Report of the review of the initial report of Portugal

Note by the secretariat

The report of the review of the initial report of Portugal was published on 15 November 2007. 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/IRR/2007/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.

Report of the review of the initial report of Portugal

According to decision 13/CMP.1, each Annex I Party with a commitment inscribed in Annex B to the Kyoto Protocol shall submit to the secretariat, prior to 1 January 2007 or one year after the entry into force of the Kyoto Protocol for that Party, whichever is later, a report (the 'initial report') to facilitate the calculation of the Party's assigned amount pursuant to Article 3, paragraphs 7 and 8, of the Kyoto Protocol, and to demonstrate its capacity to account for emissions and the assigned amount. This report reflects the results of the review of the initial report of Portugal conducted by an expert review team in accordance with Article 8 of the Kyoto Protocol.

CONTENTS

I. Introduction and summary

A. Introduction

1.   This report covers the in-country review of the initial report of Portugal, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with the guidelines for review under Article 8 of the Kyoto Protocol (decision 22/CMP.1). The review took place from 21 to 26 May 2007 in Lisbon, Portugal, and was conducted by the following team of nominated experts from the roster of experts: generalist – Mr. Paul Filliger (Switzerland); energy – Mr. Dario Gomez (Argentina); industrial processes – Mr. Mauro Meirelles de Oliveira Santos (Brazil); agriculture – Ms. Anna Romanovskaya (Russian Federation); land use, land-use change and forestry (LULUCF) – Mr. Leandro Buendia (Philippines); waste – Mr. Eduardo Calvo (Peru). Ms. Anna Romanovskaya and Mr. Dario Gomez were the lead reviewers. In addition the expert review team (ERT) reviewed the national system, the national registry, and the calculations of the Party's assigned amount and commitment period reserve (CPR), and took note of the LULUCF parameters and the elected Article 3, paragraph 4 activities. The review was coordinated by Mr. Harald Diaz-Bone (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, in this final version of the report.

B. Summary

1. Timeliness

3.   Decision 13/CMP.1 requests Parties to submit their initial report prior to 1 January 2007 or one year after the entry into force of the Kyoto Protocol for that Party, whichever is later. The initial report was submitted on 28 December 2006, which is in compliance with decision 13/CMP.1. With the initial report Portugal submitted a greenhouse gas (GHG) inventory that had been revised since its original 2006 GHG inventory submission (of 13 April 2006). In its initial report Portugal refers to its 2006 GHG inventory submission of 28 December 2006. The Party resubmitted its 2006 GHG inventory for the inventory years 1990–1995 and 2004, on 9 and 10 July 2007, in response to questions raised by the ERT during the course of the in-country visit.[1] The initial report, the national inventory report (NIR) and the revised common reporting format (CRF) tables included in this submission are considered in this review report.

2. Completeness

4.   Table 1 below provides information on the mandatory elements that have been included in the initial report and reflects revised values for the assigned amount and the commitment period reserve provided by the Party resulting from the review process. These revisions concern emissions of carbon dioxide (CO_2) from manufacturing industries and construction (see paragraph 46); CO_2, methane (CH_4) and nitrous oxide (N_2O) from military fuel use (see paragraph 47); CO_2 from iron and steel production (see paragraph 63); hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) from consumption of halocarbons and SF_6 (see paragraph 62); N_2O from manure management (see paragraph 69); CH_4 from rice cultivation (see paragraph 70); N_2O from agricultural soils (see paragraphs 71–73); CO_2 from

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[1] The Party resubmitted its 2006 GHG inventory for the inventory years 1990–1995 and 2004 again on 8 October 2007. The Party informed the ERT that all emission estimates contained in this version were identical with those from the version of 9 and 10 July 2007, as only data on land-use change areas were revised.

conversion of forests (deforestation) (see paragraph 79); CH_4 from solid waste disposal on land (see paragraph 84); and CH_4 and N_2O from wastewater handling (see paragraphs 86 and 87). These revisions changed the estimate for total GHG emissions in the base year, from 60,938.0 Gg CO_2 equivalent (CO_2 eq.) (including 973.8 Gg CO_2 eq. from deforestation), as originally reported by the Party, to 60,147.6 Gg CO_2 eq. (including 981.2 Gg CO_2 eq. from deforestation) (see paragraph 92).

Table 1. Summary of the reporting on mandatory elements in the initial report

Item	Provided	Value/year/comment
Complete GHG inventory from the base year (1990) to the most recent year available (2004)	Yes	Base year: 1990
Base year for HFCs, PFCs and SF_6	Yes	1995
Agreement under Article 4	Yes	127%
LULUCF parameters	Yes	Minimum tree crown cover: 10% Minimum land area: 1 ha Minimum tree height: 5 m
Election of and accounting period for Article 3, paragraphs 3 and 4, activities for the first commitment period	Yes	Elected Article 3, paragraph 4 activities: forest management, cropland management, grazing land management Accounting period for Article 3, paragraphs 3 and 4, activities: entire commitment period
Calculation of the assigned amount in accordance with Article 3, paragraphs 7 and 8	Yes	386 956 503 tonnes CO_2 eq.
Calculation of the assigned amount in accordance with Article 3, paragraphs 7 and 8, revised value		381 937 527 tonnes CO_2 eq.
Calculation of the commitment period reserve	Yes	348 260 853 tonnes CO_2 eq.
Calculation of the commitment period reserve, revised value		343 743 774 tonnes CO_2 eq.
Description of national system in accordance with the guidelines for national systems under Article 5, paragraph 1	Yes	
Description of national registry in accordance with the requirements contained in the annex to decision 13/CMP.1, the annex to decision 5/CMP.1 and the technical standards for data exchange between registry systems adopted by the CMP	Yes	

5.   The information in the initial report covers all the elements required by decision 13/CMP.1, section I of decision 15/CMP.1, and relevant decisions of the Conference of the Parties serving as the Meeting of the Parties (CMP).

3. Transparency

6.   The initial report is generally transparent. Two important elements which ensure technical and methodological accuracy and the completeness and reliability of the inventory – the Methodological Development Plan (PDM)[2] and the quality assurance/quality control (QA/QC) system – are mentioned in the report but not described in detail. Portugal presented all the necessary information about these elements during the in-country review. The description of the national system in the report is transparent.

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[2] The PDM is one out of three main elements of the national system and aims at improving the methodologies for GHG emission estimation in Portugal, reflecting the results of the various review processes, in particular the UNFCCC reviews, the annual inventory compilation processes, and the results of the application of procedures under the QA/QC system.

During the review the ERT raised some questions of clarification which were fully addressed by the Party. The ERT recommends the Party to further enhance transparency and

(a)   For country-specific methods, improve the NIR's description of methodologies and include all the elements stipulated by 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 "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) (see e.g. paragraphs 38, 59, 82 and 86);

(b)   Include in the NIR a description of the QA/QC plan and information on the QA/QC measures implemented in all sectors;

(c)   Provide the rationale and justification for all recalculations.

4. Emission profile in the base year, trends and emission reduction target

7.   In the base year (1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6), the most important GHG in Portugal was CO_2, contributing 73.4 per cent to total[3] national GHG emissions expressed in CO_2 equivalent, followed by CH_4, 17.1 per cent, and N_2O, 9.4 per cent (see figure 1). HFCs, perfluorocarbons (PFCs) and SF_6 taken together contributed 0.1 per cent of the overall GHG emissions in the base year. The energy sector accounted for 68.0 per cent of total GHG emissions in the base year, followed by agriculture (13.7 per cent), waste (10.0 per cent), industrial processes (7.9 per cent) and solvent and other product use (0.4 per cent) (see figure 2). Total GHG emissions (excluding LULUCF) amounted to 59,166.4 Gg CO_2 eq. in the base year and increased by 41.8 per cent from the base year to 2004. The trends of the different sectors and gases are reasonable and were explained during the in-country visit.

Figure 1. Shares of gases in total GHG emissions, base year

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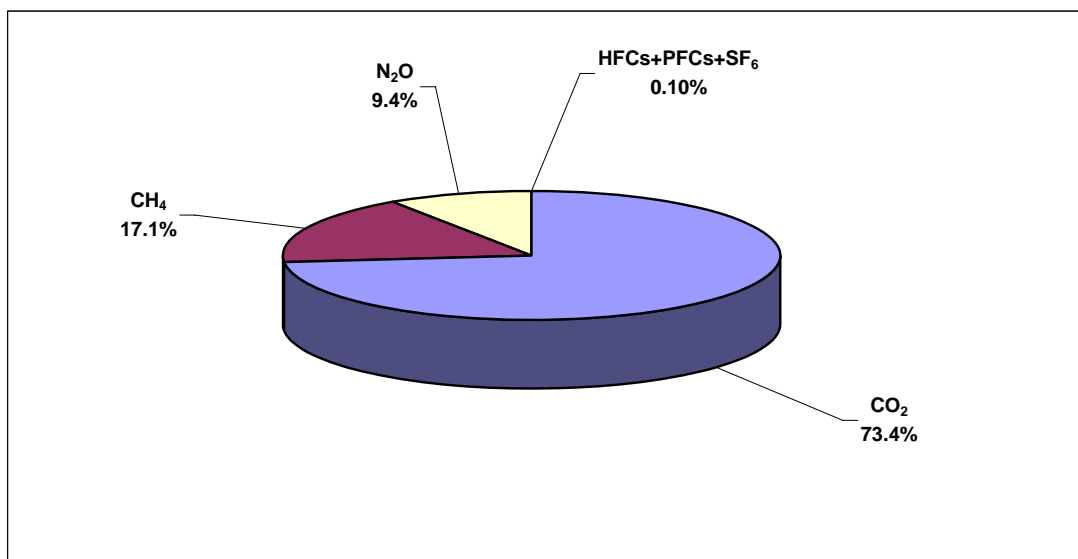
[3] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LULUCF, unless otherwise specified.

