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PORTUGAL

REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY SUBMITTED IN THE YEAR 2004[1]

EXECUTIVE SUMMARY

1. This report covers the in-country review of the 2004 greenhouse gas (GHG) inventory submission of Portugal, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8 of the Conference of the Parties. The review took place from 27 September to 1 October 2004 in Lisbon, Portugal, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Mr. Audun Rosland (Norway), Energy – Mr. Manfred Ritter (Austria), Industrial Processes – Ms. Lisa Hanle (United States), Agriculture – Mr. Paul Duffy (Ireland), Land-use Change and Forestry – Mr. Hector Ginzo (Argentina), Waste – Mr. Carlos Lopez (Cuba). Mr. Rosland and Mr. Lopez were the lead reviewers. The review was coordinated by Ms. Rocio Lichte and Ms. Jenny Wong (UNFCCC secretariat).

2. In accordance with the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Annex I Parties", 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.

3. In the year 2002, the most important greenhouse gas in Portugal was carbon dioxide (CO_2), contributing 82.7 per cent to total[2] national greenhouse gas emissions expressed in CO_2 equivalent, followed by methane (CH_4) – 9.8 per cent – and nitrous oxide (N_2O) – 7.4 per cent. Hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.07 per cent of the overall greenhouse gas emissions in the country. The Energy sector accounted for 77.9 per cent of total GHG emissions followed by Agriculture (9.9 per cent), Industrial Processes and Solvent and Other Product Use (7.3 per cent) and Waste (4.9 per cent).

4. Total greenhouse gas emissions (excluding Land-use Change and Forestry) in 2002 amounted to 81,584 Gg CO_2 equivalent and increased by 41 per cent from 1990 to 2002. Tables 1 and 2 provide data on emissions by gas and by sector from 1990 to 2002. Over the period 1990–2002, CO_2 emissions increased by 52.9 per cent, mainly by increased emissions from energy industry and transport. CH_4 emissions decreased during the same period 1.0 per cent mainly due to reduced emissions from agriculture. This reduction compensated the increased CH_4 emissions from energy and waste. N_2O emissions increased 5.4 per cent over the same period mainly due to increased emissions from road traffic. Emissions from HFCs increased from 0.23 Gg CO_2 equivalent in 1996 to 49 Gg CO_2 equivalent in 2002 (corresponding to an increase of 21,289 per cent), and emissions of SF_6 increased by 50.3 per cent between 1995 and 2002. For perflurocarbons (PFCs), Portugal does not report estimates of emissions.

[1] In the symbol for this document, 2004 refers to the year in which the inventory was submitted, and not to the year of publication.

[2] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding Land-use Change and Forestry, unless otherwise specified.

Table 1. Greenhouse gas emissions by gas, 1990–2002

GHG emissions	Gg CO_2 equivalent													Change from 1990–2002 %
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
CO_2 (with LUCF)[a]	49,703	50,332	53,186	51,313	51,626	54,392	50,545	53,424	56,795	63,999	62,593	63,484	65,858	32.5
CO_2 (without LUCF)	44,130	46,009	50,139	48,546	49,792	53,518	50,564	53,531	57,900	64,433	63,843	64,365	67,464	52.9
CH_4	8,450	8,812	8,262	8,005	8,170	8,645	8,420	8,421	8,789	9,016	8,584	8,226	8,365	–1.0
N_2O	5,782	5,755	5,469	5,312	5,542	5,727	5,841	5,744	5,782	6,224	5,870	6,012	6,097	5.4
HFCs	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.9	6.0	12.5	23.6	36.7	49.0	21,289
PFCs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	–
SF_6	0.0	0.0	0.0	0.0	0.0	4.7	4.8	5.0	5.1	5.6	6.1	6.5	7.0	50.3
Total (with CO_2 from LUCF)	63,935	64,899	66,916	64,631	65,338	68,769	64,810	67,595	71,377	79,257	77,076	77,765	80,376	25.72
Total (without CO_2 from LUCF)	58,362	60,576	63,870	61,863	63,504	67,895	64,830	67,702	72,483	79,692	78,327	78,646	81,982	40.47

[a] LUCF = Land-use Change and Forestry

Table 2. Greenhouse gas emissions by sector, 1990–2002

GHG source and sink categories	Gg CO_2 equivalent													Change from 1990–2002 %
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
Energy	41,093	43,010	47,384	45,773	46,393	49,522	46,878	49,221	53,299	60,589	59,710	59,947	63,549	54.6
Industrial Processes	4,479	4,427	4,195	4,030	4,838	5,555	5,301	5,951	6,157	5,816	5,619	6,072	5,651	26.2
Solvent Use	222	236	244	236	253	256	276	286	291	286	293	305	313	40.8
Agriculture	8,711	8,641	8,182	7,919	8,075	8,062	8,116	8,002	8,112	8,300	8,110	8,098	8,068	–7.4
LUCF[a]	6,058	5,089	3,289	2,913	1,916	1,409	167	–37	–755	–245	–832	–604	–1,208	–119.9
Waste	3,371	3,494	3,622	3,760	3,862	3,965	4,073	4,173	4,273	4,511	4,175	3,948	4,003	18.8
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	–

[a] LUCF = Land-use Change and Forestry

5. In general the expert review team found Portugal's national inventory to be complete. The inventory covers all years from 1990 to 2002 and all six direct GHGs CO_2, CH_4, N_2O, HFCs, PFCs and SF_6. Estimates on the indirect GHGs carbon monoxide (CO), nitrogen oxides (NO_X), non-methane volatile organic compounds (NMVOCs) and sulphur oxides (SOx) were also provided. However, some source categories are not included, the most important are: CO_2 Emissions and Removals from Soils (5.D), CO_2 from Asphalt Roofing, N_2O from Solvent and Other Product Use, fluorinated gases (F-gases) from Fire Extinguishers and Semiconductors, potential emissions of F-gases and CH_4 emissions from industrial sludge management (under 6.B). Furthermore, Forest and Grassland Conversion (5.B) and Abandonment of Managed Lands (5.C) were not reported individually, but their corresponding data were partly included under the Changes in Forest and Other Woody Biomass Stocks (5.A) category.

6. Portugal, in preparing its national GHG inventory, followed mostly the requirements of the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC Guidelines) and the UNFCCC reporting guidelines. The *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) was applied to the extent it was possible, but steps are taken to introduce in the short term the most important aspects still not implemented. Furthermore, the expert review team recommends Portugal to submit the national inventory report 2005 in time by 15 April together with the common reporting format tables.

7. In general the expert review team finds the national inventory report and the common reporting format both transparent and comprehensive. The national inventory report 2004 represents a significant improvement compared to the previous national inventory report. Description of methodologies and related underlying assumptions used were provided in easily understood terms as were disaggregated emission factors. However, the expert review team has identified some areas where the national inventory report outline could be revised to increase the transparency further and to improve the documentation of underlying assumptions and data. For example, the expert review team recommends Portugal to include a specific sub-chapter on "feedstocks and non-energy use of fuels", as well as a chapter on the comparison between the reference and the sectoral approach and a chapter giving an overview of the recalculations. Further the expert review team noticed the need to improve the documentation of the expert judgments and large point source data.

8. Recalculations have been carried out for all sectors and have resulted in a reduction in the emission trend from 1990 to 2001, excluding Land-use Change and Forestry, and an increase in the CO_2 removals trend in Land-use Change and Forestry. The rationale for these recalculations is provided in the national inventory report and the expert review team found the recalculations sufficiently justified. The expert review team believes the recalculations have significantly improved Portugal's inventory.

9. Quantitative uncertainty estimates were not provided, but a study has been implemented in 2004. The expert review team recommends Portugal to use results from this study in its next key source analysis and to use the study to prioritize further improvements of the GHG inventory as part of the quality assurance/quality control procedures and plans. However, Portugal does not yet have a formal quality assurance/quality control plan and procedure in place in accordance with the IPCC good practice guidance. However, a number of informal quality control checks and reviews are in place and are documented in the national inventory report. The expert review team also believes that the work underway to develop a Methodological Development Plan to establish the National System as required under the Kyoto Protocol provides a good basis for a formal quality assurance/quality control plan.

10. The expert review team believes Portugal has established a well functional institutional arrangement for its GHG inventory, in which the Institute for the Environment's key and centralized role presumably will secure the consistency with regard to methodology. However, the activity data collection is decentralized to a number of different institutions and can lead to inconsistency in e.g. the time-series, if specific attention is not paid to harmonize and verify the activity data.

11. All sectors are comprehensively covered and appropriate methods were generally followed, however the expert review team noted some areas for improvements, such as:

(a) The CO_2 emission factor for solid fuels used in the iron and steel subsector is identified to be higher than for any other reporting Parties. The expert review team found this high emission factor questionable and recommends Portugal to reconsider the use of the data obtained from the operator for deriving the emission factor, in particular the values given for the net calorific value. However, this correction would not affect the final emission estimates from this source (see paragraph 59). Further, the expert review team believes that the CO_2 emissions from use of gasoline in road transport are overestimated, due to the addition of evaporative emissions. In the year 1990 this overestimation could amount to about 0.5 million tones of CO_2 and Portugal indicated that it will correct these calculations for its next submission;

(b) Currently a number of source categories of halocarbons and SF_6 consumption are not estimated, or are only partially estimated. Portugal is encouraged to consider alternative methods for collecting activity data for this category in order to ensure completeness. The expert review team also encourages Portugal to estimate potential emissions of halocarbons and SF_6;

(c) Portugal estimates of CH_4 emissions from enteric fermentation include all livestock categories. However, national livestock statistics do not include temporary animals

(lambs) since the survey takes place in the month of December and thus gives lower estimates for the CH_4 emissions for sheep. The Party intends to look into this issue with its Ministry of Agriculture and the National Statistical Institute;

(d) As regards the Land-use Change and Forestry sector, the expert review team recommends Portugal to enhance transparency and completeness of the present GHG emissions and removals estimations and to include estimates for the two autonomous regions of Madeira and Azores Islands;

(e) The expert review team encourages Portugal to continue working in the estimation and determination of solid waste composition and also to perform an analysis of values used for the parameters of first-order decay method and to adjust them, if it is possible, to the IPCC good practice guidance recommendations.

