, while, in 1990, the sector was a net source of 1,543.23 Gg CO_2 eq. The key drivers for this change are the variability of and changes in the forest land category. The 2007 inventory submission contains data for 1990 which are more or less similar to the data contained in the 2006 submission (the sector is reported as a net source of 3,827.55 Gg CO_2 eq in the 2007 submission and as a net source of 2,592.59 Gg CO_2 eq in the 2006 submission); whereas the data reported for 2004 are very different in the two submissions (the sector is reported as a net source of 2,322.97 Gg CO_2 eq in the 2007 submission, but a net sink of 2,455.08 Gg CO_2 eq in the 2006 submission). These changes are due to the significant recalculations made for emissions/removals in the forest land category.

68. Within the LULUCF sector, there are two dominant categories: forest land, with 5,606.25 Gg CO_2 eq net removals, and settlements, with 1,113.65 Gg CO_2 eq net emissions, in 2006. Other minor net sources include cropland, wetlands and other land, accounting for 214.62 Gg CO_2 eq, 104.75 Gg CO_2 eq and 32.33 Gg CO_2 eq, respectively. Grassland is the only other category for which net removals have been reported, accounting for 24.74 Gg CO_2 eq.

69. Portugal has continued to improve the quality of its data for the LULUCF sector in its 2008 submission, making several major improvements in response to recommendations made in the previous review report. The ERT notes, however, that Portugal has not provided adequate background information on the improvements implemented, particularly on the recalculations performed. Also, the structure of the LULUCF chapter in the NIR does not make it easy to understand the characteristics of most of the categories. The ERT recommends that Portugal reconsider the structure of the LULUCF chapter in accordance with the outline suggested in the UNFCCC reporting guidelines and the IPCC good practice guidance for LULUCF, with the aim of improving the explanations and the transparency of the calculations, in particular for the key categories in the sector.

70. The ERT identified a number of inconsistencies within the land-use matrix and also between the land-use matrix and the areas reported in the CRF tables. For several land-use categories, the annual land-use change is bigger than the area available in the category. No information on cropland and grassland is available for Portugal's two autonomous regions. In addition, it is not yet clear whether the forest criteria elected by Portugal under the Kyoto Protocol apply to Montado forest (which has been

included under forest land). Portugal informed the ERT that new information on land use for the year 2007 will be available by the end of 2009, while information for 2010 will be available by the end of 2013. The ERT recommends that Portugal, for its next annual inventory submission, prioritize the construction of a consistent and complete land-use matrix and improve the consistency of the data on land use on the basis of the information from the NFI and the CORINE Land Cover project, as well as provide all the information and data required for the categories, years and regions as mentioned above, where possible. This is essential to ensure that Portugal is ready to report on its activities under Article 3, paragraph 3, and its elected activities under Article 3, paragraph 4, of the Kyoto Protocol.

B. Key categories

1. Forest land remaining forest land – CO_2

71. Emissions/removals for the land use of Portugal's two autonomous regions (the Azores and Madeira) were reported for the first time in the 2008 submission. In the NIR, information from the NFI on forest area and revised calculations of the forest area were presented and the areas under forest land remaining forest land separated from the areas under land converted to forest land using the information from the CORINE Land Cover project. However, the NIR states (p.275) that the information from the CORINE Land Cover project which was used to determine the land use and land-use changes does not include Portugal's two autonomous regions and that no annual forest data are available or were estimated for these two regions. During the centralized review, Portugal informed the ERT that the data for the two autonomous regions have been included in the CRF tables and used in the calculations, but have not yet been reported in the NIR. The ERT recommends that Portugal include such information and improve consistency between the CRF tables and the NIR in its next annual inventory submission.

72. The ERT notes that both forest land remaining forest land and land converted to forest land are key categories and recommends that Portugal improve the documentation in the NIR of the determination of the annual areas under both of these categories. The ERT encourages Portugal to pay attention to the documentation of Montado forest and also pay special attention to the criteria that Portugal elected to report under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. The ERT advises Portugal to include land conversion to forest land over the 20 year period in the documentation for land converted to forest land in the NIR, as was also recommended in the previous review report.