Figure 2. Shares of sectors in total GHG emissions, base year
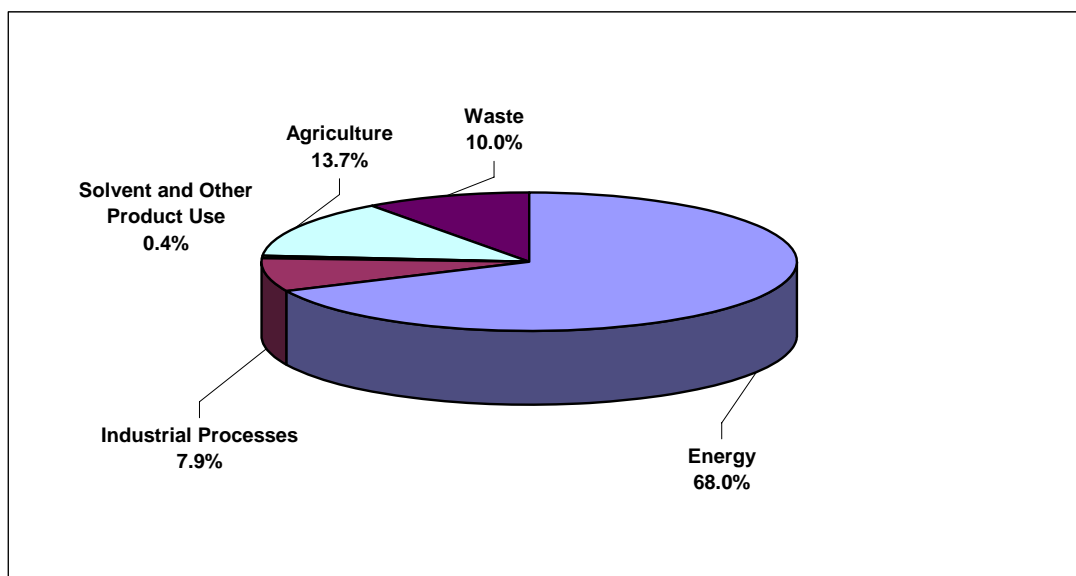
8.   Tables 2 and 3 show the greenhouse gas emissions by gas and by sector, respectively.

9.   Portugal's quantified emission limitation is 92 per cent as included in Annex B to the Kyoto Protocol. As Portugal is part of the European Community, whose member States will meet their reduction commitment jointly in accordance with Article 4 of the Kyoto Protocol, Portugal's quantified emission limitation is 127 per cent. Portugal's assigned amount is calculated based on the Party's Article 4 commitment.

II. Technical assessment of the elements reviewed

A. National system for the estimation of anthropogenic GHG emissions by sources and sinks

10.   Portugal's national system has been prepared in accordance with the guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol (decision 19/CMP.1). All the mandatory elements of the national system are defined and the organizational structure is very well defined. Questions on the QA/QC system were discussed during the in-country review and all questions were answered. The ERT noted that the inventory team works professionally and is dedicated to its task. Portugal benefits from good relationships with data providers in the government, industrial associations and consulting companies.

11.   Table 4 shows which of the specific functions of the national system are included and described in the initial report.

Table 2. Greenhouse gas emissions by gas, 1990–2004

GHG emissions (without LULUCF)	Gg CO_2 equivalent								Change BY–2004 (%)
	Base year[a]	1990[a]	1995[a]	2000	2001	2002	2003	2004[a]	
CO_2	43 444.44	43 444.44	53 191.59	63 818.60	65 084.79	69 291.05	64 623.83	65 721.09	51.3
CH_4	10 103.19	10 103.19	11 232.95	11 328.93	11 273.64	11 518.71	11 537.42	11 245.96	11.3
N_2O	5 561.16	5 561.16	5 805.98	6 259.29	6 272.65	6 386.09	5 832.25	6 258.09	12.5
HFCs	51.64	NA, NE, NO	51.64	306.95	392.77	496.49	607.03	683.66	1 224.0
PFCs	NA, NO	NE, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA
SF_6	6.00	NE, NO	6.00	8.33	9.27	10.24	11.52	13.26	120.7

Note: BY = Base year; LULUCF = Land use, land-use change and forestry; NA = Not applicable; NE = Not estimated; NO = Not occurring.

[a] The Party submitted revised estimates for the period 1990–1995 and 2004 in the course of the initial review on 9 and 10 July 2007. These estimates differ from Party's GHG inventory submitted in 2006.

Table 3. Greenhouse gas emissions by sector, 1990–2004

Sectors	Gg CO_2 equivalent								Change BY–2004 (%)
	Base year[a,b]	1990[a]	1995[a]	2000	2001	2002	2003	2004[a]	
Energy	40 261.95	40 261.95	48 993.58	59 653.91	60 896.49	64 877.97	60 425.06	61 131.83	51.8
Industrial processes	4 668.68	4 611.04	5 807.95	6 189.77	6 764.41	7 234.66	7 200.93	7 415.18	58.8
Solvent and other product use	219.71	219.71	256.27	290.02	303.81	311.62	317.93	320.15	45.7
Agriculture	8 088.34	8 088.34	8 173.55	8 796.71	8 653.13	8 726.25	8 135.33	8 660.16	7.1
LULUCF	NA	2 592.59	–2 791.03	–4 931.19	–4 735.98	–5 254.46	7 124.17	–3 536.08	NA
Waste	5 927.76	5 927.76	7 056.82	6 791.68	6 415.28	6 552.09	6 532.80	6 394.74	7.9
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	NA	61 701.39	67 497.14	76 790.90	78 297.14	82 448.14	89 736.21	80 385.98	NA
Total (without LULUCF)	59 166.44	59 108.80	70 288.17	81 722.09	83 033.12	87 702.59	82 612.04	83 922.06	41.8

Note: BY = Base year; LULUCF = Land use, land-use change and forestry; NA = Not applicable.

[a] The Party submitted revised estimates for period 1990–1995 and 2004 in the course of the initial review on 9 and 10 July 2007. These estimates differ from Party's GHG inventory submitted in 2006.

[b] The LULUCF sector was a net source in the base year. In accordance with decision 13/CMP.1, total base year emissions for the purpose of the calculation of the assigned amount under the Kyoto Protocol shall include GHG emissions from conversion of forests (deforestation). In 1990, emissions from deforestation amounted to 981.20 Gg CO_2 eq. for Portugal. Emissions from deforestation are neither shown separately nor included as a separate element of the emissions from the LULUCF sector in the rows for total emissions in this table. However, they were added to the total base year emissions for the purpose of the calculation of the assigned amount (see sections II.C and II.D of this report).

Table 4. Summary of reporting on the specific functions of the national system

Reporting element	Provided	Comments
Inventory planning		
Designated single national entity*	Yes	See section II.A.1
Defined/allocated specific responsibilities for inventory development process*	Yes	See section II.A.1
Established process for approving the inventory*	Yes	See section II.A.1
Quality assurance/quality control plan*	Yes	See section II.A.2
Ways to improve inventory quality	Yes	See section II.B.3
Inventory preparation		
Key category analysis*	Yes	See section II.B.1
Estimates prepared in line with IPCC guidelines and IPCC good practice guidance*	Yes	See section II.B.2
Sufficient activity data and emission factor collected to support methodology*	Yes	See section II.B
Quantitative uncertainty analysis*	Yes	See section II.B.2
Recalculations*	Yes	See section II.B.2
General QC (tier 1) procedures implemented*	Yes	See section II.A.2
Source/sink category-specific QC (tier 2) procedures implemented	Yes	See section II.A.2
Basic review by experts not involved in inventory	Yes	See section II.A.2
Extensive review for key categories[1]	No	See section II.A.2
Periodic internal review of inventory preparation	Yes	See section II.A.2
Inventory management		
Archive inventory information*	Yes	See section II.A.3
Archive at single location	Yes	See section II.A.3
Provide ERT with access to archived information*	Yes	See section II.A.3
Respond to requests for clarifying inventory information during review process*	Yes	See section II.A.1

* Mandatory elements of the national system.
[1] Domestic reviews by independent experts.

1. Institutional, legal and procedural arrangements

12.   During the in-country visit, host country officials explained the institutional arrangements, as part of the national system, for preparation of the inventory. The Portuguese Environment Agency (APA) is the single national entity. Other agencies are also involved in the preparation of the inventory and have defined and allocated specific responsibilities for the inventory development process.
The institutional arrangements and the responsibilities are very well defined in Council of Ministers Resolution 68/2005 of 17 March 2005. The Council also defines the tasks and competences of the assigned focal points and the entities involved. The National Statistics Institute (INE) is responsible for national statistics, the Directorate-General for Energy and Geology (DGEG) for the energy statistics, the Directorate-General for Enterprise for industrial processes and civil construction, the Department of Planning and Policies of the Ministry of Public Works, Transport and Communications together with the Directorate-General for Driver Licensing for transport, the Environmental Auditor of the Ministry for Agriculture, Fisheries and Forestry for agriculture, the Directorate-General of Forestry and the Portuguese Geographical Institute for LULUCF, and the Institute for Waste Management for waste (for a complete list see Resolution 68/2005). The APA has several contracts with external experts who help to compile the CRF and the NIR, but the experts work on the APA premises. The contracts are yearly. The ERT noted that the national inventory team has the capacity to fulfil all the reporting requirements. The budget for contracts in the current year is in place, but it is important that their renewal on a regular basis in future be assured.