I. OVERVIEW

A. Inventory submission and other sources of information

12. In its 2004 submission, Portugal submitted a complete set of common reporting format (CRF) tables for the years 1990–2002. The CRF tables were submitted on 14 April 2004. The national inventory report (NIR) was submitted on 17 August 2004.

13. During the review Portugal provided the expert review team (ERT) with additional information sources. These documents are not part of the inventory submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in annex 1 to this report.

B. Key sources

14. Portugal has transparently reported a key source tier 1 analysis, both level and trend assessment, combined with a qualitative assessment, as part of its 2004 submission. This key source analysis was based on a more disaggregated categorization of sources than the analysis prepared by the secretariat.[3] Such a disaggregated approach could result in some source categories "falling out" or on the other hand to give a too great focus on relatively small sources. The ERT did not detect any specific omissions of key sources, with one possible exception with regard to lime production (see paragraph 16 below); however, it encourages Portugal in future to revise the level of disaggregation in its key source analysis in order to enhance its usefulness for prioritizing methodological improvements. During the review Portugal informed the ERT that it wishes to revise the level of category aggregation in the key source analysis in its next submission.

15. In addition to a tier 1 key source analysis, Portugal has used a qualitative approach. This qualitative assessment includes a consideration of uncertainties and hence defines those categories of emissions that presumably are most uncertain as key sources, for example, the F-gases. The ERT recommends Portugal, according to the IPCC good practice guidance, to include other qualitative criteria as well, for instance, to take account of mitigation techniques and technologies introduced or planned, or expected high growth or reductions of emissions. Further, the ERT recommends Portugal to implement a tier 2 key source approach. Portugal informed the ERT that it plans to include a tier 2 approach for its key source analysis in the future. However, the timing of this will depend on the outcome of the uncertainty quantification study (see paragraph 30 below).

[3] The secretariat had identified, for each individual Party, those source categories which are key sources in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. Key sources according to the tier 1 trend assessment were also identified for those Parties providing a full CRF for the year 1990. Where the Party has performed a key source analysis, the key sources presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key source assessment conducted by the secretariat.

16. The ERT believes that Portugal should consider whether lime production, which is currently not reported separately in the CRF, is a key source.

C. Cross-cutting topics

Completeness

17. In general the Portuguese inventory is complete: it covers all years from 1990 to 2002 and all six GHGs (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6) as required by the UNFCCC reporting guidelines. The NIR and the CRF also include the indirect GHGs – CO, NO_X and NMVOCs as well as SO_x – and the NIR includes information on other pollutants covered by the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP) such as ammonia (NH_3), particulate matter and some heavy metals.

18. Some source categories are not included in the inventory, the most important being, CO_2 from Asphalt Roofing, N_2O from Solvent and Other Product Use, F-gases from Fire Extinguishers and Semiconductors, potential emissions of F-gases, and CO_2 Emissions and Removals from Soils. For categories 5.B Forest and Grassland Conversion and 5.C Abandonment of Managed Lands, even though reported as "not estimated" ("NE") in the CRF, emissions and removals are partly estimated and included under category 5.A.

19. In general the inventory covers emissions from the whole Portuguese territory, that is, the mainland of Portugal and the two autonomous regions of Madeira and the Azores Islands. However, the Land-use Change and Forestry (LUCF) sector does not include emissions and removals from the two autonomous regions.

20. The ERT did not find any major inconsistencies between the CRF and the NIR. In general, notation keys are also used consistently throughout the CRF tables. However, zero ("0") is frequently reported where notation keys should be used. Portugal explained that "0" generally means "not occurring" ("NO") but can in some cases represent emissions of less than 0.5 Gg. This inconsistency is a consequence of the way data are transferred automatically from the original databases to the CRF. The ERT recommends that Portugal use the correct notation key where "NO" would be correct in its next submission; and, in cases where "0" represents emissions of less than 0.5 Gg, Portugal should report all decimals in the CRF, as required by the UNFCCC reporting guidelines.

Transparency

21. In general the ERT finds the NIR and the CRF both transparent and comprehensive. The 2004 NIR represents a significant improvement compared to the previous NIR. However, the ERT has identified a few areas where the NIR outline could be revised to increase the transparency of the inventory further and where the documentation of underlying assumptions and data could be improved: see the following paragraphs.

22. The NIR includes information on pollutants covered by the CLRTAP such as SO_x, NMVOCs, NO_X, CO, NH_3, particulate matter and some heavy metals. With regard to those gases that are not covered under the UNFCCC (NH_3, particulate matter and heavy metals), the NIR would be more transparent and its volume would be reduced if these gases were not included. An exception could be made for the Agriculture sector, where the methodology for estimating NH_3 is normally linked to the calculation of N_2O. With regard to the indirect GHGs (NMVOCs, NO_X, CO and SO_x) much of the information could be regarded as too detailed for UNFCCC reporting, and hence details such as emission factors (EFs) and activity data (AD) could preferably be included in an annex or moved to the end of each chapter. During the review Portugal explained that it plans to include the CLRTAP gases in a separate report or annex/chapter in the future.

23. The NIR does not include a specific sub-chapter on feedstocks and non-energy use of fuels or a comparison between the reference and the sectoral approach, as recommended in the NIR outline of the

UNFCCC reporting guidelines. To increase the transparency of the inventory the ERT recommends Portugal to include such sub-chapters in its next submission.

24. Recalculations are presented for each source category. However, in accordance with the NIR outline given in the UNFCCC reporting guidelines, there should be a separate chapter giving an overview of the recalculations. Portugal informed the ERT that it plans to include a separate chapter that describes all recalculations in its next submission.

25. In some chapters, for example, the Chemical industry and Agriculture sections, the descriptions of the methodology used for individual subcategories are difficult to follow and hence not fully transparent, since the different steps involved in the methodologies and the descriptions of the EFs and AD used are distributed over several sub-chapters. The ERT recommends that Portugal present the different steps of the methodologies in accordance with the NIR outline given in the UNFCCC reporting guidelines. Some details on EFs could in this regard preferably be placed in annexes. Portugal informed the ERT that it will consider this issue in its next submission.

26. Most of the underlying assumptions and rationales for choices of data, methods and other inventory parameters are well documented either in the NIR itself or in Excel sheets, reports and so on that Portugal made available for the ERT during the review. However, the ERT noticed that data obtained from expert judgements and large point sources (LPS) could be more comprehensively and transparently documented and justified, taking into account any possible confidentiality issues.

27. The ERT did not identify any significant confidentiality issues that prevented it from reviewing the inventory properly.

Recalculations and time-series consistency

28. The ERT noted that the recalculations reported by the Party of the time series 1990–2001 had been undertaken to take into account improvements to methodology, AD and EFs and the inclusion of source categories not included in previous submissions. All five main IPCC sectors have been subject to recalculations. The major changes concern stationary combustion in manufacturing industries and construction; fugitive CH_4 emissions; N_2O emission from transport, manure management, agricultural soils and LUCF; and CH_4 emissions from landfills. The rationale for these recalculations is provided in the NIR and the ERT found the recalculations sufficiently justified. In general the ERT believes that the recalculations have resulted in a significant improvement of the inventory.

29. The effect of the recalculations for the year 1990 (as reported in the CRF tables) was a decrease of 5.8 per cent in the estimates of total CO_2 equivalent emissions excluding LUCF and 4.1 per cent if LUCF is included. With regard to the trend, the recalculations have resulted in a reduction in the trend from 1990 to 2001 from an increase of 36.4 per cent (reported in the 2003 submission) to an increase of 34.8 per cent, excluding LUCF.

Uncertainties

30. Portugal has not yet provided quantitative uncertainty estimates. However, qualitative uncertainty estimates are provided in table 7 of the CRF. During the review Portugal informed the ERT that an uncertainty quantification is under study using tier 1 analysis. The results from this study will probably be included in the 2005 submission.

31. The ERT recommends Portugal to use the results from this uncertainty study in its next key source analysis and to use the uncertainty study to prioritize further improvements of the GHG inventory as part of its quality assurance/quality control (QA/QC) procedures and plans.

32. Portugal's qualitative uncertainty estimates in table 7 of the CRF are based on expert judgement. These expert judgements seem to assign a too high quality to some of the sources categories. In particular, the "high quality" assigned to the estimates of CH_4 and N_2O from transport and the "medium quality" assigned the estimates of N_2O from agriculture seem to be "optimistic" compared to the

uncertainties reported by many other Parties. The ERT recommends that Portugal revise some of the most "optimistic" judgements of its qualitative uncertainty estimates. Portugal informed the ERT that it plans to revise the qualitative uncertainty estimates in table 7 of the CRF.