73. The major sources of biomass losses in Portugal are wildfires and harvests. Portugal has paid attention to both activities and reported in the NIR the improvements made in the calculation of emissions from wildfires. For fellings, a table and graph which include inconsistent data for 2004 onwards were presented in the NIR. However, during the centralized review, Portugal provided the ERT with correct updated data. The ERT recommends that Portugal include these updated data on harvests since 2003 in the NIR of its next annual inventory submission.

2. Land converted to forest land – CO_2

74. The annual area of land converted to forest land reported in CRF table 5.A for 2006 is 137,174 ha, within which 75,574 ha changed from other land to forest land. In CRF table 5.F, the total area reported of other land is only 30,196 ha (with 8,799 ha of other land remaining other land and 12,029 ha of forest land converted to other land). These reported data are not consistent. The ERT recommends that Portugal check the land-use change matrix thoroughly and provide recalculated data for all the relevant categories in its next annual inventory submission.

3. Settlements – CO_2

75. Portugal has not reported information on settlements in the NIR, which is a key category. From the general information reported in the NIR, the ERT concludes that information from the CORINE Land Cover project has been used to determine the area of settlements and land-use changes to settlements.

However, the information on land-use change presented in table 6.18 of the NIR and the area data reported in CRF table 5.E is not consistent. The ERT recommends that Portugal improve the consistency between the land-use matrix and the data reported on areas of land use in all the CRF tables of its next annual inventory submission, as well as improve the documentation in the NIR of the land-use changes. In response to questions raised by the ERT during the centralized review, Portugal informed the ERT that it is planning the development of a new land-cover cartography (COS). The ERT recommends that Portugal finish this work as soon as possible and report the information obtained in the NIR of its next annual inventory submission, including the outcome of the plan to update the CORINE information for the more recent years, if possible.

C. Non-key categories

1. Grassland – CO_2

76. Portugal has reported grassland remaining grassland as "NO". The ERT noted that the land-use change matrix presented in the NIR (p.477) suggests that changes from grassland to other land-use categories did occur over the period 1986–2000. This matrix also suggests that there is some area that remains for several years under the grassland land use. In response to questions from the ERT during the centralized review, Portugal informed the ERT that the notation key "NO" was used incorrectly and that "IE" should have been used instead, as these emissions have been reported under the category agricultural soils (4.D). The ERT also identified inconsistencies between the land-use categories and the land-use changes for grassland: each year a greater area of land is changed to other land-use categories than the area reported as available in the grassland category. The ERT recommends that Portugal correct these inconsistencies in its next annual inventory submission and pay special attention to the grassland category when improving and updating the land-use matrix.

2. Other land – CO_2

77. In the IPCC good practice guidance for LULUCF, other land is defined as bare soil, rock, ice and all unmanaged land areas that do not fall into any of the other five land-use categories. Annual changes to and from the other five land-use categories have been reported in CRF table 5.F. For 2006, an annual change from other land to forest land of 75,574 ha and from forest land to other land of 12,029 ha have been reported. In addition, information on the biomass carbon stock (table 6.11) and the annual growth of biomass to bush land (table 6.12) has been presented in the NIR, as well as information which indicates that accumulation of dead organic matter (DOM) is considered to occur in bush lands only (NIR, p.466). However, in CRF table 5.F, no carbon stock changes have been reported for other land remaining other land. The ERT recommends that Portugal consider, for its next annual inventory submission, whether reporting on bush land (or part of it) in one of the other five land-use categories would be more in line with the actual situation occurring in the country.

VI. Waste

A. Sector overview

78. In 2006, the waste sector accounted for 6,799.31 Gg CO_2 eq, representing 8.2 per cent of total GHG emissions. Emissions from the sector increased by 14.7 per cent between 1990 and 2006. The key driver for this rise in emissions was the steady increase in consumption patterns of the population, as well as in the collection and disposal of solid waste on land, which reached 100 per cent of waste generated in 2005, regardless of the rise in incineration, biogas capture and flaring, and less degradable food fractions. Within the sector, 62.1 per cent of the emissions were from solid waste disposal on land, followed by 35.5 per cent from wastewater handling and 2.4 per cent from waste incineration. Estimates for all gases and categories in the waste sector have been included in the CRF and the NIR.