13.   Portugal gave a thorough and impressive presentation on background information referring to Article 3, paragraphs 3 and 4, activities. The Portuguese Geographical Institute presented the newest development on land-use data, which will meet the reporting needs. Several institutes also carry out special field studies on carbon pool changes on grassland.

14.   In Portugal there is an established process for the official consideration and approval of the inventory, including recalculations, prior to its submission and for responding to any issues raised by the inventory review. The responsible organization is the APA. As all calculations are done within the APA, the responsibility and workflow are well defined. Portugal explained that the head of the Agency has the final responsibility for official consideration and approval of the inventory.

2. Quality assurance/quality control

15.   Portugal has elaborated a QA/QC plan in accordance with the IPCC good practice guidance and its implementation is progressing. This includes general QC procedures (tier 1) and, as a latest development which was presented during the in-country visit, source/sink category-specific procedures (tier 2) for 20 key categories covering 62 per cent of total national emissions. The NIR and the initial report give a general overview of the QA/QC system. During the in-country review this issue was discussed extensively and the ERT was provided with several documents (the PDM, and documents on QA/QC; see annex I). The ERT considered that the QA/QC system is well developed and documented (although only in Portuguese), but it is not yet fully implemented. The ERT recommends the Party to include QC information in all the sectoral chapters of its next inventory report under the Kyoto Protocol and to develop a plan for domestic review by independent experts.

16.   The NIR presents a procedure for internal review of the inventory before submission; however, the ERT noted that QA by independent national experts was only documented for one case.

3. Inventory management

17.   Portugal has an effective centralized archiving system, which includes the archiving of disaggregated emission factors (EFs) and activity data (AD), and documentation on how these factors and data are generated and aggregated for the preparation of the inventory. The information archived also includes internal documentation on QA/QC procedures, external and internal reviews, documentation on annual key categories and key category identification, and planned inventory improvements. All information is archived in the APA. During the review, the ERT was provided with the additional archived information it requested. An integrated information technology (IT) system for the management of the SNIERPA[4] (SIGA) is currently under consideration with the aim of giving the national system the capacity to archive and manage all the information necessary for the preparation of the inventory, including activity data, intermediate calculation parameters and EFs, justification for the use of particular methodologies, deadlines for the submission of data and the identification of contacts for each of the partners involved. The ERT recommends Portugal to develop this system further.

B. Greenhouse gas inventory

18.   In conjunction with its initial report, Portugal has submitted a complete set of CRF tables for the years 1990–2004 and an NIR. The Party resubmitted its CRF tables for the years 1990–1995 and 2004 on 9 and 10 July 2007 in response to questions raised by the ERT during the course of the in-country visit (see also footnote 1). Where needed the ERT also referred to the 2005 submission.

19.   During the review Portugal provided the ERT with additional information sources. These documents are not part of the initial report submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in annex I to this report.

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[4] Sistema Nacional de Inventário de Emissões por Fontes e Remoção por Sumidouros de Poluentes Atmosféricos.

1. Key categories

20.   Portugal has reported key category tier 1 and tier 2 analyses, both level and trend assessment, for all years. Key category analyses are provided with and without the LULUCF sector. The results of the key category analysis are a driving factor for the preparation of the inventory, particularly in the prioritization of resources and the selection of methodologies.

21.   The key category analyses performed by the Party and the secretariat[5] produced similar results. Portugal's tier 1 analysis differs from the secretariat's analysis mainly due to differences in levels of disaggregation. About 18 smaller source/sink categories are included in the tier 2 analysis because their uncertainties are high. The ERT encourages the Party to try to get more precise data for sources with high uncertainties (key categories in NIR table A-4.1 and 4.2 with uncertainties of 1,000–10,000 per cent) and recommends it to disaggregate the LULUCF and agriculture sectors as recommended by the IPCC good practice guidance.

2. Cross-cutting topics

22.   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 Land Use, Land-Use Change and Forestry*. The ERT noted that in the waste sector the IPCC good practice guidance has not been followed completely. For CH_4 from solid waste disposal sites, the degradable organic carbon fraction (DOC_F) should be taken from the IPCC good practice guidance and for CH_4 from industrial wastewater the method should be made consistent with the IPCC good practice guidance. Portugal resolved these issues after the in-country visit and resubmitted a revised inventory for the inventory years 1990–1995 and 2004 on 9 and 10 July 2007.

23.   The inventory has been compiled in accordance with Article 7, paragraph 1, and decision 15/CMP.1.

Completeness

24.   Portugal's inventory submission is generally complete. The ERT noted that emission/removals from LULUCF of the autonomous regions of Madeira and the Azores were not covered and recommended the Party to study how sensitive the data on the LULUCF sector would be to the inclusion of these autonomous regions. After the in-country visit Portugal included LULUCF data for the two autonomous regions and was able to show that LULUCF remains a source in 1990. The ERT noted that a considerable number of categories are reported as not estimated ("NE") in CRF table 9(a) for all years (mostly involving emissions of N_2O and PFCs). The ERT recommended the Party to provide estimates for these categories (for PFCs from 1995 onwards) and noted that a complete inventory will be important for future reviews during the commitment period.

Transparency

25.   The NIR follows the UNFCCC reporting guidelines and provides much of the information needed to assess the inventory. In order to reduce the size of the NIR, the ERT recommends the Party to delete all information concerning air pollutants (PM10, heavy metals) which are not part of the Convention or

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[5] The secretariat identified, for each Party, those source 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 Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) for the base year or base year period as well as the latest inventory year. Key categories according to the tier 1 trend assessment were also identified. 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.

the Kyoto Protocol; to provide overview tables (e.g. for emission factors in the energy sector) and to refer to these tables; and to include information on QC in all the sectoral chapters of the NIR.

Consistency

26.   The inventory is generally consistent. The ERT did not identify any time-series inconsistency. Based on the information included in CRF summary table 3, the data are largely consistent with the information included in the NIR, although the following inconsistencies were noticed: fuel combustion – other (all gases) (1.A.5) is reported as not applicable ("NA") in the NIR, but as tier 1 in CRF summary table 3; and fugitive emissions – solid fuels (CO_2 and CH_4) are reported as "NA" in the NIR, but as IPCC default or tier 1 in CRF summary table 3.

Comparability

27.   The inventory is generally comparable with those of other Parties in its use of the IPCC methodologies and of the UNFCCC reporting formats. The allocation of the categories follows the split in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. However, in the LULUCF sector, the ERT identified two implied emission factors (IEFs) which differ significantly from those of other Parties (see paragraphs 78 and 81).

Accuracy

28.   The ERT considered the inventory to be accurate in terms of containing systematically neither over- nor underestimation so far as can be judged, and of having reduced uncertainties as far as practicable.

Recalculations

29.   The national system can ensure that recalculations of previously submitted estimates of GHG emissions by sources and removals by sinks are prepared in accordance with the IPCC good practice guidance.

30.   The ERT noted that Portugal reports recalculations of the time series from the base year to 2004. The CO_2 emissions recalculations mostly relate to the LULUCF sector (use of a new methodology) but some changes refer to the energy sector, in particular transport. Most of the changes to the CH_4 emission estimates concern the waste sector, and more specifically wastewater handling, but some also occur in the agriculture sector (manure management). Recalculations of the estimates of N_2O emissions relate mainly to manure management, agricultural soils and wastewater handling. The recalculations are generally well documented in the NIR, the rationale is explained, and good overview tables are provided in the NIR. However, the ERT noted that the recalculation for industrial wastewater handling was not explained in a transparent way and recommended the Party to improve the methodology (see also paragraphs 83 and 86). The ERT detected some differences between the NIR and the CRF but these were all discussed and resolved during the review. The total effect of these recalculations (excluding LULUCF) is a 2.5 per cent increase in estimated total national emissions for 2003 and a 1.0 per cent increase for 1990.

31.   The recalculations have resulted in real improvements to the inventory.

Uncertainties

32.   Portugal has provided an uncertainty analysis following the IPCC good practice guidance. Uncertainties have been estimated, using a tier 1 analysis, for all source/sink categories. The uncertainties are estimated by expert judgement or are taken from IPCC default values. Uncertainty analyses are provided for all years. The overall uncertainty is decreasing. The ERT recommends the Party to use a tier 2 uncertainty analysis which could deal with log-normal errors and correlations.

3. Areas for further improvement identified by the Party

33.   The NIR identifies several areas for improvement covering all sectors, for example, more extensive use of plant-specific emission factors in the energy sector; revision of the clinker emission factor in the industrial processes sector; improved estimates of emissions from the application of fertilizers in the agriculture sector; revision of carbon content of soils in the LULUCF sector; and a better quantification of the amount of CH_4 recovered and flared in the waste sector. Future improvements are defined under the PDM which is revised and agreed each year within the framework of the national inventory system.

4. Areas for further improvement identified by the ERT

34.   The ERT identified the following cross-cutting issues for improvement. The Party should:

(a)   Work on the completeness of the inventory by covering all source/sink categories; in particular, include LULUCF estimates for the autonomous regions of Madeira and the Azores Islands;

(b)   Try to reduce the size of the NIR. Delete all information concerning air pollutants (PM10, heavy metals) which are not included in the CRF. Concentrate on country-specific methods (which should be described in more detail) and relevant background information, and use references for standard methodological procedures;

(c)   Continue to work on implementation of the QA/QC system. Perform step-by-step reviews of the various parts of the inventory by independent national experts;

(d)   Include information on sector-specific QC in all sectoral chapters of the NIR;

(e)   Improve the description of recalculations for industrial wastewater handling and HFC emissions;

(f)   Continue to develop the integrated IT system for the management of the national system (SIGA);

(g)   Develop a tier 2 uncertainty analysis.