Verification and quality assurance/quality control approaches

33. Currently Portugal does not have a formal QA/QC plan and procedure in place in accordance with the IPCC good practice guidance. However, a number of informal QC checks and reviews (including internal) are in place and are documented in the NIR. These activities include accuracy checks on data acquired and estimated, the documentation of methodologies, EFs and other factors, the detection of reporting errors, adequate archiving and reporting, and documentation of recalculations, and they can be regarded to some extent as quality control procedures.

34. During the review Portugal presented work under way to develop a Methodological Development Plan (MDP) within the framework of the establishment of the National Inventory System (SNIERPA) as required under the Kyoto Protocol. This MDP will provide a very good basis for the establishment of a formal QA/QC plan. The ERT was particularly pleased to see that Portugal intends to establish comprehensive procedures for independent quality assurance as well as a legal basis for SNIERPA.

35. The ERT identified the need to improve the review of information and data from LPS and emission estimates based on expert judgements (see paragraph 26). When developing the QA/QC plan, the ERT recommends that Portugal pay specific attention to procedures for QA/QC on data obtained from LPS.

Institutional arrangements

36. During the in-country visit, Portugal explained the institutional arrangements for preparation of the inventory. The Institute for the Environment (Instituto do Ambiente, IA) has overall responsibility for the national inventory and performs the annual calculation of emissions and inventory reporting. Many institutions and agencies contribute to the inventory process by providing AD, expert judgement in particular sectors, technical support and comments. These institutions and agencies include the General Directorate for Geology and Energy (DGGE), the National Statistical Institute (INE), the Road Institute (IEP), the Ministry of Agriculture, Rural Development and Fisheries (Ministério da Agricultura, Desenvolvimento Rural e Pescas, MADRP), the General Directorate for Forest Resources (DGRF), the National Institute for Waste (INR) and National Institute for Water (INAG), the General Directorate for Health/Ministry of Health, the General Directorate for Enterprises/Industry (DGE), the Ministry of Public Works, Transports and Communications (MOPTC), and industrial associations.

37. The ERT believes that Portugal has established a well functioning institutional arrangement for its GHG inventory, where the Institute for the Environment has a key role. This centralized inventory arrangement will presumably ensure consistency across sectors with regard to methodology and selection of EFs.

38. However, the collection of AD is decentralized to a number of different institutions and this can lead to inconsistency, for example, in the time series, if specific attention is not paid to harmonizing and verifying the AD. The Institute for the Environment has no legal instruments to oblige the different institutions to supply the AD needed for the calculation of emissions. The collection of data is based instead on agreements and common understanding. This lack of legal instruments appears to have posed a challenge for Portugal in acquiring a full time series of AD for several source categories.

39. The Institute for the Environment is also responsible for the inventorying and reporting of pollutants under the CLRTAP and the National Emission Ceilings (NEC) Directive. The ERT regards this institutional arrangement as an advantage because it helps to harmonize the emission inventories and reporting to the UNFCCC and the CLRTAP, and it is probably also cost-effective for Portugal to combine the two reporting requirements.

Record keeping and archiving

40. Portugal has a centralized archiving system. The information received from the various data suppliers as well as the calculations of emissions are stored. Backing-up is done periodically by the system manager in accordance with the Institute for the Environment's internal procedures. When major changes are made to methodology and EFs, older spreadsheets are frozen and work restarts on copies of those spreadsheets, which make clear reference to the period when they were used. Data reported annually, such as the CRF tables, are stored in both paper and electronic format.

41. In general the ERT regards Portugal's current archiving system as satisfactory and able to support the development of the QA/QC system.

Follow-up to previous reviews

42. The 2004 NIR represents a significant improvement compared to the previous NIR and has taken into account many of the issues that were addressed in last year's individual review report, such as transparency and completeness, as well as improvements with regard to choice of methodology and data collection for many source categories. However, some matters are still pending, as identified in the subsection on areas for further improvement below.

D. Areas for further improvement

Identified by the Party

43. The NIR identifies several areas for improvement. In the NIR Portugal highlights the work under way to establish the National Inventory System (SNIERPA) and the MDP. In this context, Portugal will develop a formal QA/QC plan.

Identified by the ERT

44. The ERT identifies the following cross-cutting issues for improvement, some of which are already planned by the Party. Portugal should:

(a) Provide quantified uncertainty estimates;

(b) Set up a QA/QC management system;

(c) Carry out a tier 2 key source analysis;

(d) Include more qualitative criteria in the key source analysis, for instance, to take account of mitigation measures introduced or planned and high expected growth or reduction in emissions;

(e) Include estimates for the LUCF sector for the two autonomous regions of Madeira and the Azores Islands;

(f) Improve transparency by revising the NIR outline according to the UNFCCC reporting guidelines; and

(g) Submit the NIR of future submissions by 15 April together with the CRF tables.

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

II. ENERGY

A. Sector overview

46. In the year 2002, energy-related activities accounted for 78 per cent of total national GHG emissions. Energy industries and transportation were the main sources of this sector, with 30 per cent and 25 per cent, respectively, of total emissions in 2002. The third-largest source is manufacturing industries and construction, with 12 per cent of total national GHG emissions in 2002. All these sources show considerable increases since 1990.

Completeness

47. The CRF includes estimates of all gases and sources of emissions from the Energy sector, as recommended by the IPCC Guidelines. The NIR gives complete coverage of the methodology for estimating fuel combustion and fugitive emissions.

Transparency

48. In general the NIR is transparent in describing the methodology, the AD and the EFs used. However, the way in which the information provided by operators is used is only described in general terms. The ERT recommends that Portugal describe the procedure followed in including operators' figures in the NIR.

49. The EFs used are a mix taken from the IPCC Guidelines, the IPCC good practice guidance, the EMEP/ CORINAIR Emission Factor Handbook and the US EPA AP-42. They are presented in source-specific tables in the NIR, but it is not possible to identify the sources for individual EFs. For transparency, the ERT recommends that Portugal document the sources of the individual EFs presented in the NIR.

Recalculations and time-series consistency

50. The recalculations include revisions caused by the acquisition of new energy and production data, revised EFs (mainly from new data from operators), methodological changes for industrial processes and fugitive emissions, and a complete revision of the methodology in the Transport sector. The recalculations have resulted in increases in the estimates for the year 1990 of +1.4 per cent for CO_2, +11 per cent for CH_4, and +3 per cent for N_2O. The main change in absolute terms is in category 1.A.2 for CO_2 (+12 per cent). These recalculations have improved the accuracy of the estimates and are well documented.

B. Reference and sectoral approaches

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

51. CO_2 emissions from fuel combustion have been calculated using the reference approach and the sectoral approach. For the year 2002, there is a difference of 6.85 per cent in the CO_2 emission estimates between the reference approach and sectoral approach. Over the period 1990–2002 the difference between the two approaches ranges from 1.23 per cent to 9.99 per cent. Explanations are provided in the documentation box of CRF table 1.A(c) but no further explanation is given in the NIR. The CRF documentation box states that the difference is partly caused by AD taken from industry, but it is not clear whether it is the reference approach data or the sectoral approach data that are taken from industry. This also seems to be inconsistent with the information given in the NIR, which states that consumption data from point sources were subtracted from the sectoral data in the national energy balance but gives no further explanation as to how this might influence the difference between reference and sectoral approach. The ERT encourages Portugal to include a chapter in the Energy sector of the NIR on the comparison between the sectoral and the reference approach, and in particular to clarify how the difference is influenced by data from operators, and the accounting for feedstocks, and to the extent possible, explain the difference to International Energy Agency (IEA) data.

52. The apparent consumption of energy in the Portuguese CRF tables differs from that reported to the IEA by a value close to 3 per cent on average between 1990 and 2001 (it was 3.7 per cent in 2001). The main component that accounts for this difference is the differences in the reporting of liquid fuels, which accounted for more than 70 per cent to total apparent consumption. Exports of naphtha are missing from the CRF in 1997 and exceeded the IEA figure by half (by more than 4,000 TJ) in 1993. Petroleum coke imports since 1998 differ considerably between the CRF and the IEA data. All figures given for natural gas in the CRF tables are given in gross calorific values (GCVs) rather than net calorific vales (NCVs) in order to follow the national energy balance. Emissions, however, are estimated in NCVs, leading to differences between the sectoral and the reference approach. The Party explained that the reference approach and the sectoral approach follow the format of the national energy balance supplemented by additional operator information collected from energy and industrial plants. Some intermediate products such as fuel gas used in the petrochemical industry may not be included in the IEA database, and the separation of bunker fuels between domestic and international is done differently by the IEA. The DGGE reports the data requested by the IEA/OECD/Eurostat joint questionnaire each year but is generally not aware how the IEA processes the data submitted. The ERT encourages Portugal to include a section in the NIR that explains and possibly quantifies the differences between the data submitted in the IEA/OECD/Eurostat joint questionnaire and the energy balance data used for the CRF.

International bunker fuels

53. The split between domestic and international bunker emissions from aviation has been extensively improved using individual origin and destination of flights from and to Portugal. To split domestic and international flights, information from national airlines from the year 2001 is used for all other airlines and all years. This results in a share of 17 per cent of domestic aviation, which has been used for all years. The Party explained that this estimate was intended as a rough first estimate and that it would be improved in future by accounting for capacity and additional years. The aim is to present a tier 2 estimate within the next few years. The ERT compliments Portugal on the improvements made and encourages the further improvements it outlines.