79. The information provided in the CRF and the NIR is transparent and generally complete. Recalculations were performed for the waste sector, taking into account recommendations made in the previous review report, and resulted in a 16.1 per cent decrease in the total estimated sectoral emissions for 1990. According to the 2007 submission, total sectoral emissions decreased by 8.4 per cent over the period 1990–2005. In 2006, sectoral emissions decreased by 4.9 per cent in comparison with the reported emissions for 2005 (2008 submission). Implementation of sector-specific QA/QC procedures has not been reported for the waste sector.

B. Key categories

1. Solid waste disposal on land – CH_4

80. Portugal applies a tier 2 first order decay (FOD) model with IPCC default parameters, except for the DOC value, which was estimated on the basis of country-specific data on waste composition. Generation rates of municipal solid waste per capita are to a large extent based on expert judgement, although the values are within the acceptable range in comparison with other countries. The amount of industrial solid waste disposed decreased sharply in 2000. During the centralized review, Portugal explained to the ERT that this was a result of the market demand for different types of waste, and of policies and measures implemented in the waste sector. The ERT recommends that Portugal make efforts to use country-specific parameters in the FOD model for its next annual inventory submission.

2. Wastewater handling – CH_4 and N_2O

81. Portugal applies country-specific data in its estimation of organic load from industrial wastewater and highlights the fact that, although the values are rather old, they are still more representative of the national situation than the default values from the Revised 1996 IPCC Guidelines. No CH_4 recovery was assumed. The MCF values for different treatment systems were taken from internationally recognized published literature. N_2O emissions were estimated using a simple methodology from the EMEP/CORINAIR handbook. The ERT recommends that Portugal make efforts to update the country-specific data used in its calculations and verify its assumptions on CH_4 recovery in its next annual inventory submission.

82. For domestic and commercial wastewater handling, Portugal uses a methodology adapted from the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Total organic content of domestic sewage was determined by multiplying the total population for each year by a per capita wastewater biochemical oxygen demand (BOD_5) production rate. National population data were taken from the INE, while the BOD_5 factor of 60 g BOD_5/capita/day was taken from Council Directive 91/271/CEE regarding urban wastewater treatment. Other background AD were based on studies covering the 1990s and were extrapolated for the period 2000–2006, taking into account the targets of water management policies and technological changes. The ERT commends the efforts made by Portugal and encourages it to continue developing country-specific parameters and updating the AD used in its calculations for its next annual inventory submission.

C. Non-key categories

1. Human sewage – N_2O

83. Emissions of N_2O from human sewage were estimated following the methodology from the Revised 1996 IPCC Guidelines. AD on protein intake were taken from the FAO database. The ERT recommends that Portugal make efforts to obtain country-specific data on protein intake and use these data in its calculations for this category in its next annual inventory submission.

2. Waste incineration – CO_2, CH_4 and N_2O

84. In Portugal, the incineration of municipal waste with energy recovery began in 1999 in three modern units where energy is recovered; thus, these emissions are accounted for under the energy sector. The incineration of hospital waste occurs without energy recovery and is therefore allocated to the waste sector. In the NIR, it is indicated that emissions were estimated for the non-biogenic and biogenic component of the waste. Emissions from the non-biogenic component have been reported in the energy sector under other fuels under public electricity and heat production. Non-CO_2 emissions from the biogenic part have been accounted for also under public electricity and heat production under biomass, while CO_2 emissions have been reported as a memo item under biomass. Although this information on waste incineration has been provided in the NIR, emissions from other fuels under public electricity and heat production have been reported as "NO" and there is no clear indication whether emissions from waste incineration plants have been included in the CRF tables for the energy sector. The ERT recommends that Portugal correct these mistakes and implement QC procedures to ensure the consistency of the information provided in the NIR and the CRF tables for this category in its next annual inventory submission.