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

5. Energy

Sector overview

36.   In the base year, emissions from the energy sector (40,261.9 Gg CO_2 eq.) accounted for 68.0 per cent of total national GHG emissions, excluding LULUCF. Fuel consumption accounted for 99.4 per cent of emissions from the sector, and fugitive emissions for 0.6 per cent. Emissions of CO_2 accounted for 97.3 per cent of sectoral GHG emissions, with CH_4 and N_2O emissions contributing 1.4 per cent and 1.3 per cent, respectively. Within the sector, the major categories were energy industries, transport, and manufacturing industries and construction, contributing 39.8, 25.0, and 23.0 per cent, respectively. Emissions from energy use in other sectors (1.A.4) contributed 11.5 per cent of sectoral GHG emissions.

37.   Emissions are estimated and reported for practically all subcategories, except for GHGs from military fuel use and N_2O from flaring. During the review period Portugal estimated emissions from the military use of jet kerosene and included these emissions in the revised estimates for the period 1990–1995 and 2004 (see paragraph 47).

38.   Overall, the energy sector inventory is presented in a transparent manner. The NIR includes descriptions of methods used, sets of EFs and energy content values. The ERT noted, however, that the 1990 national energy balance is not provided. The ERT recommends that Portugal improve transparency in the NIR by:

(a)   Avoiding repetition by presenting common methodologies used to estimate GHG emissions from stationary combustion only once;

(b)   Organizing the fuel parameters (e.g. lower heating value, carbon content, oxidation factor and density) which are used through all subcategories into a single table;

(c)   Including (at least) the energy balance for the current year, accompanied by an explanation of the differences in the classification between the AD used for estimating emissions and the energy statistics of the national energy balance.

39.   The recalculations reported in the original 2006 submission are well explained in the NIR and the CRF. Consistent methodologies are used throughout the time series. The emission estimates have been recalculated for all years from the base year to 2003, resulting in small changes as between the 2005 and 2006 submissions. For the base year, the Party reported recalculations which result in a decrease in total sectoral emissions of 0.6 per cent. This change is dominated by the decrease in CO_2 emissions from domestic aviation and domestic navigation, associated with improvements in methods and activity data.

40.   No sector-specific QA/QC procedures are mentioned in the NIR. However, during the in-country visit the inventory team was provided with information from a study that was carried out jointly by the APA and the DGEG (see annex I). This study provides the results of a comparative assessment between plant-specific data for large point sources (i.e. data available to the APA in the context of the Large Combustion Plant Directive) and data for co-generation (available at the DGEG). In reaction to this comparative assessment, fuel consumption data for wood, wood products and diesel oil were revised and data concerning intermediate products and lower heating value were reconciled. The ERT recommends that Portugal include a summary of this study in its future submissions.

41.   Uncertainties have been assessed for all subcategories using the tier 1 approach and following the recommendations of the IPCC good practice guidance. However, the ERT noted that no use is made of the country-specific information available from the results of the comparative assessment (see paragraph 40). The ERT encourages Portugal to explore the use of country-specific information (based on the results of the comparative assessment and/or other results) for its future uncertainty analyses.

Reference and sectoral approaches

42.   In the original 2006 inventory submission, the estimates for CO_2 emissions in 1990 are 5.0 per cent higher in the reference approach than in the sectoral approach. By type of fuel, the differences are 6.5 per cent for liquid fuels and 1.5 per cent for solid fuels. The differences in energy consumption are larger, with 23.6 per cent for liquid fuels and 6.2 per cent for solid fuels. The explanations provided in the documentation box of the CRF and in the NIR focus on the different estimates for large point sources and feedstock emissions.

International bunker fuels

43.   Fuel consumption in international aviation and navigation is estimated differently in the sectoral and reference approaches. International bunker fuels in the reference approach are taken from the national energy balance which uses a definition based on the carrier's flag that is not in line with the IPCC good practice guidance. Since fuel consumption for both domestic aviation and domestic navigation is estimated in a reliable manner according to the IPCC good practice guidance, the ERT recommends that international fuel consumption estimated as suggested in paragraphs 50 and 52 below be used in both approaches. The ERT also recommends that Portugal provide the corresponding explanation in the documentation box of CRF table 1.C.

Feedstocks and non-energy use of fuels

44.	In the reference approach, the non-energy use of naphtha, lubricants, bitumen and residual fuel oil is taken into account. IPCC default values are used for the fraction of carbon stored in lubricants and bitumen, and country-specific values are used for naphtha and residual fuel oils. In the sectoral approach, the use of refinery gas for energy purposes is accounted while the emissions associated with the use of lubricants are not. The use of coal as a reducing agent in blast furnaces is accounted for in the energy sector. The ERT recommends that Portugal continue making efforts to improve the estimates of emissions from feedstock use in the sectoral approach, specifically those associated with the combustion of waste oils.

Key categories

Stationary combustion: liquid fuels, biomass – CO_2, CH_4, N_2O

45.	The ERT noted that plant-specific fuel consumption data are used to estimate part of the emissions from energy industries and manufacturing industries and construction, which can be considered as a methodological refinement according to the IPCC good practice guidance. Key issues concerning the inclusion of this type of data, namely the statistical relationship between the AD for individual plants and the whole subcategory, time-series consistency and recalculations back to 1990, are dealt with adequately. The ERT commends Portugal on its efforts to implement a system that is capable of dealing with these estimations. However, the ERT identified some opportunities for improvement. The ERT recommends the Party to:

(a)	Continue its efforts to harmonize parameters (i.e. lower heating value, CO_2 EFs, and plant-specific data versus fuel consumption from the national energy balance);

(b)	Avoid unnecessary unit conversions (i.e. from energy units to physical units to energy units);

(c)	Critically assess possible under/overestimations that may lead to bias;

(d)	Assess the consistency of the linkages between GHG inventories, annual reporting from companies and emissions trading.

The Party may also wish to consider the preparation of a background document on the use of plant-specific data in GHG inventories.

Manufacturing industries and construction : other fuels – CO_2

46.	An updated value of the CO_2 emission factor for the combustion of old tyres in the cement industry was received from the DGEG during the in-country visit. The CO_2 EF that was used to estimate these emissions in the 2006 submission is 99.8 t CO_2/TJ. The new EF reported to the DGEG by the operator of the only plant in Portugal that uses old tyres for energy purposes is 85 t CO_2/TJ. During the review period Portugal estimated these emissions using the newly reported EF and included these emissions in the revised estimates for the period 1990–1995 and 2004. For the base year, this led to a decrease in the figures of 2.9 Gg CO_2 (from 19.7 to 16.8 Gg CO_2).

Military fuel use, liquid fuels – CO_2, CH_4, N_2O

47.	Emissions from military fuel use are not included in the Portuguese national inventory. However, the energy balance under services (Serviços), which includes the military, reports the following use of fuels: liquid fuels in the period 1990–2004; city gas in the period 1990–2001; and natural gas in the period 1997–2004. During the in-country visit, the ERT recommended the Party to estimate the emissions from military fuel use. For the case of mobile combustion, the ERT also recommended the Party to make efforts to follow the IPCC good practice guidance (sections 2.4 and 2.5) concerning the

differentiation between domestic, international and multilateral operations. In the course of the review, Portugal informed the ERT that the only fuel use that has not been accounted for in the 2006 submission corresponds to the military use of jet kerosene. In response to the review, Portugal estimated these emissions using a tier 1 approach with IPCC default EFs, assuming that all jet kerosene was used for domestic purposes. The resulting emissions were included in the revised estimates for the period 1990–1995 and 2004 and, for the base year, led to an increase in the figures of 96.0 Gg CO_2 eq.

Road transportation: liquid fuels – CO_2

48. CO_2 emissions are estimated using a country-specific lower heating value and the default hydrogen : carbon ratio provided by the COPERT III model. The ERT recommends that Portugal improve the consistency of the inventory by using for each fuel the country-specific carbon content that corresponds to the country-specific lower heating value.

Non-key categories

Civil aviation: liquid fuels – CO_2, CH_4, N_2O

49.   A tier 2 approach is used to estimate emissions from civil aviation based on detailed information on arrival and departures, distance travelled, fuel consumption, landing and take-off (LTO) and other parameters. The available data allow Portugal to be mostly in line with the IPCC good practice guidance. The only information that is lacking if the inventory team is to meet all the criteria to differentiate between domestic and international trips (table 2.9) concerns the movement of passengers or cargo at intermediate stops. The ERT commends Portugal on its efforts to improve these emission estimates and recommends it to identify in its future NIRs the missing AD that would enable it to make the split between domestic and international fuel consumption.

50.   Domestic fuel consumption for jet kerosene is estimated in a reliable manner, while that for aviation gasoline has larger uncertainties; however, it has been estimated using the best available information for the period 1990–2004. For each fuel, the ERT recommends that Portugal estimate international fuel consumption as the difference between total fuel consumption reported in the energy balance and the domestic fuel consumption estimated using the tier 2 approach.

Navigation: liquid fuels – CO_2, CH_4, N_2O

51.   Domestic navigation is estimated in a way that is similar to that used for aviation using a tier 2 approach (see paragraph 49). The only information that is lacking if the inventory team is to be able to fulfil all the criteria of the IPCC good practice guidance to differentiate between domestic and international trips (table 2.8) concerns the movement of passengers or cargo at intermediate stops. The ERT commends Portugal on its efforts to improve these emission estimates and recommends it to clarify in its future NIRs which the missing AD are that would enable it to make the split between domestic and international fuel consumption.