Feedstocks and non-energy use of fuels

54. The data on fuel used as feedstocks have been revised following recommendations from the institution responsible for the national energy balance (the DGGE). Corresponding fuel use is accounted for in the Industrial Processes sector for ammonia, black carbon and ethylene. The distribution to these sectors and the fuel consumption remaining in sector 1.A.2c Chemicals were explained during the review as being based on a model using data from operators to split the amount of fuel oil and naphtha given in the national energy balance for feedstock use that result in CO_2 emissions. The model was explained during the review but is not included in the NIR. The ERT encourages Portugal to include a chapter in the NIR explaining the methodology used to account for feedstocks.

C. Key sources

1.A.1a Public electricity and heat production

55. In this sector a tier 2 bottom–up methodology using a mix of EFs from IPCC/CORINAIR/AP-42, supplemented with AD from information obtained from operators and the DGGE, has been applied. The NIR states that the choice was made such in a way as to best reflect national circumstances; however, individual EFs are not referenced. The ERT recommends that references to the EFs and the rationale for the choice be given individually in the NIR.

56. The EF for geothermic energy is 500 t CO_2/GWh prior to 1994 and 737–782 thereafter (1994–1999). Portugal explained during the review that this is caused by the existence of two operating units, one of which only started in 1994. The ERT recommends that this information be included in the NIR.

1.A.1b Petroleum refining

57. In CRF table 1.A(a) only liquid fuels are reported for petroleum refining. However, figure 3.10 in the NIR also refers to gas consumed in this sector. The Party explained that the figure refers to fuel gas derived from liquid fuel and is therefore included under liquid fuels in the CRF. The ERT recommends that this information be included in the NIR.

1.A.1c Manufacture of solid fuels and other energy industries

58. AD coke gas consumption in coquerie for the period 1991–1994 are taken from information obtained from industry operators. Coke production and total coke gas consumption are available from 1990 to 2001 (DGGE). The Party explained that consumption for other years is estimated on the basis of the relation of coke oven gas consumption in coquerie to total coke oven gas consumption over the years 1991–1994 as obtained from the national energy balance. No references for the NCVs used for coke oven gas, extraction of coal and town gas are given. The ERT encourages Portugal to document the references for the NCVs and to describe the model used to establish the time series in the NIR.

1.A.2a Iron and steel

59. The CO_2 implied emission factor (IEF) values for solid fuels in this subsector for the period 1990–2001 (182–249 t/TJ) have been identified as being the highest of all reporting Parties. This results from the EF for blast furnace gas used in the inventory, which is comparatively high (298 kg CO_2/GJ). The Party explained that the data were obtained directly from the operator and presented the report in question to the ERT. The information about the NCV of blast furnace gas is considered questionable but the installation closed down in 2002 and further investigation is no longer possible. The questionable NCV has, however, not been used for the calculation of the emissions, that being based solely on the information on the composition of the gas given by the operator. The ERT suggested that the Party use NCVs from the national energy balance in the CRF and a derived EF (226 Kg CO_2/GJ), which would bringing the IEF within the range of other reporting Parties without altering the emissions estimates.

1.A.2b Non-ferrous metals

60. No information (data or notation keys) except "0" are reported for 1.A.2.b Non-ferrous Metals. The Party explained that these emissions are now reported in 1.A.2f. The zero values appear to be due to automatic collection of data. The ERT encourages Portugal to replace these zero values by the corresponding notation key in the next submission.

1.A.3a Civil aviation

61. The EFs presented for landing and take-off (LTO) movements per aircraft type in the NIR (tables 3.78 and 3.79) are substantially lower than the IPCC default values. The Party explained that CORINAIR and EPA EFs were used for LTO. The difference is explained by the fact that the IPCC default figures are designed for a mix of bigger aircrafts, whereas the Portuguese EF also takes into account smaller aircrafts with lower LTO EFs. The ERT encourages Portugal to document this in the NIR.

1.A.3b Road transportation

62. The CO_2 IEF from gasoline decreases continuously by about 0.2–0.3 per cent per year. Over the period 1990–2002 it decreased by 2.7 per cent. This is the largest decrease among reporting Parties. In addition, the CO_2 IEF values for gasoline for 1990–2002 (74.3–76.4) have been identified as being the highest among reporting Parties (except for the year 2002). The decreasing trend is caused by a reduction in non-CO_2 emissions (evaporative emissions, mainly NMVOCs from cold-start emissions) which have been converted to CO_2 and added to the CO_2 emissions calculated by using the national EF for gasoline (66.3 tonnes CO_2 per TJ). The value and trend of the CO_2 IEF follow the reduction of cold start emissions over the years due to the introduction of end-of-pipe technology (catalysts). However, ultimate CO_2 emissions from gasoline are not changing over time. The Party recognizes that adding evaporative emissions in this way has led to overestimation of the base year (1990) emissions (by about 0.5 million

tonnes of CO_2) and will correct the underlying model calculation for the next submission, that is, it will only use the national CO_2 EFs to calculate CO_2 and remove the evaporative emissions from the calculation of CO_2.

63. Total natural gas consumption from transport and corresponding CO_2 emissions show some very large inter-annual variations – for consumption, a 863 per cent increase between 1996 and 1997; a 162 per cent increase between 1990 and 1991; a 146 per cent increase between 1994 and 1995; and a 523 per cent increase between 1995 and 1996. Additionally, the N_2O IEF values for natural gas (5.5–5.7) for 1990–2002 appear very high when compared with those of other reporting Parties. For most years of the time series they are the highest among reporting Parties. The Party explained that this consumption has been wrongly labelled and will be renamed liquefied petroleum gas (LPG) consumption for the next submission. LPG fuel was introduced only recently. Its use has been promoted during the past decade, and this is the reason for the steep increase in usage. The ERT recommends that these changes be made in the next NIR.

1.A.3.d Navigation

64. The CO_2 IEF values for 1990–2002 for gas and diesel oil show inter-annual fluctuations from a 0.7 per cent decrease to a 0.9 per cent increase. They are among the higher values of reporting Parties. The ERT recommends that Portugal further investigate the reasons for the trend and document the results in the NIR.

1.A.4b Other sectors: Residential

65. Military aviation is correctly included under national aviation. It is, however, unclear where military transport (non-aviation) has been accounted for. The Party explained that the allocation for the underlying fuel consumption within the national energy balance is not known. The ERT recommends that Portugal investigate this and document it in the NIR.

66. The NIR does not distinguish between different boiler technologies in the Residential sector. The Party explained that these data would in principle be available but only from an outdated survey. The ERT recognizes that this would not change the estimates of CO_2 emissions but encourages Portugal to include a technology split as far as possible with the available data.

67. The CRF reports refinery gas in the Residential sector. The Party explained during the review that this was wrongly labelled. The ERT encourages Portugal to rename it town gas and keep it within the Liquid Fuel category for the whole time series.

68. NCVs are taken from the national energy balance with the exception of that for natural gas, which is taken from information submitted by the gas supplier. The national energy balance gives a GCV that differs from what would be expected from the NCV:GCV ratio. The ERT encourages Portugal to investigate the reasons for this and document them in the NIR.

D. Areas for further improvement

Identified by the Party

69. Portugal identified a number of improvements for the Energy sector. These include in particular

(a) Increased use of data obtained from operators available through national and European Union-wide reporting requirements such as under the EU Large Combustions Plant Directive, EPER and Auto-control;

(b) Increased use of sector-specific methodologies and EFs; and

(c) Further improvements in the Transport sector, such as including vehicle ageing and maintenance in the model calculation.

70. The ERT encourages Portugal to carry out the improvements identified in the NIR.

Identified by the ERT

71. Additional to the further improvements identified by the Party, the ERT recommends that Portugal:

(a) Extend its referencing of the EFs used in the inventory;

(b) Extend the documentation on the comparison between the reference and the sectoral approach by adding a consideration of the differences between the national energy balance and the national IEA/OECD/Eurostat joint questionnaire data; and

(c) Include documentation on feedstocks.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

72. In the year 2002, the Industrial Processes sector accounted for 6.9 per cent of total national CO_2 equivalent emissions and Solvent and Other Product Use for 0.4 per cent. CO_2 emissions represented 88 per cent of Industrial Process emissions (with cement production and ammonia production accounting for 60 and 30 per cent of CO_2 emissions, respectively). N_2O emissions accounted for 10 per cent of Industrial Process emissions (with nitric acid production being responsible for slightly less than 100 per cent of those emissions). The remaining 2 per cent of emissions from the sector were primarily emissions of HFCs in refrigeration and air conditioning, and foam blowing. From 1990 to 2002 emissions from the sector increased by 26 per cent. CO_2 emissions increased by 27 per cent over this period. CO_2 emissions from Solvent and Other Product Use increased by 41 per cent from 1990 to 2002.

73. In addition to the key sources identified by the secretariat for the sector (cement, ammonia and nitric acid production), Portugal also identified glass production as a key source category. The Party also identified HFC emissions from refrigeration and air conditioning and foam blowing, and SF_6 emissions from electrical equipment, as key sources using qualitative criteria.

Completeness

74. The CRF includes estimates of most gases and sources of emissions from the Industrial Processes sector, as recommended by the IPCC Guidelines. Not included are potential emissions for HFCs, PFCs and SF_6. Actual emissions of PFCs have not been estimated, while only partial estimates of actual emissions of HFCs have been provided for a number of source categories. Emissions have not been estimated for asphalt roofing, fire extinguishers and semiconductors, as well as N_2O emissions from Solvent and Other Product Use. Although aerosols are reported as "not occurring" (NO) for HFCs and PFCs because these do not occur from domestic aerosol use, this does not apply for emissions from imported aerosols which are not estimated. The Party assumes, however, that emissions from these aerosols are not significant. Portugal is encouraged to provide estimates for these source categories. It is suggested that Portugal include a clear discussion of the AD and EFs adopted in the NIR, along with sources of documentation for the data.