VII. Other issues

1. Changes to the national system

85. Portugal has not reported on any changes to its national system in the 2008 submission. In response to questions raised by the ERT during the centralized review, Portugal confirmed that no changes to the national system have taken place.

86. However, the ERT noticed that the lack of formal agreements under the current institutional arrangements made by Portugal prevents the full implementation of the national system for performing the functions defined in the guidelines for national systems (decision 19/CMP.1) regarding the provision of data by governmental agencies and other entities within the national system for the preparation of the inventory, particularly for the industrial processes sector.

87. During the centralized review, in response to questions raised by the ERT, Portugal explained that the existing legal arrangements under the national system do not include agreements between APA and the relevant collaborating institutions. Furthermore, Portugal provided formal letters signed by the Joint Secretary of the CSE and the Head of the Economic Statistics Department detailing the steps taken to establish these formal agreements along with the proposed timeline for the deliberation of the legal arrangements, which have now been referred to the Statistical Council for its evaluation and approval of the delivery of the confidential data. The ERT considered Portugal's response to be sufficient and the timelines proposed to be appropriate.

88. The ERT notes in particular that this issue will be considered at the next meeting of the Permanent Body of Statistical Secret and that a resolution is expected by early 2009 to ensure that Portugal meets the requirements under general functions of the national system in accordance with decision 19/CMP.1. The ERT recommends that Portugal implement the detailed steps referred to in paragraph 87 above to institute these formal agreements; provide clear and detailed information on the final legal arrangements for the delivery of confidential information requested by APA, including statistics for industrial production, required AD and country-specific EFs for the relevant categories; and report on the outcome of these actions in its next annual submission. Additional information provided by Portugal after the centralized review indicates that the Permanent Body of Statistical Secret, upon a positive deliberation on the use of confidential information for inventory purposes, has approved the provision of required data to APA annually, which will make available updated AD for the inventory compilation from 2010 onwards.

89. Portugal indicated that the institutional framework established by the Council of Ministers Resolution 68/2005 of 17 March 2005 will be updated in order to accommodate its new responsibilities resulting from the reporting requirements associated with activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, regarding Portugal's elected activities of grazing land management, cropland management and forest management. The ERT considers these intended changes a critical part of Portugal's plan to improve its reporting on the LULUCF sector under the Kyoto Protocol and recommends that Portugal report in detail on the outcome of these changes in its next annual submission under the Kyoto Protocol.

2. Changes to the national registry

90. Portugal has not reported on any changes to its national registry in the 2008 submission. In response to questions raised by the ERT during the centralized review, Portugal confirmed that no significant changes had occurred, but informed the ERT that since 15 November 2007, the registry software was updated from CR v1.1.4 to CR v1.2.2 on 30 September 2008 and, in November 2008, the Portuguese registry was linked to the international transaction log (ITL). The additional information provided by Portugal also indicated that the hardware infrastructure is currently being improved, with the aim of managing emergency situations better and reducing the risk of long periods of non-operation. As such, a new independent link to the ITL is being implemented from the secondary data centre. Tests are currently being performed and the new infrastructure architecture is expected to be operational in early 2009. The ERT recommends that Portugal report on all these improvements/changes to its national registry in its next annual submission under the Kyoto Protocol.

3. Commitment period reserve

91. Portugal has not reported its commitment period reserve in the 2008 submission. In response to questions raised by the ERT during the centralized review, Portugal reported that its commitment period reserve has not changed since the initial report review (343,743,774 tonnes of CO_2 eq). The ERT agrees with this figure and recommends that Portugal include information on its commitment period reserve in its next annual submission.

VIII. Conclusions and recommendations

92. Portugal has submitted a complete set of CRF tables for 1990–2006 and an NIR. The inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF, and is complete in terms of years, geographical coverage, sectors and gases. However, Portugal has reported actual and potential emissions from the production and consumption of halocarbons and SF_6 for the period 1995–2006 only. The ERT formulated a number of recommendations relating to the completeness of the inventory and methodological choices that should be addressed in the next annual inventory submission in line with the IPCC good practice guidance, which are discussed in detail in the sector chapters of this report (e.g. the use of a simple linear interpolation to obtain the values of AD for the period 2001–2006 for most categories in the industrial processes sector).