International bunker fuels: marine, liquid fuels – CO_2, CH_4, N_2O

52.   International navigation is estimated using a tier 2 approach that is not in line with the IPCC good practice guidance. The ERT recommends that Portugal estimate international fuel consumption as the difference between total fuel consumption reported in the national energy balance and the domestic fuel consumption estimated using the tier 2 approach.

6. Industrial processes and solvent and other product use

Sector overview

53.   In the base year, emissions from the industrial processes sector amounted to 4,668.7 Gg CO_2 eq. or 7.9 per cent of Portugal's total national emissions. The dominant gas was CO_2 (86.4 per cent of

sectoral emissions), almost all of it from mineral products; it is followed by N_2O (12.1 per cent) and minor contributions of HFCs (1.1 per cent), CH_4 (0.2 per cent) and SF_6 (0.1 per cent). For CO_2 emissions the major source was cement production (77.0 per cent), followed by ammonia production (14.1 per cent) and lime production (4.4 per cent); all N_2O emissions come from nitric acid production.

54.   The reported recalculations in the original 2006 submission for the inventory year 1990 revised the estimates for CO_2 emissions related to the consumption of carbonate products by ceramic industries (+9.20 Gg CO_2 eq.) and to the production of monomers (+1.50 Gg CO_2 eq.). For 1995, emissions of HFCs have been estimated for the first time in this submission (+9.75 Gg CO_2 eq.), and SF_6 emissions have been recalculated (–1.84 Gg CO_2 eq.).

55.   Emissions from solvent and other product use are only estimated for non-methane volatile organic compounds (NMVOCs) and their CO_2 equivalent, with a share of 0.4 per cent of total base year emissions. No recalculations have been made.

56.   The NIR is fully complete and transparent, with some inconsistencies in the CRF tables, the most substantial of which were resolved during this review.

57.   Portugal has provided key category assessments for the base year using both tier 1 and tier 2 methodologies. The analysis below is based on the first case. For fluorinated gases, whose base year is 1995, the 2004 key category assessment was used.

Key categories

Cement production – CO_2

58.   This is the largest source in the industrial processes sector. Its emission estimate is based on a single EF and clinker production as activity data (tier 2). Information on these data comes from the plants. All six plants recycle all cement kiln dust (CKD) in their processes. The ERT recommends the Party to develop a country-specific lime (CaO) content in clinker and to verify the information that all CKD is in fact recycled to the process in the plants.

Ammonia production – CO_2

59.   The second-largest CO_2 source belongs to a single ammonia production plant and has an EF that is not comparable with those of other Parties because an uncommon feedstock, namely vacuum residual fuel oil (VRF), is used to produce hydrogen for the process. VRF has higher carbon content (86 per cent) than ordinary natural gas. To improve transparency, the ERT recommends that Portugal provide this clarification in its future NIRs.

Nitric acid production – N_2O

60. N_2O emissions come from three plants of the same type, with no abatement technology. The N_2O EF is derived from monitoring data from just one of these plants. This EF is in the upper range for this type of medium-pressure installation, according to the IPCC good practice guidance. The ERT commends Portugal for using plant-specific data to estimate these emissions.

Consumption of halocarbons and SF_6 – HFCs, SF_6

61.   Not significant in the base year, this category and its subcategories have the highest rates of increase in emissions, as is the general tendency among developed countries. Activity data are derived from a model, based on tier 2a.

62.   The ratios between potential and actual emissions (P : A) are very high, which indicates that there may be some overestimation of potential emissions (imports, since there is no in-country production) or underestimation of actual emissions. Some sources were underestimated due to lack of information, as was noted during the review. The Party presented corrections to minor errors that had been discovered in

some time series and noted that further important information has become available since the 2006 inventory was compiled. These modifications may lead to a smaller P : A ratio. The ERT recommended the Party to increase the coverage of these activities and improve these estimates. In the course of the review, Portugal revised the whole time series of emissions from the use of both SF_6 in electrical equipment and HFCs for refrigeration and air conditioning equipment and foam blowing. These emissions were included in the revised estimates for the inventory years 1995 and 2004. For the base year (1995), this implied increases in the figures of 41.9 Gg CO_2 eq. for the use of HFCs (from 9.7 to 51.6 Gg CO_2 eq.) and of 3.2 Gg CO_2 eq. for the use of SF_6 (from 2.8 to 6.0 Gg CO_2 eq.).

Non-key categories

Iron and steel production – CO$_2$

63.   The Party indicated that there may have been some double counting in the emissions from steel production using basic oxygen furnaces (BOFs) and electric arc furnaces (EAFs), as carbon monoxide (CO) emissions have already been accounted for in CO_2 emissions from the decarbonization of pig iron. For BOFs, the CO_2 EF used does not take account of the conversion of carbon (C) to CO_2. In addition, the activity data used to estimate emissions from BOFs and EAFs from one unit were mistakenly made equal to coke production. The ERT recommended the Party to provide the related corrections. In the course of the review, Portugal estimated these emissions using the corrected values for AD and EFs and included these emissions in the revised estimates for the period 1990–1995 and 2004. For the base year, this implied a decrease in the figures of 13.4 Gg CO_2 (from 26.7 to 13.4 Gg CO_2).

7. Agriculture

Sector overview

64.   In the base year, emissions from the agriculture sector amounted to 8,088.3 Gg CO_2 eq. and accounted for 13.7 per cent of total national GHG emissions. Between 1990 and 2004, they increased by 7.1 per cent. In 1990, CH_4 and N_2O contributed 50.1 and 49.9 per cent, respectively. Portugal identified the following key categories in its tier 2 key category analysis: N_2O from agricultural soils; CH_4 from enteric fermentation (cattle, sheep); CH_4 from manure management (swine); N_2O from manure management (solid storage); and CH_4 from rice cultivation. This is in general agreement with the secretariat's key category analysis. The ERT encourages the Party to disaggregate the category agricultural soils into subcategories for future key category analyses. In 1990, agricultural soils, enteric fermentation, manure management, rice cultivation and field burning of agricultural residues accounted for 42.5, 32.4, 21.6, 2.8 and 0.6 per cent, respectively, of sectoral emissions. Prescribed burning of savannas does not occur in Portugal.

65.   Following revisions of the activity data on livestock populations, synthetic fertilizers and manure applied to soils, revisions of methodologies for enteric fermentation and manure management, and the development of country-specific data on the shares of manure management systems, climatic zones and nitrogen (N) excretion rates, Portugal recalculated the relevant emission estimates for the whole time series for the 2006 submission. As a result of these recalculations, as compared with the 2005 submission, estimated sectoral emissions in 1990 decreased by 11.7 per cent.

66.   Portugal reports complete estimates of all gases and categories for the agriculture sector with descriptions, as recommended by the IPCC good practice guidance and the Revised 1996 IPCC Guidelines. The ERT noted that Portugal's uncertainty analysis does not account for correlated emissions in the sector. The Party may wish to consider the possibilities to account for correlated emissions (see also paragraph 32, and sections 6.3 and 6.5.4–6.5.7 of the IPCC good practice guidance).

Key categories

Enteric fermentation – CH$_4$

67.   The ERT noted that the population number for sheep in 1990 is 42.6 per cent lower than the Food and Agriculture Organization of the United Nations (FAO) data. The differences between the national inventory and the FAO data are not explained in the NIR. In the course of the review Portugal clarified that the FAO data for sheep are not based on country data and that they will be changed for the whole time series in accordance with the INE/Statistical Office of the European Communities (Eurostat) data in future. The data supplied to Eurostat are currently used for Portugal's GHG inventory. The ERT encourages the Party to provide these explanations in the NIR of its next submission.

68.   The ERT noted that the same digestibility value (60 per cent) is used for all dairy cattle. However, animals kept on pasture and in stall may have different diets. The ERT encourages the Party to carry out further work to clarify this and to revise the methodologies and parameters if appropriate for the whole time series. Portugal reports, additional to the IPCC good practice guidance and the Revised 1996 IPCC Guidelines, the subcategory rabbits, and the ERT commended it for this effort. However, the ERT noted that the AD include only the number of breeding females. In the course of the review Portugal clarified that the EF (volatile solid (VS) production per animal) was obtained from international sources (the French Institut National de la Recherche Agronomique) and refers to the production of VS per female cage in husbandry, including growing animals and males. Portugal may wish to include these clarifications in the NIR of its next submission.

Manure management – N$_2$O

69.   The ERT noted that there is no clear justification of the new country-specific N excretion rates provided in the NIR, and that these country-specific rates largely disagree with the IPCC default values. In the course of the review the Party confirmed the country-specific N excretion rate for swine and revised the N excretion rates for adult sheep and lambs – from 7.0 and 2.1 to 9.2 and 2.8 kg N/head/yr, respectively. The revision of the estimates resulted in an increase in estimated N$_2$O emissions from sheep in 1990, by 88.7 Gg CO$_2$ eq. (from 285.5 to 374.2 Gg CO$_2$ eq.). The ERT recommends the Party to explain in its next inventory submission the differences between the country-specific parameters and the default values.