75. Portugal has indicated that, in addition to using national statistics, it intends to collect an additional amount of data directly from LPS. The ERT encourages the use of LPS data and believes that these data can be useful in QA/QC activities.

Transparency

76. Transparency could be enhanced by following the recommended structure for the NIR outlined in the UNFCCC reporting guidelines. For example, in the chemical industry a number of source categories are discussed, but it is not transparent which emissions estimation methodology was followed for each of them. Portugal is encouraged to outline the methodology followed for each source category and discuss

how emission factors were obtained (e.g., whether they are default EFs or were obtained from expert judgement, monitoring, etc.). Throughout the sector, all sources of data should be documented, including assumptions made by expert judgement.

Recalculations and time-series consistency

77. Recalculations of the 2001 data have led to an 11 per cent increase in the estimates of emissions in the Industrial Processes sector for that year. The greater part of this increase was due to a revision of AD in the chemical industry. In the previous submission, AD were held constant for a number of source categories, including ammonia production and nitric acid production. In the current submission, these AD have been revised using survey data, which constitutes an important improvement. Activity data are still presumed constant for some source categories (e.g., ferroalloys and refrigeration and air conditioning) and Portugal is encouraged to recalculate these estimates in future submissions based on actual AD to ensure time-series consistency.

78. The most important issue affecting time-series consistency in the Industrial Processes and Solvent and Other Product Use sectors is the fact that two different surveys have been used for AD for a majority of the sources. The surveys, covering 1990–1991 and 1992–2000, are based on different levels of establishment aggregation and different economic classifications. It is difficult to assess whether the use of the two different surveys impacts on the trend in emission estimates. Furthermore, for some source categories, AD for 2001–2002 are provisionally based on extrapolation. Portugal is encouraged to follow the IPCC good practice guidance related to methodological choice and recalculation in these sectors to help ensure time-series consistency.

B. Key sources

Cement production – CO_2

79. Although Portugal indicates in the CRF that it bases its estimates of these emissions on cement production, this is an error, and in practice the Party is following the IPCC good practice guidance by implementing a tier 2 approach based on clinker production. The ERT welcomes Portugal's efforts to collect data directly from the industrial plants. Portugal currently does not estimate emissions from cement kiln dust (CKD), assuming that all CKD is recycled. It is encouraged to examine this assumption further to ensure that it reflects national circumstances. If Portugal is able, as it intends, to develop a better knowledge of lime (CaO) content in the country, this would lead to even more accurate estimates.

Glass production – CO_2

80. There is minimal methodological guidance in the IPCC Guidelines or the good practice guidance for this source category. The most accurate methodology for estimating emissions from glass production might be based on estimating emissions from the carbonate input. On the basis of the available data, Portugal separates different types of glass production and uses appropriate default EFs. Some of its methodological choices introduce uncertainty into the estimates for this source category. They include the use of different data sources for the time series, assumptions regarding the conversion of glass products from area to mass (e.g., m^2 to kg), and the assumption that no recycled glass is used in glass production. Portugal is encouraged to consider these issues in its future submissions.

Ammonia production – CO_2

81. After discussion with the Portuguese experts it appears that the Party is following the IPCC tier 2 good practice guidance, basing its estimates of emissions on feedstock consumption (vacuum residual fuel oil). This source category, however, was difficult to assess and the Party is encouraged to consider the following suggestions to improve the transparency of its emission estimation methods. Portugal indicates in the NIR and the CRF that its estimates of emissions are based on ammonia production; however, they were in fact based on feedstock use. Activity data for the feedstock use are only available until 1994, after which time an estimate is made based on the relationship between ammonia production and

feedstock use. The ERT encourages Portugal to update the AD for this source category. The difficulty in assessing this source category is also the result of the overall structure of category 2.B in Portugal's NIR. Portugal is encouraged to reorganize the structure of this discussion in accordance with the UNFCCC reporting guidelines.

Nitric acid production – N_2O

82. Portugal has introduced a number of major improvements to this source category, including updating the AD time series and revising the EF to take into consideration plant-specific data. These improvements have reduced the uncertainty of the national estimates. Nevertheless, emissions from nitric acid production have not been fully developed in accordance with the IPCC good practice guidance. According to the good practice guidance, Portugal should account for the types of N_2O emissions abatement technology employed at each facility, along with the utilization of these technologies. Furthermore, it is suggested that Portugal consider each nitric acid plant, rather than inferring an emissions estimate from data from only one plant.

Consumption of halocarbons and SF_6 – HFCs, PFCs, and SF_6

83. No significant changes to this source category have occurred since the last inventory submission. Portugal does not estimate potential emissions or PFC emissions for any source category. The ERT encourages Portugal to estimate potential emissions, allowing for the comparison of potential/actual emissions among Parties and over time, and to estimate PFC emissions where applicable. Furthermore, a number of source categories are not estimated or only partially estimated. Portugal is encouraged to consider alternative methods for collecting AD for this category in order to ensure completeness.

84. Following qualitative criteria, Portugal has identified refrigeration and air conditioning and electrical equipment as key sources following qualitative criteria. As recommended by the IPCC good practice guidance, a tier 2 methodology is followed, but only partially. Portugal is encouraged to fully separate emissions from assembly, operation and disposal for each sub-source category. Where AD have been held constant over a period, it is suggested that the Party attempt to identify ways to collect this data or fill in missing years, taking into consideration the IPCC good practice guidance. With respect to electrical equipment specifically, Portugal is encouraged to investigate the EFs used for assembly, operation and disposal.

C. Non-key sources

Lime production – CO_2

85. The ERT welcomes the inclusion of emission estimates for lime production for the first time in the NIR and looks forward to seeing them included in the CRF in future submissions (the estimate is currently only given in a highly aggregated manner). From the NIR it appears that dolomitic lime is not produced in Portugal. However, upon further discussion with the inventory team it was determined that dolomitic lime is in fact produced. Because of lack of AD the IPCC default for different lime types was assumed. Portugal is encouraged to document this assumption. Further, emissions from non-marketed lime production may be currently either not estimated or allocated to the wrong source category. Portugal is encouraged to investigate this further.

Limestone and dolomite use – CO_2

86. The ERT welcomes the updating of the AD time series, as well as the EFs, for this source category. Portugal is encouraged to discuss further the quantity of different types of carbonate consumed, including dolomite, in the NIR. The ERT also noted that Portugal includes consumption of limestone by the iron and steel industry in that source category. It is suggested that it include these emissions from carbonates used as a flux under Limestone and Dolomite Use. It is also suggested that Portugal investigate the consumption of carbonates further to determine whether emissions for this source category may be currently underestimated.

Solvent and other product use – CO_2

87. Portugal has introduced a number of methodological and data improvements for this sector that have increased transparency and improved the estimates of emissions. Portugal does not estimate N_2O from product use because data are not available. Portugal is encouraged to include estimates for this source in future inventory submissions.

D. Areas for further improvement

Identified by the Party

88. Portugal has identified a number of general areas for future improvement, including the updating of the time series and the use of LPS data. Specific areas for improvement identified by Portugal include further investigation of carbonate use in the mineral industry; the consumption of feedstocks in industrial processes; sources of HFCs, PFCs and SF_6 currently not estimated (e.g., industrial refrigeration, fire extinguishers, aerosols, solvents and foams); the revision of AD for consumption of halocarbons and SF_6 (e.g., commercial refrigeration and mobile air conditioning); and the revision of default factors for the F-gases.

Identified by the ERT

89. In addition to the source-specific recommendations above, the ERT provides more general recommendations, as follows. Because of the number of source categories and gases included in the Industrial Processes and Solvent and Other Product Use sectors, transparency in these sections would be enhanced by adherence to the NIR structure outlined in the UNFCCC reporting guidelines. Transparency would be further enhanced by clearly referencing the methodologies followed and data sources used, including where expert judgement has been sought. QA/QC procedures are very important for these sectors, particularly when acquiring data directly from facilities. The ERT welcomes the overall plan for QA/QC outlined by the Party and looks forward to seeing it applied to the inventory in future submissions.

IV. AGRICULTURE

A. Sector overview

90. In the year 1990, GHG emissions from the Agriculture sector were estimated to be 8,711Gg CO_2 equivalent. By 2002, they had decreased by 7 per cent to 8,068 Gg CO_2 equivalent. The share of emissions from the sector in total national GHG emissions also fell, from 14.9 per cent in 1990 to 9.9 per cent in 2002.

91. In 2002, CH_4 accounted for 51.5 per cent and N_2O for 48.5 per cent of total emissions from the sector. Enteric fermentation accounted for 31.2 per cent, manure management for 30.9 per cent and agricultural soils for 35.2 per cent of total agricultural emissions. The remaining 2.7 per cent were from rice cultivation and burning of crop residues.

Completeness

92. The CRF includes estimates of most gases and sources of emissions from the Agriculture sector, as recommended by the IPCC Guidelines, except for the cultivation of histosols and the application of sewage sludge to agricultural soils in category 4.D. During the review the ERT agreed with the Party that no cultivation of histosols occurs in Portugal and this will be reported accordingly as "NO" in future submissions. The ERT recommends that the Party find appropriate data to estimate emissions from the application of sewage sludge.