93. The ERT recommends that Portugal further improve the transparency of its NIR by providing more supporting information on the estimates which are based on expert judgement and the rationale for using other input parameters for the agriculture sector. In addition, the ERT noted that the current structure of the reporting on the LULUCF sector does not make it easy to understand the assumptions, calculations and national circumstances in most of the categories. The ERT recommends that Portugal restructure the LULUCF chapter in the NIR in accordance with the UNFCCC reporting guidelines and the IPCC good practice guidance for LULUCF, with the aim of improving the explanations and the transparency of the calculations, in particular for the key categories in the sector.

94. The ERT also recommends that Portugal implement its planned actions to address the issue of the lack of formal arrangements with the collaborating institutions under the national system. Specifically, Portugal should provide clear and detailed information on the final legal arrangements for the delivery of confidential information requested by APA, including statistics for industrial production, required AD and country-specific EFs for the relevant categories for the entire time series; and report on the outcome of these actions in its next annual submission. The ERT therefore welcomes the additional information provided by Portugal after the centralized review indicating that the Permanent Body of Statistical Secret, upon official deliberation on the provision of the required data on industrial production and external commerce and use of confidential information for inventory purposes, has approved the provision of required data to APA annually, and that in the case of further requirements, it will be necessary to have a new deliberation of the Permanent Body of Statistical Secret.

95. The key additional recommendations made by the ERT are that Portugal:

(a) Make every effort to collect plant-specific AD and improve the accuracy and reduce the uncertainty of AD and EFs in order to improve the quality, transparency and time-series consistency of its emission estimates for all categories under the industrial processes sector;

(b) Make every effort to provide emission estimates for the categories that are currently reported as "NE" and for which the Revised 1996 IPCC Guidelines and the IPCC good practice guidance provide estimation methodologies;

(c) Provide information on the planned migration to COPERT IV for the calculation of emissions from road transportation, which may imply a significant change to N_2O EFs;

(d) Make every effort to achieve the required level of detail needed and the split between domestic and international flights and marine transport, including military fuel consumption, in accordance with the IPCC good practice guidance;

(e) Develop and utilize country-specific livestock characterization data for enteric fermentation for the entire time series in line with the IPCC good practice guidance, replacing its current use of a regression model based on the default IPCC EFs;

(f) Prioritize the construction of a consistent land-use matrix and improve the consistency of the land-use information based on information from the NFI and the CORINE Land Cover project, which is being developed to ensure that Portugal is ready to report on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol;

(g) Strengthen the implementation of its QA/QC plan in all the agencies involved in the preparation of the inventory and include information on sector-specific QC procedures in the relevant sector chapters of the NIR;

(h) Develop a tier 2 uncertainty analysis for inventory estimates in order to further enhance the already high level of quality of its inventory;

(i) Strengthen and use its unique PDM to identify areas for improvement in terms of the planning and preparation of its inventory, including the effective involvement of national experts in independent reviews.

IX. Questions of implementation

96. 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 for Portugal 2007. FCCC/ASR/2007/PRT. Available at <http://unfccc.int/resource/docs/2007/asr/prt.pdf>.

Status report for Portugal 2008. FCCC/ASR/2008/PRT. Available at <http://unfccc.int/resource/docs/2008/asr/prt.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>.

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>.

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

FCCC/IRR/2007/PRT. Report of the review of the initial report of Portugal. Available at <http://unfccc.int/resource/docs/2007/irr/prt.pdf>.

B. Additional information provided by Portugal

Responses to questions during the review were received from Ms. Teresa Costa Pereira (Portuguese Environment Agency/Agência Portuguesa do Ambiente), including additional material on the methodology and assumptions used. The following documents were also provided by Portugal:

Translation of a letter from Conselho Superior de Estatistica/CSE (the Statistical Council) on confidential information requested by APA of 7 November 2008, signed by the Joint Secretary of the CSE.

Translation of a letter from the National Statistical Office on confidential information on statistics for industrial production of 7 November 2008, signed by the Head of the Economic Statistics Department.

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