Rice cultivation – CH$_4$ and field burning of agricultural residues– CH$_4$ and N$_2$O

70.   In CRF table 4.C, organic amendments applied to soils are reported as not occurring ("NO") and the scaling factor for organic amendments is not used. In CRF table 4.F, the Party reported that only 50 per cent of rice residues was burned. The ERT noted that the fate of the remaining rice residues was unclear and that Portugal might underestimate CH$_4$ emissions from rice cultivation in the base year. The ERT recommended the Party to investigate whether the practice of incorporating rice residues (or their fraction) into soils existed in Portugal in the base year and to provide estimates for CH$_4$ emissions from rice fields. In response to this recommendation the Party examined this issue and clarified that agricultural practices have changed over time in Portugal: While in the early 1990s, all rice residues were burnt, it recently became common to leave the straw on the field and incorporate it into soil by plowing. Based on these findings, the Party revised the estimates for CH$_4$ emissions from rice cultivation and provided new estimates of GHG emissions from burning of residues in rice paddies. These changes resulted in a decrease of estimated CH$_4$ emissions from rice cultivation, by 28.9 Gg CO$_2$ eq. (from 255.7 to 226.8 Gg CO$_2$ eq.), and an increase in GHG emissions from field burning of agricultural residues, by 16.8 Gg CO$_2$ eq. (from 35.4 to 52.2 Gg CO$_2$ eq.), for the base year.

Agricultural soils – N$_2$O

71.   The ERT noted that trend extrapolations were used to obtain the missing data on the consumption of synthetic fertilizers and the Frac$_{GASF}$ value for 1990. The ERT noted, however, that these trends are

not stable. During the in-country visit, the ERT recommended the Party to calculate the arithmetic mean values during the period using reliable statistical data and to use this value as an estimate for 1990. As a result of the review process, Portugal provided revised estimates for the consumption of synthetic fertilizers and $Frac_{GASF}$ which led to an increase in estimated N_2O emissions from synthetic fertilizers applied to agricultural soils in 1990, by 111.6 Gg CO_2 eq. (from 1,426.0 to 1,537.6 Gg CO_2 eq.).

72.   For the 2006 submission, the Party obtained country-specific data on the fraction of manure stored in anaerobic lagoon that was applied to soils (80 per cent). The remaining fraction (20 per cent) was not accounted for in the inventory. The ERT supported the intention of the Party to estimate N_2O emissions from this fraction for 1990 in the subcategory leaching and run-off. The revision of this estimate resulted in an increase in estimated base year N_2O emissions from leaching and run-off, by 30.8 Gg CO_2 eq. (from 1,600.0 to 1,630.8 Gg CO_2 eq.).

73.   The Party indicated that some double counting may have occurred for grape production in the subcategory crop residues left on fields in 1990. In the course of the review Portugal revised the estimate, which resulted in a decrease of estimated N_2O emissions from grape residues for the base year, by 10.1 Gg CO_2 eq. (from 10.5 to 0.4 Gg CO_2 eq.). The ERT recommends the Party to provide information on the revised estimate in the NIR and CRF of its next submission.

8. Land use, land-use change and forestry

Sector overview

74.   In 1990, the LULUCF sector was a net source of 2,592.6 Gg CO_2 eq. Since 1993 it has gradually become a net sink. The sector was a considerable source of emissions due to forest fires in 2003 (of 3,032.1 Gg CO_2 eq.). Even so, despite the 2003 forest fires, the sector returned to being a net sink in 2004, with a carbon removal of 3,536.1 Gg CO_2 eq. The largest source of emissions in 1990 was forest land, followed by settlements, cropland, wetlands and other land. Grassland is reported to be a net sink.

75.   The coverage of categories and gases is complete for the base year. However, where geographical coverage is concerned, GHG emissions and removals from the autonomous regions of Madeira and the Azores were not included in the initial 2006 submission. The ERT noted that this could lead to underestimation or overestimation of the base year emissions for the LULUCF sector. The ERT recommended that Portugal provide estimates from these two autonomous regions to complete the coverage for the whole country. In the course of the review, Portugal provided conservative estimates of emissions and removals from the autonomous regions. The addition of these estimates resulted in a decrease in estimated base year emissions for the LULUCF sector overall, of 32.0 per cent as compared with the initial 2006 submission (from 3,818.2 to 2,592.6 Gg CO_2 eq.). The ERT noted that, even with the inclusion of the net removals from the two autonomous regions, the LULUCF sector was still a net source of CO_2 in 1990. The ERT recommends that Portugal include these estimates in its future submissions.

76.   The ERT noted that recalculations made in the 2006 submission have been very useful in increasing the accuracy and transparency of the inventory. They include the improvement of the estimates for the changes in carbon stocks in forest land, where below-ground biomass has been accounted for (previously only carbon stock changes from above-ground biomass were estimated). Portugal has also improved its calculation of annual losses due to wildfires by taking into account the fraction of the biomass that is not affected by disturbance (a tier 3 approach). The recalculations in 2006 resulted in a 37.0 per cent decrease in the estimates of GHG emissions in the LULUCF sector compared with the 2005 submission.

77.   Portugal identified the following key categories, based on tier 1 and tier 2 approaches: CO_2 emissions/removals from forest land; CH_4 emissions from forest land; CO_2 emissions/removals from cropland; and CO_2 emissions/removals from land converted to settlements.

Key categories

Forest land – CO$_2$

78.   The 1990–2004 values of the IEFs for net C stock change in living biomass, from land converted to forest land, (12.56 Mg C/ha) and in soils, from cropland converted to forest land (11.23 Mg C/ha), are the highest of all reporting Parties. These high values are not justified or explained in the NIR. The ERT noted that this could lead to possible underestimation of the base year emissions from the LULUCF sector and consequently of the assigned amount (since the LULUCF sector in the base year was a net source). During the in-country visit, the ERT recommended Portugal to check the methodology and parameters used in estimating the changes in C stocks in living biomass and soils, in order to justify the high value of the IEF for the whole time series and to avoid the potential problems that would affect the base year estimates. In the course of the review, Portugal informed the ERT that the problem lies in reporting the annual area converted to forest land. In response to a recommendation by the ERT, Portugal revised the area converted to forest land (from 9.80 kha to 137.17 kha) in CRF table 5.A, with unchanged net emissions/removal from this subcategory (see also footnote 1). Portugal clarified that the problem did not affect the reported emission estimates.

Cropland – CO$_2$, N$_2$O

79.   N$_2$O emissions from disturbance associated with land-use conversion to cropland (e.g. forest land converted to cropland) have not been estimated in the 2006 submission. The ERT noted that this could lead to underestimation of base year emissions for the LULUCF sector. In the course of the review, Portugal provided an estimate for N$_2$O emissions from the conversion of forest land to cropland. The resulting emissions were included in the revised estimates for the period 1990–1995 and 2004. For the base year, the new estimate implied an increase in total national emissions of 24.2 Gg CO$_2$ eq.

80.   The ERT also noted the absence of an estimate of CO$_2$ emissions from agricultural lime application, which could lead to underestimation of the base year emissions for the LULUCF sector. Portugal informed the ERT that data to estimate these emissions are not available and that it will make efforts to estimate them in its future submissions.

Settlements – CO$_2$

81.   The 1990–2004 value for the IEF for the net C stock change in soils for forest land converted to settlements (–69.9 Mg C/ha) is the lowest of all reporting Parties. This low value is not justified or explained in the NIR. The ERT noted that this could lead to possible overestimation of the base year emissions for LULUCF sector and consequently of the assigned amount (since the LULUCF sector in the base year was a net source). The ERT recommended Portugal to review the methodology applied and the parameters used in estimating the changes in C stocks in soils, in order to justify the low value of the IEF for the whole time series. In the course of the review Portugal stated that that the problem lies in reporting annual area converted to settlements. In October 2007, Portugal submitted a revised GHG inventory for the period 1990–1995 and 2004, with corrected annual area, and assured the ERT that the correction did not affect the total emission estimates reported (see also footnote 1).

9. Waste

Sector overview

82.   In the base year, the waste sector accounted for 10.0 per cent of total national emissions. Within the sector, CH$_4$ from solid waste disposal on land and CH$_4$ and N$_2$O from wastewater handling contributed 51.2 per cent, 41.2 per cent and 7.5 per cent, respectively. In 2004, sectoral emissions were 7.9 per cent above the 1990 level. The ERT noted that the reporting for the waste sector is generally complete, with minor gaps due to the lack of statistics on composting. The methodologies and emission factors are transparently described; however, the transparency of the reporting of AD could be improved.

83.   Recalculations were made for the waste sector in 2005 and all categories were recalculated following recommendations by a previous review with revised estimates of CH_4 and N_2O from solid waste disposal on land and wastewater handling. Sector-specific QA/QC procedures have not been implemented. Uncertainties have been calculated for all emissions and are high for all categories. During the in-country review, host country experts informed the ERT that several improvements are forthcoming, including the metering of gas flared and recovered from solid waste disposal on land, and a new survey and database for wastewater management.

Key categories

Solid waste disposal on land – CH$_4$

84.   The methodologies used correspond to tier 2 of the IPCC good practice guidance. The emission factors used are IPCC defaults. An issue was identified during the review regarding the use of the value for DOC_F of the Revised 1996 IPCC Guidelines (0.77) instead of the value recommended by the IPCC good practice guidance (0.6). The activity data are appropriate even though they are based to a great extent on estimates. During the review process, Portugal submitted revised estimates which resolved this concern, resulting in a decrease in the emission estimates, of 859.2 Gg CO_2 eq. (from 3,891.8 to 3,032.6 Gg CO_2 eq.).

Wastewater handling – CH$_4$

85.   For domestic and commercial wastewater handling, Portugal has used projections to estimate the emissions for the period 2000–2004, taking into account the effects of population increases and technological changes. The ERT recommends the Party to improve the method by using country-specific parameters for biochemical oxygen demand (BOD) associated parameters (fraction of BOD that readily settles and FTA, the fraction of BOD in sludge that degrades) using available surveys and estimates.