Transparency

93. The NIR is well structured and generally transparent. The ERT, however, recommends that chapters be organized by IPCC categories rather than by GHGs, following the structure outlined in annex I to the UNFCCC reporting guidelines (e.g. as regards category 4.B Manure management, both

CH_4 and N_2O emissions should be addressed in one chapter). Information on animal manures and amounts of nitrogen (N) tabulated in the NIR should be used in filling in the tables in the CRF.

94. The NIR would benefit from a more detailed discussion of expert judgements and assumptions on manure management practices. The ERT recommends that the Party tabulate the derivation of country-specific EFs, according to the good practice guidance equation used, in the NIR or in an appendix to the report.

Recalculations and time-series consistency

95. Portugal has carried out substantial recalculations of its emissions estimates from agricultural sources since its last submission. These recalculations have reduced the estimates by approximately 30 per cent consistently across the time series, with little effect on trend. The main sources of recalculations are in manure management and indirect emissions from agricultural soils.

96. The reasons for these recalculations are well documented in each source sector of the NIR. It is the view of the ERT that the Party has improved its estimates of emissions from these sources, as recommended in previous reviews, and that the methodology now used corresponds more closely with the IPCC good practice guidance.

B. Key sources

Enteric fermentation – CH_4

97. Portugal uses a tier 1 methodology for estimating CH_4 emissions from enteric fermentation for all livestock categories, together with country-specific and default EFs.

98. Livestock data are collected by the National Statistics Institute (INE). However, livestock surveys take place in December, and consequently the number of individuals of some species whose breeding is seasonal, such as sheep, could be lower than national annual averages due to the possible exclusion of temporary animals. This may also explain the considerable differences between the data in the Portuguese national inventory and those published by the Food and Agriculture Organization of the United Nations (FAO). The Party states in its NIR that it intends to look into this issue with its Ministry of Agriculture and the INE. This issue was also identified in the previous centralized review.

99. Since CH_4 from enteric fermentation is a key source, the ERT encourages the Party to adopt a tier 2 approach with an enhanced livestock characterization for cattle (dairy and non-dairy) and possibly sheep, depending on the outcome of the investigation into sheep numbers. The ERT welcomes the Party's intention to move to tier 2 as soon as country-specific data become available.

Manure management – CH_4

100. Portugal uses a tier 2 methodology along with country-specific and default EFs in estimating CH_4 emissions from manure management.

101. Country-specific manure excretion rates and the allocation of wastes to the different manure management systems are identified as the reasons why the Party's IEFs for most animal species differ from the IPCC defaults. The derivation of these EFs is well explained in the NIR, but the report would benefit if these EFs were tabulated in the format of the IPCC good practice guidance equation 4.17.

102. In adopting the Ministry of Agriculture's allocations of manure to different management systems (Seixas et al., 2000), the Party inherited an error of an over-allocation of swine manure to take into account the small percentage of swine kept outdoors. The Party agreed to correct this minor error in its next submission.

103. The ERT encourages Portugal to separate livestock according to different climatic regions and to estimate emissions using the appropriate methane conversion factors (MCFs).

Manure management – N_2O

104. Portugal uses a tier 2 methodology for estimating N_2O emissions from manure management together with country-specific and default EFs. The Party has applied the IPCC methodology correctly in estimating emissions from this source, according to the recommendations of the previous centralized review, and the ERT welcomes this. This required the Party to recalculate emissions for the time series from this key source.

105. Country-specific manure excretion rates are used along with IPCC default manure management systems EFs. The Party also should correct the error discussed in paragraph 102 for this key source.

Direct emissions from agricultural soils – N_2O

106. The IPCC default tier 1a methodology has been used to estimate direct emissions from agricultural soils. Portugal has compiled estimates from synthetic fertilizers, animal manures applied to soils, N-fixing crops and crop residues. However, it has not estimated emissions from cultivation of histosols. During the review the ERT and the Party concluded that Portugal has little or no histosols, and in future submissions this source should be reported as "NO".

107. Portugal states that default EFs are used for direct N_2O emissions from agricultural soils; however, all the IEFs in CRF table 4.D are lower than the IPCC defaults. The ERT found that the Party has reported total nitrogen (N) inputs to soils in table 4.D instead of N inputs adjusted for ammonia volatilization, which are presented in the NIR in table 6.15. The ERT recommends that the Party report these adjusted N inputs in CRF table 4.D in future.

108. Portugal uses a $Frac_{GASM}$ of 0.16, estimated using the EMEP/CORINAIR methodology presented in table 6.16 of the NIR, and a $Frac_{GASF}$ of 0.10, which is an IPCC default. The ERT recommends that Portugal develop a country-specific fraction for synthetic fertilizers based on type of fertilizer applied to soils.

Animal production – N_2O

109. The Party identified this source as key by level and trend assessment in its analysis; the secretariat identified it as key by trend only. Portugal uses a country-specific value for $Frac_{GRAZ}$, the fraction of livestock N excretion and deposition onto soil during grazing, of 0.27. Emission factors used to calculate ammonia volatilization from animal manures during grazing according to animal type can be found in table 6.17 of the NIR.

110. Portugal uses an IPCC default value of 0.02 kg N_2O-N/kg N. The ERT recommends that the Party use the same N input value in table 4.D of the CRF as is reported in table 6.15 of the NIR, in order to improve coherence within its submissions.

Indirect emissions from agricultural soils – N_2O

111. Portugal estimates emissions of N_2O from atmospheric deposition and from leaching and run-off using the IPCC default methodology (tier 1a) and EFs for this key source. The Party has assumed that emissions from volatilization are mostly ammonia. The amount of N deposited on soils indirectly is disaggregated by emission source in table 6.24 of the NIR.

112. Portugal uses a country-specific $Frac_{GASM}$ of 0.16 and a default $Frac_{GASF}$ of 0.10. Again, the ERT recommends that Portugal develop a country-specific fraction for synthetic fertilizers as this source accounts for over 20 per cent of N deposited on soils.

113. Portugal reports using the IPCC default value for $Frac_{LEACH}$ of 0.30. However, the value in the additional information of CRF table 4.D is 0.27. The ERT recommends that the Party use the same N amounts reported in tables 6.15 and 6.27 of the NIR and table 4.D of the CRF.

Rice cultivation – CH_4

114. Portugal identifies CH_4 emissions from rice cultivation as a key source by trend assessment in its tier 1 key source analysis. Emissions of CH_4 from this source decreased from 256 Gg CO_2 equivalent to 162 Gg CO_2 equivalent, a reduction of 37 per cent. The downward trend for this source is due to a decrease in the rice cultivation area from 33,824 ha to 21,726 ha. Inter-annual fluctuations in emissions are due to annual variations in hydrological conditions.

115. Emissions were estimated using equation 4.41 of the IPCC good practice guidance. Portugal uses an EF of 36 g/m^2/yr, the same factor as used by Italy, which has similar environmental conditions to Portugal.

C. Non-key sources

Field burning of agriculture residues – CH_4 and N_2O

116. Portugal reports emission estimates from this source based on expert opinion from the Ministry of Agriculture (Seixas et al., 2000) and following the methodology of the IPCC Guidelines. It is assumed that the residues from vines, olive oil cultivation and orchards are burned on-site. AD are from the INE.

D. Areas for further improvement

Identified by the Party

117. Portugal intends to use a tier 2 methodology in estimating CH_4 emissions from enteric fermentation for significant species and to address the issue of temporary livestock numbers, such as numbers of lambs. The question of disaggregating livestock by climatic regions may also be reviewed for future submissions.

118. The Party intends to revise manure allocations to different manure management systems under its MDP, possibly accounting for temporal variations.

Identified by the ERT

119. The ERT recommends that Portugal use a three-year average for livestock characterization as annual livestock surveys have large inter-annual fluctuations.

120. Portugal should perform a quantitative uncertainty analysis of its national GHG estimates so as to be in a better position to identify areas where additional resources should be employed. Agricultural sources are usually the most uncertain among Annex I Parties, especially sources in category 4.D.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

121. In 1990, the LUCF sector constituted a net source of CO_2 emissions responsible for about 9.5 per cent of total national GHG emissions, but it evolved to a net sink of CO_2 in 2002, when the sector's removals were equivalent to about 1.5 per cent of total national GHG emissions. This was caused by a 25.3 per cent decrease of CO_2 emissions and an 8.3 per cent increase in CO_2 removals over the 1990 - 2002 period. These were the outcomes of a linearly increasing trend (slope ± standard error) of 114.8 ± 4.0 Gg CO_2/y for carbon stocks in forests and plantations, and a more steep but linearly decreasing trend of 450 ± 52.2 Gg CO_2/y for carbon stocks in harvested logs between 1990 and 2002.

122. The LUCF inventory is based on information produced by the General Direction for Forestry Resources (Direcção Geral dos Recursos Florestais; DGRF) of the Ministry of Agriculture, Rural Development and Fisheries (Ministério da Agricultura, Desenvolvimento Rural e Pescas; MADRP) referring to periodical forest and plantation inventories in mainland Portugal. These inventories are not

carried out in the overseas territories (Madeira and the Azores) because there are no legal agreements with those autonomous regions for inventorying their forests.

Completeness

123. The CRF tables contain estimates of most gases, sources and sinks from the LUCF sector, as recommended by the IPCC Guidelines. Regarding category 5.D CO_2 Emissions and Removals from Soils, for which no estimates have been provided, Portugal explained that, so far, it has not been possible to quantify emissions and removals from this category, mainly due to the lack of information on the organic carbon content of the soils and its evolution in time. The Party acknowledges the existence of under-storey woody vegetation in forests, but their biomass has not been measured. The ERT was informed that Portugal will endeavour to fill in those gaps in the information in the near future.