86.   For industrial wastewater handling, there is a lack of transparency because the method used is not consistent with the IPCC good practice guidance. During the review process, Portugal reviewed the methodology applied in this category and improved the transparency of its reporting. In response to a question raised by the ERT, Portugal revised the activity data time series and the chemical oxygen demand (COD) coefficients, focusing on the six industries with major potential for wastewater CH_4 emissions, resulting in a decrease in estimated CH_4 emissions of 15.1 per cent (from 1,632.2 to 1,385.8 Gg CO_2 eq.) compared to the estimates reported in the 2006 submission.

Wastewater handling – N$_2$O

87.   For N_2O from industrial wastewater treatment, emissions have been calculated based on an inhabitants-equivalent basis, instead of comprehensive data on wastewater characteristics. The ERT encourages Portugal to improve its information about the characteristics of wastewater. In the course of the review, Portugal revised the values for wastewater output and COD coefficients (see paragraph 86), resulting in a decrease in estimated N_2O emissions of 2.6 per cent (from 580.4 to 565.2 Gg CO_2 eq.) compared with the estimates reported in the 2006 submission.

Non-key categories

Wastewater handling – N$_2$O

88.   For N_2O from human sewage, Portugal has used a variable EF for the period 1990–2004, reflecting the changes in dietary protein consumption. However, Portugal has used the default EF for sewage discharged to rivers and estuaries even though it only discharges to estuaries. The ERT recommends Portugal to apply the values according to both protein consumption and place of discharge.

Other – CO$_2$, CH$_4$ and N$_2$O

89.   A small amount of industrial solid waste is treated by open burning. Portugal included this category following the recommendation from previous reviews that it should report these emissions not under waste incineration but under solid waste disposal on land – other (6.A.3). Portugal, however, has preferred to report it under the category other (6.D). The dominant GHG under this category is N$_2$O. The ERT recommends Portugal to report these emissions according to the previous recommendation.

C. Calculation of the assigned amount

90.   The assigned amount pursuant to Article 3, paragraphs 7 and 8, has been calculated in accordance with the annex to decision 13/CMP.1.

91.   Portugal's base year is 1990 and the Party has chosen 1995 as its base year for HFCs, PFCs and SF$_6$. Portugal's quantified emission limitation is 92 per cent as included in Annex B to the Kyoto Protocol. As Portugal is part of the European Community, whose member States will meet their reduction commitment jointly in accordance with Article 4 of the Kyoto Protocol, Portugal's quantified emission limitation is 127 per cent. Portugal's assigned amount is calculated based on the Party's Article 4 commitment.

92.   Land-use change and forestry constituted a net source of GHG emissions in 1990. In accordance with decision 13/CMP.1, Portugal's GHG emissions from deforestation (all emissions by sources minus removals by sinks reported in relation to the conversion of forests) were included in the total base year emissions for the purpose of the calculation of the assigned amount. In 1990, these emissions amounted to 981.2 Gg CO$_2$ eq.

93.   Based on Portugal's original estimate of base year emissions, including emissions from deforestation – 60,938.032 Gg CO$_2$ eq. – and its Kyoto Protocol target (+27 per cent), the Party calculated its assigned amount to be 386,956,503 tonnes CO$_2$ eq.

94.   In response to inventory issues identified during the review, the Party submitted revised estimates of its base year inventory, which resulted in a recalculation of the assigned amount. Based on the revised estimates for Portugal's base year emissions, including emissions from deforestation – 60,147.642 Gg CO$_2$ eq. – the Party calculates its assigned amount to be 381,937,527 tonnes CO$_2$ eq. The ERT agrees with this figure.

D. Calculation of the commitment period reserve

95.   The calculation of the required level of the commitment period reserve is in accordance with paragraph 6 of the annex to decision 11/CMP.1.

96.   Based on its original calculated assigned amount – 386,956,503 tonnes CO$_2$ eq. – Portugal calculated its commitment period reserve to be 348,260,853 tonnes CO$_2$ eq.

97.   In response to inventory issues identified during the review the Party submitted revised estimates of its base year inventory, which resulted in a recalculation of the commitment period reserve. Based on the revised estimates, the Party calculates its commitment period reserve to be 343,743,774 tonnes CO$_2$ eq.. The ERT agrees with this figure.

E. National registry

98.   Portugal has provided all the information on the national registry system required by the reporting guidelines under Article 7, paragraphs 1 and 2, of the Kyoto Protocol (decision 15/CMP.1). The information provided is broadly transparent and in accordance with the requirements of the UNFCCC reporting guidelines. However, the ERT noted that some of the information is not clearly indicated in the initial report, for example, conformity with the United Nations data exchange standards (DES),

procedures to minimize discrepancies, and disaster management. The ERT recommends that Portugal provide more detailed information in its next inventory report under the Kyoto Protocol.

99.   Table 5 summarizes the information on the mandatory reporting elements on the national registry system, as stipulated by decisions 13/CMP.1 and 15/CMP.1, which describes how its national system performs the functions defined in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1.

100.   During the initial review, the ERT was provided with additional and updated information on the national registry of Portugal. The national registry is administered by the APA. To fulfil its obligations, the APA has constituted a team for setting up, operating and maintaining the national registry. Since 2004, a significant part of this effort has been outsourced to an IT company (eChiron). In 2006, Portugal decided to change its registry software from Seringas v2.9.5 (CDC, France) to CR v1.1 (an open-source product for European Union (EU) member States from Trasys, Belgium). A test version of this software product has been undergoing tests by eChiron since early May 2007. Test results were not made available to the ERT.

101.   During the review visit to Lisbon, the ERT visited one of the data centres (run by Portuguese Telecom) at which the servers hosting the national registry are located. Host country representatives informed the ERT that connectivity and interoperability tests with the international transaction log (ITL) were expected to be completed by 15 September 2007. The initialization process was completed by 8 October 2007 and the registry is ready for full operation with the ITL. Information on the national registry will become publicly available at <https://rple.iambiente.pt>.

102.   The ERT was also informed about the procedures and security measures in place to minimize discrepancies, terminate transactions and correct problems, and minimize operator error. These procedures and security measures include the use of a secure sockets layer (SSL) digital certificate that provides authentication and encryption power for secure online transactions, strict confidentiality agreements with the registry administrators, well defined business rules to ensure a common and tested way of maintaining the registry, and application manuals and support documentation. The ERT acknowledged the security measures that were implemented for the already existing registry of Portugal under the EU emissions trading scheme (ETS). The ERT noted that Portugal attaches high importance, and allocates sufficient resources, to the development, operation and maintenance of the national registry under the Kyoto Protocol.

Table 5. Summary of information on the national registry system

Reporting element	Provided/ referenced	Comments
Registry administrator		
Name and contact information	Yes	
Cooperation with other Parties in a consolidated system		
Names of other Parties with which Portugal cooperates	Yes	During the review, the Party clarified that no such cooperation exists.
Database structure and capacity of the national registry		
Description of the database structure	Yes	
Description of the capacity of the national registry	Yes	
Conformity with data exchange standards (DES)		
Description of how the national registry conforms to the technical DES between registry systems	Yes	Covered in the independent assessment report (IAR)[a]
Procedures for minimizing and handling of discrepancies		
Description of the procedures employed in the national registry to minimize discrepancies in the transaction of Kyoto Protocol units	Yes	
Description of the steps taken to terminate transactions where a discrepancy is notified and to correct problems in the event of a failure to terminate the transaction	Yes	
Prevention of unauthorized manipulations and operator error		
An overview of security measures employed in the national registry to prevent unauthorized manipulations and to prevent operator error	Yes	
An overview of how these measures are kept up to date	Yes	
User interface of the national registry		
A list of the information publicly accessible by means of the user interface to the national registry	Yes	
The Internet address of the interface to Portugal's national registry	Yes	
Integrity of data storage and recovery		
A description of measures taken to safeguard, maintain and recover data in order to ensure the integrity of data storage and the recovery of registry services in the event of a disaster	Yes	
Test results		
The results of any test procedures that might be available or developed with the aim of testing the performance, procedures and security measures of the national registry undertaken pursuant to the provisions of decision 19/CP.7 relating to the technical standards for data exchange between registry systems.	Yes	

[a] Pursuant to decision 16/CP.10, the administrator of the international transaction log (ITL), once registry systems become operational, is requested to facilitate an interactive exercise, including with experts from Parties to the Kyoto Protocol not included in Annex I to the Convention, demonstrating the functioning of the ITL with other registry systems. The results of this exercise will be included in an independent assessment report (IAR). They will also be included in the annual report to the CMP.

103.   The ERT took note of the results of the technical assessment of the national registry, including the results of standardized testing, as reported in the independent assessment report (IAR) that was forwarded to the ERT by the administrator of the ITL, pursuant to decision 16/CP.10, on 24 October 2007.

104.   The ERT reiterated the main findings of this report, including that the registry has fulfilled all of its obligations regarding conformity with the DES. These obligations include having adequate transaction procedures; adequate security measures to prevent and resolve unauthorized manipulations; and adequate measures for data storage and registry recovery.

105.   Based on the results of the technical assessment, as reported in the IAR, the ERT concluded that Portugal's national registry is fully compliant with the registry requirements as defined by decisions 13/CMP.1 and 5/CMP.1, noting that registries do not have obligations regarding operational performance or public availability of information prior to the operational phase.

F. Land use, land-use change and forestry parameters and election of activities

106.   Table 6 shows the Party's choice of parameters for forest definition as well as elections for Article 3, paragraphs 3 and 4, activities in accordance with decision 16/CMP.1.