124. Emissions of CO_2 from land-use conversions (5.B Forest and Grassland Conversion, and 5.C Abandonment of Managed Lands) are not reported. The estimates of carbon sequestration resulting from the establishment of new plantations, which could have been reported under either 5.B or 5.C, are included in 5.A for practical reasons. The ERT advised the Party to make the necessary technical and methodological arrangements to report those emissions/removals in the pertinent categories in future submissions under the current reporting format or the format required by the 2003 IPCC good practice guidance for Land Use, Land-use Change and Forestry (LULUCF).

Transparency

125. The information presented in the NIR is not entirely transparent. Though Portugal reports CO_2 emissions from the combustion of firewood and accounts them under the Energy sector (domestic or industrial use), the ERT advises Portugal to report those emissions under the LUCF sector, despite of the fact that firewood is considered a non-extractive forest sub-product.

Recalculations and time-series consistency

126. The expansion factors and biomass density factors used for category 5.A in the 2003 inventory submission have been replaced with new values based on a study by a Portuguese university, the Universidade Técnica de Lisboa, and these new factors have been used to recalculate the carbon removal data from 1990 through 2002. The recalculations were recommended by a previous UNFCCC centralized review in order that wood harvest data should be updated on an annual basis. The result of these recalculations is that LUCF was a large source of CO_2 in 1990 (rather than a small sink, as it was before the recalculation), and a moderate sink of CO_2 in 2001 (a sink three times larger than before). The recalculations yielded a higher estimate of net CO_2 emissions in both 1990 and 2001 than in previous submissions. The consistency in the time series is good, because the series can be fitted with a large probability to a second-degree polynomial. It is not possible to ascertain whether the accuracy of the estimates has been improved, because the uncertainties of both the AD and the factors used are unknown. The growth rate values for some species (groups of species) are lower than comparable values reported by other Parties because they come from particular Portuguese agro-ecosystems, namely agroforests, and specialized cork and under canopy agricultural and livestock production systems.

127. There are basically two major improvements to the inventory in the 2004 submission: (a) the calculation of country-specific parameters for estimating the growth of forest trees, and (b) the calculation of non-CO_2 emissions from burnt forests.

B. Sink and source categories

5.A Changes in forest and other woody biomass stocks – CO_2

128. The methodology used for calculating the net CO_2 emissions from this category is that recommended by the IPCC. However, the estimated data may not be specific to the present category 5.A because data on CO_2 removals may also come from any one of the categories 5.B through 5.C (see paragraph 124 above).

5.D Emissions and removals from soils – CO_2

129. The Party has not reported estimates from this category. The Party commented that it abstained from reporting in the current year because: (a) there are some regional studies on soil organic carbon (SOC), but few of them are related to changes in land use, and (b) it lacks data on the effect of soil management practices on SOC. The ERT advised the Party to set up a national system for monitoring changes in forest SOC; to this end, the permanent sampling plots of the National Forest Inventory programme could be used for sampling changes in SOC.

5.E Others: Forest fires – CO_2, CH_4, N_2O, CO, NO_X

130. Emissions of CH_4, N_2O, CO and NO_X have been estimated using the IPCC methodology for biomass burning applied to an estimate of forest under-storey biomass. The reporting on forest fires in the 2004 NIR is an improvement: they were not reported in the 2003 NIR. The Party has estimated CO_2 emissions from forest fires by the weight of carbon in logs salvaged from wildfires and reported them in category 5.A without taking into account the potential emissions from dead wood, non-harvested fallen logs, and snags remaining in the forest. The ERT advised the Party to enhance the transparency and completeness of the present estimates.

C. Areas for further improvement

Identified by the Party

131. The Party recognizes the need to improve the quality of the parameters—expansion factors and growth rates—needed for estimating the net emissions of CO_2 from forests. The Party is also aware that not estimating the undergrowth stratum in forests means missing the carbon sequestered by that forest stratum while, on the other hand, it may also contribute to a possible underestimation of CO_2 losses in the case of vegetation burnt by wildfires. Further, the Party will make efforts to disaggregate the recording of the net CO_2 emissions in categories 5.B through 5.C; it intends to use remote sensing data together with a thorough compilation of the available existing data. The Party also acknowledges the importance of the periodical monitoring of SOC content in forest soils for estimating emissions and removals from soils (category 5.D). The Party will endeavour to make the necessary arrangements to extend the coverage of the National Forest Inventory to its overseas territories (the Azores and Madeira) and to include LUCF estimates from these territories in the national GHG inventory. The Party is also preparing to use the 2003 good practice guidance for LULUCF in the near future.

Identified by the ERT

132. The main concerns raised by the ERT were some lack of transparency in the reporting and the potential underestimation of CO_2 emissions from the combustion of forest biomass by wildfires.

VI. WASTE

A. Sector overview

133. In the year 2002, the Waste sector contributed 4.9 per cent of total national GHG emissions (without CO_2 from LUCF), and 5 per cent (with net CO_2 emissions/removals). During the period 1990–2002 total GHG emissions from the sector increased by 18.8 per cent, reaching their maximum value in 1999. The increase is considered to be mainly related to changes in recent decades in consumption patterns and the geographical distribution of the population (an increase of the urban population). At the same time, there was an increase in the proportion of the population that is served by solid waste collection systems. Of the GHG emissions from the Waste sector, in 2002, 75.7 per cent was CH_4, 14.8 per cent was N_2O and 9.5 per cent was CO_2. CH_4 emissions from this sector represent 36.2 per cent of total emissions of CH_4.

134. The bulk of CH_4 emissions in the sector comes from the source category Solid Waste Disposal on Land (73.9 per cent) and the rest from Waste-Water Handling (26.0 per cent) and waste incineration

(0.03 per cent). The emissions of N_2O come almost exclusively from waste-water handling, with a smaller contribution from incineration (5.2 per cent). All CO_2 emissions come from waste incineration.

135. In the Waste sector, Portugal has introduced several improvements in this inventory submission compared to the previous submission. The ERT considers that the work undertaken by Portugal for the preparation of the Waste Information Management System has been very important and useful, both for this sector and for the inventory. There are also other issues identified in previous reviews that have not yet been addressed. The cause of many of these problems is the lack of the information needed to estimate emissions.

Completeness

136. The NIR and the CRF include estimates of all gases (CO_2, CH_4 and N_2O) from the Waste sector, as recommended by the UNFCCC reporting guidelines. Also included are emissions of ozone and aerosol precursors (NO_X, CO, NMVOCs and SO_2). Emissions have been estimated in most of the source categories except in 6.B Industrial Waste-water Handling, where emissions from sludge were reported as "not estimated" ("NE"). In addition, CH_4 recovered and flared (both in waste water and in sludge) are reported as "NE". All the CRF tables for the Waste sector have been completed from 1990 to 2002, with only minor omissions and/or inconsistencies.

Transparency

137. From the information provided, both in the CRF and in the NIR, it is possible to reproduce the emissions estimates made in this sector. Nevertheless, for some of the emission parameters used the information given does not ensure the transparency of the estimation, for instance, in the category Waste-Water Handling, where the information submitted is very limited. The ERT recommends Portugal to provide more detail and precise descriptions in this category in its next submission. In several categories, expert judgement is used for the determination of time series, selection of parameter values and so on. The ERT recommends Portugal to further apply the methodological criteria for expert judgement included in the IPCC good practice guidance. The information provided in the documentation boxes under all the CRF tables for the Waste sector is limited. The ERT recommends Portugal to improve the information submitted in the documentation boxes.

Recalculations and time-series consistency

138. The CRF provides all the recalculations performed in the Waste sector and summarizes the changes made for the period 1990–2002. The NIR explains the recalculations related to the use of international data sources for AD, changes of AD and emission parameters and factors, corrections of errors detected, and a change in the location and distribution of one source category. The recalculations have improved the time series in terms of accuracy and consistency. The ERT encourages Portugal to collect country-specific data on protein intake in order to improve its estimation and recalculations of N_2O emissions from human sewage.

B. Key sources

Emissions from solid waste disposal sites: Municipal waste disposal on land – CH_4

139. For the estimation of CH_4 emissions, the first order decay (FOD) method (tier 2) has been used. The AD are country-specific and the NIR includes references to most of the reports and data sources used. The parameters of the method are specified in the NIR and the CRF. Both default and country-specific parameters were used in this estimation. There is an error in the calculation of the average per capita generation rate for the years 1996–1999. During the review the Party provided new data and the recalculated figure. According to the NIR, two values were used for the methane generation rate constant k (1/yr) with the objective of differentiating between areas of the country where conditions differ. The values used refer to recommended AP-42 defaults. They are lower than the recommended default (0.05) in the IPCC Guidelines for cases where there are not enough data on the composition of

waste. Portugal adopts an extension of 30 years for the time series based on the emission model used (EPA, 1993). This series seems a little short for the k values used, when checked with $k=\ln 2/t_{1/2}$. In national inventories it is usually necessary to include data for 3–5 half-lives in order to achieve an acceptably accurate result.

140. A national estimate has been made for degradable organic carbon (DOC) based on the little information that is available on the composition of waste. However, using the same DOC value for the whole period 1990–2002 cannot represent appropriately the actual evolution in the composition of solid waste. The default value of (0.77) of the IPCC Guidelines was used for fraction DOC dissimilated (DOC_f). This value may be an overestimate and can only be used if lignin C is excluded from the calculations. If lignin C is included in DOC then the preferred value for DOC_f is within the range 0.5 to 0.6. During the review the Party explained that it used that value because it considered that the quantity of lignin C in municipal solid waste (MSW) is probably small. This point can be further investigated in the near future. If the FOD method is used, the Party is recommended to use different DOC_f values for wastes with different half-lives. However, from the available information on waste composition in the country, it was not possible to achieve this degree of detail. The ERT encourages Portugal to continue working on the estimation and determination of solid waste composition and to perform an analysis of the values used for the parameters of the FOD method and adjust them, if possible, to the recommendations of the IPCC good practice guidance.

141. Sludge from waste-water handling is often disposed of to solid waste sites, and emissions from this sludge should be included under this category. According to the information provided by the Party, emissions from sludge disposal are still not quantified. More complete information should be researched. The ERT encourages Portugal to work on the determination of these emissions and the production and destination of sludge in the country.

142. There were no dedicated industrial disposal sites in Portugal until 2002. All industrial waste generated is considered to be disposed in solid waste disposal sites (SWDS) together with urban waste. Historical data on waste disposal have been estimated on the basis of expert judgement and the time series for some of the parameters used are based on 1999 data. For industrial waste, DOC values of 0.28 (for the period 1960–1999) and 0.20 (for later years) have been used. The NIR and the CRF do not provide information on the composition of those wastes or references to studies that would support those DOC values. Neither are arguments provided to justify the use of the value obtained for the year 1999 for the whole period 1960–1999. During the review the Party provided additional information on the sources used and the approaches followed in selecting the values used in the calculation.

Emissions from waste-water handling – CH_4

Domestic and commercial waste water

143. CH_4 emissions have been estimated using a methodology based on the IPCC Guidelines and the good practice guidance. The IPCC method does not allow for the inclusion of latrines, river discharge, sewer lines and septic tanks. In the inventory, MCF values for individual private treatment facilities such as septic tanks are set as 0.5. This value was set by expert judgement, assuming partial anaerobic conditions. Currently no information is available on the production and destination of sludge. The amount of sludge produced is assumed to be, for all years, 20 per cent of total organic waste (TOW) originating in waste-water treatment plants. Since default factors are used (e.g., methane-producing capacity (B_o) = 0.6 for waste water and sludge), emissions from waste water and sludge can be estimated together. The Party has not used the "check method" provided in the IPCC good practice guidance to check the emissions estimates in this category. The ERT recommends Portugal to use that method additionally. The comparison with other methods assists in validating the factors used and results obtained.

Emissions from waste-water handling – N_2O

6.B.2 Domestic and commercial waste water: Emissions from discharge of human sewage to aquatic environments

144. N_2O emissions have been estimated for total population following the method in the IPCC Guidelines, using the default emission parameters and data on protein consumption per capita from the FAO database for 2003. To avoid double counting, N from sewage should be reduced by the amount of sewage N that is applied to soils in the form of sewage sludge. Taking into account the information provided in the NIR, in Portugal part of the nitrogen present in sewage is applied to soils through sewage sludge application. This is not currently accounted for because the necessary information is not available, which leads to N_2O emissions from this source category being overestimated. The ERT encourages Portugal to further improve its estimates of N_2O emissions in this source category.

Emissions from waste incineration – CO_2

145. Emissions from open burning of industrial solid waste on land are included in the category corresponding to incineration. Emissions from combustion used as a management practice at waste disposal sites are to be included under Solid Waste Disposal. The ERT recommends Portugal for the next submission to report these emissions under the category 6.A Solid Waste Disposal on Land – Other. Activity data for clinical waste incinerated refer only to mainland Portugal. The ERT recommends Portugal to extend these data to the whole country in order to improve the completeness of the inventory. In 1999 two incineration units dedicated exclusively to MSW began to operate. In all cases it was assumed that incineration occurs without energy recovery, even though, according to the NIR, that assumption does not reflect reality. The ERT recommends Portugal to estimate emissions from the energy recovered from the incineration, and to report those emissions in the Energy sector.

C. Non-key sources

Emissions from waste-water handling – CH_4 and N_2O

6.B.1. Industrial waste water

146. Under the method used by the Party, quantities of industrial waste-water organic charge (in million of inh.eq) are multiplied by an EF for each pollutant. The Party's calculation is based on national estimates for industrial waste-water organic content and default EFs from the CORINAIR Guidebook. The information submitted in the NIR is very limited, thus reducing the transparency of the emission estimates reported. In this category emissions from sludge are reported as "NE". Also in this category, CH_4 recovered and flared (both in waste water and sludge) is reported as "NE". The ERT encourages Portugal to improve the completeness and transparency of the inventory by exploring the possibilities of including these estimates.

Emissions from waste incineration – N_2O

147. N_2O emissions have been estimated as the product of the mass of total waste combusted and an EF for the pollutant emitted. One single factor, not country-specific, has been used in this estimation. The N_2O EF used does not take into account the characteristics of incinerators as the IPCC good practice guidance recommends. The ERT recommends Portugal to further improve the selection and use of EFs for this source category.

D. Areas for further improvement

Identified by the Party

148. The Party is planning the following improvements:

(a) Better quantification of the amount of CH_4 recovered and flared;

(b) The collection of annual data on the composition of wastes;

(c) Improvements to the characterization of industrial organic waste-water load;

(d) The collection of data on the application of sewage sludge to soils to improve the emissions estimate of N_2O from human sewage; and

(e) Improvements to the collection of information on energy recovery in waste incineration.

Identified by the ERT

149. In addition to the source-specific recommendations above, the ERT identified the following major areas for improvement related to the Waste sector. Portugal should:

(a) Estimate emissions of source categories not reported in the inventory to improve the degree of completeness (e.g., CH_4 emissions from sludge handling and recovery of CH_4 in the category Industrial Waste-water Handling); and

(b) Reallocate emissions to the appropriate source categories where allocation errors were detected (e.g., emissions from open burning of industrial solid waste on land).

ANNEX 1: MATERIALS USED DURING THE REVIEW

A. Support materials used during the review

2003 and 2004 inventory submissions of Portugal. 2004 submission including a set of CRF tables for 1990–2002 and an NIR.

UNFCCC secretariat (2004). "Report of the individual review of the greenhouse gas inventory of Portugal submitted in the year 2003 (centralized review)". FCCC/WEB/IRI(3)/2003/PRT (available on the secretariat web site at http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/626.php

UNFCCC secretariat. "2004 Status report for Portugal" (available on the secretariat web site at http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/2994.php)

UNFCCC secretariat. "Synthesis and assessment report of the greenhouse gas inventories submitted in 2004. Part I": FCCC/WEB/SAI/2004 (available on the secretariat web site at http://unfccc.int/resource/webdocs/sai/2004.pdf) and Part II – the section on *Portugal* (unpublished).

UNFCCC secretariat. Review findings for Portugal (unpublished).

Portugal's comments on the draft "Synthesis and assessment report of the greenhouse gas inventories submitted in 2004" (unpublished).

UNFCCC secretariat. "Handbook for review of national GHG inventories." Draft 2004 (unpublished).

UNFCCC secretariat. "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", "Part II: UNFCCC reporting guidelines on national communications" and "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention." FCCC/CP/1999/7 (available on the secretariat web site at http://www.unfccc.int/resource/docs/cop5/07.pdf).

UNFCCC secretariat. "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC Reporting guidelines on annual inventories" and "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention." FCCC/CP/2002/8 (available on the secretariat web site at http://unfccc.int/resource/docs/cop8/08.pdf).

UNFCCC secretariat. Database search tool – *Locator* (unpublished).

IPCC. *IPCC good practice guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000* (available on the following web site: http://www.ipcc-nggip.iges.or.jp/public/gp/good practice guidanceaum.htm).

IPCC/OECD/IEA. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volumes 1–3, 1997* (available on the following web site: http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm).

B. Additional materials

Responses to questions during the review including additional materials on the methodologies and assumptions used were received from Ms. Teresa Pereira (Instituto do Ambiente), Mr. Vitor Gois (consultant), Mr. Pedro Torres (under contract with the Universidade Nova de Lisboa/Faculdade de Ciências e Tecnologia) and Mr. Tiago Seabra (under contract with the Universidade de Aveiro/ Departamento de Ambiente e Ordenamento do Território).

Antonio Carreira (Air liquide): Fluorocarbonetos, Actividade 2001, April 2002 (in Portuguese language).

General Directorate for Geology and Energy (DGGE): National Energy balance of Portugal for 1990– 2002.

General Directorate for Geology and Energy (DGGE): Background information to the energy balance; unpublished (two pages, dated 1 October 2004).

General Directorate for Geology and Energy (DGGE): Questionnaires for electrical installations (Declaração relativa a instalaçoes eléctricas de serviço particular / publico), (in Portuguese language).

João Santos Pereira et al. Mimeo. Instituto Superior de Agronomia. Universidade Técnica de Lisboa: Quantificação dos sumidouros terrestres de carbono em Portugal continental. Julho 2002 (51 pages, in Portuguese language).

Seixas et al., "Emissions and control of greenhouse gases in Portugal"; 2000. Emissão e Controlo de Gases com Efeito de Estufa em Portugal. Ministério do Ambiente e Ordenamento do Território, GASA-DCEA-FCT, Março 2000; CD (in Portuguese language).

Report from the iron and steel operator (excerpt: four pages out of a larger report, no date/authors provided)(in Portuguese language).

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