Table 6. Selection of LULUCF parameters

Parameters for forest definition		
Minimum tree cover	10%	
Minimum land area	1.0 ha	
Minimum tree height	5 m	
Elections for Article 3, paragraphs 3 and 4, activities		
Article 3, paragraph 3 activities	**Election**	**Accounting period**
Afforestation and reforestation	Mandatory	Commitment period
Deforestation	Mandatory	Commitment period
Article 3, paragraph 4 activities		
Forest land management	Elected	Commitment period
Cropland management	Elected	Commitment period
Grazing land management	Elected	Commitment period
Revegetation	Not elected	Not applicable

107.   The parameters chosen for the definition of forest are within the agreed values in decision 16/CMP.1. Portugal states in the initial report that the threshold value selected for minimum area (1 hectare) is higher than the value used for reporting to the FAO, which is 0.5 hectare. The value selected corresponds to the most detailed information available from the national mapping of land-use and forest areas for 1990.

III. Conclusions and recommendations

A. Conclusions

108.   The expert review team concluded that the information provided by Portugal in the initial report and during the review process is complete and in accordance with the relevant provisions of the annex to decision 13/CMP.1, relevant elements of section I of the annex to decision 15/CMP.1, and other relevant decisions of the CMP; that the assigned amount pursuant to Article 3, paragraphs 7 and 8, has been calculated in accordance with the annex to decision 13/CMP.1, and is consistent with the revised inventory estimates as submitted and reviewed; that the calculation of the required level of the commitment period reserve is in accordance with paragraph 6 of the annex to decision 11/CMP.1, and is consistent with the revised inventory estimates as submitted and reviewed; and that the LULUCF definitions are within the agreed range.

109.   Portugal has in place a national system in accordance with the guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol, contained in decision 19/CMP.1. This includes a single national entity, associated institutional arrangements and procedures for official approval of the inventory, a QA/QC plan, a working archive system, processes for collecting data and developing

estimates, the identification of key categories, and processes for making recalculations to improve the inventory.

110.   Portugal's greenhouse gas inventory is largely complete and has been compiled in accordance with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The inventory is functionally complete for the base year; some source/sink categories have been identified as not estimated. The omission of these will not lead to overestimation of base year emissions and is therefore conservative.

111.   Based on Portugal's base year emissions (60,147.642 Gg CO_2 eq., including the revised estimates provided in the energy, industrial processes, agriculture, LULUCF and waste sectors) and its Kyoto Protocol target (127 per cent) the Party calculates its assigned amount to be 381,937,527 tonnes CO_2 eq. Portugal calculates its commitment period reserve to be 343,743,774 tonnes CO_2 eq. The ERT agrees with these figures.

112.   Portugal's choice of the parameters to define forest (minimum tree cover: 10 per cent; minimum land area: 1.0 hectare; minimum tree height: 5 metres) are in accordance with decision 16/CMP.1. Portugal has elected to account for forest, cropland and grazing land management activities under Article 3, paragraph 4, of the Kyoto Protocol. It has elected commitment period accounting for the activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

113.   Based on the results of the in-country review visit and the technical assessment, as reported in the independent assessment report, the ERT concluded that Portugal's national registry is fully compliant with the registry requirements as defined by decisions 13/CMP.1 and 5/CMP.1.

B. Recommendations

114.   In the course of the review, the ERT formulated a number of recommendations relating to the completeness and transparency of Portugal's information presented in the initial report. The key recommendations[6] are that Portugal:

(a)   Provide more transparency in the NIR on the description of methodologies, especially for country-specific methods, paying particular attention to the task of centralized review teams that will need to make conclusions on the basis of the NIR text;

(b)   Further strengthen the implementation of its QA/QC plan at all the agencies involved in the preparation of the inventory, include specific QC information in all the sectoral chapters of the NIR, and develop a plan for review by independent national experts;

(c)   Reduce the size of the NIR, deleting all information concerning air pollutants which are not part of the Convention or the Kyoto Protocol.

115.   Portugal responded to the identification of potential problems during the review by providing additional information and revising its estimates. The ERT noted that during the review Portugal provided timely and thorough replies to all questions concerning potential problems.

116.   The ERT believes that in future reviews of the national system the following topics should be examined in depth:

(a)   Improvements in the NIR's descriptions of methodological, data and reporting choices, in order to improve transparency;

(b)   Progress in implementing Portugal's QA/QC plan;

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[6] For a complete list of recommendations, the relevant sections of this report should be consulted.

    (c)   Progress in developing the integrated system for archiving and managing all the information required for the preparation of the inventory;

    (d)   Progress in implementing a tier 2 uncertainty analysis.

C. Questions of implementation

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

Annex I

Documents and information used during the review

A. Reference documents

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories,
2000. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

IPCC. Good practice guidance for land use, land-use change and forestry, 2003. Available at
<http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

IPCC/OECD/IEA. Revised 1996 IPCC Guidelines for national greenhouse gas inventories, volumes 1–3,
1997. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

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the Convention, Part I: UNFCCC reporting guidelines on annual inventories. FCCC/SBSTA/2004/8.
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Protocol. FCCC/KP/CMP/2005/8/Add.2. Available at
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Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

UNFCCC secretariat. Status report for Portugal. 2006. Available at
<http://unfccc.int/resource/docs/2006/asr/prt.pdf>.

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2006. FCCC/WEB/SAI/2006. Available at <http://unfccc.int/resource/webdocs/sai/2006.pdf>.

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submitted in the year 2005. FCCC/ARR/2005/PRT. Available at
<http://unfccc.int/resource/docs/2006/arr/prt.pdf>.

UNFCCC secretariat. Portugal: Independent assessment report of the national registry of Portugal.
Reg_IAR_PT_2007_1. Will be available at <http://www.unfccc.int>.

B. Additional information provided by the Party

Responses to questions during the review were received from several national experts and coordinated by Ms. Teresa Pereira (APA), including additional material on the methodology and assumptions used.

Auditoria Ambiental. 2004. Análisa do Inventário para a Estimativa das Emissões Antropogénicas e Remoção por Sumidouros de Poluentes Atmosféricos. [QA study.]

Directorate-General for Energy and Geology (DGEG), Directorate-General for Energy Statistical Division. 2003. *Energy in Portugal, the 1990s.* Study conducted in the framework of a grant agreement awarded by the European Community (Eurostat file no. 200245501003), April.

EcoProgresso. 2004. *Concepção do Sistema Nacional de Inventário de Emissões por Fontes e Remoção por Sumidouros de Poluentes Atmosféricos – SNIERPA – Volume I, II and III.* Agosto. [On the QA/QC system.]

EcoProgresso. 2004. *Relatório de Progresso do programma de Desenvolvimento Metodológico.* Agosto. [Methodological Development Plan (PDM).]

EcoProgresso. 2005. *Aplicação de procedimentos de CO_2 ao INERPA de 2005.* [On the tier 2 QC procedures.]

EcoProgresso. 2007. *Aplicação de Procedimentos de Controllo de Qualidade de Nível 2 ao INERPA 2007.* [On the tier 2 QC procedures.]

EcoProgresso. 2007. *Relatório de Progresso.*

Listas de Verificação de Controllo de Qualidade da Informação: recebida, estimada, arquivada. [QC tier 1 checklists].

Memorandums of Working Group SNIERPA (GT SNIERPA).

Portuguese Environment Agency (APA) and Directorate-General for Energy and Geology (DGEG). Results of a comparative assessment between plant-specific data for large point sources and data for co-generation.

Presidência do Conselho de Ministros. 2005. Resoluçao do Conselho de Ministros N. 68/2005.

Annex II

Acronyms and abbreviations

AD	activity data		IPCC	Intergovernmental Panel on Climate Change
APA	Portuguese Environment Agency		IT	information technology
BOD	biochemical oxygen demand		ITL	international transaction log
C	carbon		kg	kilogram (1 kg = 1 thousand grams)
CH_4	methane		kgoe	kilograms of oil equivalent
CITL	community independent transaction log (European Community)		LTO	landing and take-off
CMP	Conference of the Parties serving as the Meeting of the Parties		LULUCF	land use, land-use change and forestry
CO_2	carbon dioxide		m^3	cubic metre
CO_2 eq.	carbon dioxide equivalent		MCF	methane correction factor
COD	chemical oxygen demand		Mg	megagram (1 Mg = 1 tonne)
CPR	commitment period reserve		Mt	million tonnes
CRF	common reporting format		Mtoe	millions of tonnes of oil equivalent
DES	data exchange standards		N	nitrogen
DGEG	Directorate-General for Energy and Geology		N_2O	nitrous oxide
DOC_F	degradable organic carbon fraction		NA	not applicable
EF	emission factor		NCV	net calorific value
ERT	expert review team		NE	not estimated
EU	European Union		NIR	national inventory report
FAO	Food and Agriculture Organization of the United Nations		NMVOC	non-methane volatile organic compound
FOD	first order decay		NO	not occurring
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF		PDM	Methodological Development Plan
			PFCs	perfluorocarbons
			PM10	Particulate matter, max diameter: 10 micrometre
GJ	gigajoule (1 GJ = 10^9 joule)		QA/QC	quality assurance/quality control
HFCs	hydrofluorocarbons		SF_6	sulphur hexafluoride
IAR	independent assessment report		SWDS	solid waste disposal site
IE	included elsewhere		Tg	teragram (1 Tg = 1 million tonnes)
IEA	International Energy Agency		TJ	terajoule (1 TJ = 10^{12} joule)
IEF	implied emission factor		UNFCCC	United Nations Framework Convention on Climate Change
INE	National Statistics Institute			

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